SIPAS Meeting
March19-20-2015
Montichiari

M.F.de Jong DVM PhD

Disease Control and Eradication,

academically and practical experience,

PRRS, AR, M.hyo, mange, App
and all you can think of

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Disease control and eradication, academically and practical

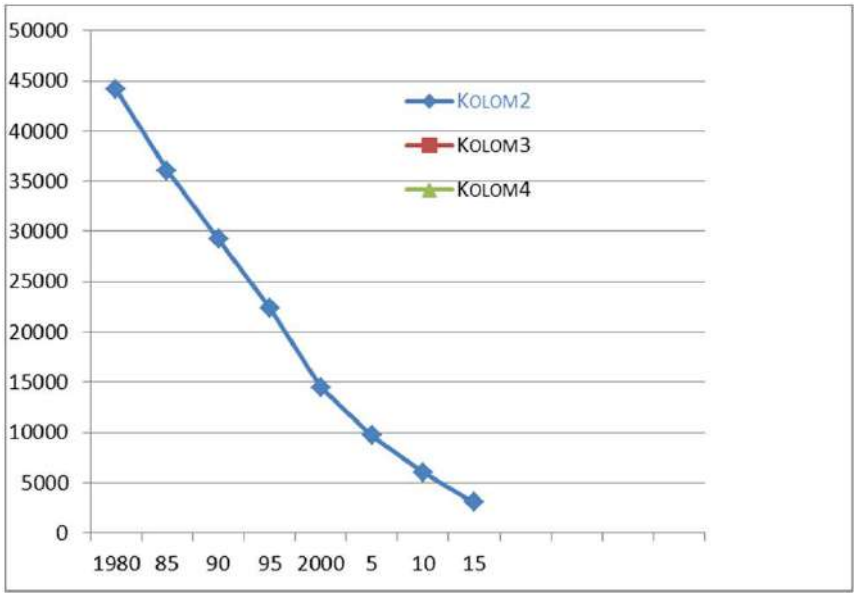
M.F. de Jong. DVM, PhD.

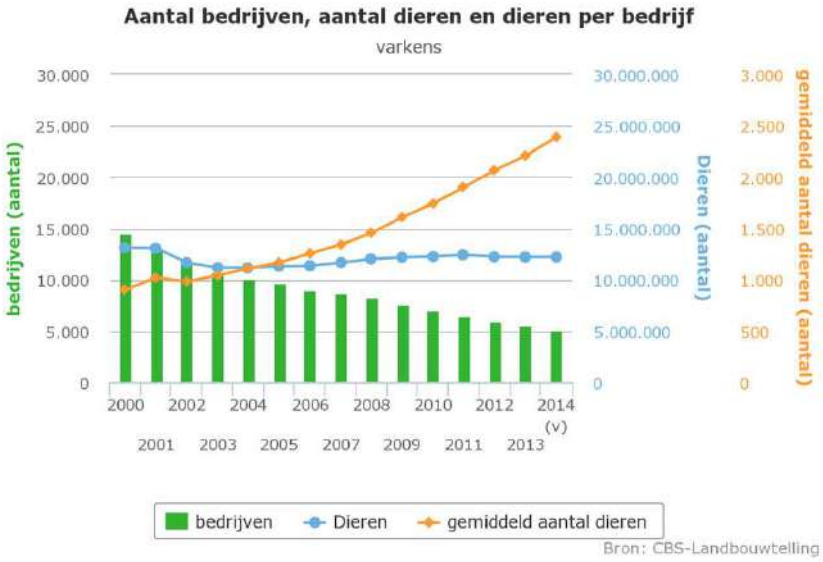
Introduction

- Some of the swine diseases which appeared in the last 4 decades

  academically and practical experience,
  Ecto- and endo-parasites (Scabies and Ascaris)
  E.coli
  AR,
  PRRS,
  M.hyo,
  App,
  Circo2,
  PED
  (and all you can think of)

Decline of the number of herds and incline of the average number of pig since 1980

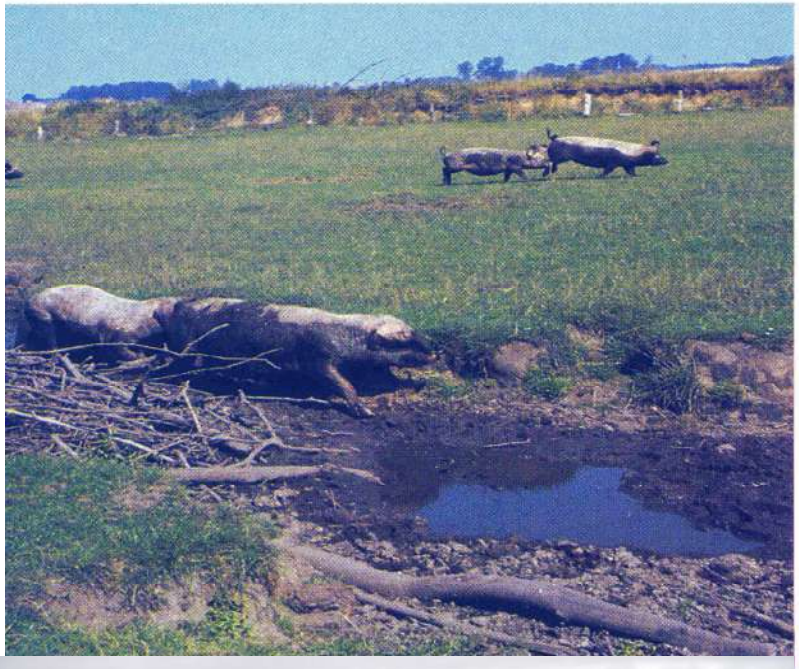




The fight against ecto-and endo parasites

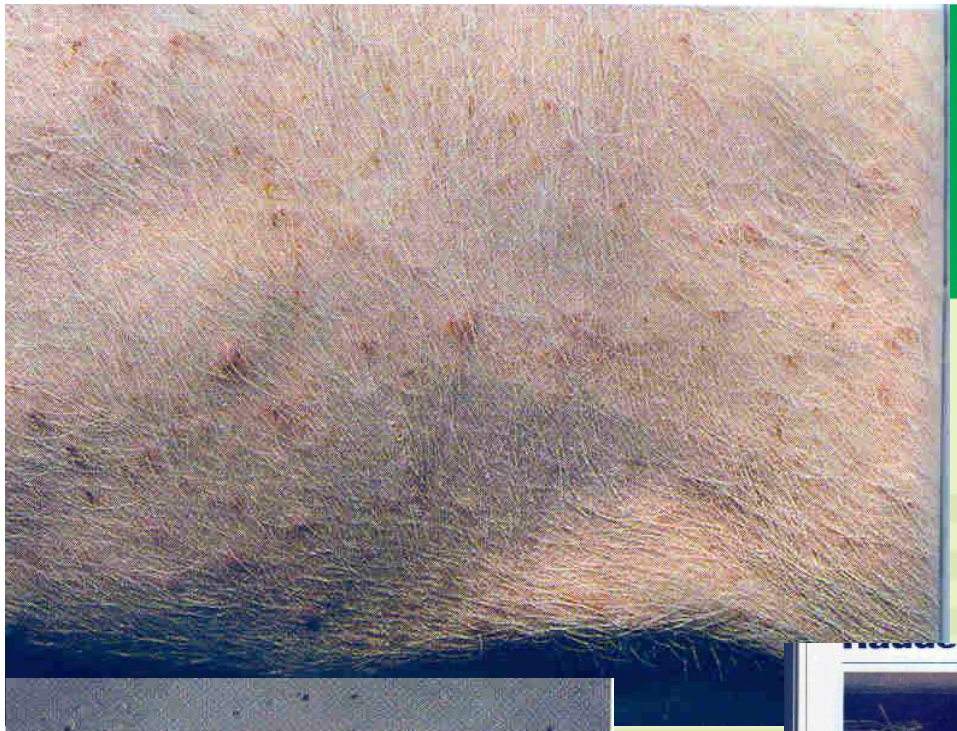
- Out door systems turned into indoor systems (crates)
- Batch wise production on slatted concrete floors instead of continue production on solid floors (straw less)
- Hygiene and AI /AO
- Strategic treatments versus control on symptoms or eggs or worms
- Monitoring by Elisa tests for Scabies and Ascaris

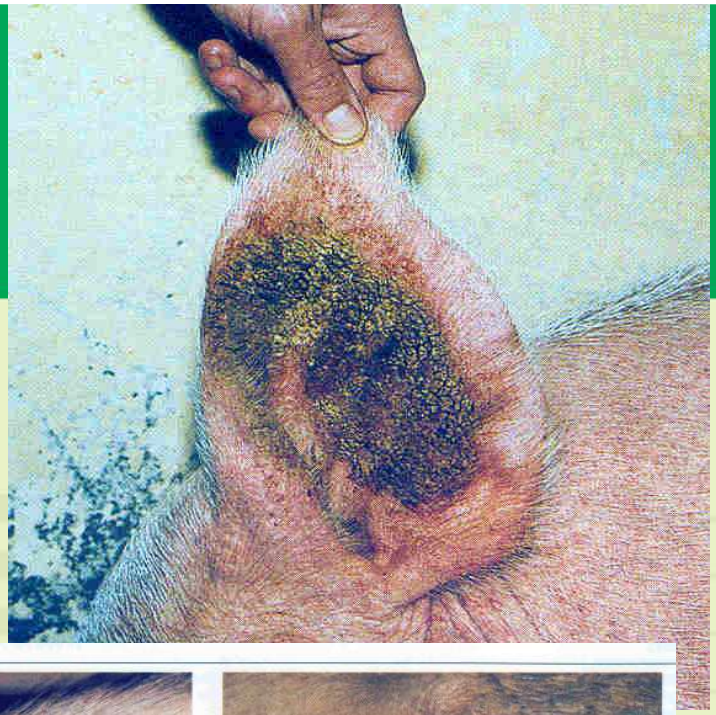
- Today free group ranged pig herds
- Today slats are restricted, more solid floors.
- Today Hygiene difficult to maintain in instable groups on straw bedding.
- Today less individual clinically controlled.
- Today more lab test or slaughter checks necessary
- Worms form always a hidden danger

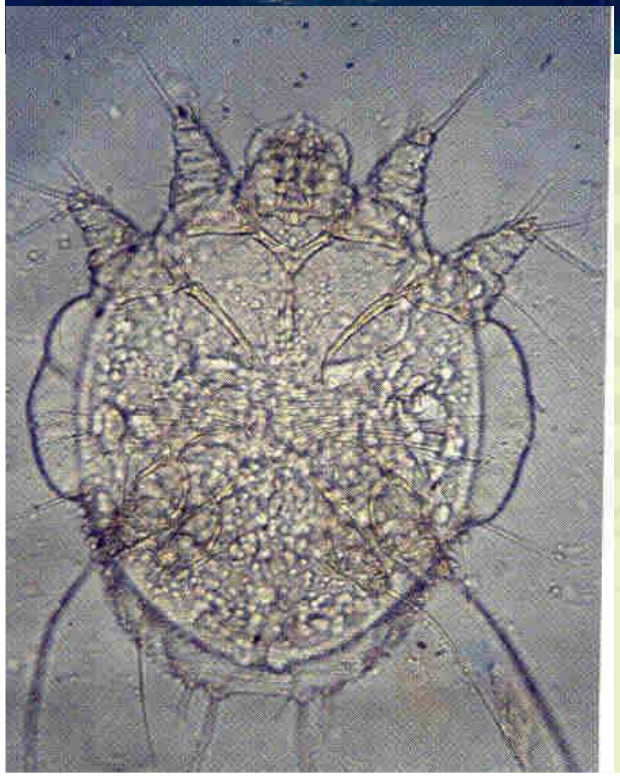


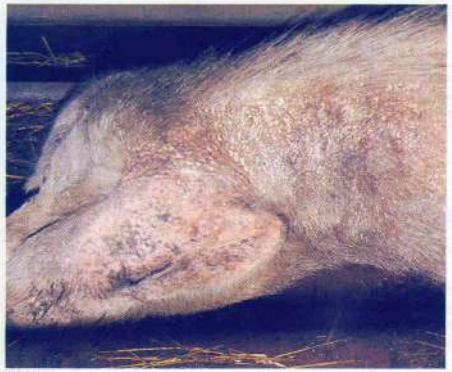
Mange

- Mange positive herds have a financial loss of €12,70 per sow per year (AHS Deventer)
- Disease control: clinical and serological monitoring(3x/y)
- Introductions in free herds are rare, attention buying boars or gilts, transport, humans
- Eradication: Ivomec or Dectomax herd medication program (2x with14 d. interval, all animals at same day)









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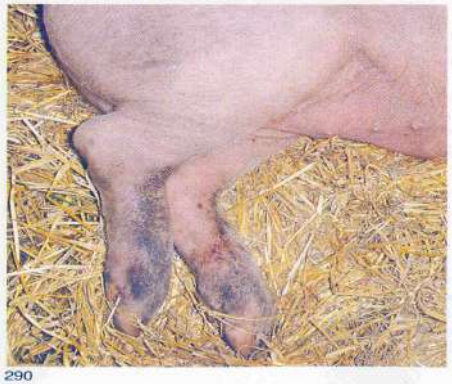

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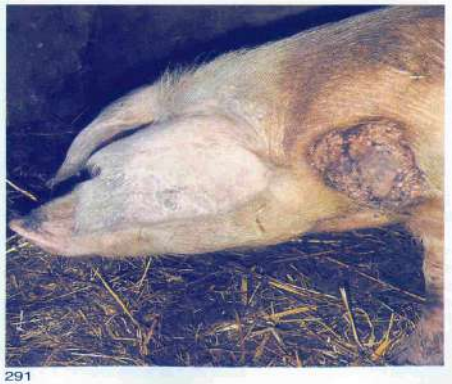

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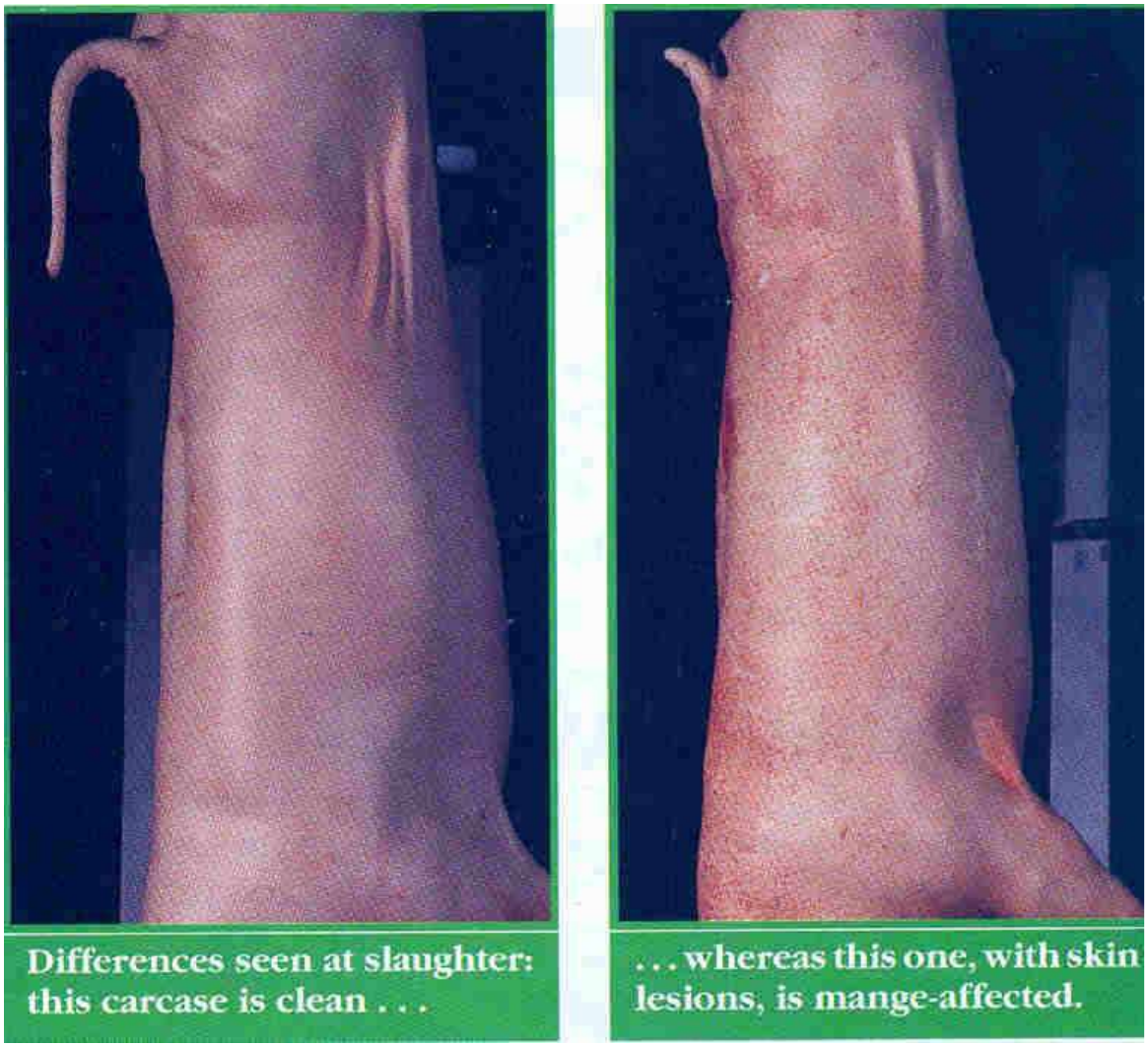
Slaughterline

- Carcasses with papular lesions
- score 0 – 3
- Elisa test for mange control (Scabies suis)
- All Dutch breeding herd certified ,,scabies free,, (clinical and serological 3x/y)



Differences seen at slaughter: this carcase is clean . . .

. . . whereas this one, with skin lesions, is mange-affected.

1. Re: deworming pasture pigs, treating sneezing pigs (Cunningham, Frederick L - USDA/APHIS/WS/NWRC)

- how long it took for a sow to stop shedding roundworm eggs after deworming. The next question was how long it took before she would shed eggs again.
  Infected naive gilts, confirmed they were shedding eggs and then treated them with all the available products at label doses.
  Treatment per group (n=6) it took 5 days .

	Gilts stop shedding eggs, (days post treatment):	**Gilts did not shed eggs**
Banmith 800(Pyrantel)	**10**	**27**
Atgard	**9**	**30**
Ivomec	**11**	**51**
Dectomax	**9**	**72+**
Safe Guard (fenbendasole)	**8**	**73+**

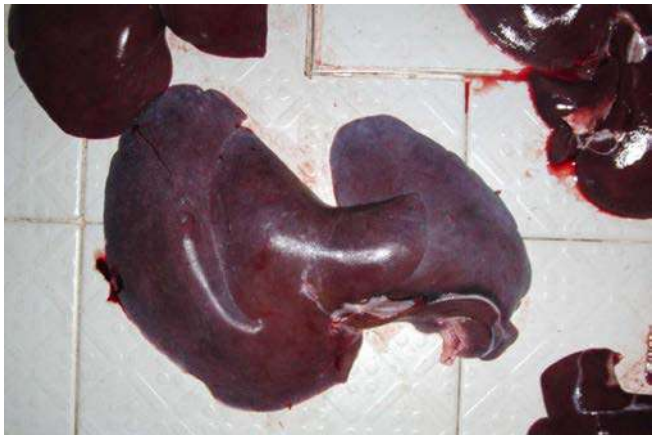
It is important to consider these times when designing a deworming program prefarrowing.
If you deworm too early or too late you can have egg shedding in lactation.

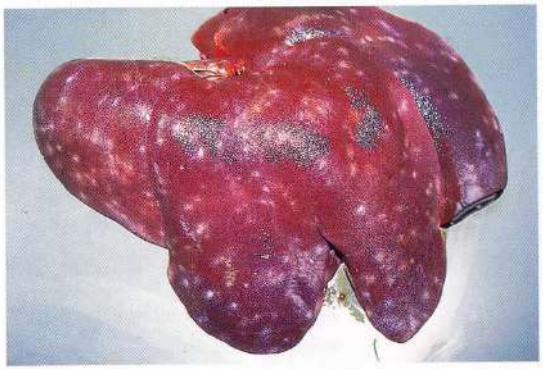
Prepatent period : Ascaris suum in young pigs ± 35 days, in sows ± 50-75 days

Ascaris and serology

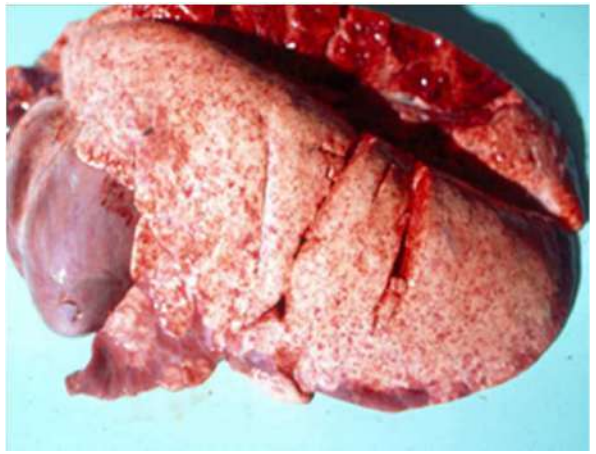
Jungsau mit Spulwurmbefall.

Massiver Spulwurmbefall bei einem Mastschwein.





Durch wandernde Spulwurmlarven verursachte Entzündungsherde in der Leber (Milkspots).



Deworming Strategy for : Ascaris suum

- **Sows -1or 2 weeks for entering farrowing sites. If liver condamnations increase or when over 5%, Deworm sows and gilts also 3times a year.**
- **Boars- 3 times a year**
- **Weaners- before leaving the nursery.**
- **Fattening pigs; on gide of liver score or % condamnations (or egg count), over 10% milkspots = 3 times, in week, 1, 6 and 11 (withdrawal time!) of fattening period**

  2 to 5-10% = 2 times, week 1 and 6

  0,5- 2 to5%= 1 times, week 1

  less than 0,5%= no deworming(?)

Lung-liver scores

- Grades of milkspots
- Grade of scars
- Frequency of deworming for Ascarsis
- Elisa Serasca test is a strategic methode for deworming for Ascaris suum (Uni Gent)
- Larval migration is accompanied with respiratory problems

E.Coli 1

- **Introduction**
- *Escherichia coli* are ubiquitous in animals.
  Some types are normal inhabitants of the intestine, but other strains cause a variety of recognised colibacillosis diseases.
  These pathogenic *E coli* bacteria generally have;
  -fimbriae (pili) for attachment,
  -enterotoxigenic exotoxins,
  -endotoxins and
  -capsules.
- There are various ways to classify *E coli* infections in pigs;.
  The list of major clinical diseases due to *E coli* in pigs would include:
  --neonatal colibacillosis,
  --post-weaning colibacillosis diarrhoea and
  --oedema disease;
  as well as colisepticaemia, coliform mastitis and urinary tract infections.

E.coli

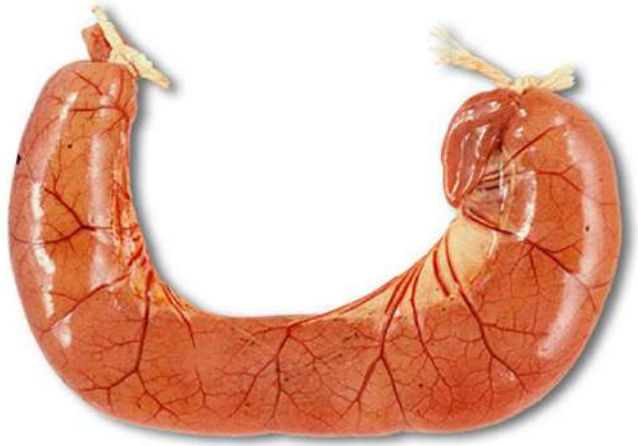
- fimbrial antigens F4, F5, F6, F41 etc, although still frequently known by earlier designations of K88, K99, 987P etc. This attachment and adherence then allows the ETEC to resist normal gut movements and so colonize the intestine

PWD, endotoxineshock and edema disease, associated with E.coli

Adhesiefactor	(entero)toxine	Serotype of O-serogroep
F4 (K88)	STb en/of LT*	O8:(K87), O45:K-, O138: (K81), O141: (K85ab), O141: (K85ac), O147: (89), O149: (K91), O157: K-
? (2134P, F107=F18)	STb en/of LT* SLT?, endotoxine	O138: (K81), O141: (K85ab), O141; (K85 ac)
?(F107=F18), 2134P) oedeemziekte	SLTII iv (VT II v)	O138: (K81), O139: (K82), O141: (K85ab), O141; (K85 ac), O147: (K89)

Ligated gut test

entro-toxin	LGT	BMT	Vero cells
LT	+	–	+
STa	+/-	+	–
STb	+	–	–



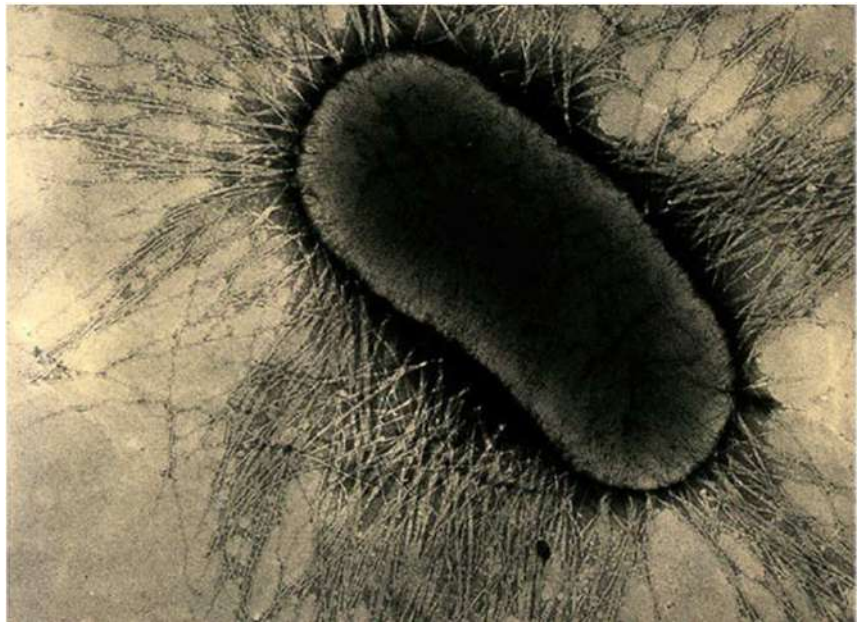
PCR technologie en E.coli to day

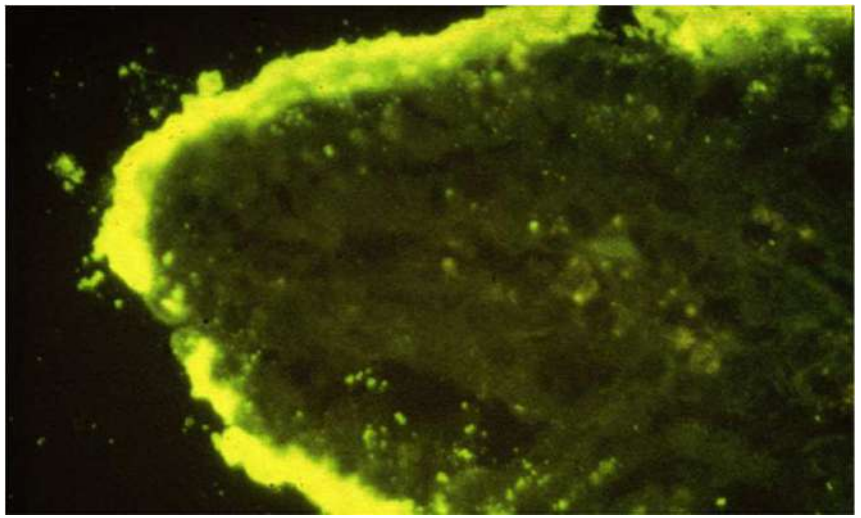
- Polymerase chain reaction primers used to emplify virulence genes of E coli isolates.
- 9 Target genen;
- LT, STa, STb, Stx2e, K88(F4), K99(5), 987P(F6), F41, F18ab(Shiga Stx2e=STEC), F18ac(ETEC),

Figure 1. The attachment factors on ETEC are specialized fimbrial or pilus proteins, which firmly attach to enterocyte glycoprotein receptors on the intestinal cells.

Neonatal colibacillosis

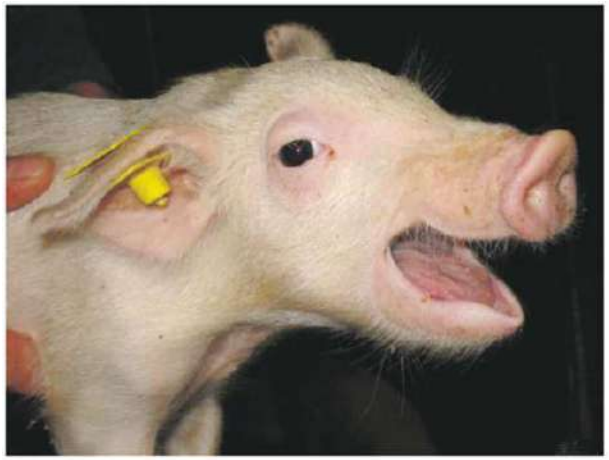
Colibacillosis due to **enterotoxigenic** *Escherichia coli* (ETEC) in suckling piglets often occurs at an early age, within the first week of life. It is most often associated with litters derived from gilts, which become infected quickly after birth, due to environmental contamination and inadequate maternal antibody levels.
Vaccination of late pregnant gilts and sows should be performed routinely to induce lactogenic immunity for neonatal piglets against ETEC infections.



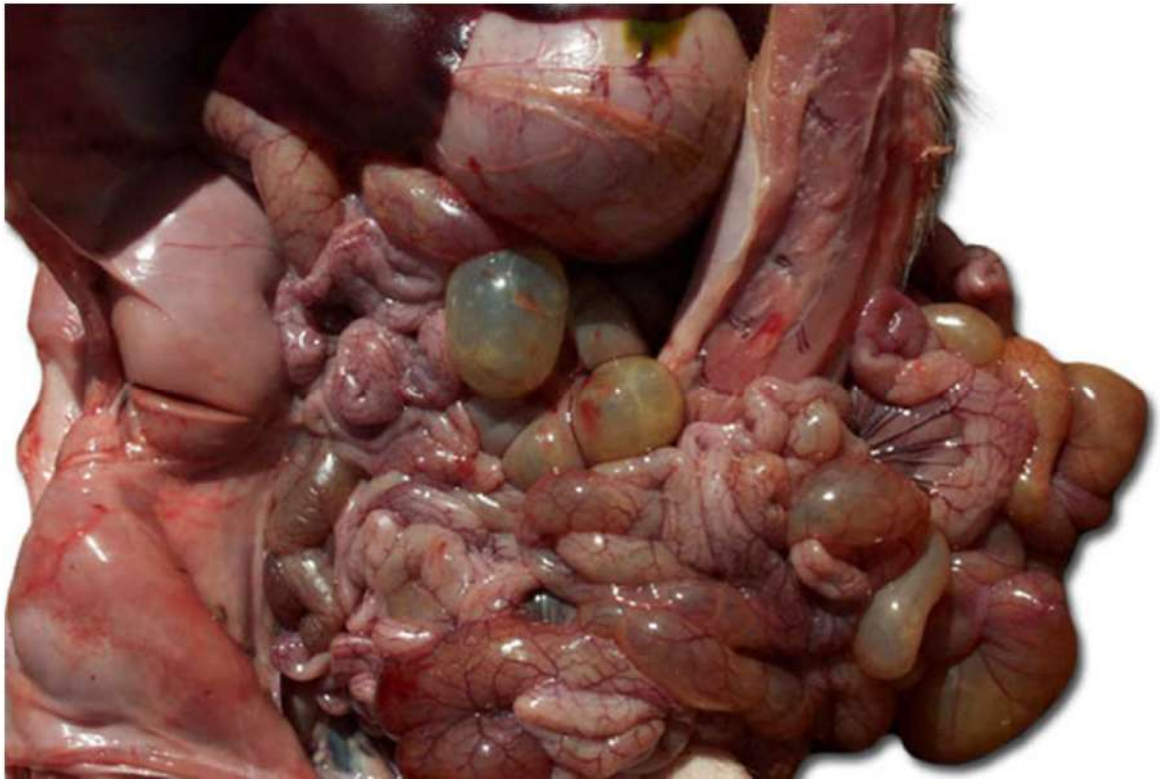


Oedema disease

- The *E coli* strains involved in oedema disease are usually of the **F18 fimbrial adhesin type and they also contain specific verotoxins or shiga-like toxins, such as Stx2e.**
  These toxins enter the bloodstream of the pig and damage extra-intestinal blood vessels, producing neurological signs and gelatinous oedema of the head, eyelids, larynx, stomach and mesocolon.
- *Clinical signs* – The onset of disease is also around 2 weeks after weaning. The first sign is often the sudden deaths of a few pigs.
  The main clinical signs in the affected groups are dullness, ataxia, stupor, recumbency and dull waddling and running.
  When handled, pigs may respond with an abnormal high-pitched squeal. **Soft gelatinous swelling of the skin over the eyelids** is a prominent feature. So the affected piglets look like “drunk, squeaky puppies”. The illness lasts in each batch of pigs for around 2 weeks.



Autopsy of affected nursery pig, note loops of small and large intestine.
Some samples of fresh faeces and intestines were sent to the lab for testing.
The differential diagnosis at this stage includes E. coli, Salmonella, PCV, Lawsonia, TGE, PED, rotavirus.



Some days later the team receive the results. In conversation with the lab, it is confirmed that culture of intestine samples on blood and McConkey agars show heavy pure growth of lactose-fermenting, indole-positive, oxidase-negative and beta-haemolytic colonies of Gm - coliforms. Agglutination reactions indicate fimbrialK88 [F4] ++ reactions (typical of enterotoxigenic *Escherichia coli* (ETEC).

To control ETEC

- **Measures taken**
- Neomycin sulfate at 100 ppm orally against ETEC in outbreaks with little evidence of clinical recovery.
  Colistin is regarded as the drug of choice for ETEC therapy, with no clear indication yet of resistance among European isolates., each outbreak occurring over a 2 to 3 week period, was expensive and logistically difficult.Restriction by Human Medicin . **Baytril 100 (enrofloxacin). The drug may now be used intramuscularly or subcutaneously for the control of colibacillosis in groups of swine where *E. coli* has been diagnosed**
- Zinc oxide at pharmaceutical levels on veterinary prescription and the clinical signs and losses resolved within 2 weeks on all sites.
- The clinical signs of the outbreaks suggested that **vero-toxin (shiga-like toxin)** positive strains of ETEC were also present
- *E. coli* and ETEC strains are a common background organism explains its constant nature of occurrence and outbreaks when appropriate control measures are not taken.
- **German IDT vaccin (after lab confirmation**.)
- Antibodies rapidly multiply and prevent the colonization of pathogenic ETEC bacteria in the intestine**.**

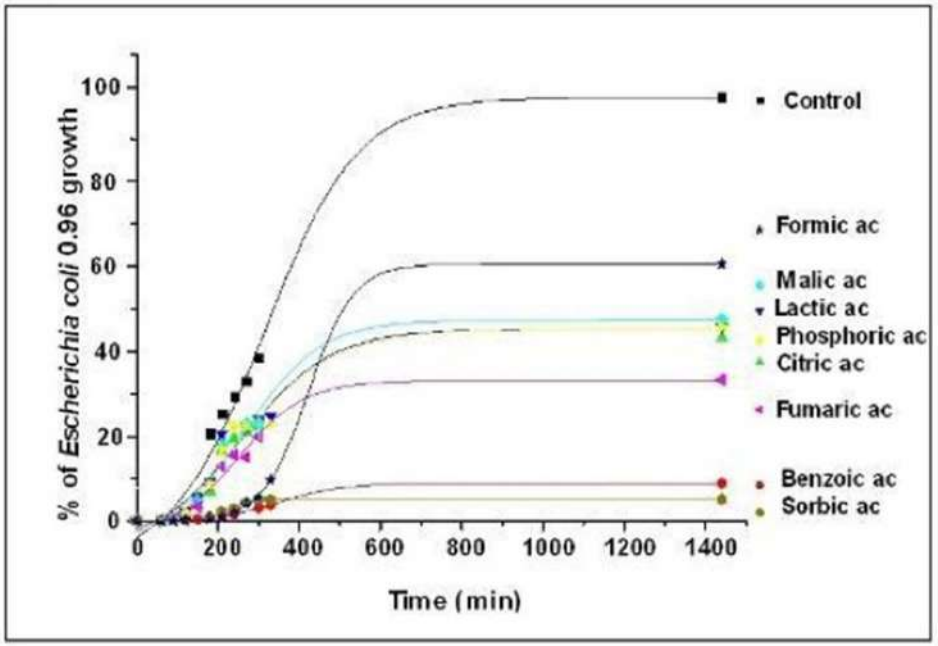
One-shot vaccine available against oedema disease (Pig Progress 19-2- 2015)

- Oedema is a lethal infectious disease seen in pig production. It primarily occurs in piglets during the first 2 weeks after weaning. It causes serious losses to the pig industry due to a high mortality rate among infected pigs.
- The vaccine* induces a high level of immunity against shiga toxin, produced by the *E coli* bacteria which cause oedema. It has proved highly successful in Germany where it was developed by **IDT** Biologika. In a comparative study involving 319 pigs no mortality was recorded among the vaccinated group compared with 11.4% in the unvaccinated control group.
- **Preventative measures in a cost-effective way**
- "Vaccines* like this reduce the use of antibiotics in piglet rearing, in a cost-effective way..
- German calculation showed a reduction in margin of €83 (£74) per sow or €41,000 (£32,500) for a 500-sow herd. UK farmers will be able to carry out at DIY calculation of their ROI online using their smartphones of by visiting the shiga toxin website.

ways

Table 1 - Genetic *E. coli* F18 resistance in Suisag Al boars (February 2012).

Breed	AA	AG	GG	Total	Resistant allele
Swiss LW	16	0	0	16	100%
Swiss LR	2	3	5	10	35%
Premo	49	70	17	136	62%
Duroc	3	10	10	23	35%
Piétrain	0	9	14	23	20%



AR

- Disease control
- Eradication

Rhinitis and Differential Diagnoses.

- Infectious causes

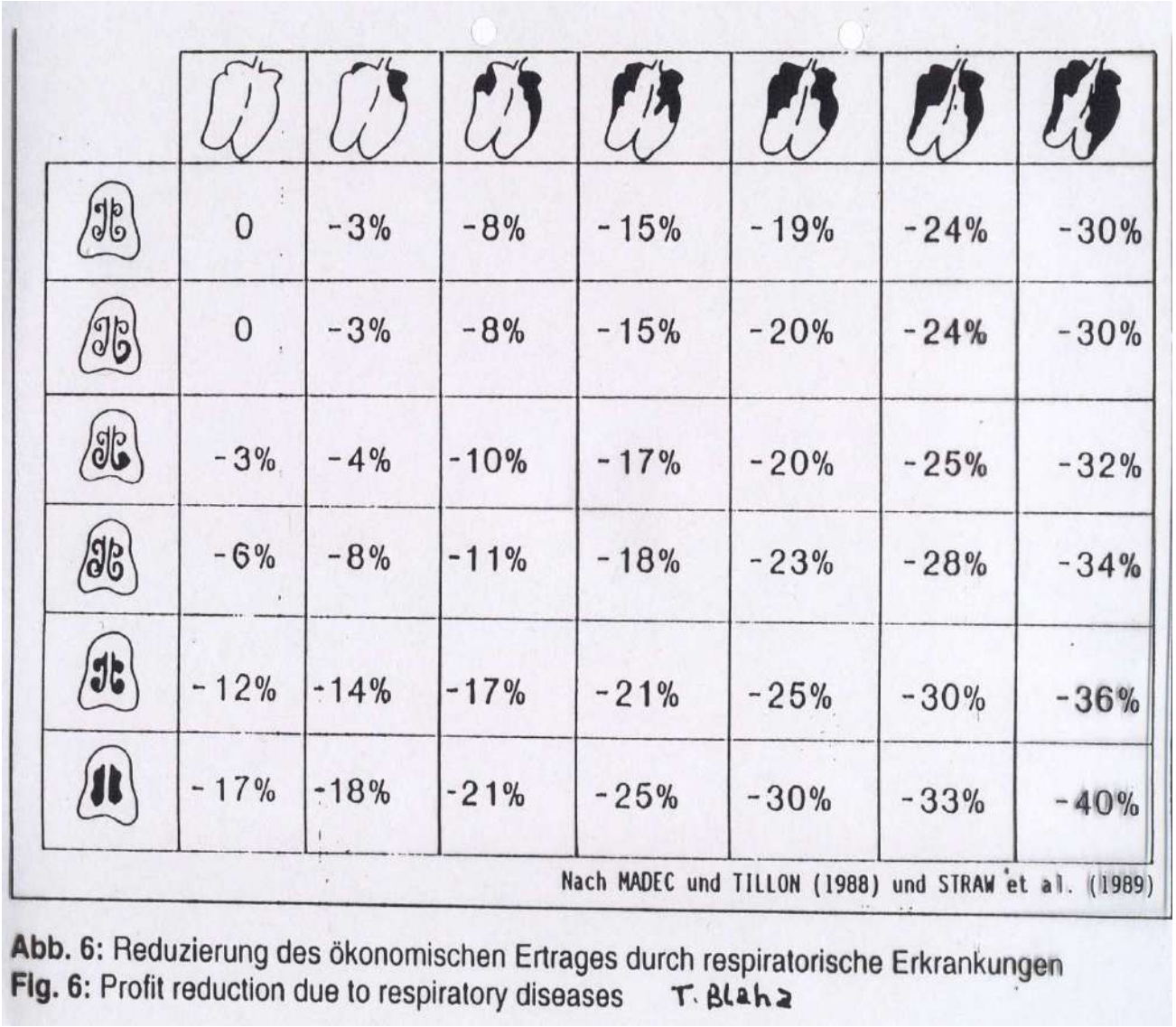
- **Virisses**
- -IBR(Cytomegalo)
- -Circo2
- -Influenza
- -PRRS
- -Aujeszky
- -KVP en AVP
-
- **Bacteria**
- -DNT+ P.multocida
- -Bordetella
- -Mycoplasmata
- -Streptococces
- -H.parasuis

- non infectious causes

- Dry air
- Toxic gasses
- Dust

- Colt air
- Draft
- Changes in temp.

Profit reduction due to respiratory diseases (Blaha)



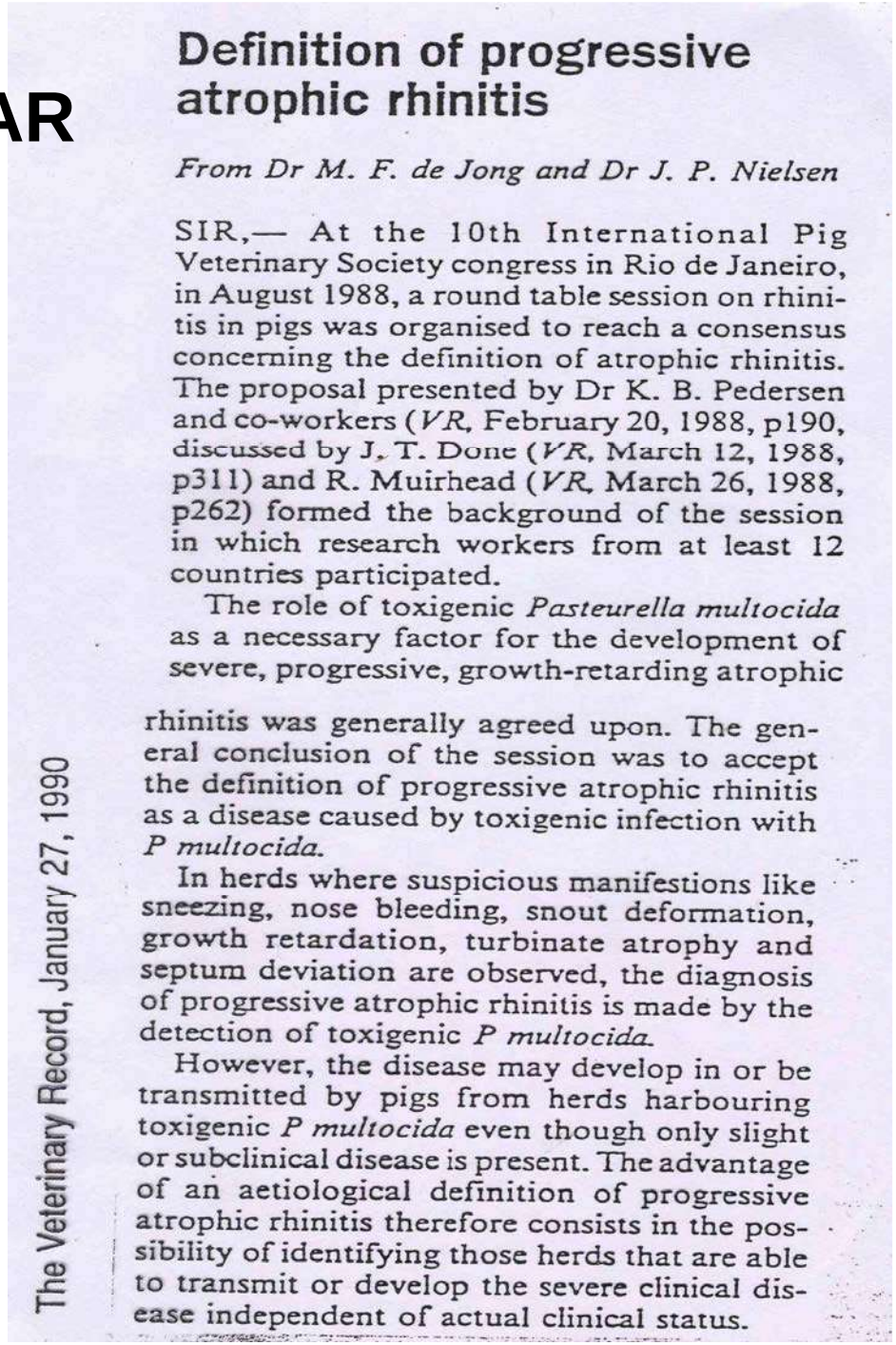
	0	-3%	-8%	-15%	-19%	-24%	-30%
	0	-3%	-8%	-15%	-20%	-24%	-30%
	-3%	-4%	-10%	-17%	-20%	-25%	-32%
	-6%	-8%	-11%	-18%	-23%	-28%	-34%
	-12%	-14%	-17%	-21%	-25%	-30%	-36%
	-17%	-18%	-21%	-25%	-30%	-33%	-40%

Nach MADEC und TILLON (1988) und STRAW et al. (1989)

Abb. 6: Reduzierung des ökonomischen Ertrages durch respiratorische Erkrankungen
Fig. 6: Profit reduction due to respiratory diseases T. Blaha

Definition of Progressive AR

- The advantage of an aetiological definition of **progressive AR** consist in the possibility of identifying those herds that are able to transmit or develop the severe clinical disease independent of actual clinical status



Definition of progressive atrophic rhinitis

From Dr M. F. de Jong and Dr J. P. Nielsen

SIR,— At the 10th International Pig Veterinary Society congress in Rio de Janeiro, in August 1988, a round table session on rhinitis in pigs was organised to reach a consensus concerning the definition of atrophic rhinitis. The proposal presented by Dr K. B. Pedersen and co-workers (*VR*, February 20, 1988, p190, discussed by J. T. Done (*VR*, March 12, 1988, p311) and R. Muirhead (*VR*, March 26, 1988, p262) formed the background of the session in which research workers from at least 12 countries participated.

The role of toxigenic *Pasteurella multocida* as a necessary factor for the development of severe, progressive, growth-retarding atrophic rhinitis was generally agreed upon. The general conclusion of the session was to accept the definition of progressive atrophic rhinitis as a disease caused by toxigenic infection with *P multocida*.

In herds where suspicious manifestions like sneezing, nose bleeding, snout deformation, growth retardation, turbinate atrophy and septum deviation are observed, the diagnosis of progressive atrophic rhinitis is made by the detection of toxigenic *P multocida*.

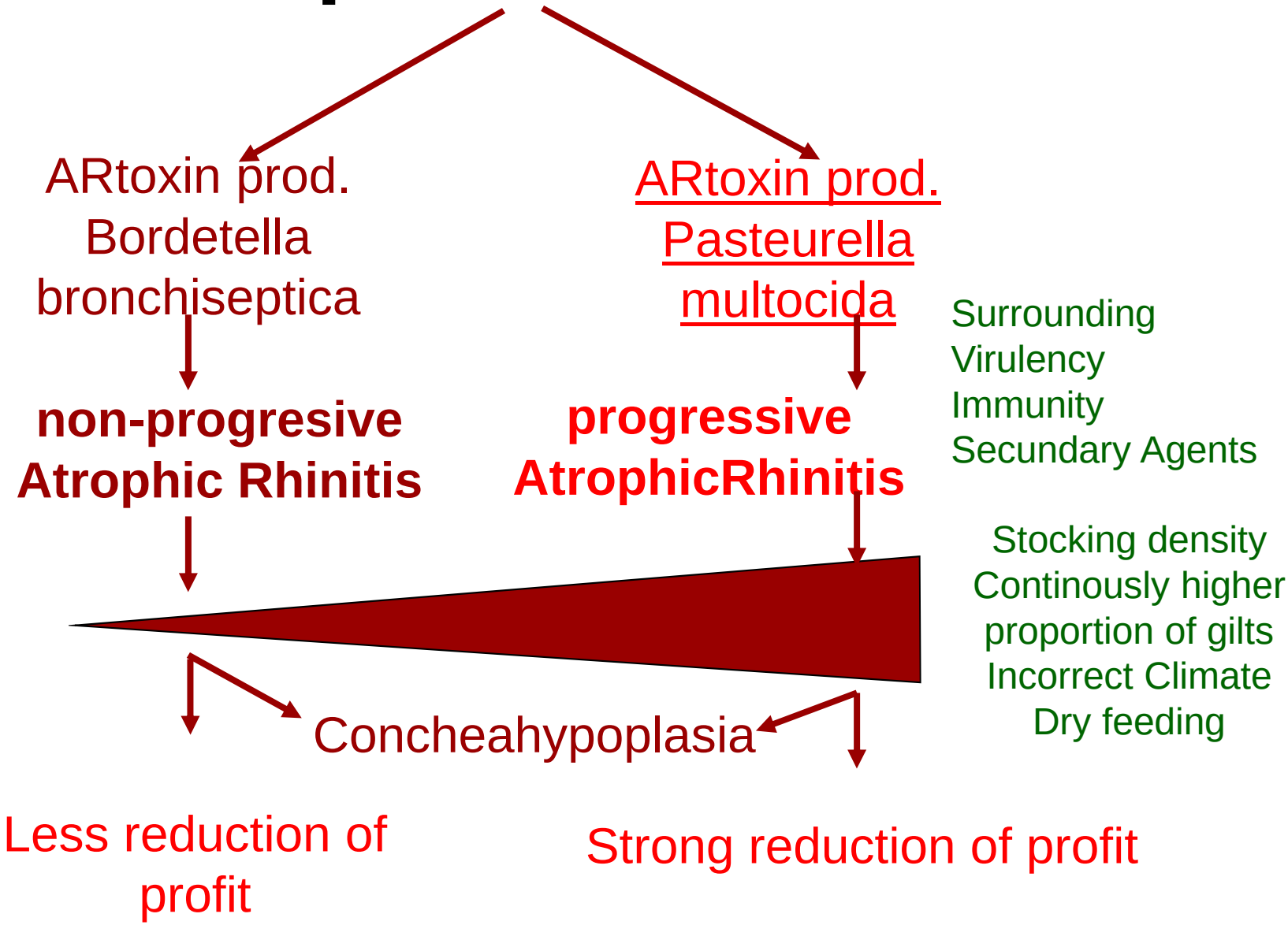
However, the disease may develop in or be transmitted by pigs from herds harbouring toxigenic *P multocida* even though only slight or subclinical disease is present. The advantage of an aetiological definition of progressive atrophic rhinitis therefore consists in the possibility of identifying those herds that are able to transmit or develop the severe clinical disease independent of actual clinical status.

The Veterinary Record, January 27, 1990

Progressive- and non-progressive Atrophic Rhinitis

- When in a pig herd the Toxigenic P.multocida can be found, the herd and the pigs will be called suffering Progressive Atrophic Rhinitis (also in combination with other agents eg B.bronch.)
- Pigs in a pig herd with turbinate lesion where no Toxigenic P.m. can be detected but eg B.bronch. will be called a Non Progressive Atrophic Rhinitis herd.

Atrophic Rhinitis=?



Progressive Atrophic Rhinitis Pathogenesis and DD

Destruction mucosa
Mucus accumulation

Infectious causes

non infectious causes

Toxinforming
Pasteurella

catarrhalic-purulent Rhinitis
Osteoblast reduction

dry-air
-toxic gasses
-dust

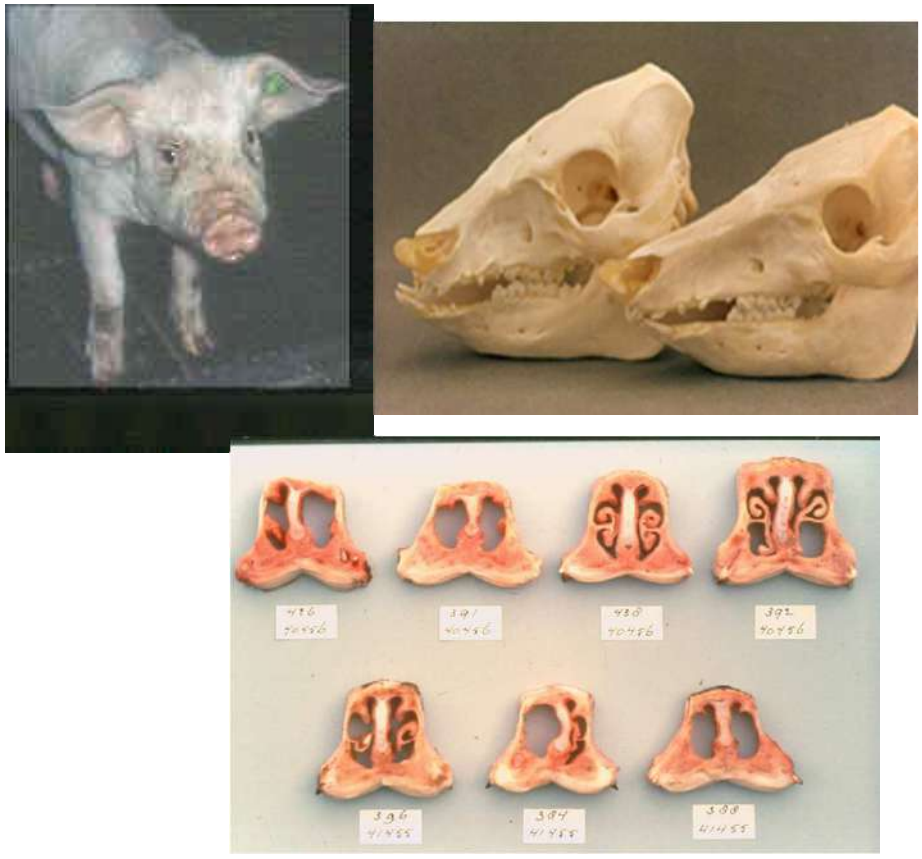
Viruses
-IBR(Cytomegalo)
-Influenza
-PRRS
-Aujeszky
-Circo2
Bacteria
-Mycoplasmata
-Streptococces
-Bordetella

Conchae hypoplasia

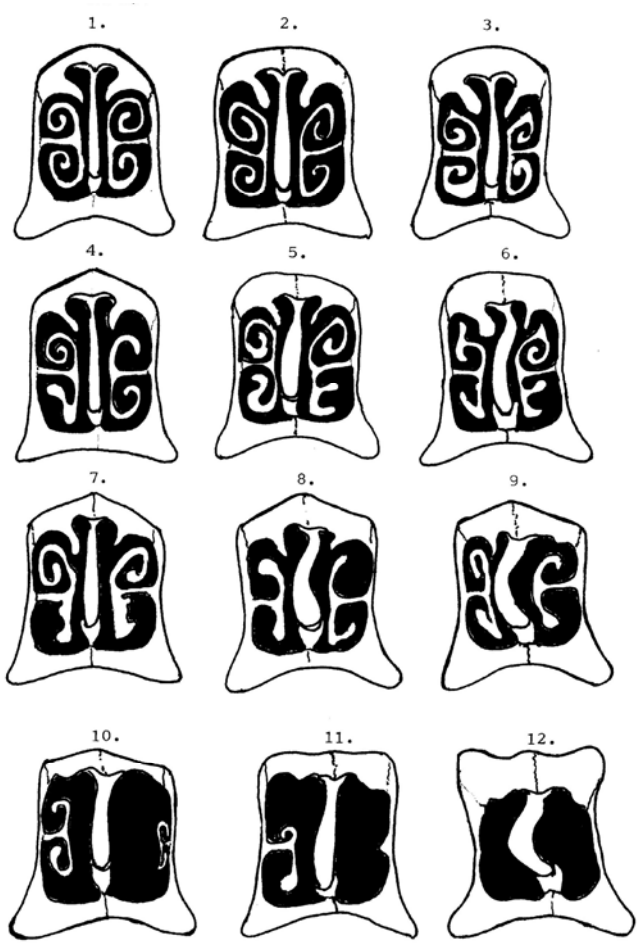
-colt air,draft
-chancegings in temperatur

Clinical and pathological Features indicative for (P)AR

- Sneezing, sharp till snorting
- Lacrimation, nose bleeding
- Brachygnatia superior
- Snout deformations, torsion, twisting, bending, wrinkling
- Turbinate atrophy, septum deviation (snout scoring)
- Growth retardation
- (Endoscopy)(Radiography/ tomography)

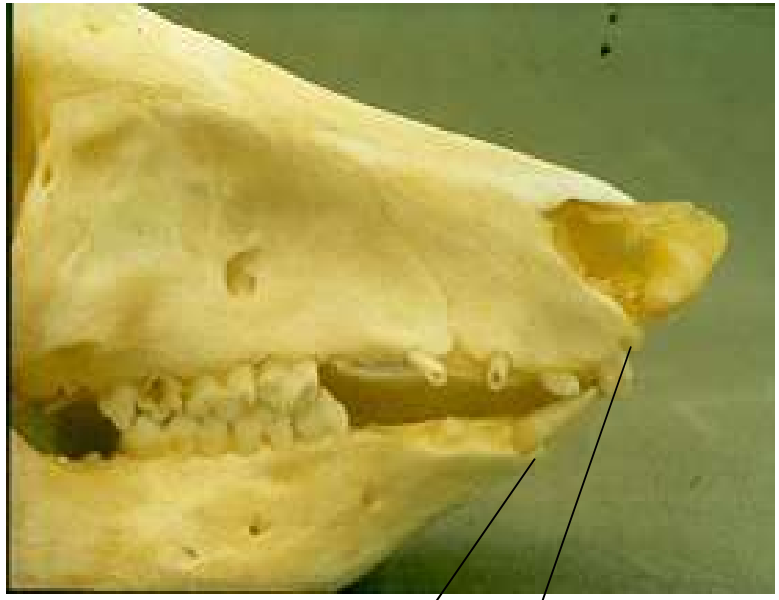


Diagnosing suspicious “AR” by: Snout scouring method



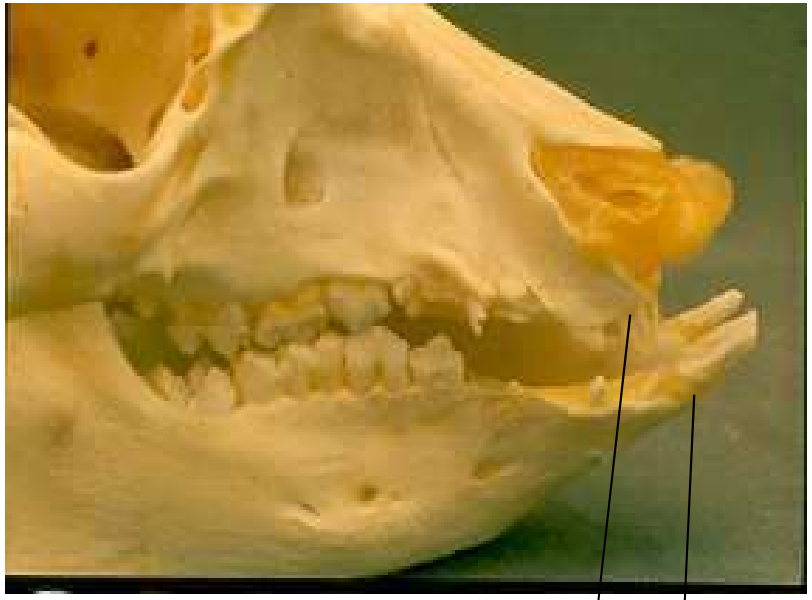
nr	Os nasale	Sept.	AVC	ADC	HVC	HDC
1	convex	0	0-0	0-0	0-0	0-0
2	convex	0	0-0	0-0	0-0	0-0
3	convex	+	0-0	0-0	3-1	1-0
4	Roof-shape	0	1-1	1-0	1-0	0-0
5	Asym.	+	1-1	1-2	2-1	1-0
6	Asym	++	2-1	0-2	1-1	3-1
7	Roof-shape	0	2-2	0-2	1-3	0-0
8	Roof-shape	++	3-3	1-2	2-0	1-1
9	Roof-shape	+++	2-3	2-2	1-1	1-2
10	Rfs/flat	+	3-4	3-3	1-*	1-0
11	flat	++	3-4	3-3	1-*	1-2
12	concave	+++	4-4	3-3	*-*	3-3

Brachygnatia superior; a simple clinical feature for scoring of suspicious ”AR”



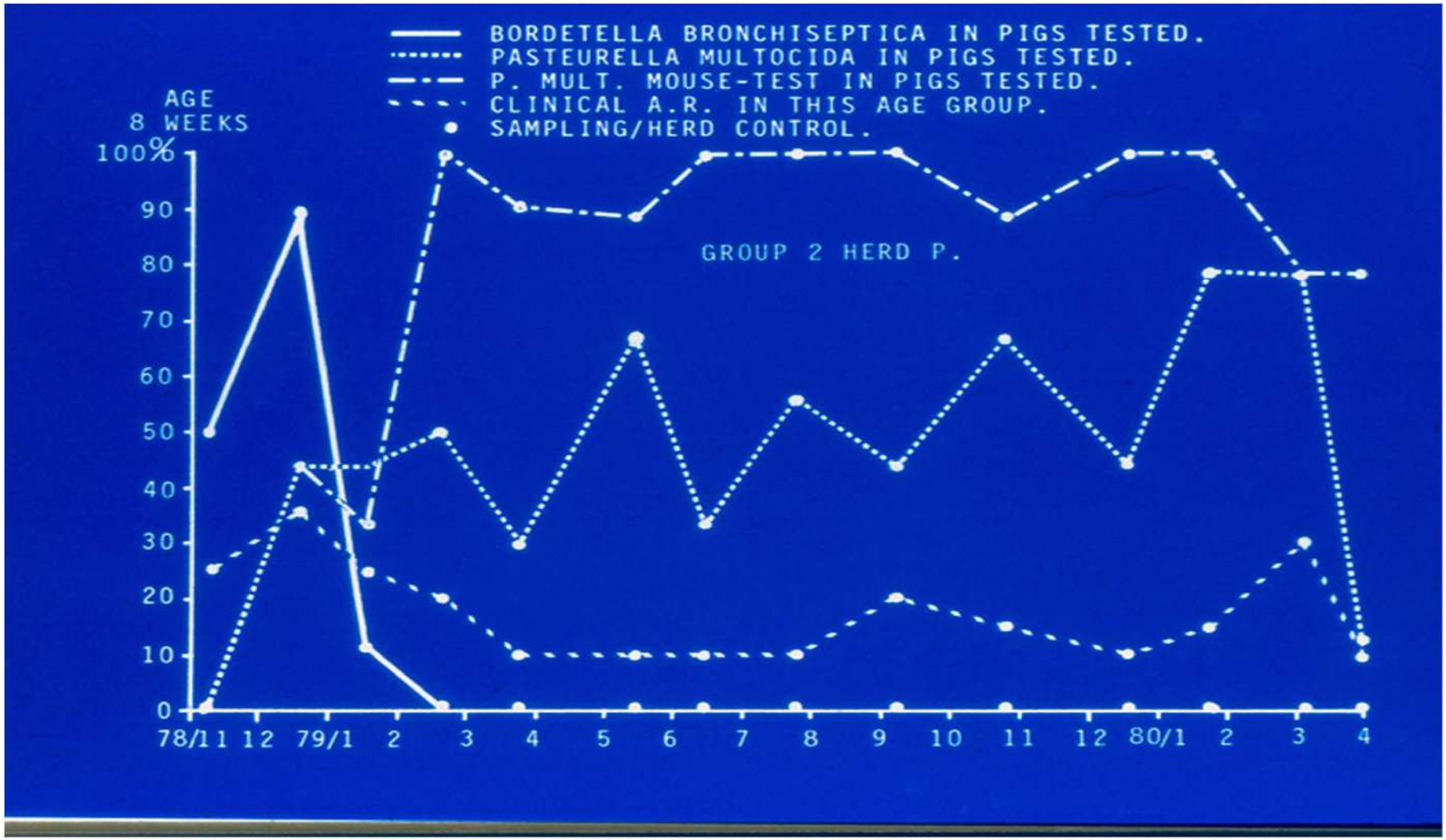
Inplant position
incisor teeth

Normal



Inplant position
Incisor teeth
Brachygnatia
superior, severe

Reduction of Bb in 8 weeks old pigs after a Bb sow vaccination but Pm and clinical AR persisted



Pathogenicity tests for Bb and Pm

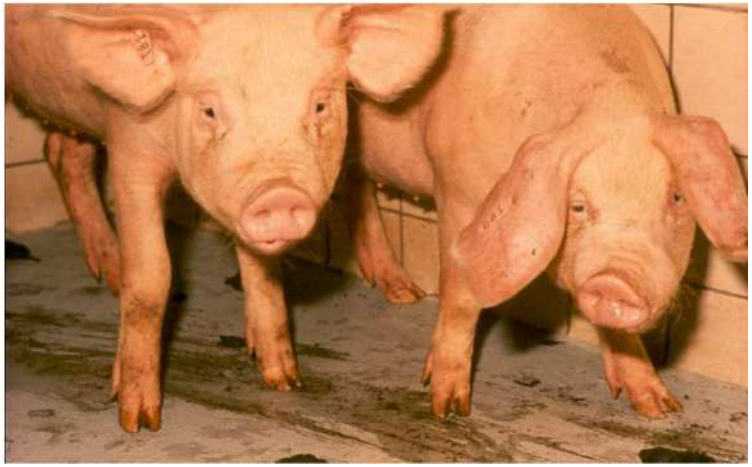
- The Dutch results obtained with fighting Bb alone to control “AR” were disappointing
- P.multocida increased every time in such AR herds when Bb was under control(!!)
- **Question:** are there Pm strains with a special AR pathogenicity?
- 1974 Dutch investigations started to test different Pm and Bb strains for AR pathogenicity in caesarian derived and colostrum deprived (SPF) piglets

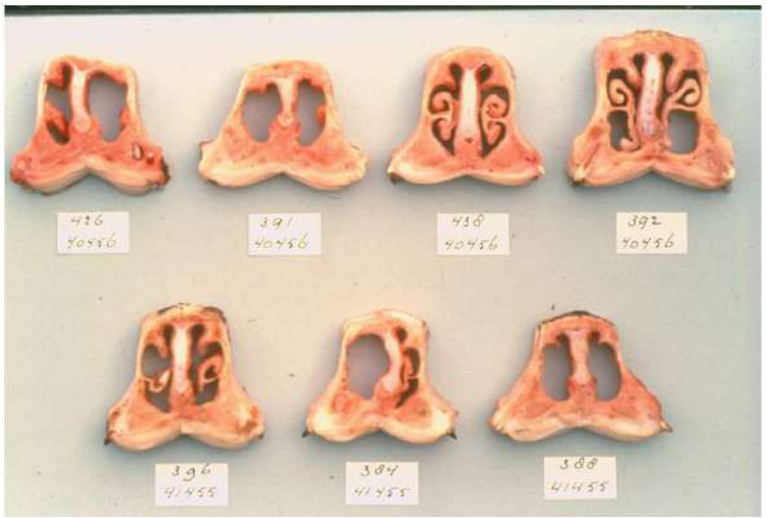
Bordetella bronchiseptica

- Since 1956 Switzer stated that Bordetella bronchiseptica plays an important part in the etiology of AR
- Since 1962 R.F. Ross eo ; B.bronch. induced Porcine Atrophic Rhinitis
- Based on severe turbinate/ conchea atrophy after nasal B. bronch. infection in gnotobiotic **colostrum deprived, 3 day old SPF piglets.**

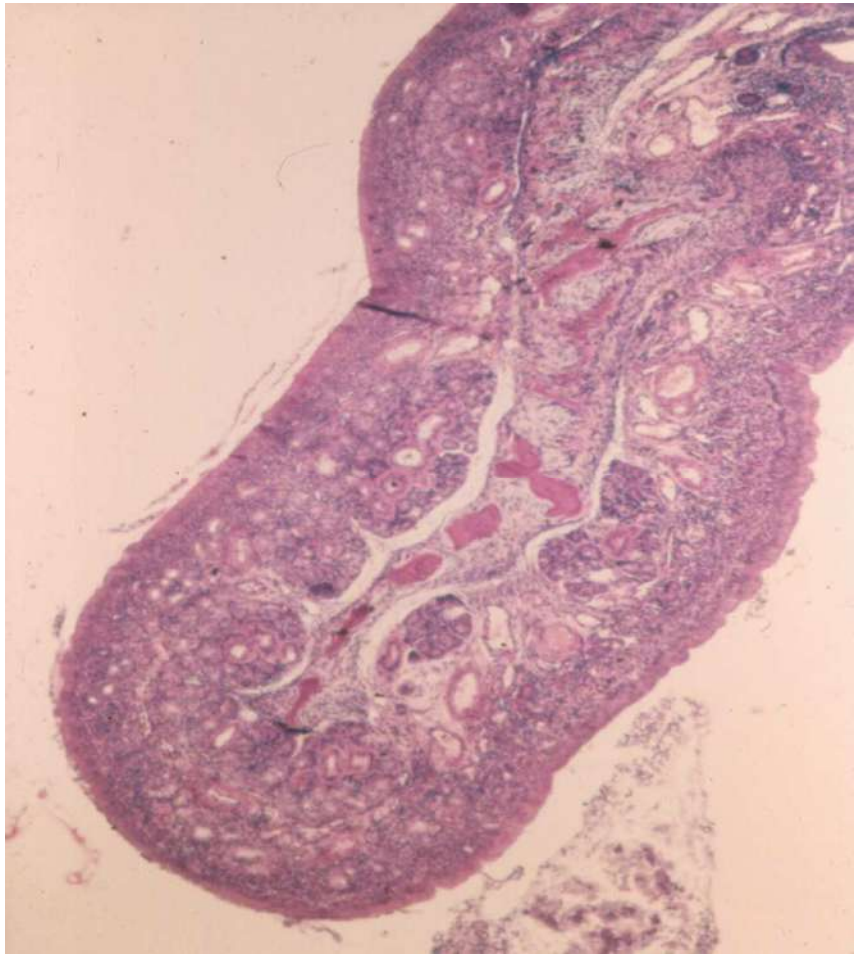
Some clinical and pathological features suspicious for (P)AR

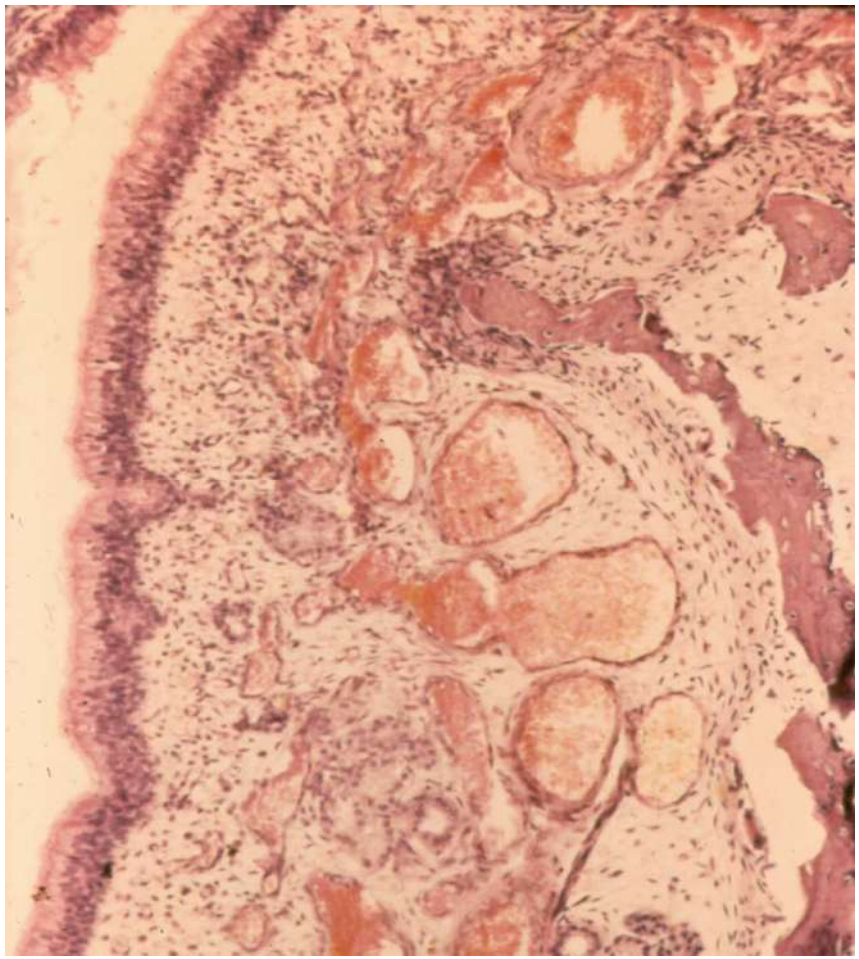
- First SPF pigs showing AR after intra nasal Pm infection with a Pm strain from severe AR diseased pigs, lacrimation, twisting snouts and brachygnatia superior
- Different macroscopical features e.g. ventral and dorsal turbinate atrophy, septum deviation, malformation of nasal bones.





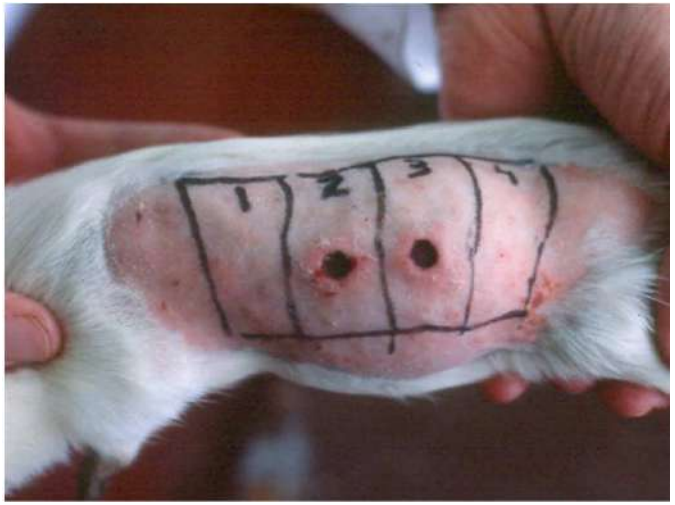
Differences in histopathology between an AR tox+ Bb and a AR tox+Pm strain in SPF pigs

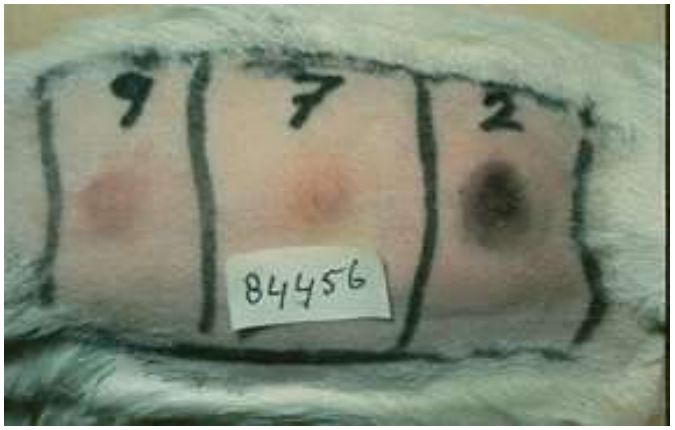




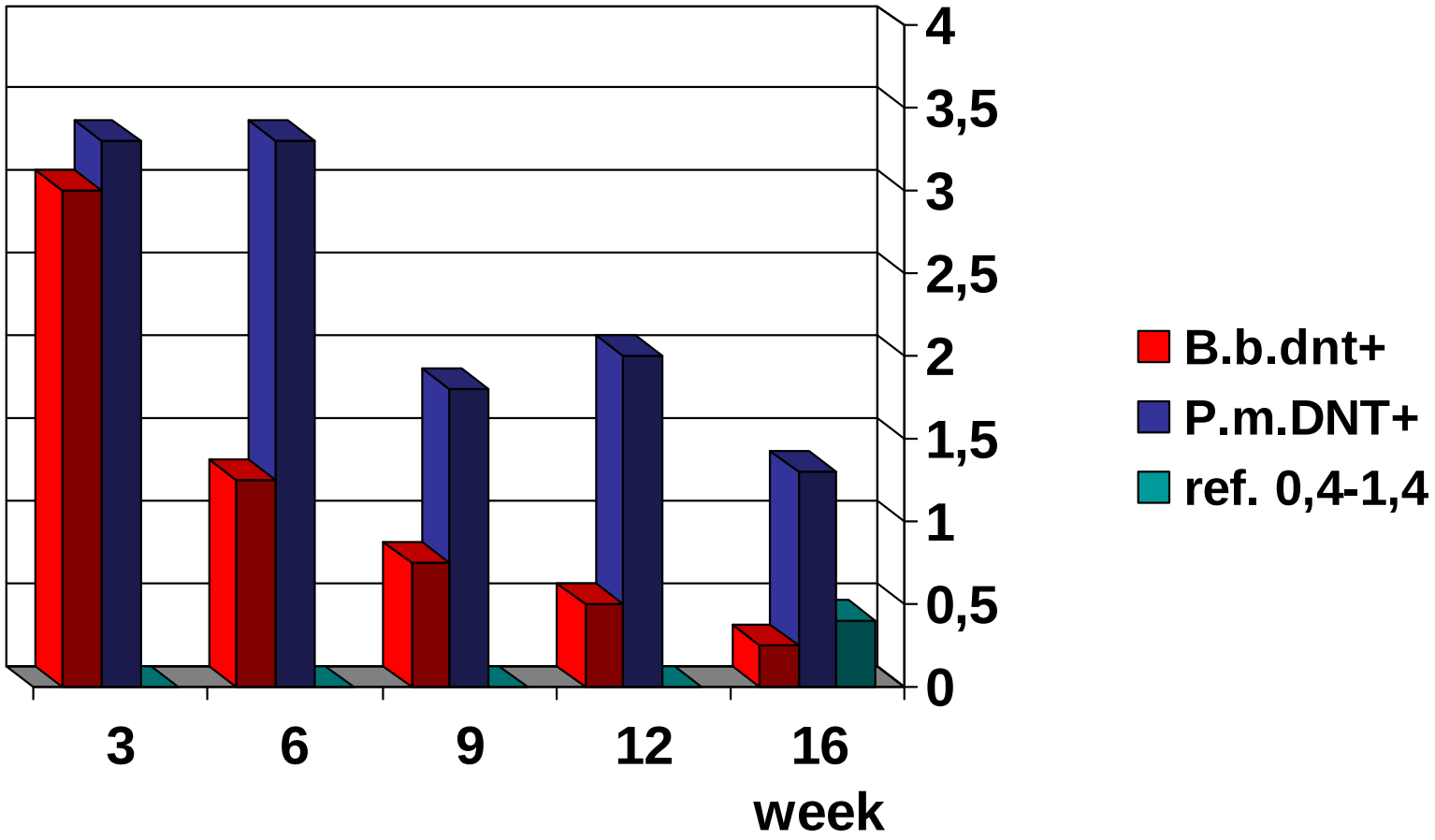
The Guinea Pig Skin test; a simple test to select AR toxigenic Bb and Pm strains

- B.bronch. 2 of 4 strains with pos. Dermo-necrotic Toxin Skin Reaction (no 2 and 3)(97% of strains)
- P. mult. guinea pig skin test with 1 pos. DNT reaction (no 2) (51% of strains)
- Toxins of Bb and Pm are different. No cross neutralization





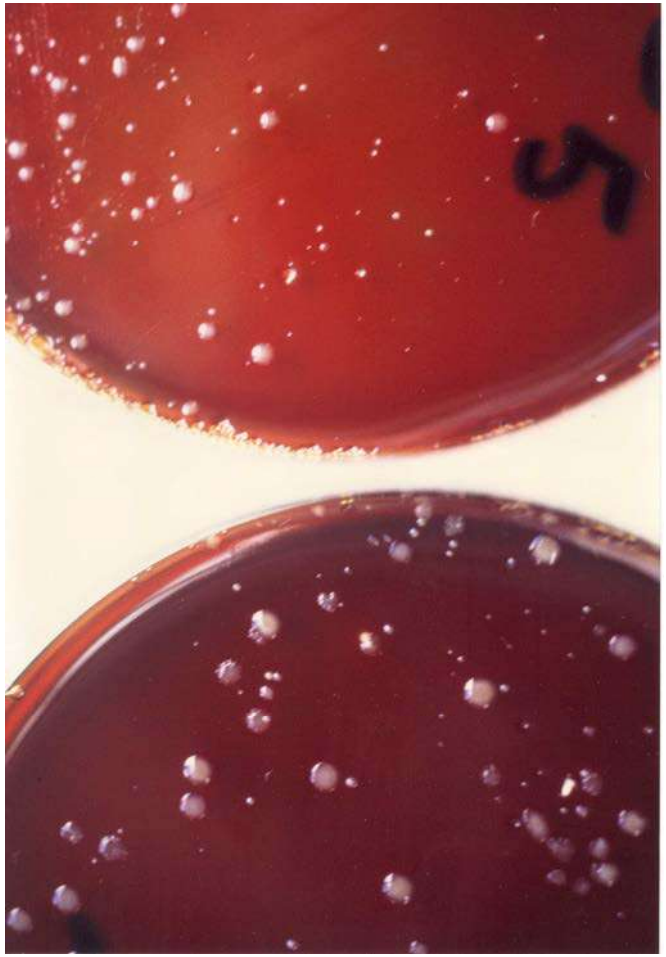
Relation Conchae Atrophy (grad0-4) and Age of Infection with Bb dnt+ or P.m DNT+



Diagnostic Improvements

Selective CVGA culture plate with mucoid Pm and whitish B.bronch.

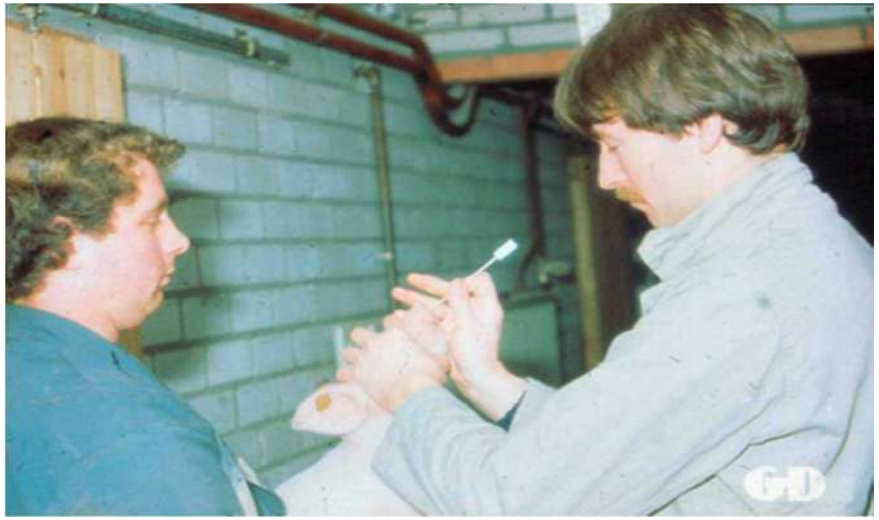
- Culture plate with a mixture of different antibiotics, suppresses the mixed flora and favours Pm and Bb after **48-72 h**.
- Clindamycine 0,75mg/l
- Vancomycine 4mg/l
- Gentamycine 0,75mg/l
- Amphotericine 5mg/l
- **Replacement for Pm pre-selection in mice**

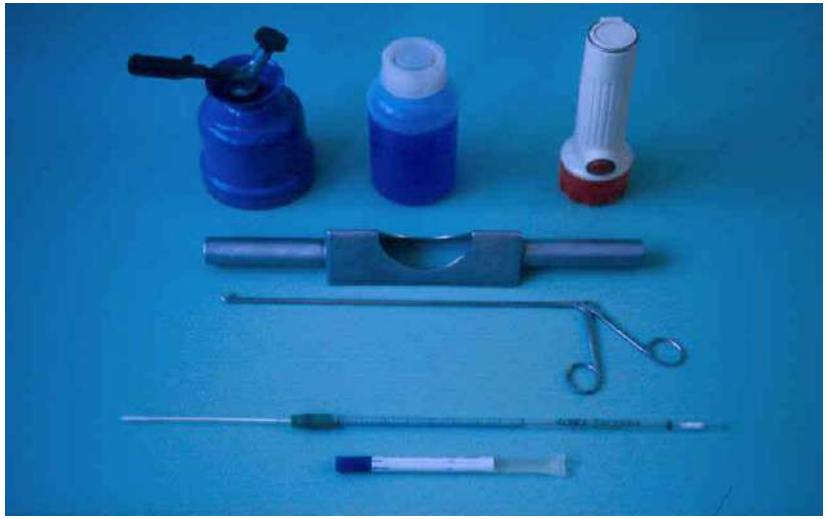


Comparison of Elisa and PCR-test in 374 pigs of PAR herds

- Total examined pigs 374
- Pos. by subculture+ Elisa 32
- Pos. by Plate Washing+Elsa 27
- Total pos. with Elisa 44
- Total pos. with PCR 96
- Total AR-Tox.Pm pos 98

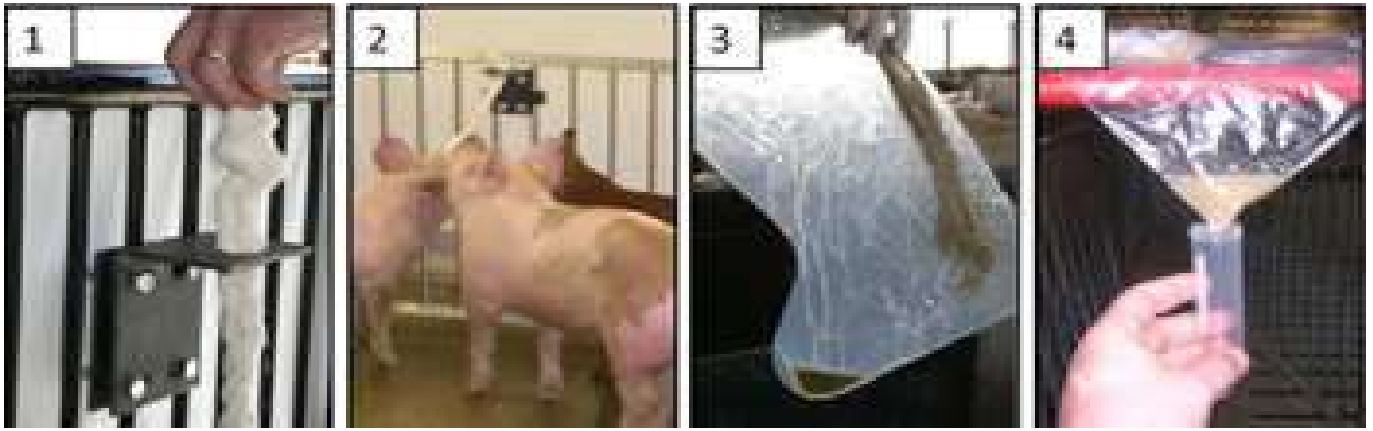
Sampling of Pigs: collection of nasal and tonsil- samples





Tonsil scratching: boar

Collection of oral fluid: New sampling method to detect DNT pos P.mult and Bb by PCR?



Anti – AR toxin of P.mult. in 8 week old pigs born from AR vaccinated sows

Number of herds	Examined serum samples	Antibody- titer profile (SN in Vero cell-line)			Clinical AR
		< 2 %	2-32 %	≥64 %	BS %
7	98	5	23	72	0
3	36	11	19	70	<1
6	90	27	24	49	<5
7	84	55	35	10	≥5

Reduction of profit by PAR

Pedersen K.B. and Barfod K.
Nord. Vet. Med. 1982-34-293-302.

Mean daily weight gain (g) in relation to the degree of turbinate atrophy.

(Med)	Turbinate Atrophy	challenged with B.bronch. and P. mult. tox. -	B.bronch. and P. mult. tox. +	Index
0	0	633.7	633.5 a	100
1	?	623.8	636.9 a	101
2	+	662.7	617.6 a	98
3	++	647.5	568.4 b	90
4	+++	--	540.0 c	85

no significant difference (analysis of variance)

means with diff. superscripts differ significantly P 0.05, t - test

Treatment and vaccination
Therapy for Piglet producers

- Sow herd treatment; for14d (by water/feed)
- Sows 1W before 2W after farrowing (w/f)
- Oral;500-1000 ppm Trim-sulfa or OTC 400 ppm
- All piglets per injection: OTC, Pen/strp,on D.3, 6, 9,12 (Bb) +15,18,21,24(Tox Pm) or 1xpW with LA,s; Doxy,Draxxin,Naxel till weaning
- All piglets treated by feed/water till 10-12W (25-30kg)
- Growers and Fatteners: Pulsmedication by Feed/water
- Herdvaccination; after confirming Tox.Pm.
- Improve colostrum uptake to reduce Bb and Tox.P.m.

Eradication of Tox.Pm by vaccination ??

- Medication and vaccination are helpful to reduce the damage of so called “AR”
- Also a reduction of the Bb and Tox. Pm are obtained by vaccination.
- Different vaccines showed a different protection
- So far herd stamping out is the method to get free from Tox. Pm.
- **Question**: Is an eradication of Tox.Pm be achievable by a vaccination program?

Bb MAP Titers of 4 AR Vaccines; % sows which sero-converted and gave a colostrum-titre

Vakz	MAP Bb (log2)						Sero-conversion		
	T0	sd	T1	sd	T2	sd	%	Colostr.	sd
a	3,5	1.5	8,4	1.4	8,8	1.8	100%	10.9	1.4
b	3,1	1.4	7	1.7	8,1	1.9	100%	10.8	1.7
c	1,8	0.8	6,3	0.9	7,1	1.3	100%	8,9	2.5
r	2,1	0.3	11	1.1	10,5**	1.6	100%	11,8***	0.7
con	2,6	2.6	2,4	1	4,3	1.5	78%	7,6	3.9
**p<0.05 with respect to a, b, c, con ***p<0.05 with respect to c and con									

Av. DNT-SN Pm Titers; % sows which Sero-converted; Sero-conversion Index; colostrum Titers of 4 AR vaccines

(Proc. IPVS Durban 2008 po3.097p.316)

vacc	SN-DNT Pm						Seroconversion			
	T0	sd	T1	sd	T2	sd	%	SI	sd	Colostr
a	0	--	0	--	0	--	0%	0	--	0
b	0	--	0	--	0,1	0,2	0%	0	--	0,7
c	0	--	0,3	0,7	0,6	0,9	15,8%	0,2	0,54	2,0
r	0	--	5,8**	1,4	9,2**	2,3	100%	8,2	2,28	10,3
con	0	--	0	--	0	--	0%	0	--	0
**p<0.001 with respect to a,b,c and con.										

Eradication of ARtox.Pm in PAR sow herds by help of ART vaccination and management

- Buy only gilts (and boars for AI) from AR Tox Pm free breeding herds and bring them in the in quarantine.
- Bring these gilts (boars) in the vaccinated sow herd, after repeatedly ART vaccination (3 or 4x).
- Continue this procedure for at least 4-5 years.(**Push out system**)
- Improve: AI-AO, -climate, -reducing other diseases, -colostrum uptake.
- Minimize risks that the AR Tox.Pm can be introduced by other potential carriers (including Human)
- Anti bodies against the toxic components of Pm and also of Bb were shown to reduce colonization
- This anti colonization factor looked to be stronger in vaccinated animals with high titers
  eg anti Pm tox ≥1:512; eg anti Bb tox ≥1: 64 (?)

Acceleration to obtain vaccinating sow herds free of Tox Pm

Results of screening sows on a ART vaccinating breeding farm with a PAR history by using the PCR-test and the test and removal programme.

Farm	Test run	Number	ART-Pm PCR	
4	1	sows 124	19 (15%)	1-7-'98
	2	sows 102	4 (4%)	
	3	sows 111	6 (5%)	
	4	sows 116	4 (3%)	
	5	sows 126	2 (2%)	5-11-98
	6	sows 91	0	10-12-98
	7	sows 98	0	7-01-99
	8	sows 103	0	1-6-'99,stop vac.
	9	sows 102	0	5-1-2000
	10	sows 19	0	13-3-2000

Results of a test and removal program in a ART vaccinating breeding farm with ± 1000 sow, farrow to finish, by PCR of nose + tonsil samples of sows to eradicate Tox Pm

- Testcycle period no. of animals carriersTox.Pm
- 1st inv. Dec.03/Febr04 Sows* 928: Carriers(64) = **6,9 %**
- 2 nd inv.Febr.04/May04 Sows* 999: Carriers(30) = **3,0 %**
- 3 rd inv. Juli.04 Sows*1065: Carriers(16) = **1,5 %**
- 4 th inv. Aug.04 Sows*1100: Carriers(4) = **0,36%**
- 5 th inv.Sept.04 Sows*1022: Carriers (1) = **0,001%**
- 6 th inv. Nov.04 Sows* 898 : Carriers (0) = **0,%**
- 7 th inv. Dec 04 Sows*1080: Carriers (2) = **0,002%**
- 8 th inv. Jan 05 Sows* 989: Carriers(1?)= **0,0%**
- 9 th inv. Feb 05 Sows* 1010: Carriers (0) = **0,0%**
- 10th inv.May 05 Sows* 1030: Carriers (0) = **0,0%**

- * **boars included**

ARtox. P.mult. is isolated from different animal species and from human

- Pigs
- Rabbits/hares
- Turkey / poultry / birds
- Sheep / goat/ cattle
- Dogs
- Cats
- Rats / mice
- Human
- **ARtox.Pm has to be considered as a zoonotic disease agent**

Table 1. Source of isolation and toxigenic properties of 44 isolates of P. multocida ssp. multocida from humans

SOURCE	TOXIN PRODUCTION +	-
SPUTUM	6	8
SINUS	2	0
PLEURA	3	2
BITE	0	3
BLOOD	2	3
APPENDIX	0	2
OTHER	0	7
UNKNOWN	2	4
TOTAL	15	29

= 34 %

(Hospitalized

ATROPHIC RHINITIS IN PIGS CAUSED BY A HUMAN ISOLATE OF TOXIGENIC PASTEURELLA MULTOCIDA

J.P. NIELSEN[1] & W. FREDERIKSEN[2]

1) National Veterinary Laboratory, Bülowsvej 27, P.O.Box 373, DK-1503, Copenhagen V, Denmark.

2) The State Seruminstitute Copenhagen, Amager Boulevard 80, DK-2300 Copenhagen S, Denmark

Dutch Pm+ free Certified Breeding farms

year	**1982 1987**	**1988 1994**	**1990 1991**	**1992 1993**	**1994 1998**	**1999 2000**	**2001 2003**	**2004**	**2005 2006**	**2007 2010**	
Gw Pm+ inf	**213 66 31%**	**1398 13**	**1375 11**	**1115 8**	**1098 3**	**750 1**	**600 -**	**425 -**	**350 -**	220 -	
Pm+ Free cert	**72**	**440**	**493**	**596**	**876**	**750**	**600**	**425**	**350**	220	
Pm+ inf		**9**	**4**	**5**	**3**	**1**	**0**	**2**	**0**	0	
						Human introduction		Human introduction			

Summery concerning ARtox Bb and ARtox Pm

- The quickest method to clean a farm from ARtox.Pm is de- and repopulation. Restock with certified free pigs.
- Eradication of ARtox Pm by vaccination:
  Vaccinate infected sow herds with a high potent ART vaccine, until the last carrier is replaced (in 4-5years).
  This procedure can be speeded up with a Test and Removal program.
  Introduce only gilts/boars from a free source after proper vaccination.
- Use consequent Ai/Ao
- Test the farm staff and laborers for AR tox Pm.
- Vaccination against AR tox.Pm can be finished when the herd is repeatedly tested free of AR tox.Pm.
- By high biosecurity standards, herds can kept free of AR tox.Pm
- Use semen or boars from certified AR tox.Pm free breeders or AI centers.

Future perspectives concerning ARtox Bb and ARtox Pm

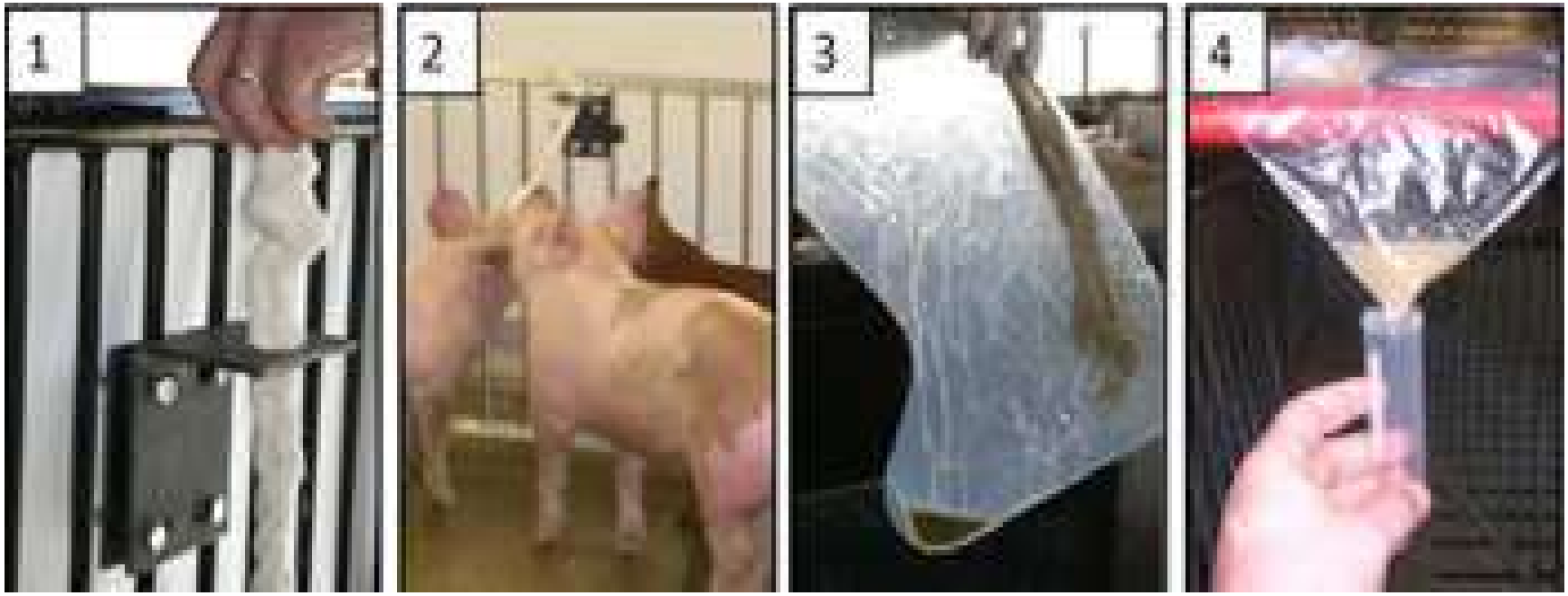
- The influence of a Bb infection can be minimized by vaccinating replacement gilts and boars.
  The sow herd can be vaccinated when the Bb antibody profile is low
  This influences the colostrum quality to protect the young piglet.
- Anti bodies against toxin components of Pm and Bb have to be investigated to find the mechanism blocking the colonization (and to reduce pneumonia).
- Postpartum hypogalactiae, mastitis and large litters are risk factors for insufficient colostrum uptake.(10-15% of body weight with in first 16-24 hours)
- Combination of Bb with other vaccines e.g. Erysipelotrix, Parvo, M.hyo or Circo2 has to be taken into consideration.
- New herd sampling methods have to be tested for the detection of ARtox Pm and Bb by PCR on herd level (Oral fluid).
- Automatic application of AR vaccines with needle less or intra dermal techniques have to be investigated

Future perspectives to reduce losses by ARtox Bb and ARtox Pm

non progressive Atrophic Rhinitis ? (isolate Bb.)

progressive Atrophic Rhinitis ?(isolate Tox.Pm)

Collection of oral fluid:
New sampling method to detect DNT pos P.mult and Bb by PCR?



Is it profitabel to eradicate PAR(1)

- herd size(500 sows;14000 Farrow to Finnish pigs); **1st.Year**; **2nd year**
- Extra cost:herd;
- PAR vaccination: per sows/boars(60%), 3x=€7.50/s; 2x=€5,/s
  per gilts (40%): 3x=€7.50/g; 3x=€7.50
  = €3750 ;= € 3000

- medication: suckling piglets=
  1st 4 month= `4(LA) or 8(2xp/w)inj.=
  ±€1,-+ Labor €1,- = €2,-/p/px12,5 = €25,-/sowx500 = €12500
  weaners= 1st 6 month=6wks feed/water med=
  7200pigs =€2,50+labor = € 3000
  growers and fatteners= 1st 8mnth
  (pulsdos.3x2wks+interval 2weeks)+labor= € 1250
  sows = 1st 4 month (med.1w before+1w after farr,)+labor = € 6300
  total = €26800
- Extra vaccination and medication cost for PAR
  1 st and 2nd year per sow = € 53,60 ; € 6,-

Is it profitable to eradicate PAR (2)

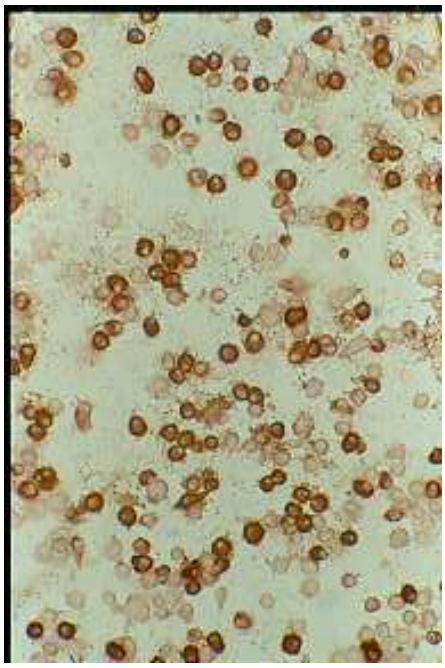
- **herd size 500 sows; 14000 (Farrow to Finnish) pigs/ year** ;
- Growth retardation: 20 – 100 gr/d = € 0,56 - € 2,80 p/fattener
- Increased feed conversion:0.05 – 0,3 kgF/kgG = € 0,75 - € 4,50 p/fattener
- Increased mortality; 0,5%- 2,5% = € 0,34 - € 1,70 p/fattener
- Reduction of **sl**aughter carcas quality degradation;= ±€2,50 p/sl.pig
- Reduction of market price: weaners; €1; €5 (susp-); €25 (clin. signs)
  gilts; select. susp gilts, PARvacc gilts= live time 8x€2,50 = €20
  5000 giltsx €20 = €100.000 p/y + safety belt for recievers of the gilts.= Producer herds .boars; use= limmited !!!!
-
- **Herd test and removal; av 8 runs = ± 8x €15/sow= tot. €120/sow= €60.000**
- **Herd depop-repop between €400 (slow)or €700 p/sow (60%direct)= €200.000-310.000**
- Improving; Ai-Ao, climate controle, biosecurity: PM =…….??.
- **Protection of laborers for infection with DNT+ Pm (zoonosis !) =……??.**

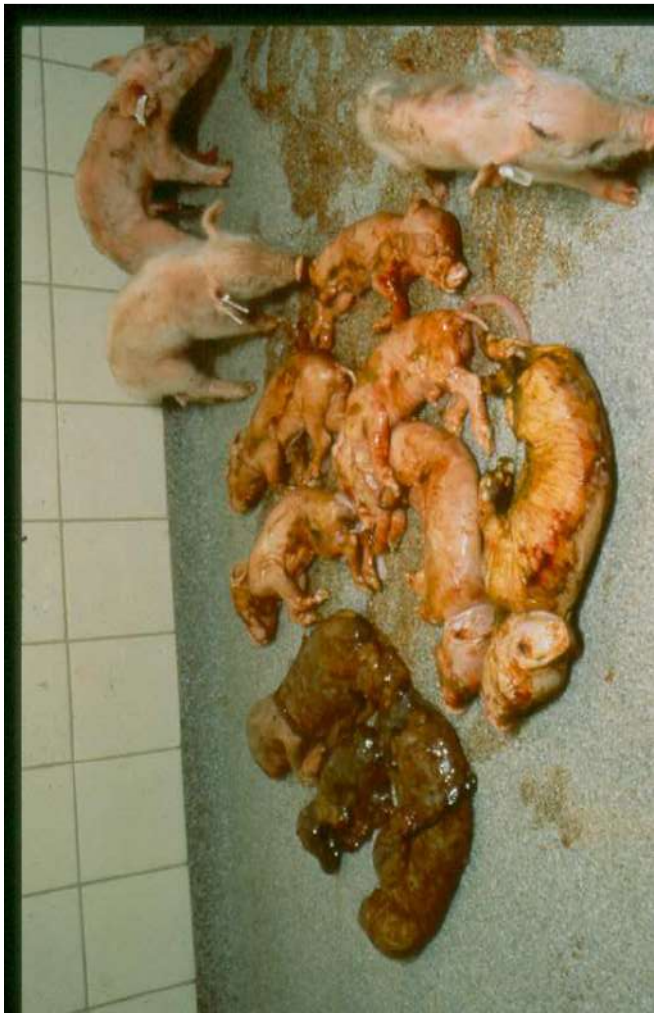
- **DNT Pm free Certification program Animal Health Service**;
  contribution p/y= €380, samples 3/p/y=96x €9 = **€1244** = **per sow € 2,50**

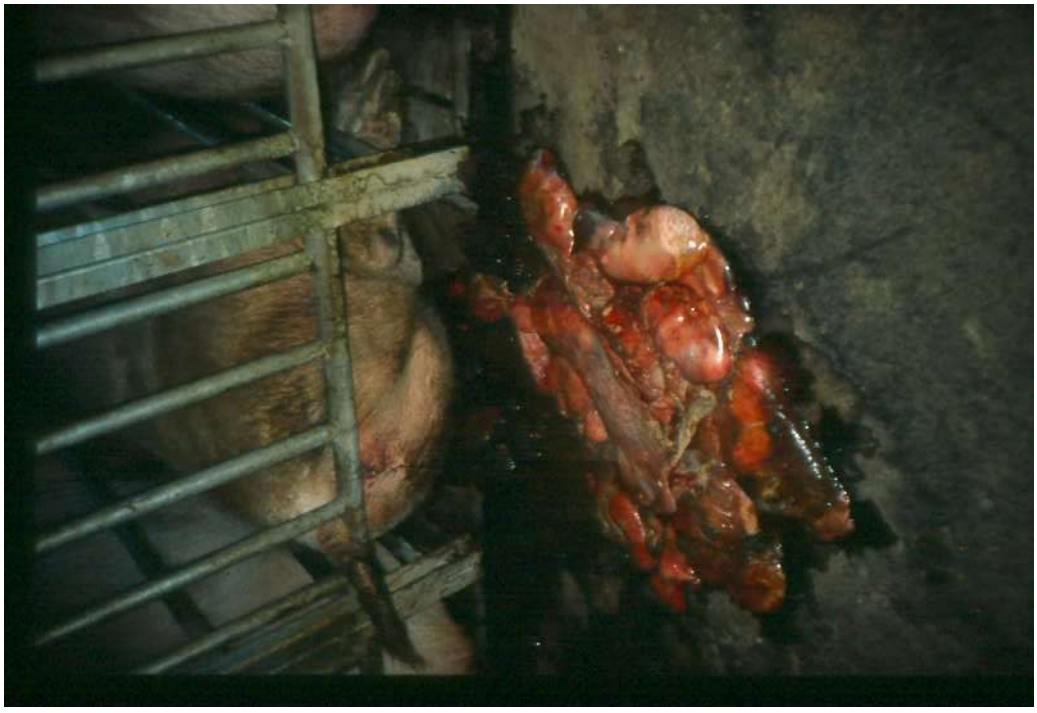
PRRS

1. Reproduktion:
   late abortion, weak piglets

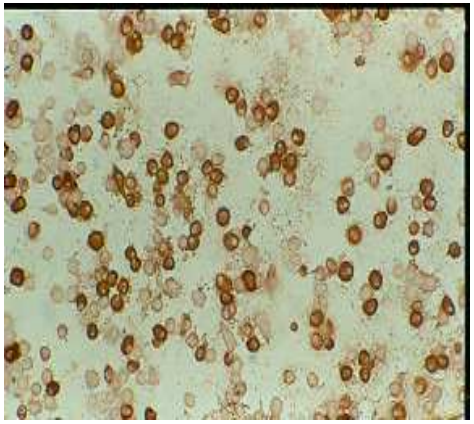
2. Respiration :
   pneumonia

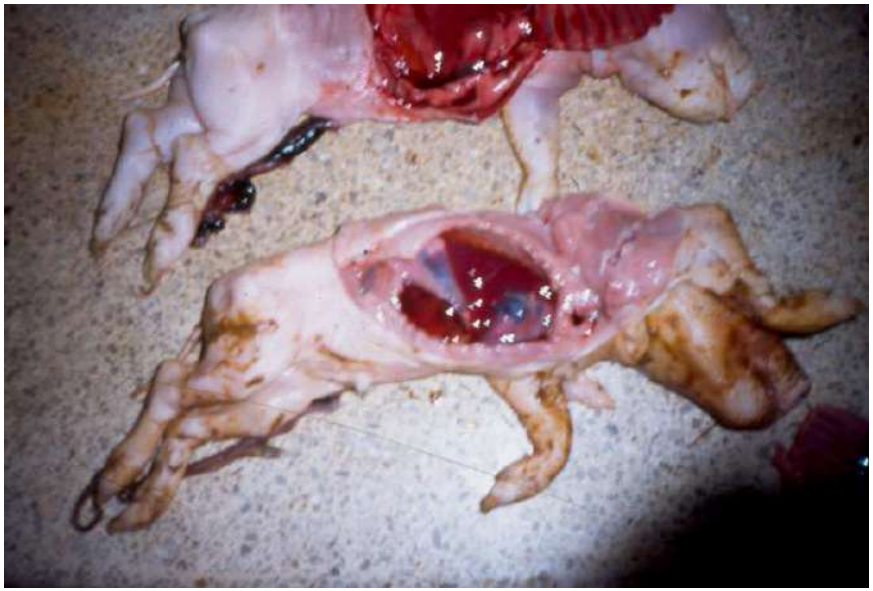


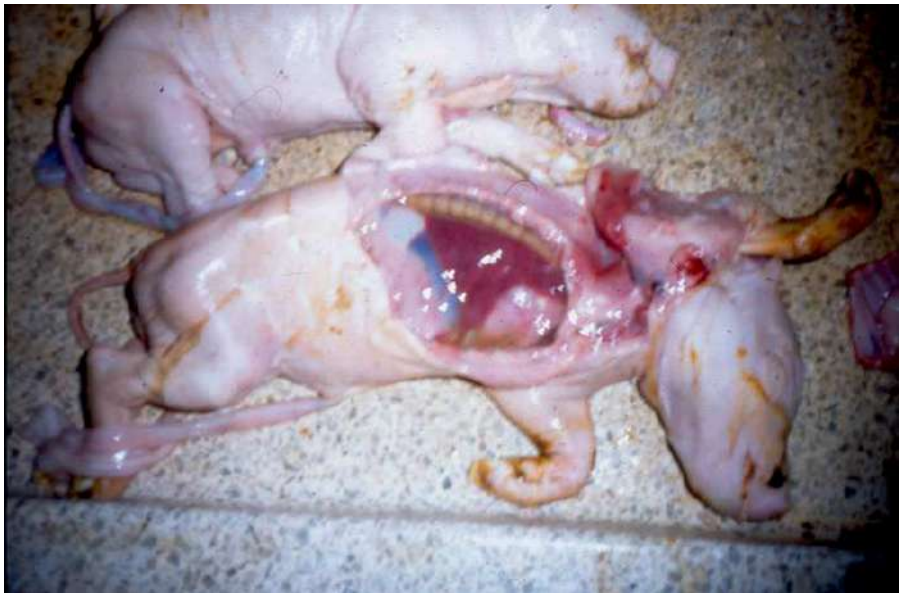




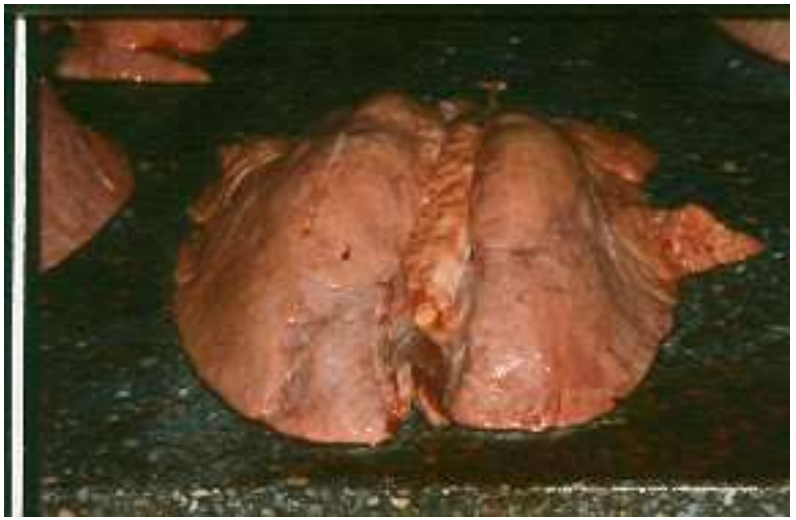
PRRS symptoms

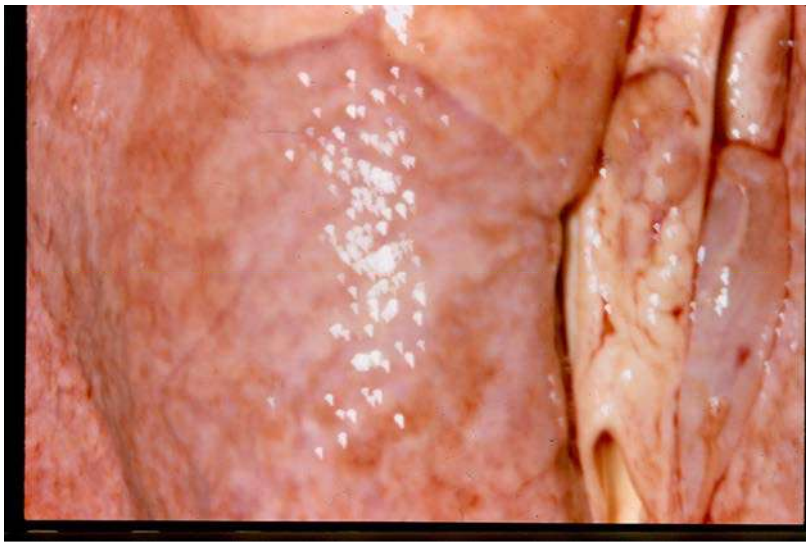






PRRS respiratory symptoms



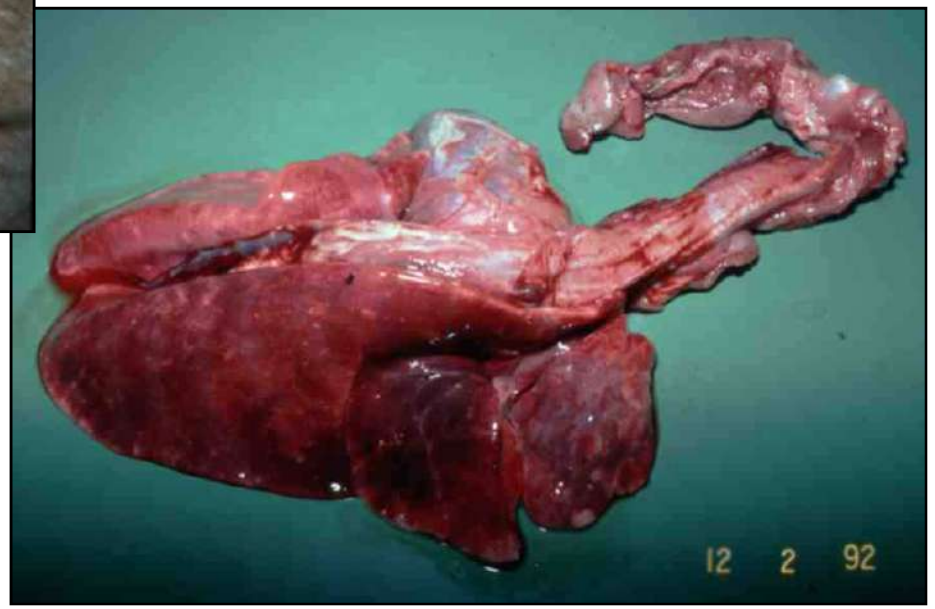


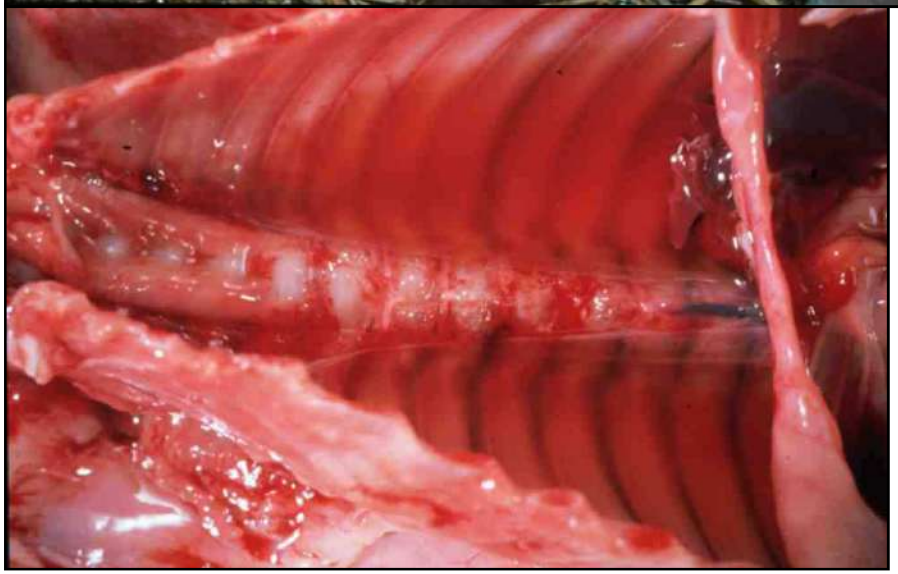
PRRSV - differences in virulence

- barely detectable respiratory disease of short duration
- persistant respiratory disease with thumping, lasting more than two weeks
- some isolates produce encephalitis, myocarditis and splenomegaly

PRRS (mistery swine disease; blue ear disease;late abortion)

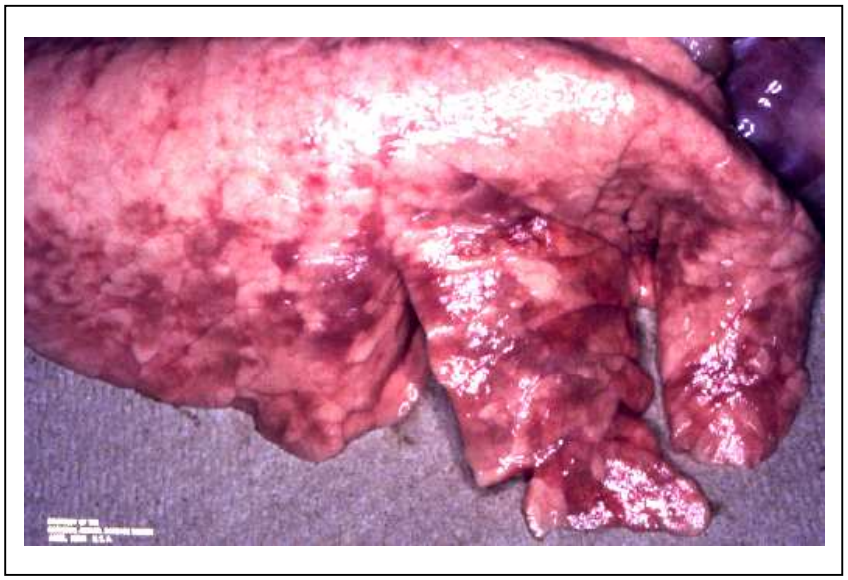
interstitial pneumonia, transparant surface

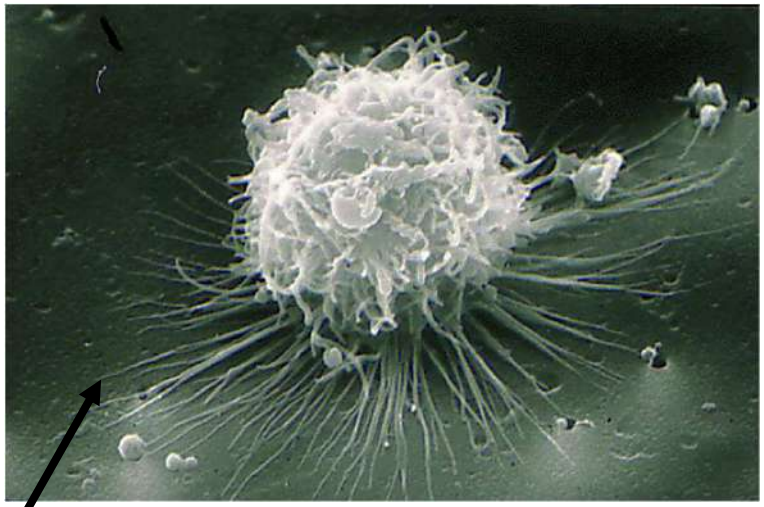


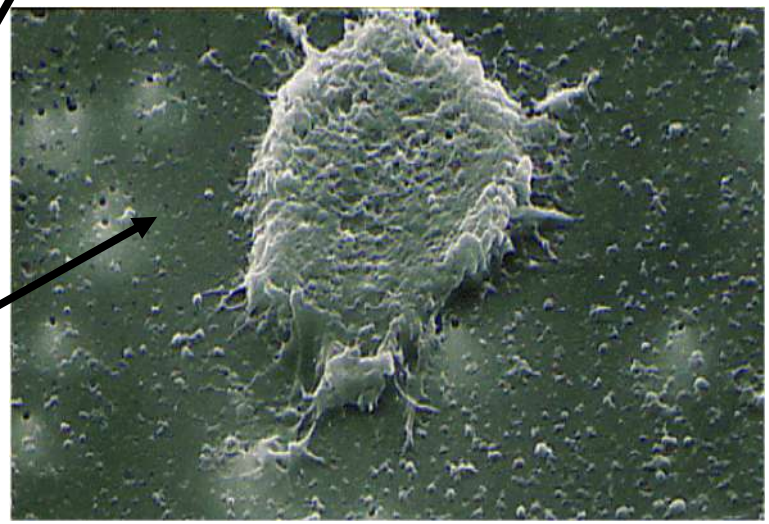


sereose pleuritis

Pathogenesis: Lungs







- Infektion:
  oro-nasal (mating, AI)
- Viraemia (12 h p.inf.)
- Replication in
  Alveolairemacrophages
- Clinical relapse (age-and isolate dependend)

PRRS- (late)abortion

- > 80. Days: Late abortion, early- stillborne
- weak borne piglets, pigglet mortality % ↑
- 50. - 70. Day:Mumification a./o.+ death and live piglets
- repeat breeders ↑ and AI%↓

PRRS-Virus (1)

- RNA-Virus
- Ø: 50 - 65 nm
- Temp. of surviving
- : -70 °C till -20 °C, years

  4 °C: 1 weak- (till 30 d)

  20 °C: 1 - 6 days

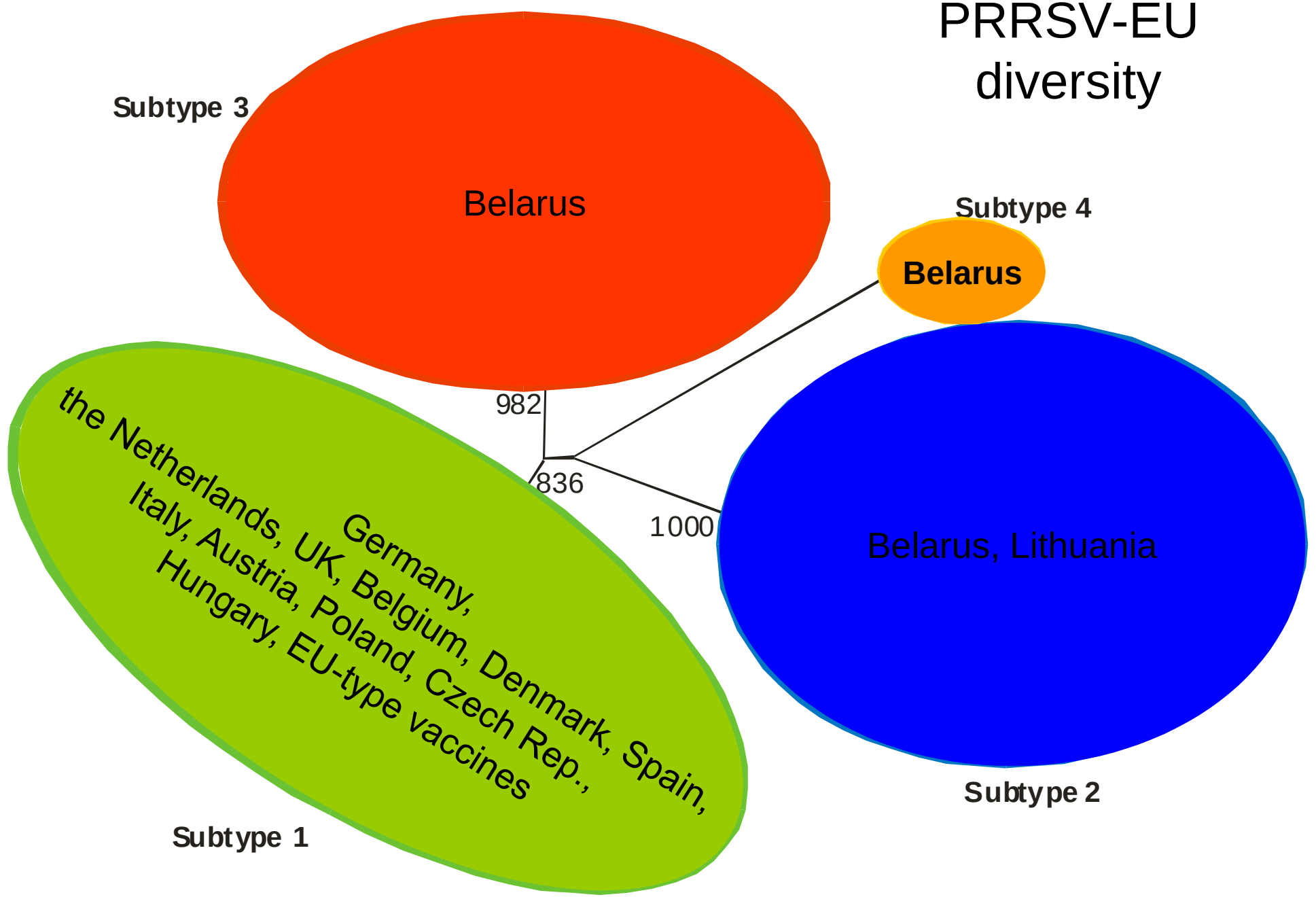
  37 °C: 3 - 24 hours

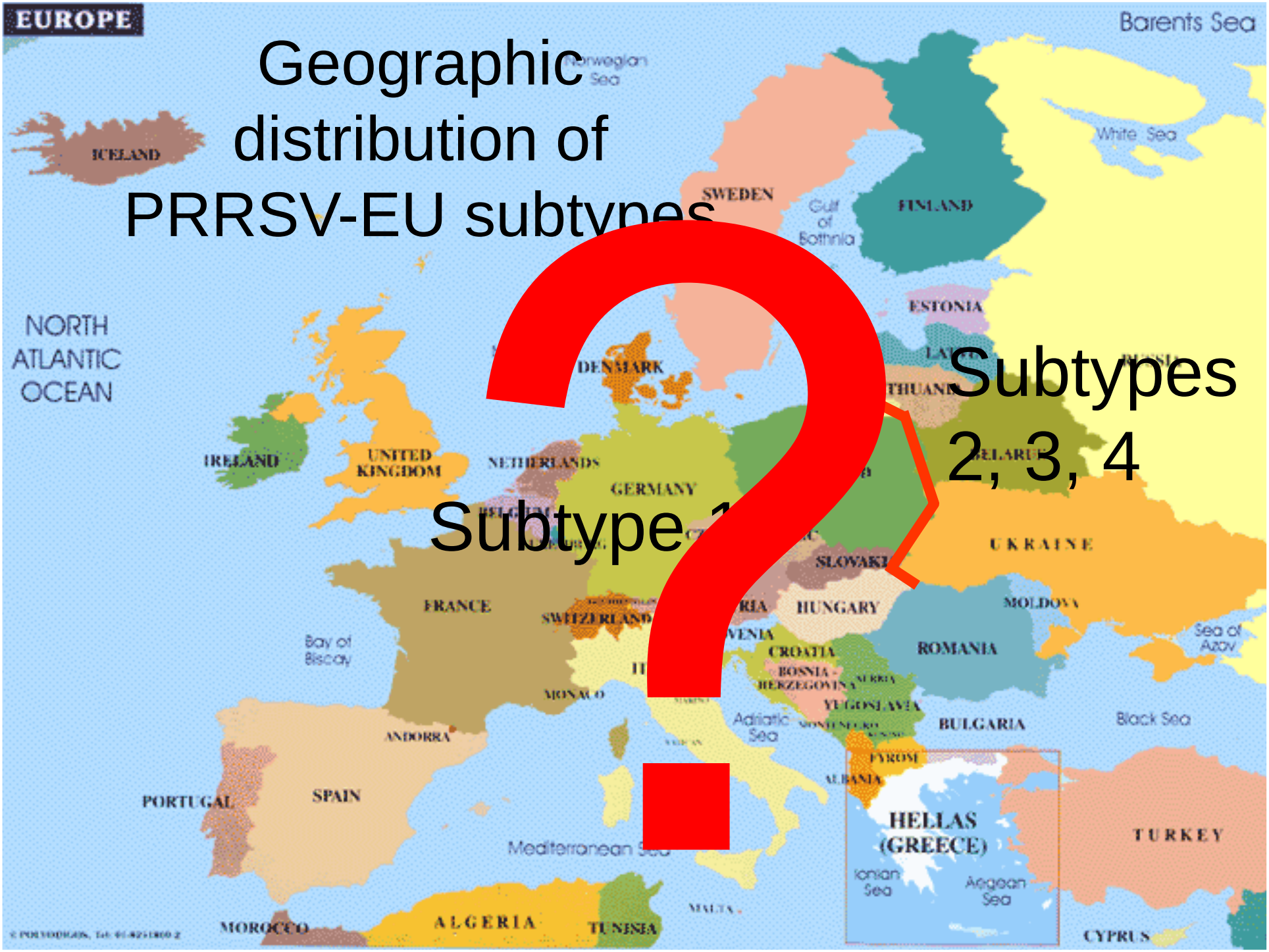
  56 °C: 6 - 20 min.
- pH: 6,5 - 7,5 stabile
- Send in samples (VI, PCR):-20°C tot 4 °C

PRRS-Virus (2)

Biological and genetic Variability

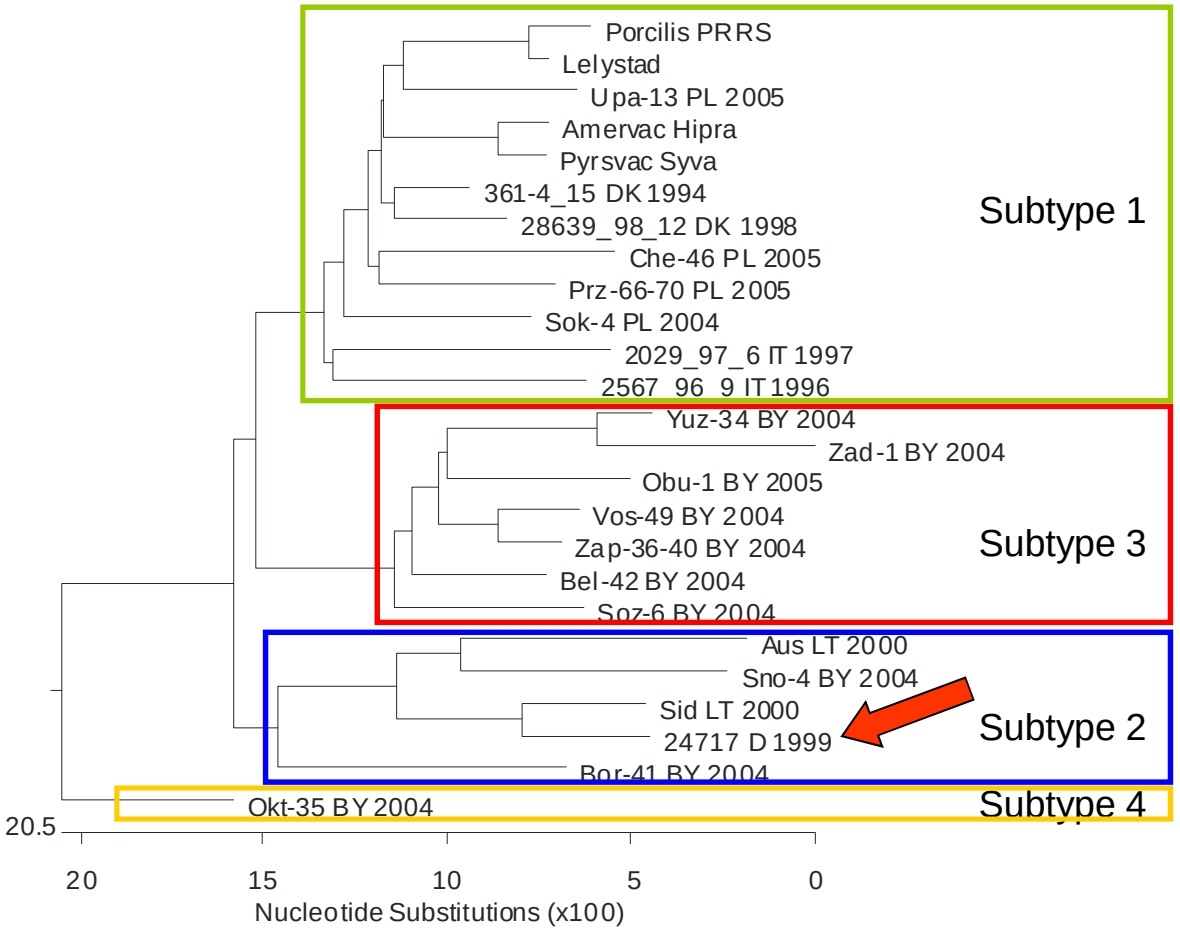
- 2 (main) strains:
  EU (LV) and US (VR-2332)
- High mutation grade → many new Isolates
- Discussion concerning back mutation of vaccin virus in virulent fieldvirus isolaten


PRRSV-EU
diversity
Subtype 3
Belarus
Subtype 4
Belarus
982
836
1000
Belarus, Lithuania
Germany,
the Netherlands, UK, Belgium, Denmark, Spain,
Italy, Austria, Poland, Czech Rep.,
Hungary, EU-type vaccines
Subtype 2
Subtype 1


EUROPE
Geographic distribution of PRRSV-EU subtypes
Barents Sea
ICELAND
SWEDEN
FINLAND
White Sea
Gulf of Bothnia
ESTONIA
NORTH ATLANTIC OCEAN
DENMARK
IRELAND
UNITED KINGDOM
NETHERLANDS
GERMANY
Subtype 1
Subtypes 2, 3, 4
UKRAINE
FRANCE
SWITZERLAND
HUNGARY
MOLDOVA
Bay of Biscay
CROATIA
ROMANIA
Sea of Azov
BOSNIA - HERZEGOVINA
YUGOSLAVIA
MONACO
Adriatic Sea
BULGARIA
Black Sea
ANDORRA
FYROM
ALBANIA
PORTUGAL
SPAIN
HELLAS (GREECE)
TURKEY
Mediterranean Sea
Ionian Sea
Aegean Sea
MALTA
MOROCCO
ALGERIA
TUNISIA
CYPRUS

The diverse East European PRRSV strains can be present in West Europe!!!

Phylogenetic tree of ORF5 amino acid sequences including German sequence 24717 from Pesch et al., 2005



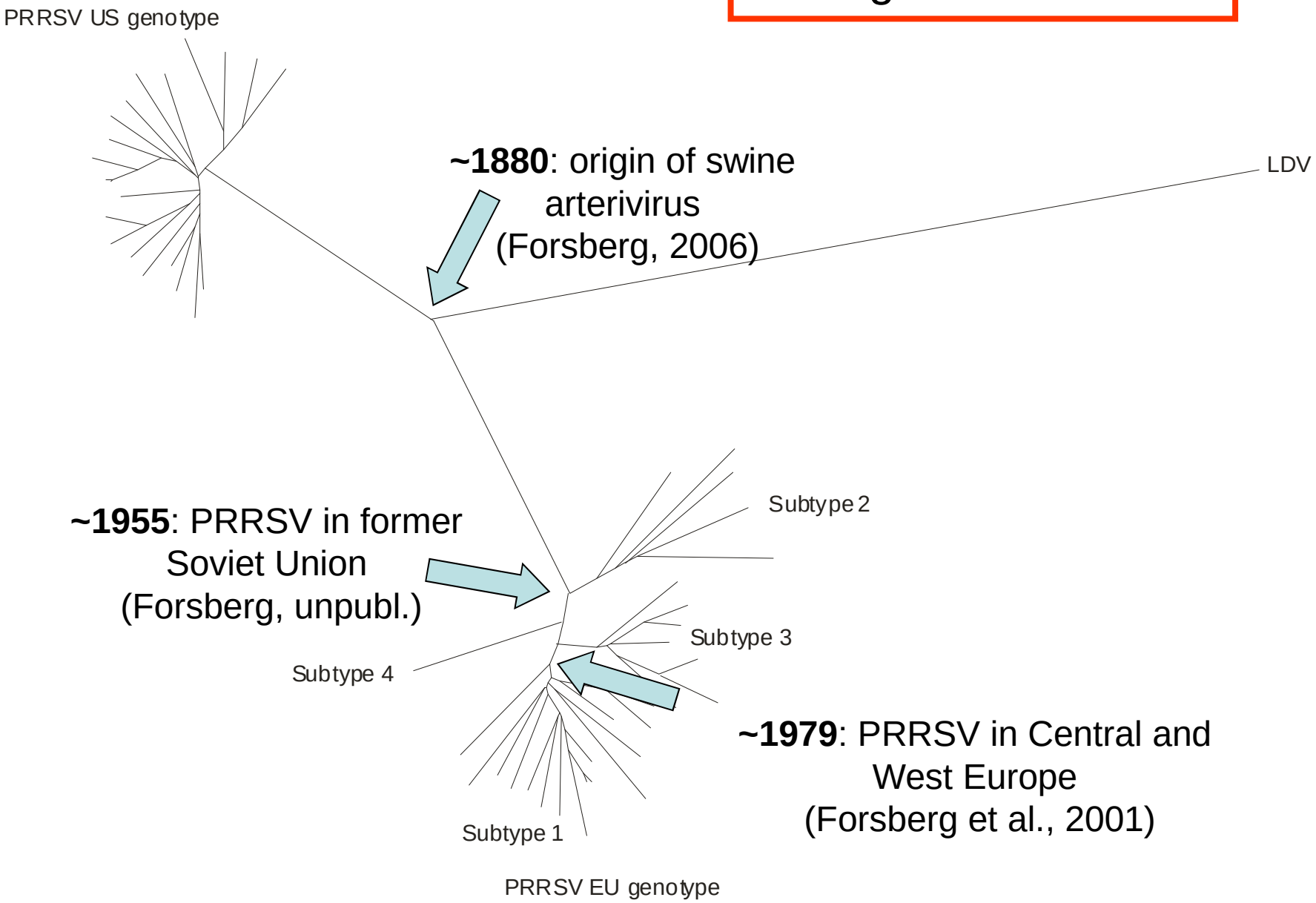
West and Central Europe

Belarus

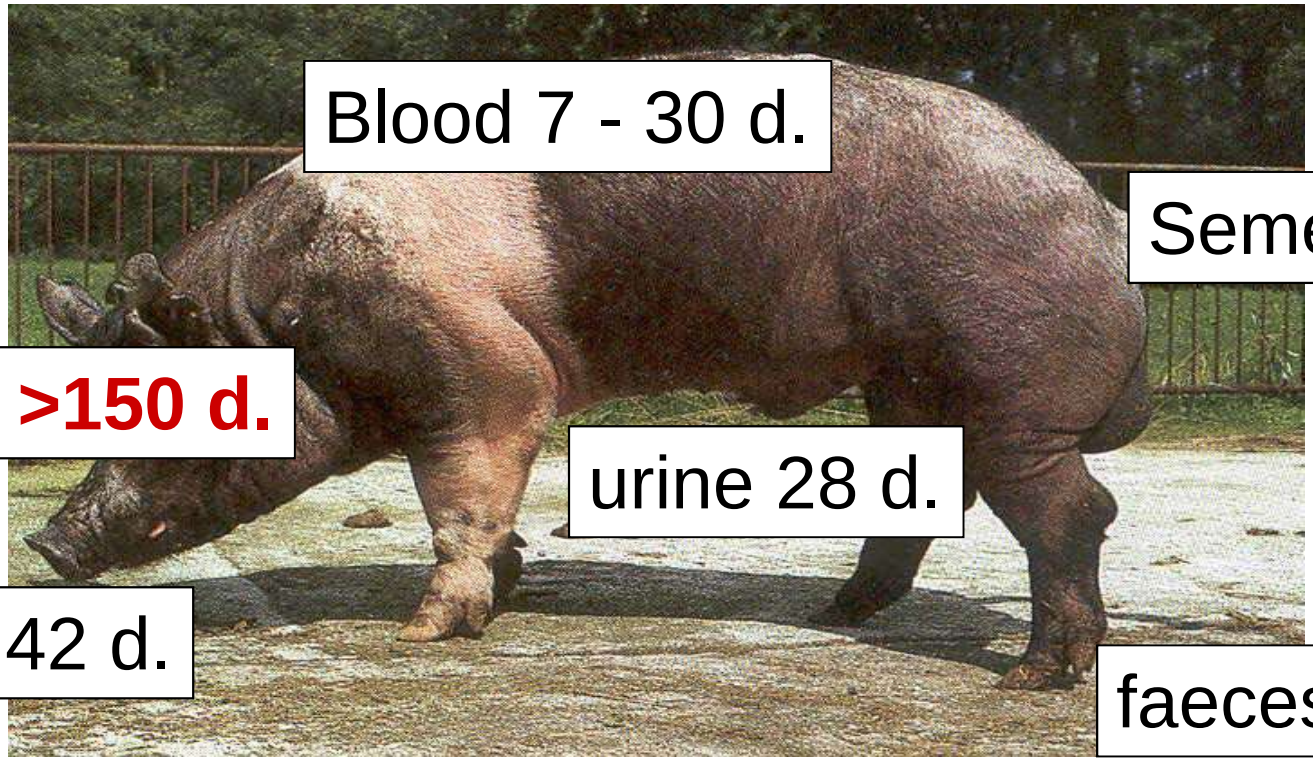
Belarus, Lithuania

Belarus

Origin of PRRSV

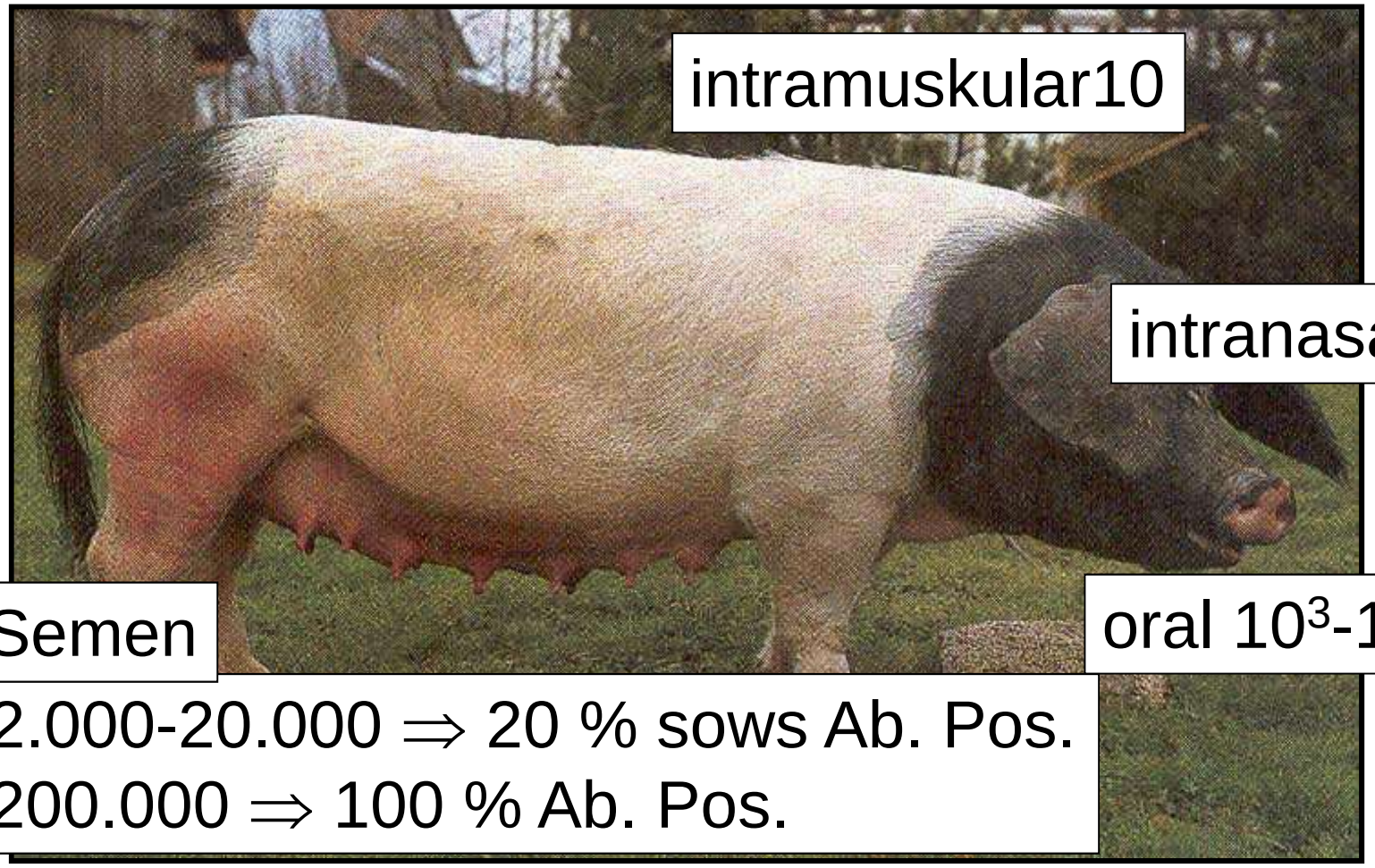


PRRS - excretion: time



infektious: 1–3 days, clean water 8 – 11dagen

PRRS – Infektion dosis



2.000-20.000 ⇒ 20 % sows Ab. Pos.

200.000 ⇒ 100 % Ab. Pos.

PRRS: transmission

- Direct
  - pig to pig
  - Semen
    Indirect
  - saliva
  - airosol: by air transmitted (10 km)
  - Vectors
    - biological: Human !! flies, birds/ ducks
    - mecanical: eg. **Snow** and dirty boots; lorries

Reproduction problems

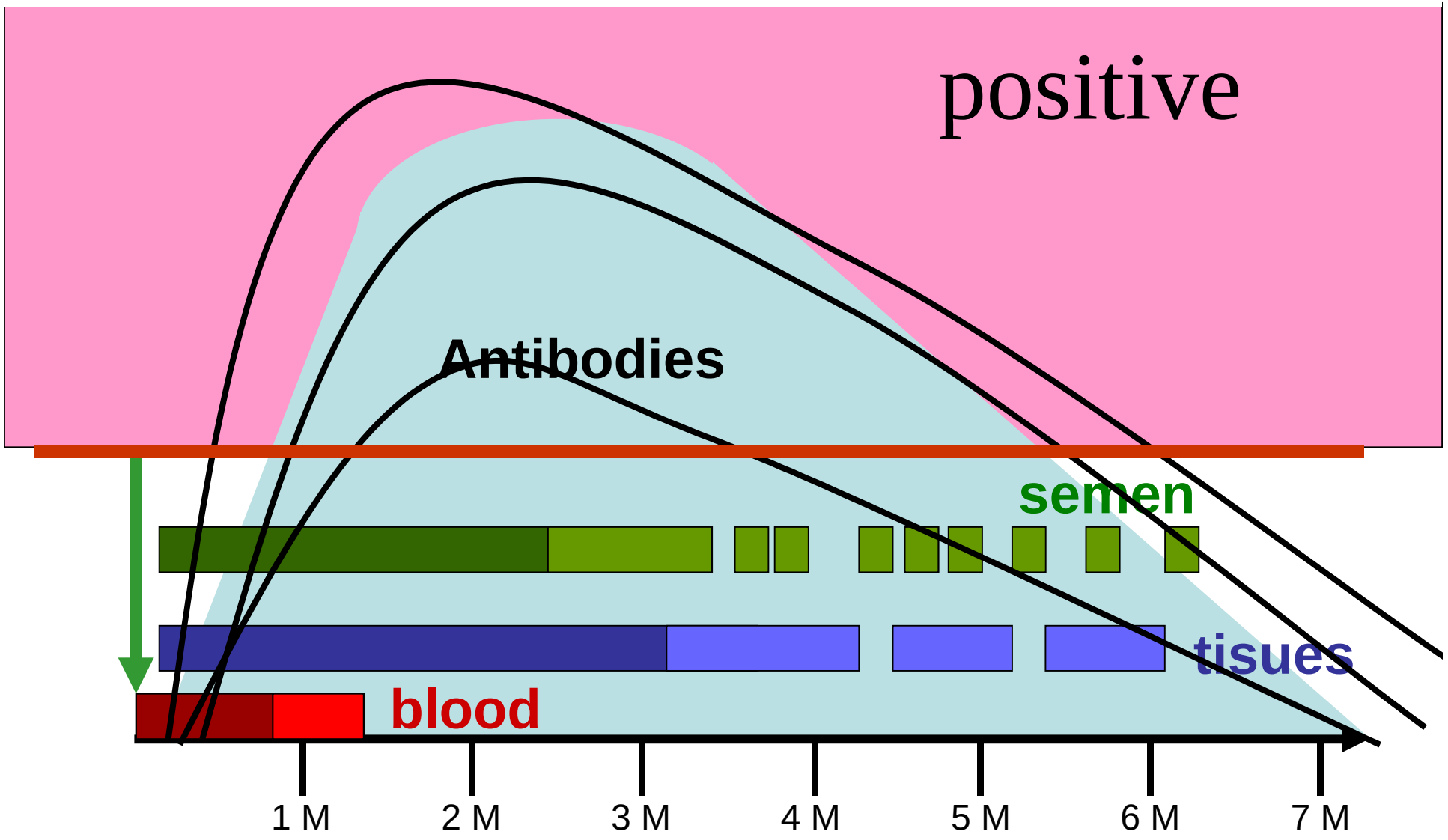
- Before placentation
  - Embryo less sensitive.
- After placentation
  - With increasing pregnancy length the foetal sensitivity is increasing
  - Older animals less sensitive as younger animals
- Transplacentary infection is possible within 1 week after the infection of the sow.

PRRSV: transmission

Transmission in weeks from infected to negative PRRS animals is possible.

22 weeks	Albina, et al. 1994
16 weeks	Benefield, et al. 1997
8 weeks	Mengeling, et al. 1996
5 weeks	Yoon, et al. 1993
14 weeks	Zimmerman, et al. 1992

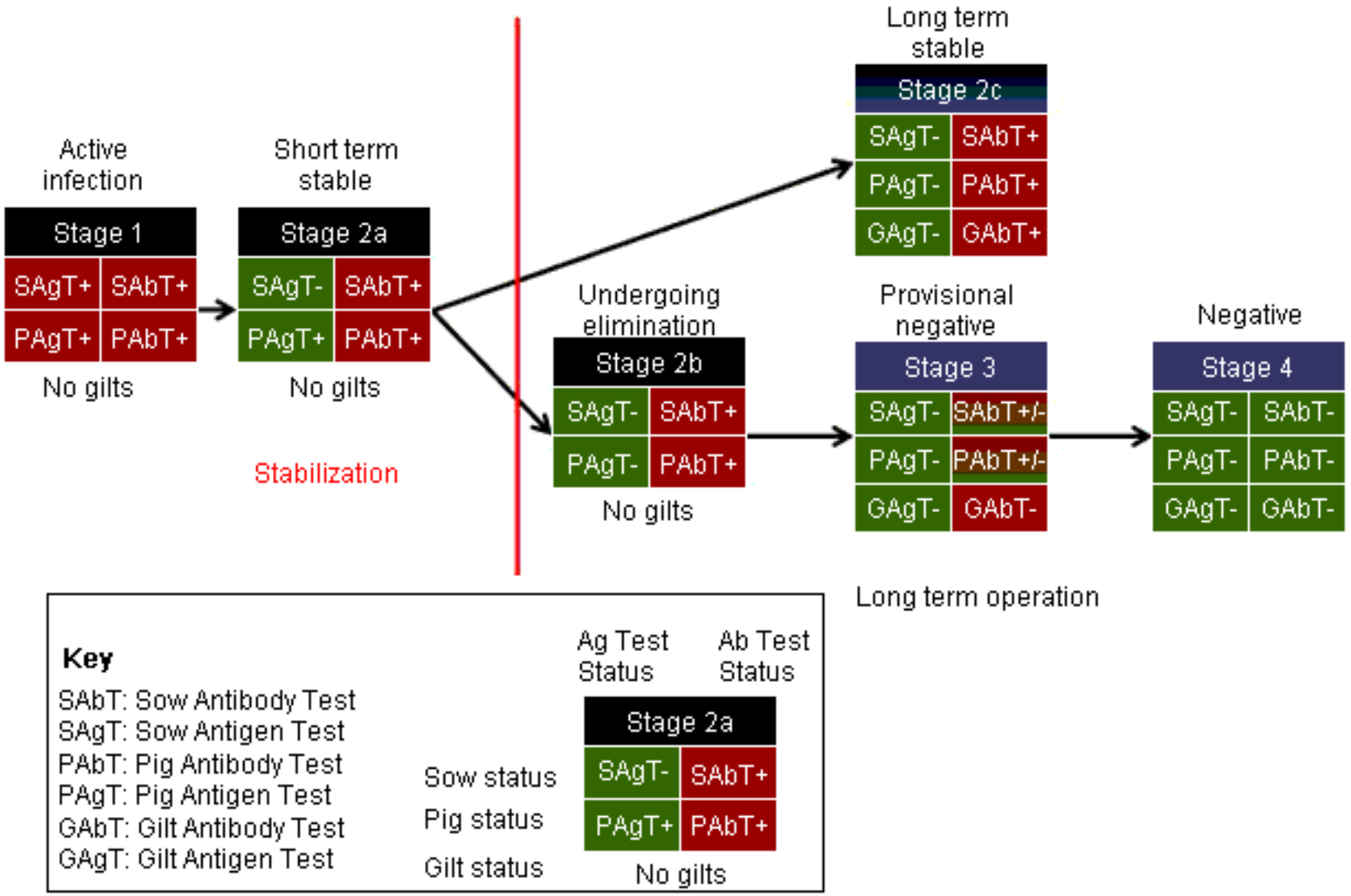
PRRS: Virus and Antibodies



PRRS: economical losses

- Economical losses p/sow: Netherlands AHS.
  - € 126,-€ 236,00 / p.sow. Less live born piglets, higher % , increase FC, less growth,more dead piglets,higher cost for medication and labor.
  - € 5,- tot € 15,00 / fattener. (US €3-4,-)
- Less export possibilities.
- Increase of demand for PRRS free semen from neg. boar stations bought from neg breeding (or sero-positive herds but PCR neg.?)
  - ELISA: < 0,4 negatief
  - Serologische PRRS-AL neg. boars may exscrete PRRSV in semen.

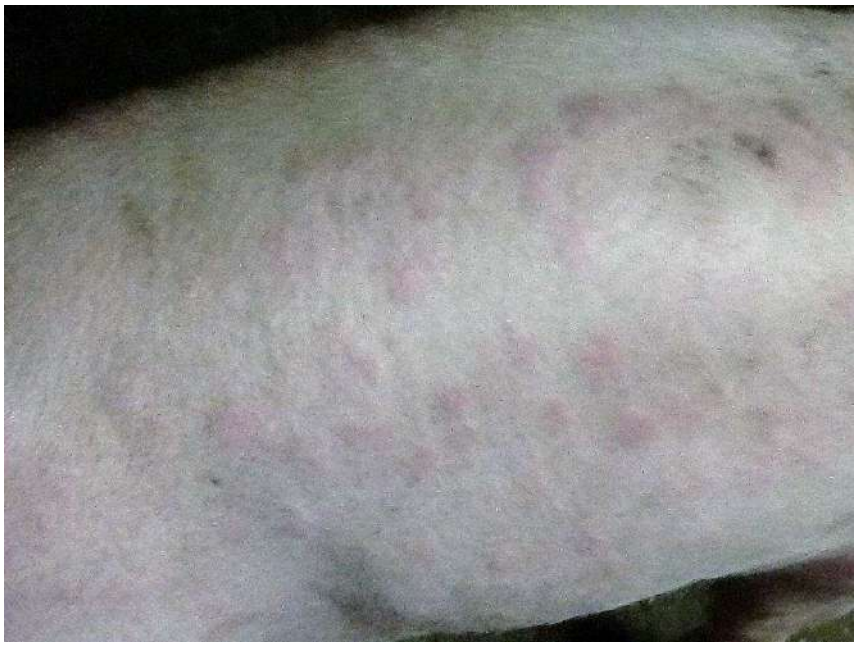
Holtkamp (US) scheme



PRRS control or eradication?

- 1st step: control the disease by vaccination with proper vaccine and vaccination schema
- Control pig flow by AI-AO, push out departments with infection circulations
- Biosecurity optimalisation,
- Incomming animals only by quarantine.
- Air filtration

Erysipelothrix



vaccination

- Current vaccines contain E.rh serotypes 1 or 2 (most) inactivated or attenuated 1a (via drinking water) are effective. Duration of immunity varies between 6 (3) and 12 month.
- Not very effective in preventing against chronic artritis (E.rh.in cytoplasm of chondrocytes)
- Vaccination breeding animals reduces,
  -periparturient vulval discharge,
  -decrease farrowing intervals,
  - increase live-born piglets in clinically affected herds
- Cost of E.rh. Vaccine is rel. cheap. Avoid risks

Eradication ?

- By SPF prinicipals?.
- Difficult to keep a herd free for extended periods of time
- Do our vaccins protect against all strains?
- Out break can be a reflection of vaccination problem? (colostrum protection too less, time of vaccination improper)
- Try to isolate the strains for comparison .

Aujeszky episode1975-1980

- Exudative keratoconjuntivitis, sereuse tot fibrinonecrotische rhinitis, laryngitis,tracheitis, necrotische tonsilitis.
- Pulmonair oedeem en multipele necrose haardjes, haemorrhagische tot bronchointerstitiele pneumonie (cranio-ventrale longlobuli)
- Multipele kleine heamorrhagische necrosehaardjes in lever, nier,milt ,darmen,klieren en placenta.
- Abortus met mumificatie, (necrose haardjes in org.)
- CNS laesies
- Voor 1975 vnl herkauwers (kalf,schaap,lam,jeuk) + (hond+kat)

Pseudo-rabies/ Aujeszky Disease

- Disease control
- Eradication by discriminating vaccines. In the eighties in the Netherlands 80 % of sows and 70% of fatteners were infected with Aujeszky-virus. In 1993 the decision was made to vaccinate pigs 3x per year. Trade and transport between herds only allowed with ADV free declaration. Serological monitoring 3xp.y.
- Art 10 status countries (regions) Nederland is country no 12 in Europe as Danemark, Germany, UK and main parts of France. No ADV vaccination allowed.
- Art 9 countries; Belgium, parts of France, Italy and Spain
- Aujeszky risks by wild boar
- Eradication by a strict vaccination strategy and correct pigflow and biosecurity.

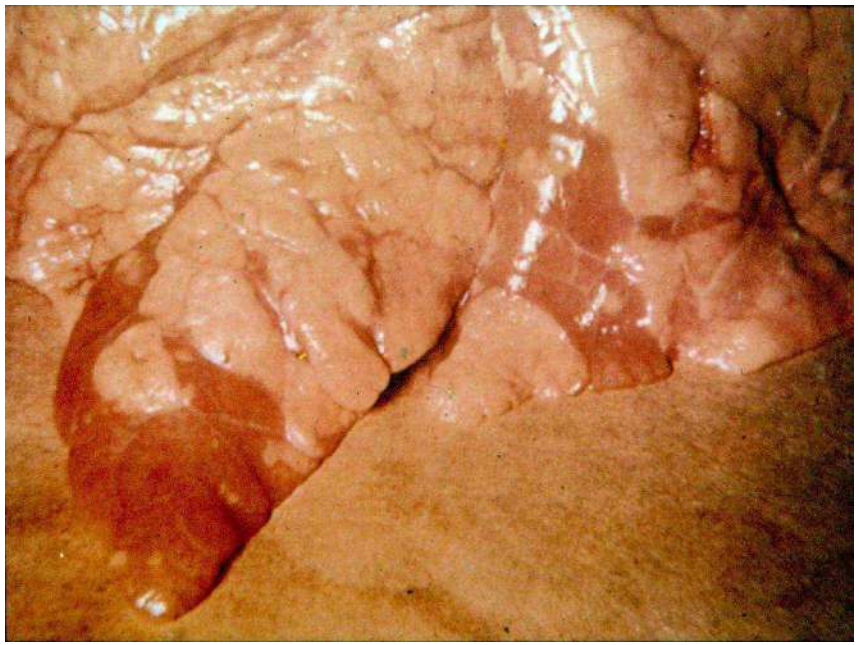
M.hyo

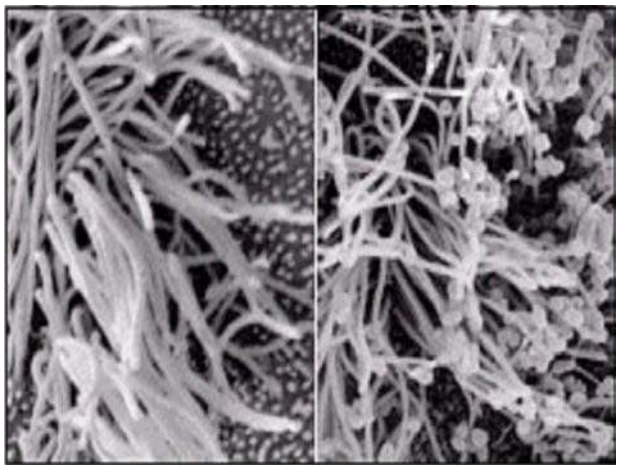
- Disease control
- Eradication

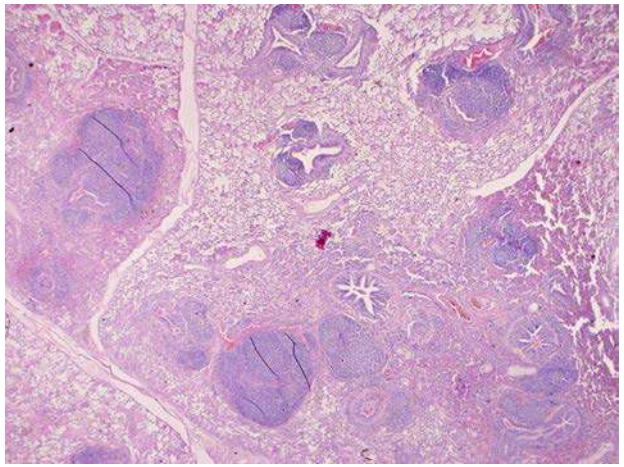
Mycoplasmen

M. hyopneumoniae	pneumonia	(3 - 24w)
M.hyorhinis	polyserositis	(3 - 10w)
M. hyosynoviae	arthritis	(10 - 30w)
M. flocculare	apathogenic	

M.hyo lung lesions

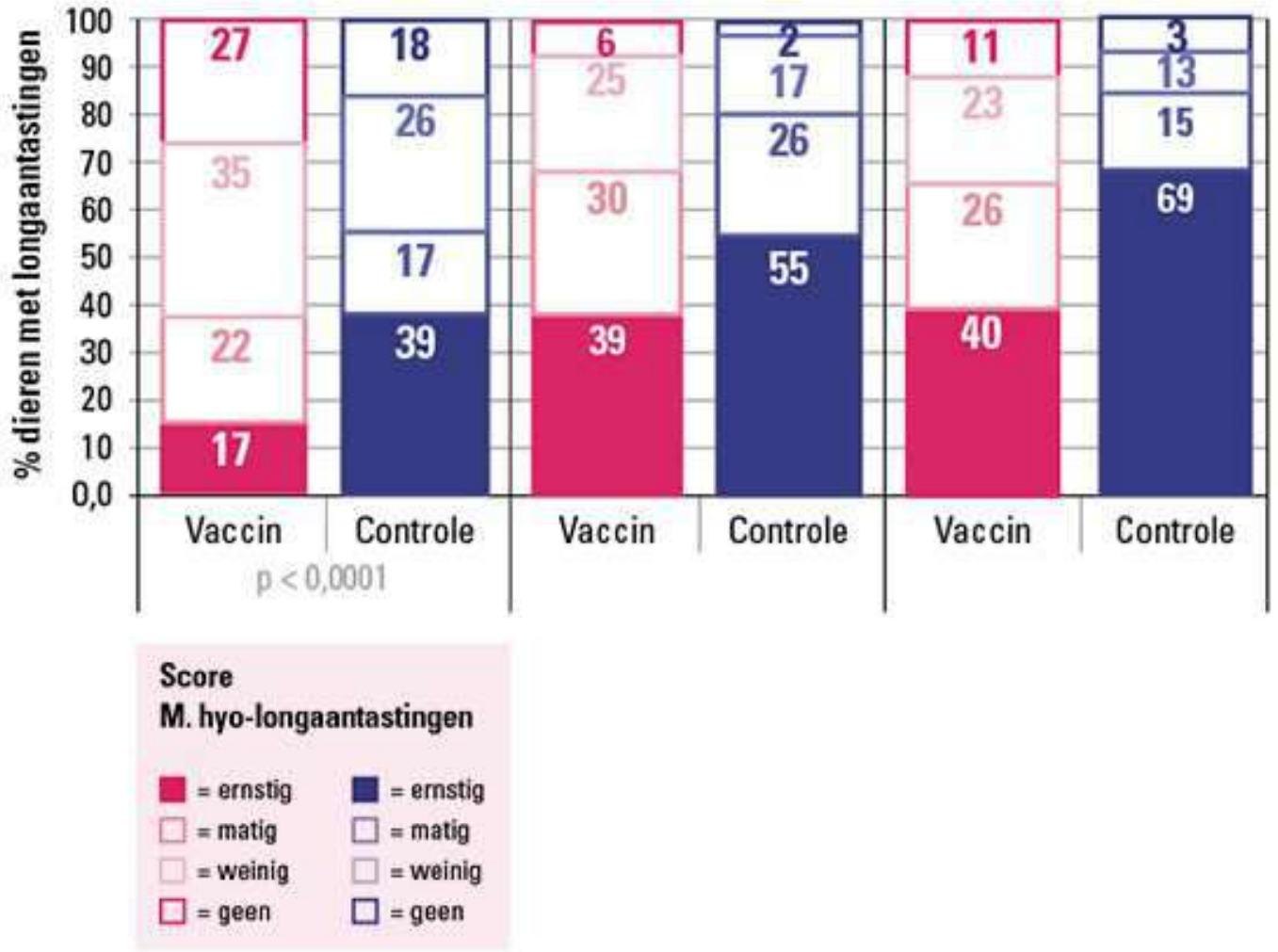






Porcilis PCV M Hyo protects piglets against M. hyo-infections.

The severity of the the number of M. hyo-lung lesions (slaughtercheck) is after vaccination significant lesser in farms with Circo- and M. hyo-infections.



H. Hyo control

- Vaccination piglets only partial protection (40 to 80% of lung lesions on slaughterline)
- Vaccination sows, boars and replacement gilts + piglets, cleans the breeding and farrow sections in a farrow to finish herd in 2 years.
  After than an pushing out procedure can be started. Pigflow always AI-AO
- Swiss eradication program (+ medication)
- Depop – Repop of the herd

App

- Disease control
- Eradication

Table 1. A summary of the major toxins produced by the recognised serotypes of APP

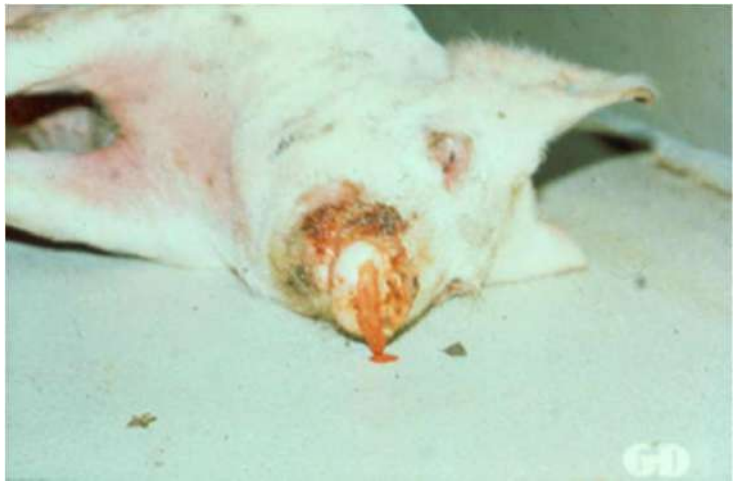
Toxins produced APP	serotypes
ApxI and ApxII	1, 5, 9, 11
ApxII and ApxIII	2, 3, 4, 6, 8, 15
Apx II only	7, 12, 13
ApxI only	10, 14

clinical forms and postmortum

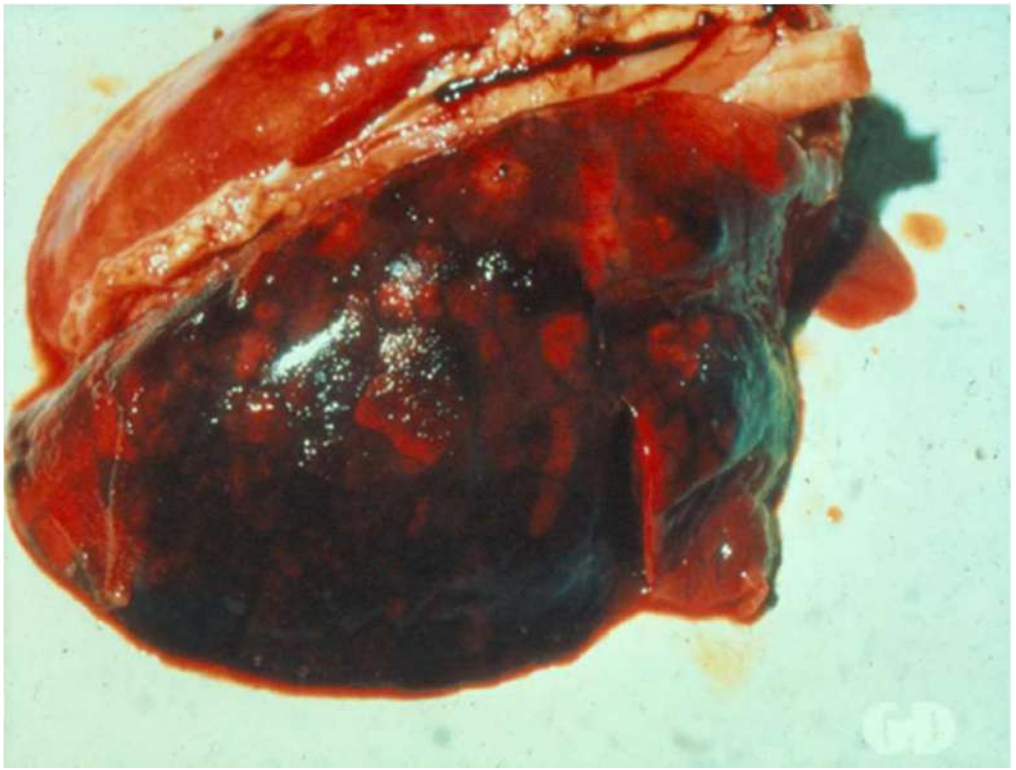
- per acute Form — sudden death; foamy, bloody,mucous Exsudate in Bronchials and Trachea; Zyanose
- acute Form — heavy necrotising and hemorrhagic Pneumoniea fibrinous Pleuritis, cut surface crumpy
- chronical Form — Pleura attached (fibrinous pleuritis), Lungs attached with Pleura

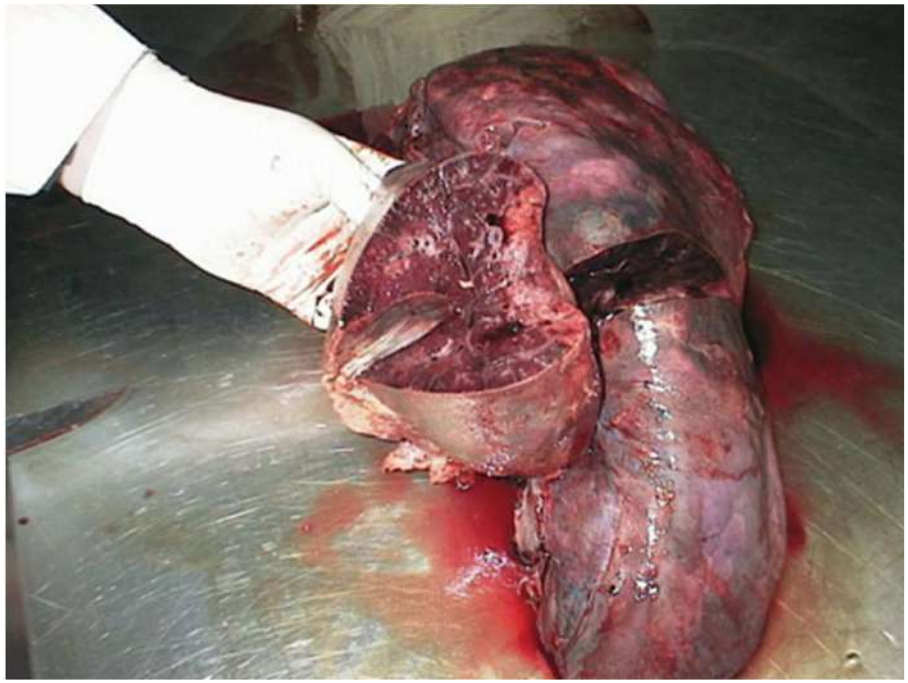
Diagnosis

- Clinical Symptoms
- Postmortum
- Serology (paired Bloodsamples)
  - CFT: Sens. 67 –90%, Spez. 100 %
  - Screening / Titration
  - APX IV Elisa

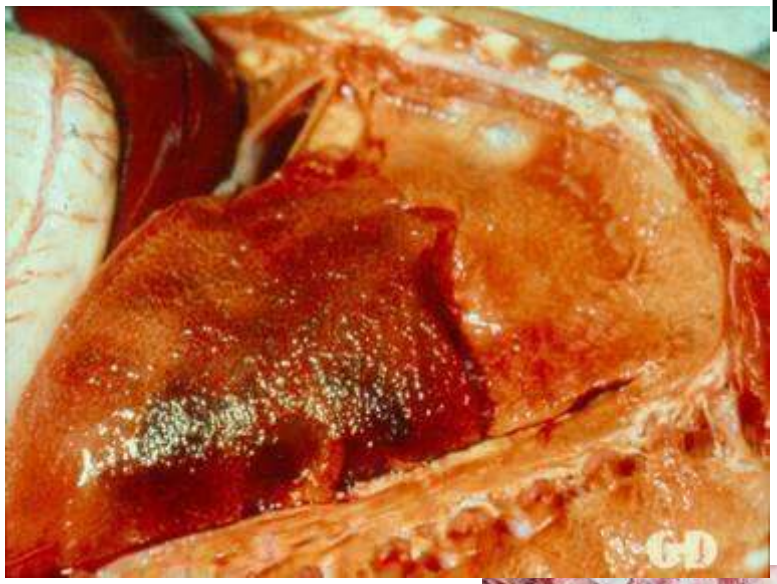


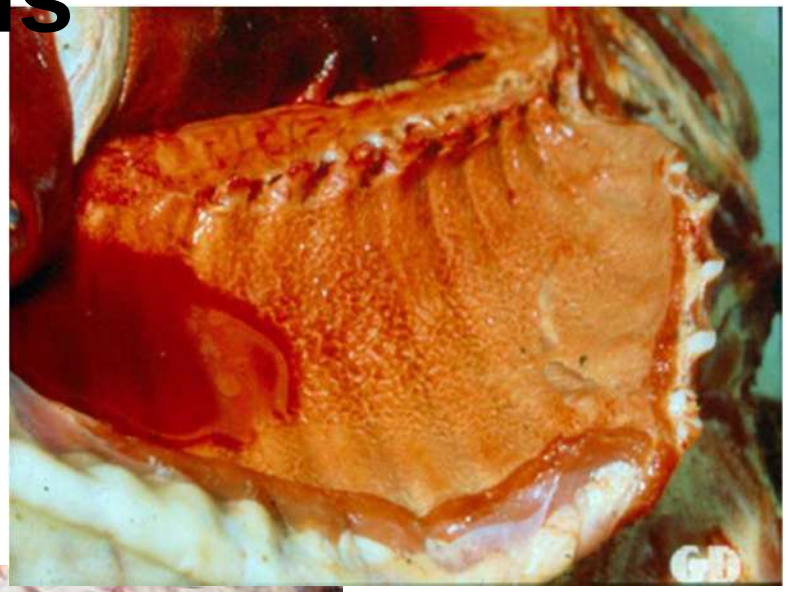
Post mortum findings

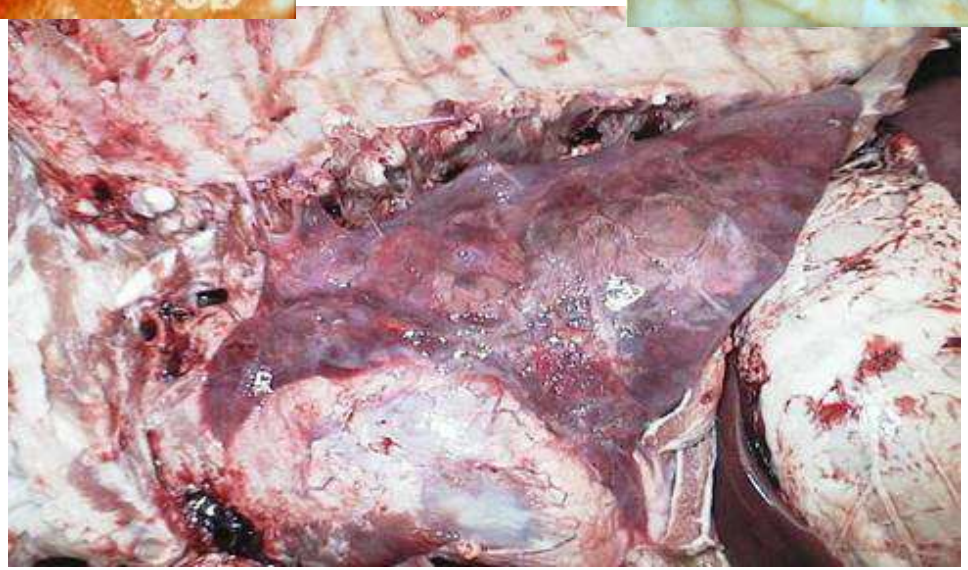




Development of a fibrinouses Pleuritis in a chronic fibrousis Pleuritis







APP Serology

- Maternal Antibodies till ca.8. weeks of age
- First Antibodies ca.10 days after Infection
- After 3- 4 Weeks all pigs are seropositive

APP challenge model

Aantal cfu	Aantal biggen besmet	Sterfte %
	Intratracheaal met 1ml	
5 5x 10.2 5x 10.4 5x 10.6 5x 10.8	3 4 6 7 5	0 0 50 85 100
5x 10.8	Intranasaal met 2ml 6	17
5 5x 10.2	Mhyo geïnf.+ Intratrach.met 1ml 2 2	50 50

App aerosol-challenge 3w.na 2e vacc.(type 9= tox I en II)

		Clinical score	Death	Long lesion score(pn+pl= max 5/lobus= tot. 35)	App isolatie uit tonsillen (1w na challenge)
1	Porcillis App (sub unit Toxoid)	3,7	0/7 (0%)	8 (23%)	5/7
2	Coglapix Ceva (bacterin)	4,7	3/7 (43%)	12,5 (36%)	6/7
3	Haemophylin Ceva (bact.)	3	2/7 (29%)	17,5 (50%)	6/7
4	Polypleurosin APX IM Bioveta (bact.)	5,7	3/7 (43%)	20,5 (59%)	5/7
5	Contr.	7,5	6/7 (86%)	20 (57%)	6/7

Switzerland

- Sow herds
- 1= App Serology - pos.= total stamping out
  type 2
  (type 9 = rare)
  2 = App: Serologie - neg.
  Mhyo: Serologie - pos. Mhyo=
  “partly” stamping out

Hps

- Disease control
- Eradication

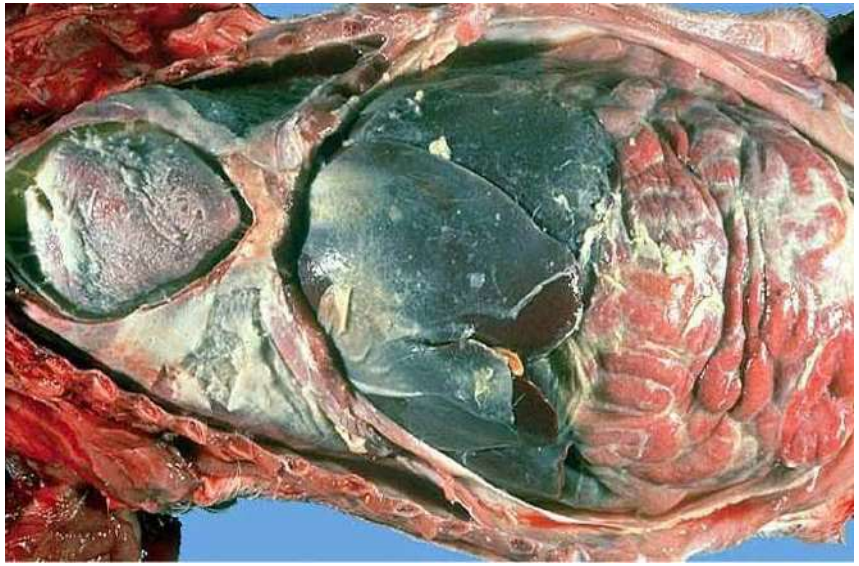
clinic: Problem

- Transport disease
  - Clinical signs with same Symptoms, but two different epidemiological backgrounds (SPF, Stress)
- different Differential diagnoses, which are not easy to exclude.

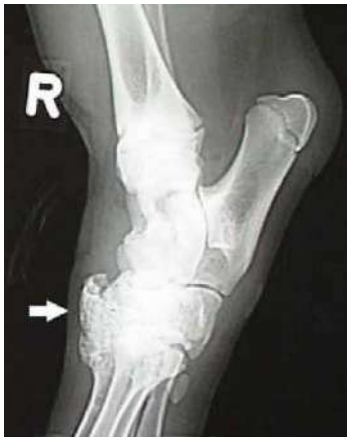
Infektion

- Sepsis
- Polyserositis
  - brain- Meningitis (80 %)
  - joints- Polyarthritis (70 %)
  - abdominal- Peritonitis (60 %)
  - chest- Pleuritis
  - heart- Perikarditis (40 %)

Polyserositis



Arthritis: Rotlauf



Prophylaxe

- vaccins:
  - Porcilis®-Glässer (Intervet International):
    - HPS-Serotyp 5, Strain 4800
    - Cross immunity with HPS-Serotypes 1, 12, 13, 14 (pathogens 1, 10, 12, 13, 14; ofter 1, 2, 4, 13)
    - 17 Weeks after vaccination still protection
    - Zoetis: HPS serotype 4 and 5 + Mhyo
  - Herdspecific vaccins:
    - Problems; Which Serotype is isolated? pathogin?
    - Cultivation method
    - Antigen amount /Pro dosis
    - Adjuvant
    - Vaccination schema

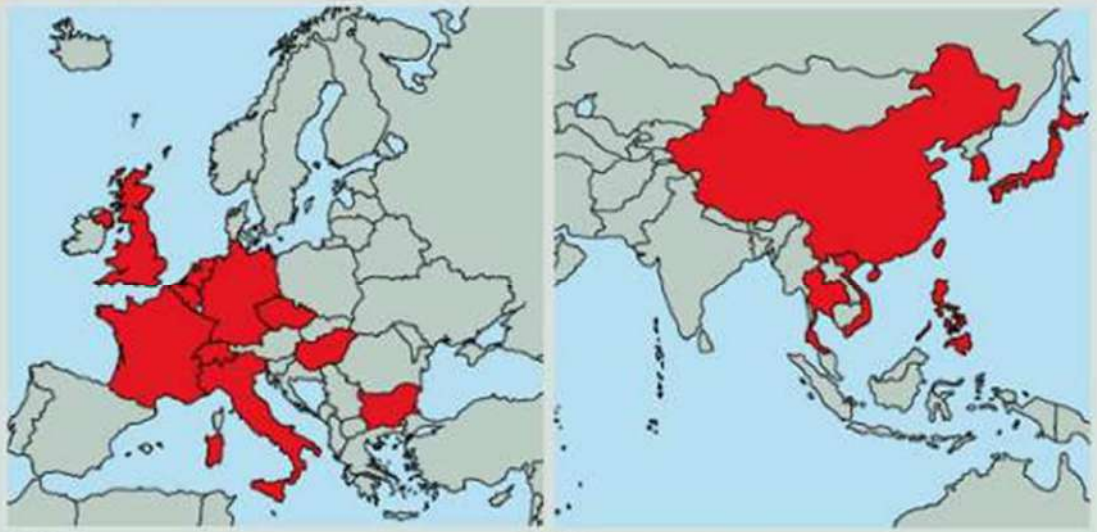
Prophylaxe

- Gilts (for sale):
  1. Injection: 4 Weeks for transportation
  2. Injection: 2 Weeks for transportation
- Pregnant sows:
  1. Injection: Mid of pregnancy
  2. Injection: 3 Weeks befor farrowing

PED

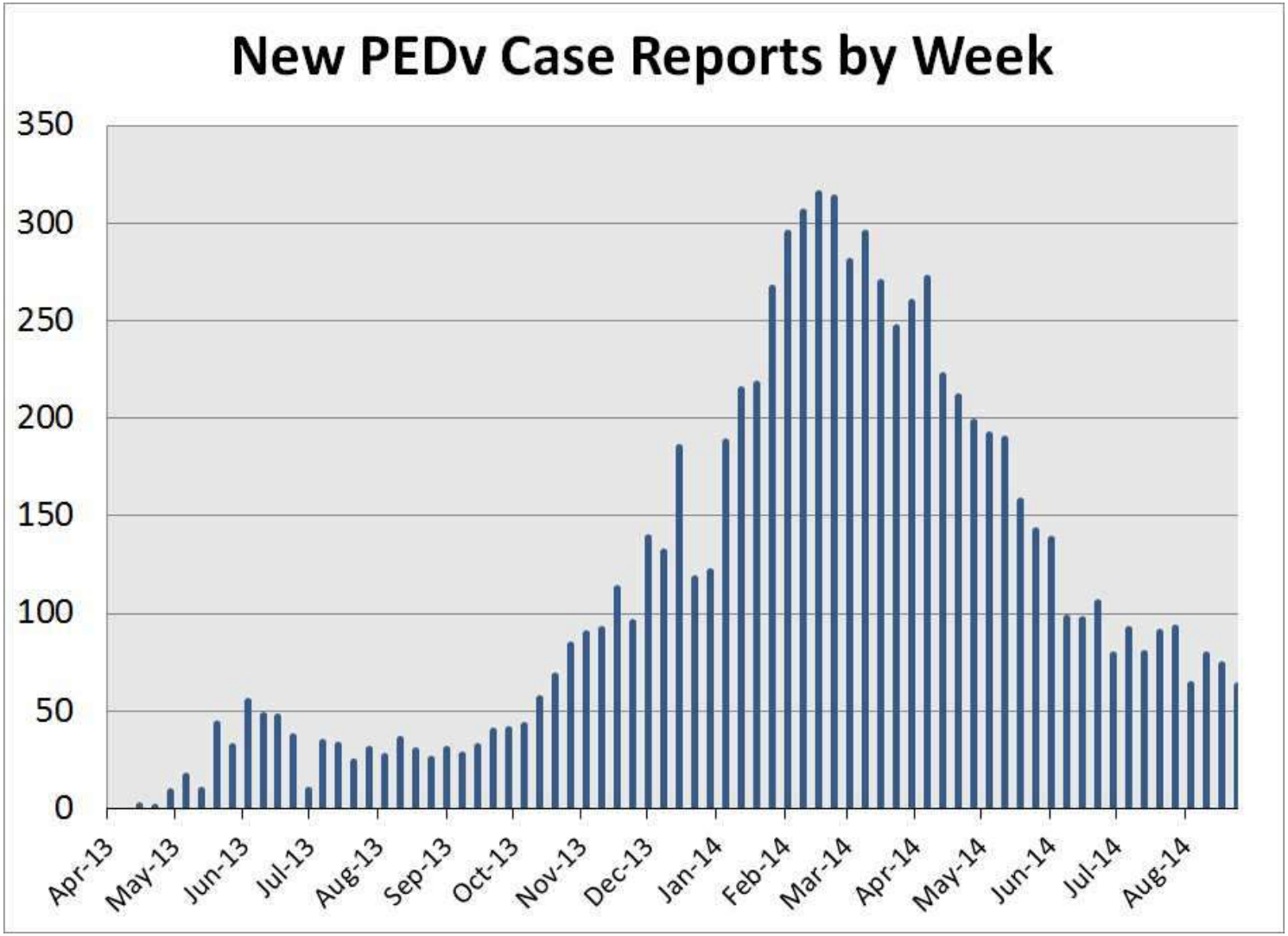
- Disease control
- Eradication

Figure 1. Emergence of PEDV. Since the disease was first discovered in Europe 1971, antibodies for PED have been detected in following countries.

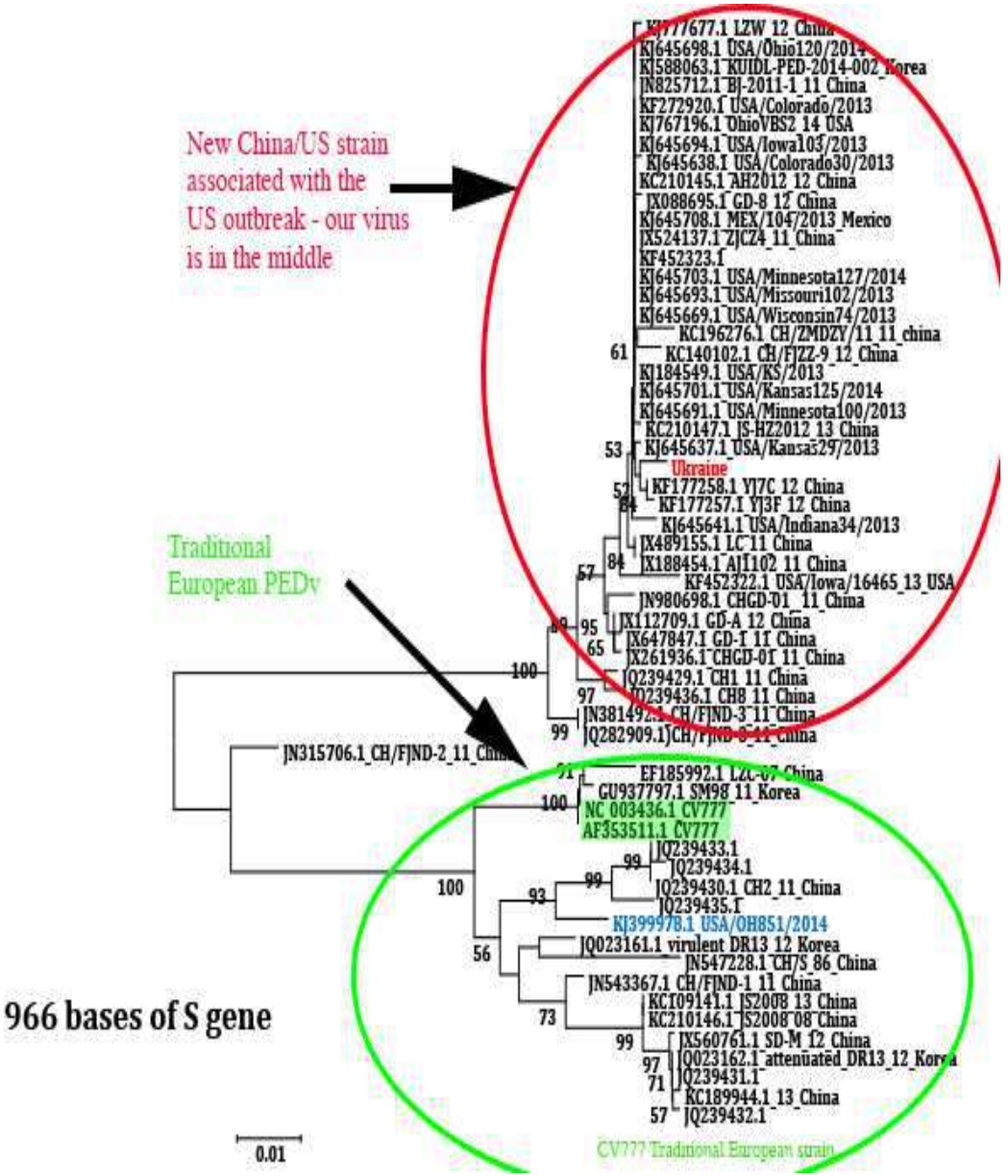


EUROPE:
Belgium, Bulgaria, Czech Republic, France, Germany, Hungary, Italy, the Netherlands, Switzerland, UK

ASIA:
China, Japan, the Philippines, South Korea, Taiwan, Thailand, Vietnam


New PEDv Case Reports by Week
350
300
250
200
150
100
50
0
Apr-13
May-13
Jun-13
Jul-13
Aug-13
Sep-13
Oct-13
Nov-13
Dec-13
Jan-14
Feb-14
Mar-14
Apr-14
May-14
Jun-14
Jul-14
Aug-14

PED


New China/US strain associated with the US outbreak - our virus is in the middle
Traditional European PEDv
966 bases of S gene
0.01
CV777 Traditional European strain
KJ777677.1 LZW 12 China
KJ645698.1 USA/Ohio120/2014
KJ588063.1 KUIDL-PED-2014-002 Korea
JN825712.1 BJ-2011-1 11 China
KF272920.1 USA/Colorado/2013
KJ767196.1 OhioVBS2 14 USA
KJ645694.1 USA/Iowa103/2013
KJ645638.1 USA/Colorado30/2013
KC210145.1 AH2012 12 China
JX088695.1 GD-8 12 China
KJ645708.1 MEX/104/2013 Mexico
JX524137.1 ZJCZ4 11 China
KF452323.1
KJ645703.1 USA/Minnesota127/2014
KJ645693.1 USA/Missouri102/2013
KJ645669.1 USA/Wisconsin74/2013
KC196276.1 CH/ZMDZY/11 11 china
KC140102.1 CH/FJZZ-9 12 China
KJ184549.1 USA/KS/2013
KJ645701.1 USA/Kansas125/2014
KJ645691.1 USA/Minnesota100/2013
KC210147.1 JS-HZ2012 13 China
KJ645637.1 USA/Kansas29/2013
Ukraine
KF177258.1 YJ7C 12 China
KF177257.1 YJ3F 12 China
KJ645641.1 USA/Indiana34/2013
JX489155.1 LC 11 China
JX188454.1 AJ1102 11 China
KF452322.1 USA/Iowa/16465 13 USA
JN980698.1 CHGD-01 11 China
JX112709.1 GD-A 12 China
JX647847.1 GD-1 11 China
JX261936.1 CHGD-01 11 China
JQ239429.1 CH1 11 China
JQ239436.1 CH8 11 China
JN381492.1 CH/FJND-3 11 China
JQ282909.1 CH/FJND-3 11 China
JN315706.1 CH/FJND-2 11 China
EF185992.1 LZC-07 China
GU937797.1 SM98 11 Korea
NC 003436.1 CV777
AF353511.1 CV777
JQ239433.1
JQ239434.1
JQ239430.1 CH2 11 China
JQ239435.1
KJ399978.1 USA/OH851/2014
JQ023161.1 virulent DR13 12 Korea
JN547228.1 CH/S 86 China
JN543367.1 CH/FJND-1 11 China
KC109141.1 JS2008 13 China
KC210146.1 JS2008 08 China
JX560761.1 SD-M 12 China
JQ023162.1 attenuated DR13 12 Korea
JQ239431.1
KC189944.1 13 China
JQ239432.1

Could we predict the future of emerging and re-emerging pig diseases?

- 1950th Atrophic Rhinitis
- 1960th Enzootic Pneumoniae (M.hyo.)
- 1970th Aujeszky's Disease(PRD)
  Actinobacillis pleuropneumonia(App)
  Influenza (H1N1)
  TGE and PED
- 1980th MSD (PRRS) and PRDC (M.hyo, Strep.s. H.ps)
  Progressive AR and Non progr.AR
  Influenza H3N2
  PRCV,
  ASF
- 1990th PMWS and PDNS (Circo2) aggravate; PRRS, M.hyo, App, Hps and
  Strep.s,Lawsonia spp,
  Influenza H1N2,
  CSF
- 2000 till now,PRRS strains China,
  Circo2 strains a ,b and new,
  Influenza strains eg pH1N1, H1N5
  PED strains China, US, Ukraine, Europe
  FMD

Thank you for your attention