เข้าใจโรค เข้าใจเชื้อ ASF

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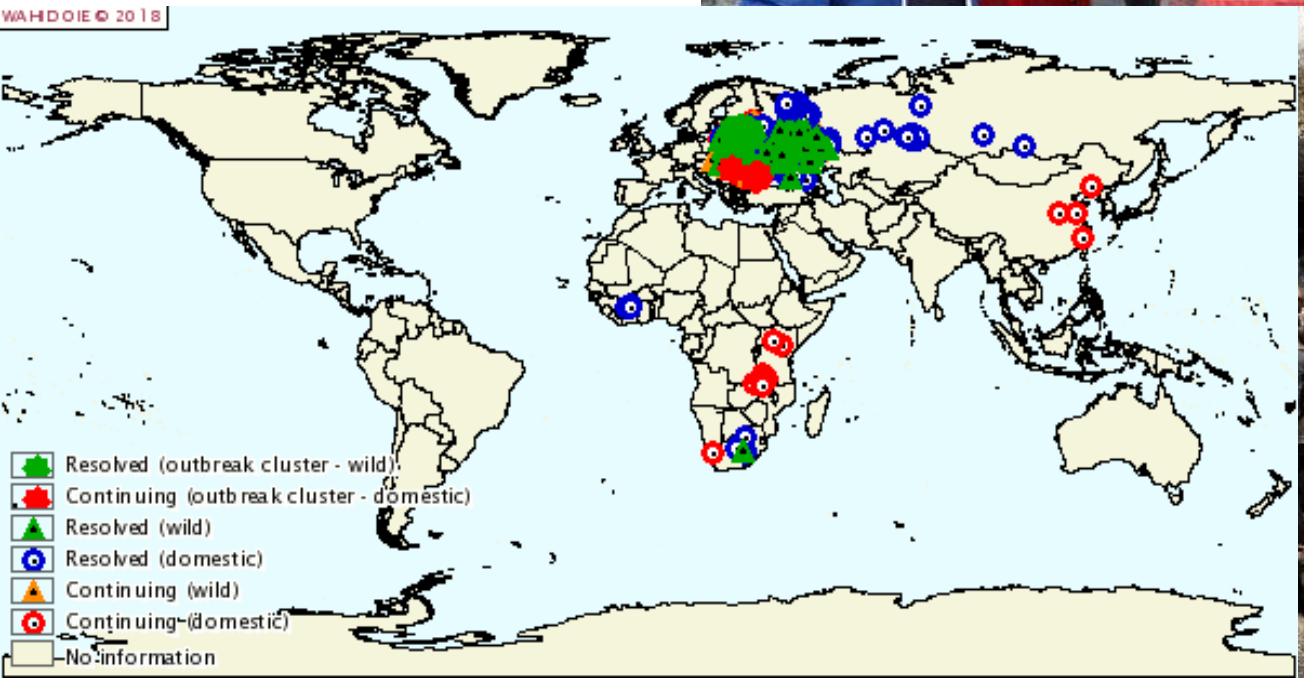
คณะสัตวแพทยศาสตร์ มหาวิทยาลัยเกษตรศาสตร์

“ASF”

www.express.co.uk/news/nature



ASF global risk

Countries that currently have ASF present in wild and/or domestic swine species. *Since the introduction of ASF to Georgia in 2007, the virus has spread throughout Eastern and Central Europe with the most recent emergence in the Czech Republic (2017). Map is based upon the findings of Arias et al., 2017.*

China: 2018

Korea: 2018

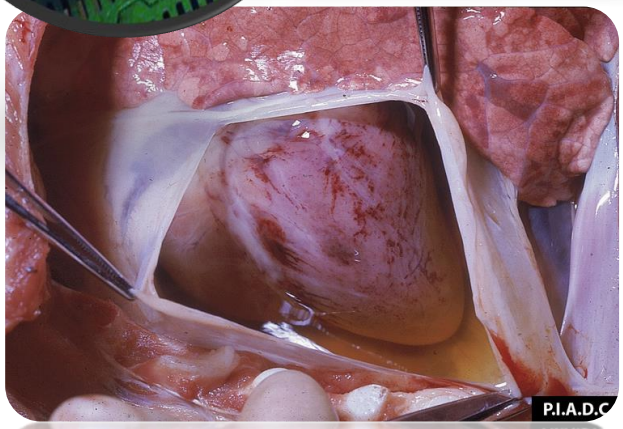
In Shenbei New District, Shenyang City, Liaoning Province

47 cases and 47 pigs dead
<u>local authorities culled 913 pigs</u>

(Arias et al., 2017)

African swine fever (ASF)

https://www.pig333.com

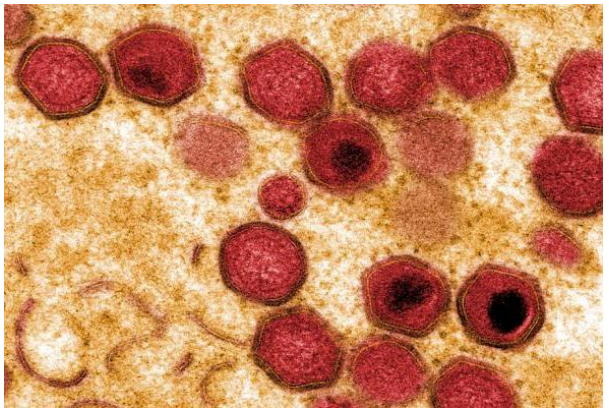


- A **highly contagious** viral disease of all pigs (family Suidae)
- High fever, hyperemia, severe hemorrhages and high mortality rate
- Very similar to acute CSF and HP-PRRS
- **No vaccine or effective treatment**
- **No effective neutralising Ab**

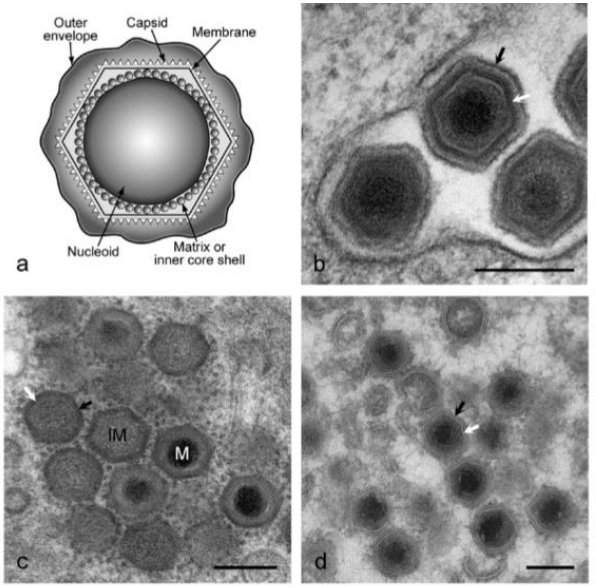
African swine fever virus

- Genus *Asfivirus*, Family Asfarviridae

  (ASF And Related Virus)
- **A large complex multilayer virus**
- Icosahedral, **enveloped DNA virus**, 170-190 kbp
- Only DNA arbovirus (transmitted by arthropod vectors)

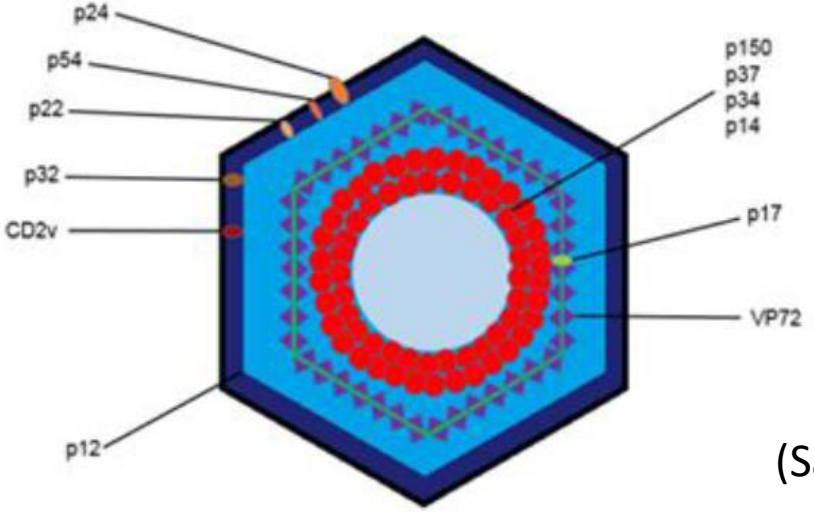


Pippa Hawes IAH



Structure of ASFV

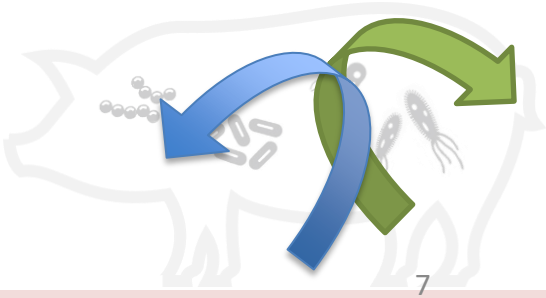
- **p72: The viral capsid**, antibody and CTL target
- **p54: Transmembrane**, involved in virus particle maturation, antibody target
- **p32: Immunogenic**, implicated in virus internalization, antibody target



(Sánchez-Vizcaíno et al., 2009)

Molecular Epidemiology

- **Partial p72 sequencing**
  - B646L gene encoding p72 capsid protein
  - More than 20 genotypes
  - **Genotype I**: West Africa, Europe (endemic in Sardinia, Italy), central and south America and the Caribbean
  - **Genotype II**: South-eastern Africa, Caucasus region, Ukraine

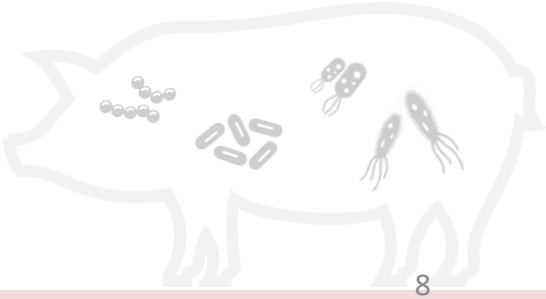


(Simulundu et al., 2018)

Transmission and Dissemination

- **Direct contract** (between sick or carrier and healthy animals)
  - Parenteral exposure
  - **Oronasal exposure**
- **Indirect contract**
  - Contact with **Contaminated objects (fomites)**
  - *By vectors:* ***Ornithodoros*** **ticks**

By David Almquist



Transmission and Dissemination

- **Routes of shedding:**

  - Blood, tissues, secretions and excretions

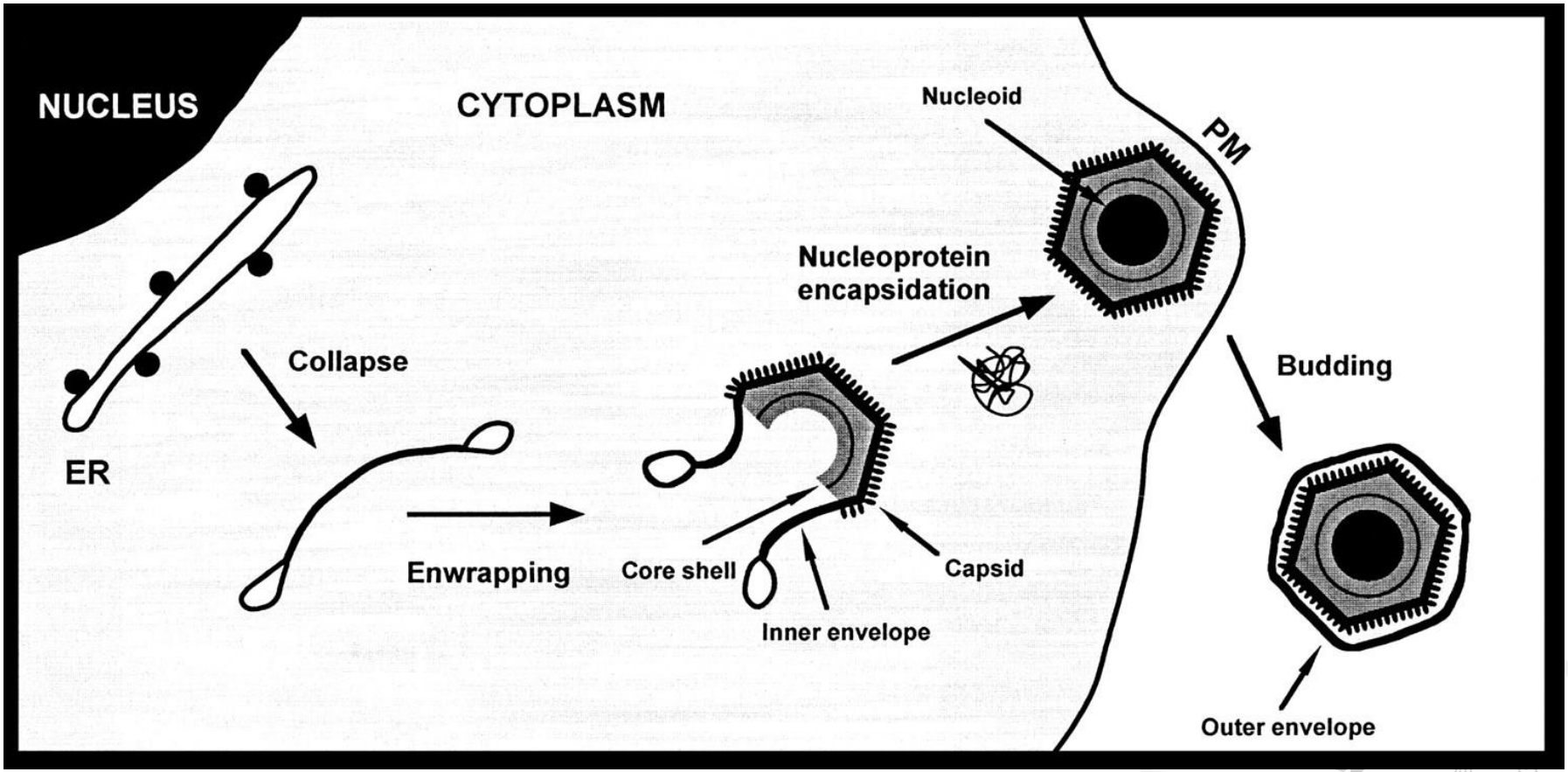
    (such as oronasal fluid, urine, feces)

- **Very stable and persistent** in the environment

  – At least 30 days in pens

  – ~ 140 days in some **pork products**

Viral replications



Pathogenesis

Oronasal routes

Tick bite

Viral exposures

Main Target Cells: **monocytes/macrophages**

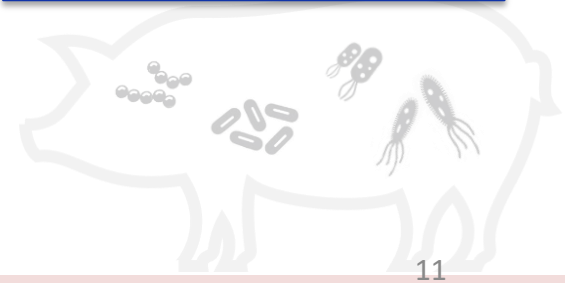
Rapidly spreads to the main sites of secondary replication
i.e.,lymph nodes, bone marrow, spleen, lung, liver, and kidney

Systemic distribution (4-8 days post infection)

Blood coagulation disturbances
- Damage to endothelial cells
- Impairment of thrombocytopoiesis

Effect on red blood cells; hemadsorption

Severe bleeding and Thrombocytopenia



Immune response

1. Impaired immune system
   - **Inhibits host signalling pathways**; block transcription of host immunomodulatory genes
   - **Inhibits the action of apoptosis**
2. Resulting in immune modulation and immune suppression
3. ASFV can escape from the host immune system
4. Results in **carriers showing no clinical symptoms**

Pathogenicity

Incubation period:

- Natural infection: 5-21 days
- Experimental infection: 2-5 days

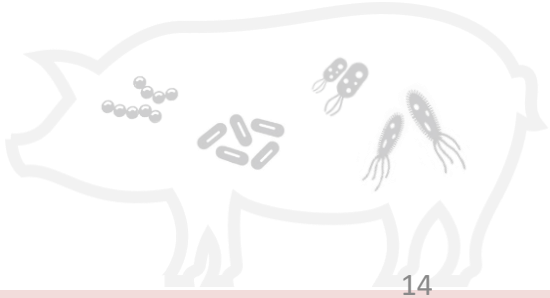
Vary in pathogenicity: High to low virulence forms

	Clinical develop	Mortality
Highly virulence - Peracute - Acute form	Sudden death <7 days	100% 100%
Moderate virulence - Subacute form	5-30 days	20-40% adults 70-80% young animals
Low virulence - Chronic form (Seroconversion)	>1 month	<30% (pregnant sows, young animals)

Clinical signs and lesions

Acute disease

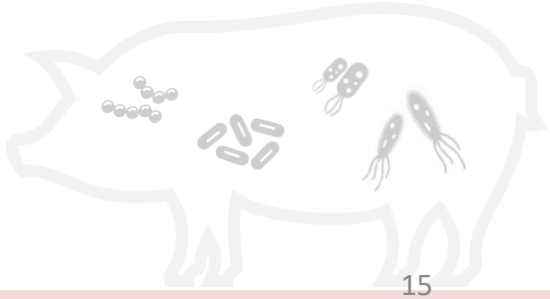
- **Sudden death** with few clinical signs
- **High fever** (up to 42°C)
- **Hyperaemia and cyanosis** (seen as reddening) of the skin, particularly ears and snout
- Depression and loss of appetite
- Vomiting and diarrhea (sometimes bloody)
- Abortions

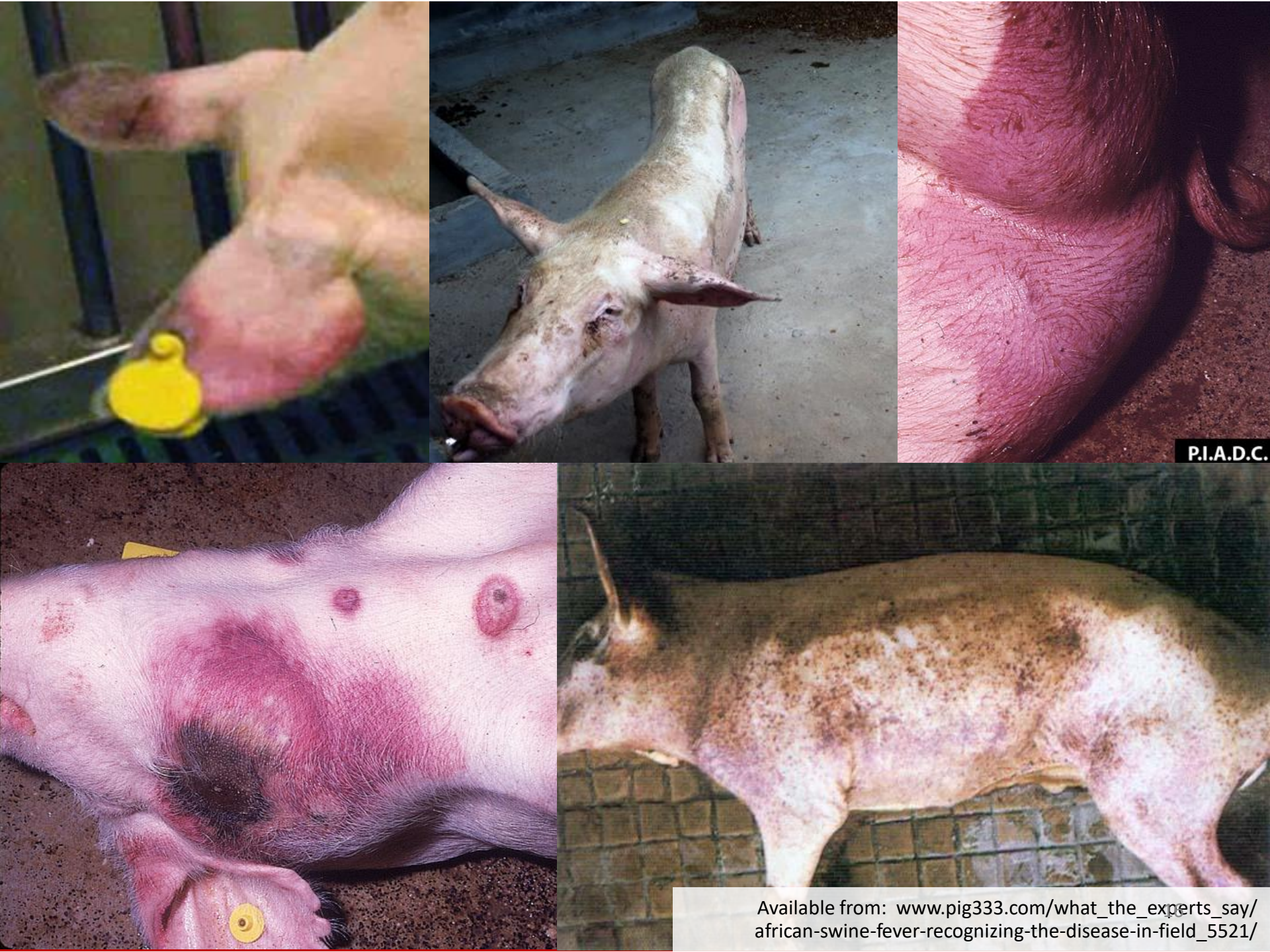


Clinical signs and lesions

Subacute and chronic disease

- More common outside of Africa
- **Various signs**: slight fever, depression
- Transitory thrombocytopenia, leukopenia
- Numerous hemorrhagic lesions
- Necrosis in areas of skin, chronic skin ulcers, arthritis, pericarditis, adhesions of lungs
- Abortion





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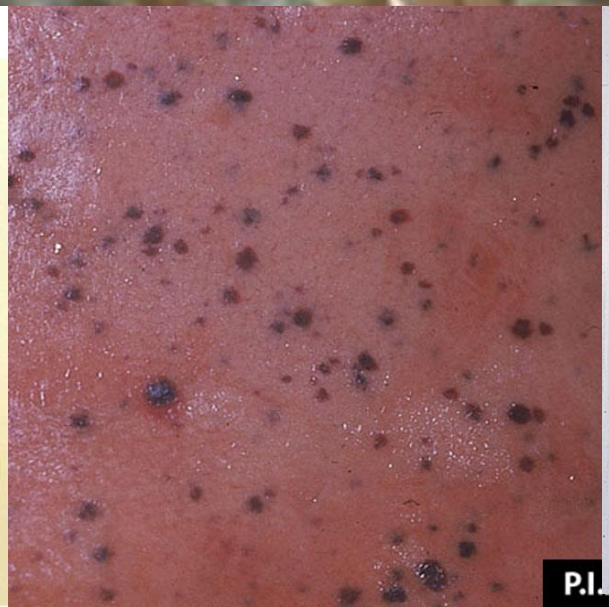
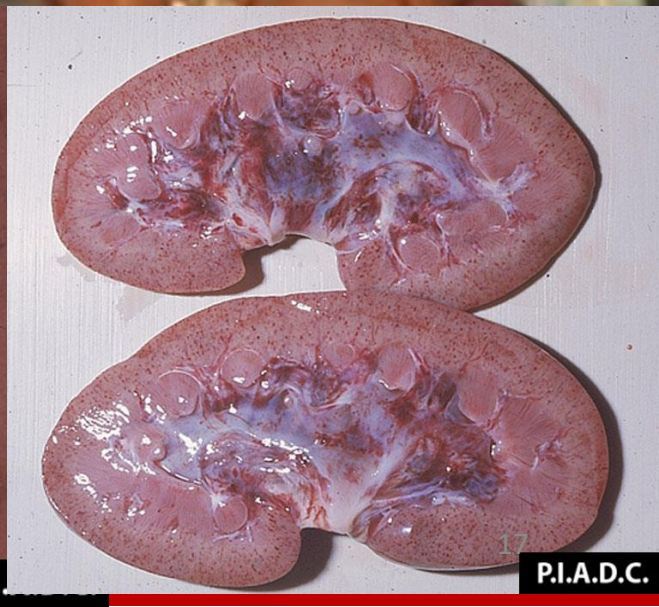
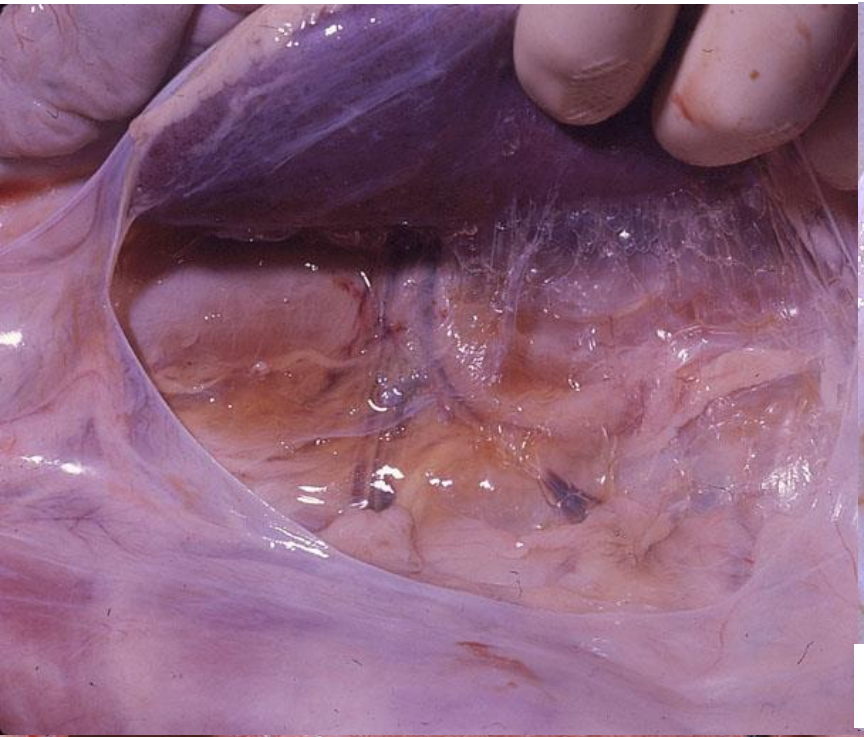
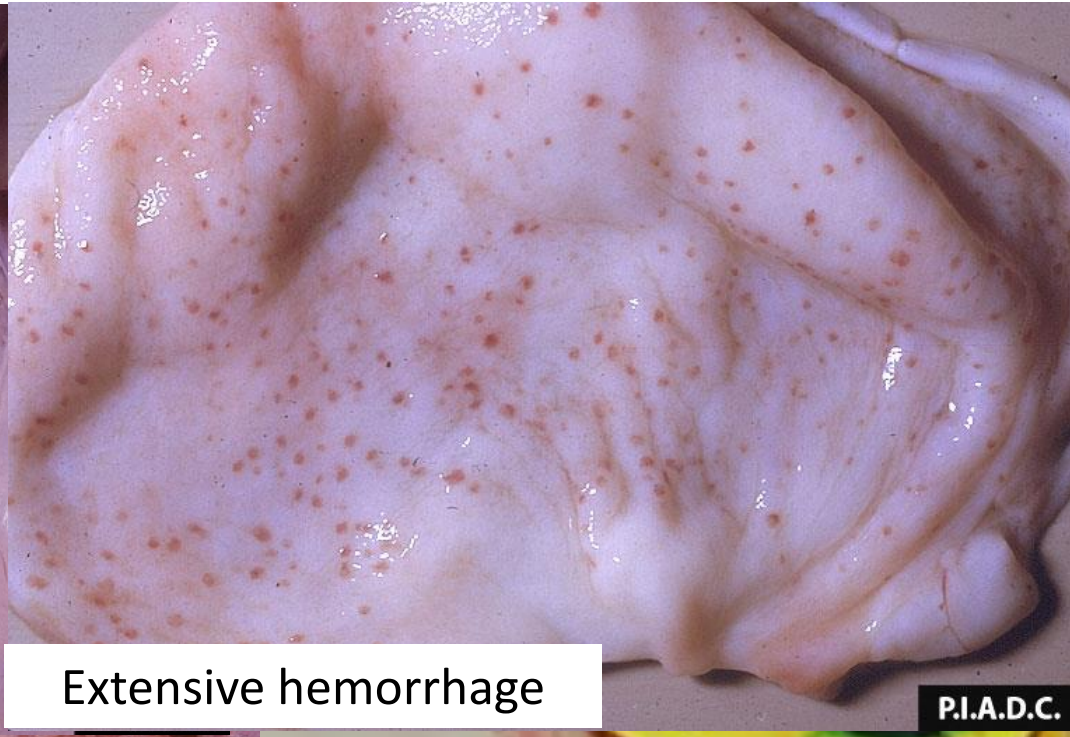
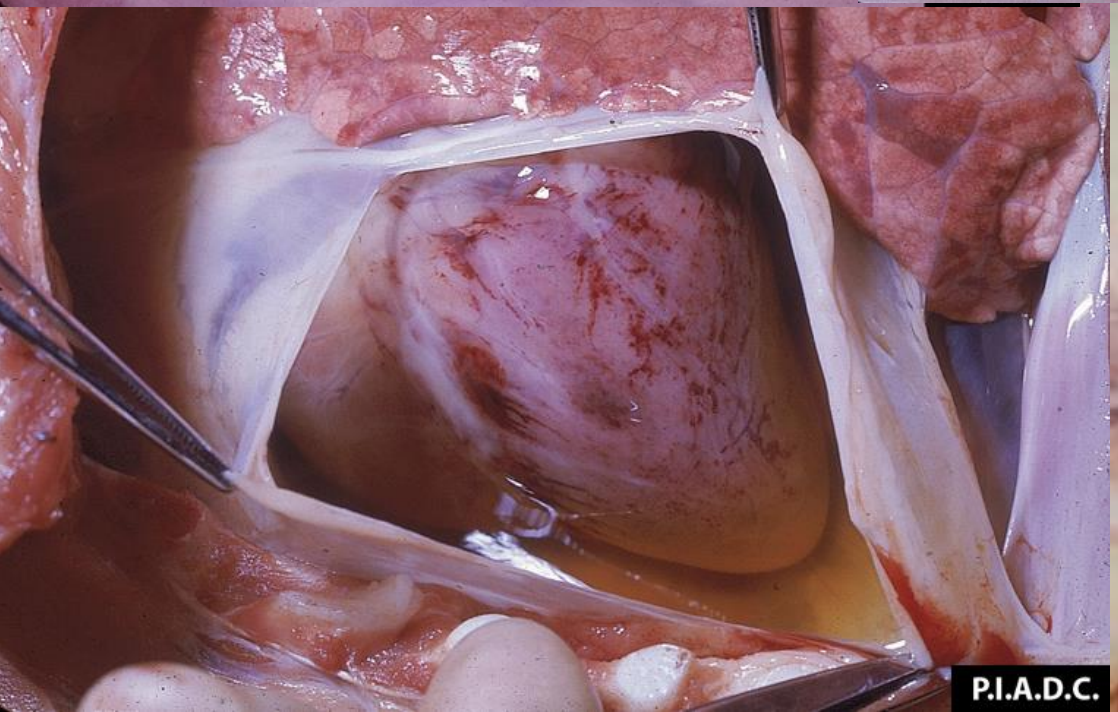


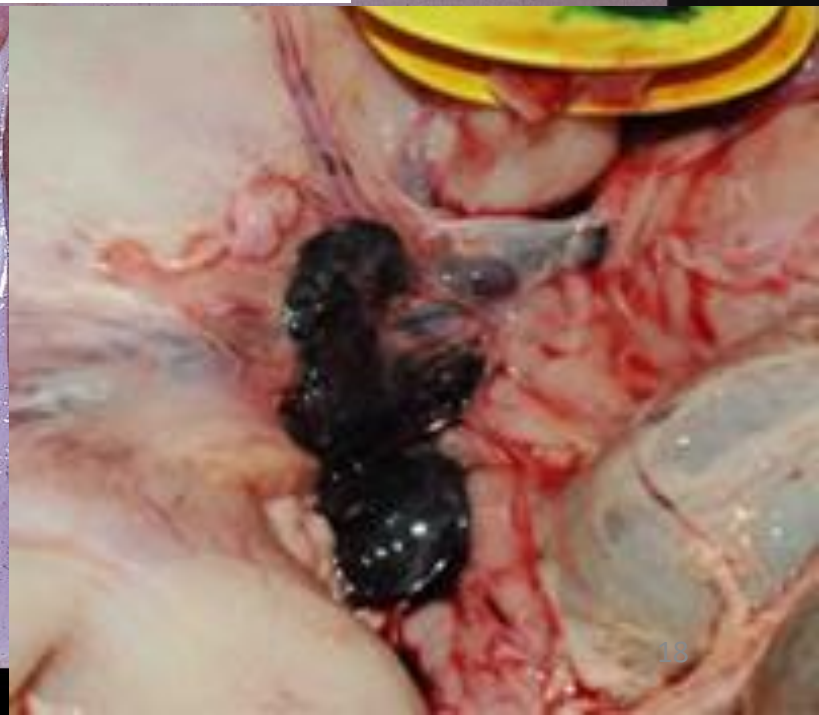






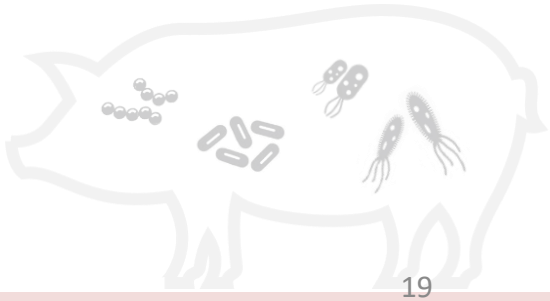
Extensive hemorrhage





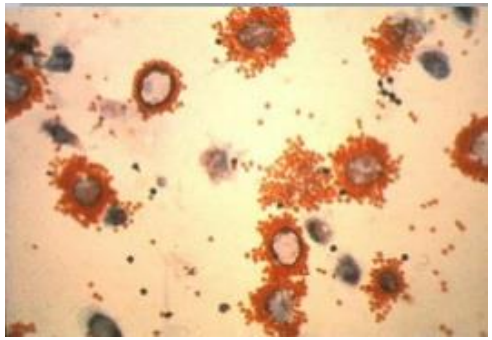
Differential diagnosis

- African swine fever(ASF)
- Classical swine fever(CSF)
- Highly pathogenic strain of porcine reproductive and respiratory syndrome (HP-PRRS)
- Systemic salmonellosis
- Erysipelas

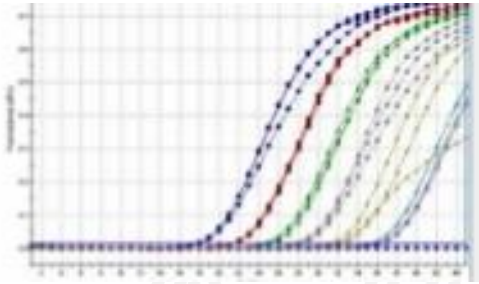


Diagnostic methods

Virus detection (OIE protocol)



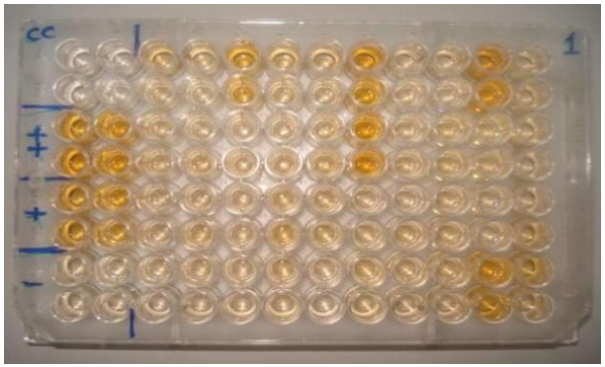
- Immunological methods:
  - Fluorescent antibody test (FAT)
  - Ag captured ELISA
- Viral isolation: Primary cultures of pig monocytes or bone marrow cells
- Haemadsorption test
- PCR

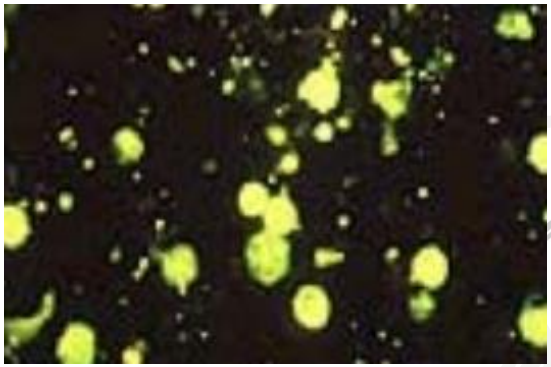


Diagnostic methods

Antibody detection (OIE protocol)

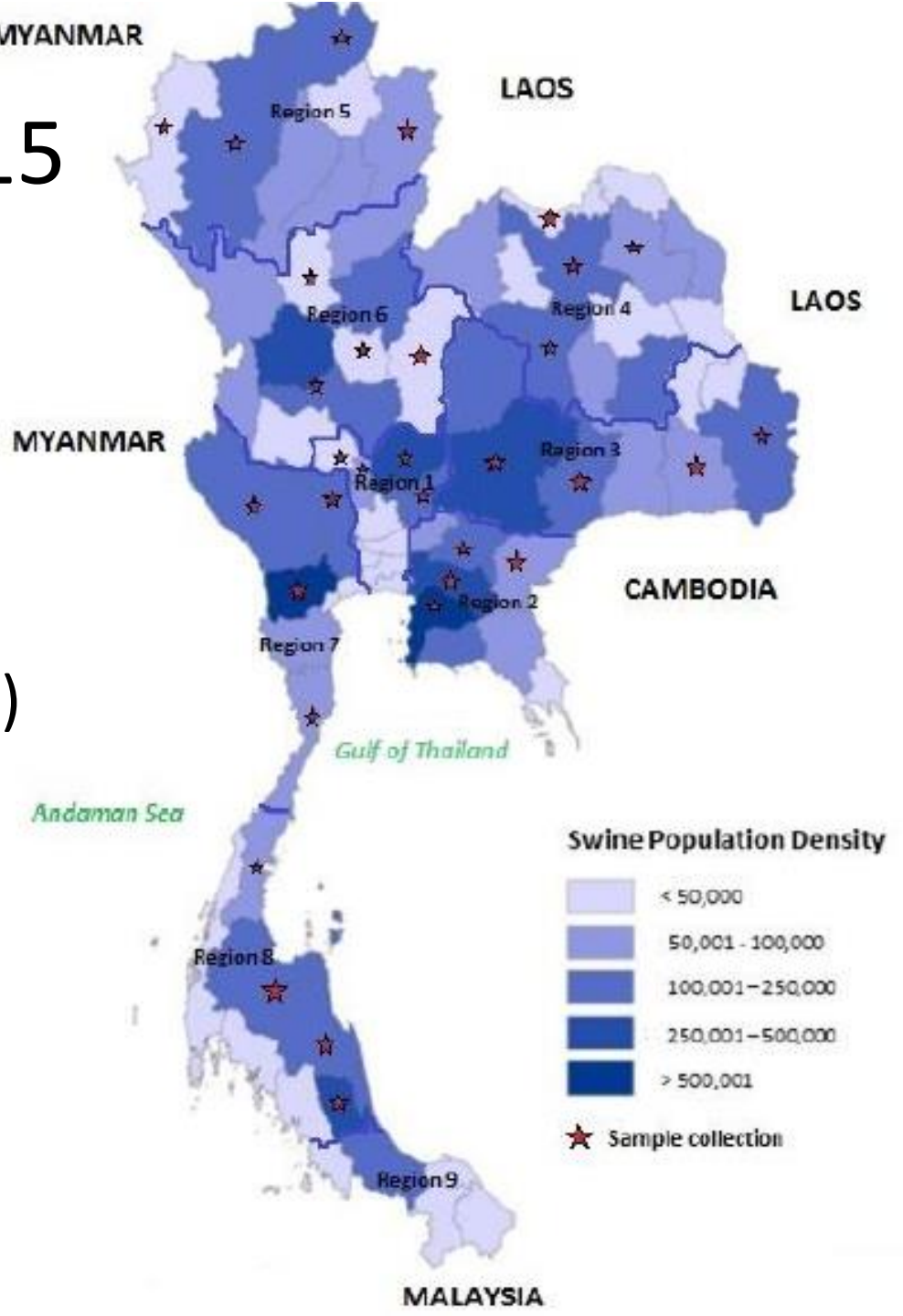
- anti-ASFV antibodies are detectable from about **6 days post-infection**
- Enzyme-linked immunosorbent assay
- Indirect fluorescent antibody (IFA) test
- Immunoblotting test





ELISA: 2010 to 2015

- An indirect ELISA
- Coated with three recombinant proteins (p32, p62, and p72)
- 6,184 samples (230 farms)
- 71 samples (1.15%) showed unclear results
- However, repeated confirmatory tests were negative



Vaccine development

TABLE 2 General approaches to develop vaccine candidates for African swine fever

Vaccine type candidate	Protection	Side effects/ residual virulence after challenge	References
Live attenuated candidates based on passages in bone marrow cells	Partial and/or full protection	Yes	Petisca (1965)
Inactivated virus	No	Not applicable	Blome, Gabriel, and Beer (2014), Bommeli, Kihm, and Ehrensperger (1981), Mebus (1988), Stone and Hess (1967)
Recombinant proteins/peptides	No, or delay in the onset of the disease	Not applicable	Argilaguet et al. (2013), Burmakina et al. (2016), Neilan et al. (2004), Revilla et al. (2016), Ruiz-Gonzalvo et al. (1996)
DNA vaccine candidates	No, or delay in the onset of the disease	Not applicable	Argilaguet et al. (2011, 2012), Lacasta et al. (2014), Revilla et al. (2016)
Viral vectored vaccines	Ongoing	Not applicable	Lokhandwala et al. (2016)
Naturally attenuated virus isolates	Partial and/or full protection. Protection against homologous and heterologous virus challenge	Yes	Boinas, Hutchings, Dixon, and Wilkinson (2004), Gallardo, Soler, et al. (2012), King et al. (2011), Leitão et al. (2001), Sánchez-Cordón et al. (2016)
Live attenuated candidates based on deletion mutants from virulent ASF virus isolates	Partial and/or full protection against homologous virus and heterologous virus challenge	Yes	O'Donnell et al. (2016), Reis et al. (2016), Rodríguez (2015)
Live attenuated candidates based on deletion mutants from attenuated virus isolates	Full against homologous virus and partial protection against heterologous virus challenge	Yes	Gallardo, Soler, Carrascosa, et al. (2015)

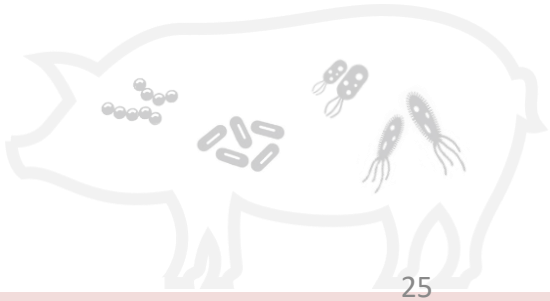
Vaccine

- **Live-attenuated virus vaccine**
- Stimulates both cellular antibody response and confer protection
- Safety concern
- Risk of long-term viral persistence

- **Inactivated and subunit vaccine (recombinant protein, DNA vaccine, virus vector)**
- Safety
- Can induce antibody responses, but not confer strong protection
- May delay in the onset of disease

Prevention and control

- **No vaccine available**
- No effective treatment
- Biosecurity is the main prevention strategy
- **Culling (stamping out)** is the main control strategy



Thank you

For your attention