

# **African Swine Fever Research And Current Situation**

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# African Swine Fever Virus

- Sole member of Asfarviridae
- Large Icosahedral DNA virus
- Large dsDNA genome: 170-190 kbp
- Replicates in cell cytoplasm
- Infects and persists in soft ticks and members of *Suidae* family



# African Swine Fever

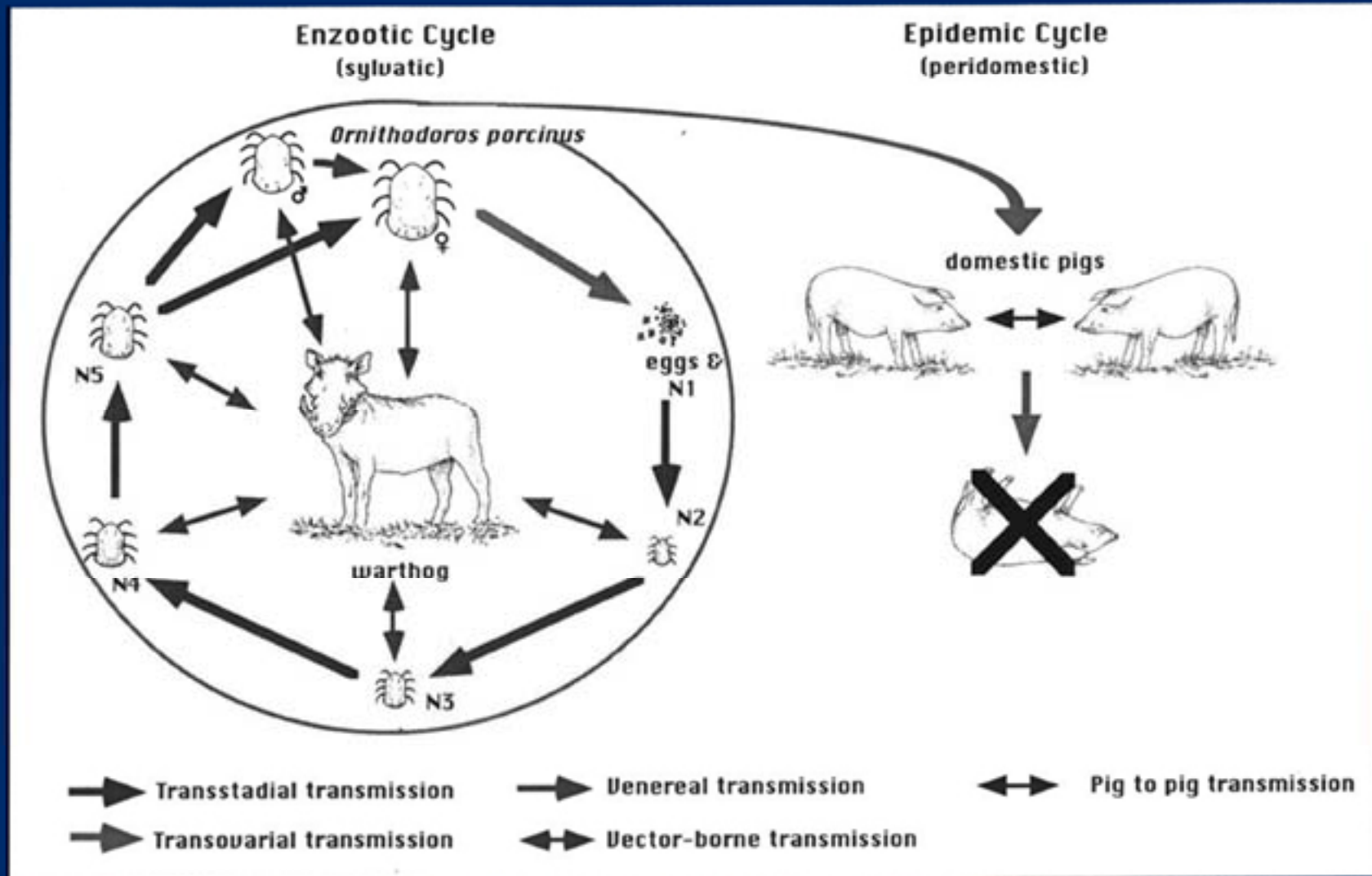
- Virulence ranges from
  - high to low
- Affects domestic and wild pigs
  - Produces **inapparent** infection in two species of wild African swine
    - Wart hog
    - Bush pig
- **High mortality in domestic pigs**



# *Suidae* family



# African Swine Fever Virus Natural Cycle



# African Swine Fever Virus

- Stable in the environment
  - Resistant to wide pH range (3.9 - 11.5)
  - It can survive for a year and a half in blood stored at 4° C, and at least a month in contaminated pig pens
  - Remains infectious for 150 days in boned meat stored at 39° F, 140 days in salted dried hams, and several years in frozen meat



# ASF: The Disease

- Highly lethal (100%) to subclinical
- Edema, ascites and hemorrhage
- Virulence associated replication and spread within the mononuclear-phagocytic system
- Long-term persistent/latent infection
- All domestic pigs susceptible
- Large natural reservoir in nature
- No vaccine available



# Clinical Signs: Acute Form, High Virulence

- Incubation period: 48-72 hours
- High fever (animals huddled)
- Moderate anorexia
- Leukopenia, thrombocytopenia
- Recumbency
- Erythema, cyanotic skin blotching
- Possibly diarrhea (bloody) and abortions
- Vomiting
- Ocular discharge
- Death can follow (100% mortality in domestic pigs)
- Survivors are virus carriers for life





# Clinical Signs: Acute Form, High Virulence

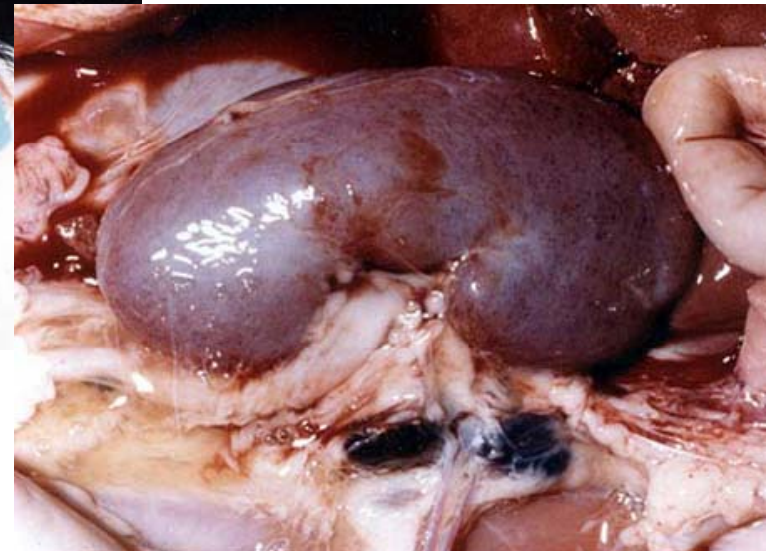
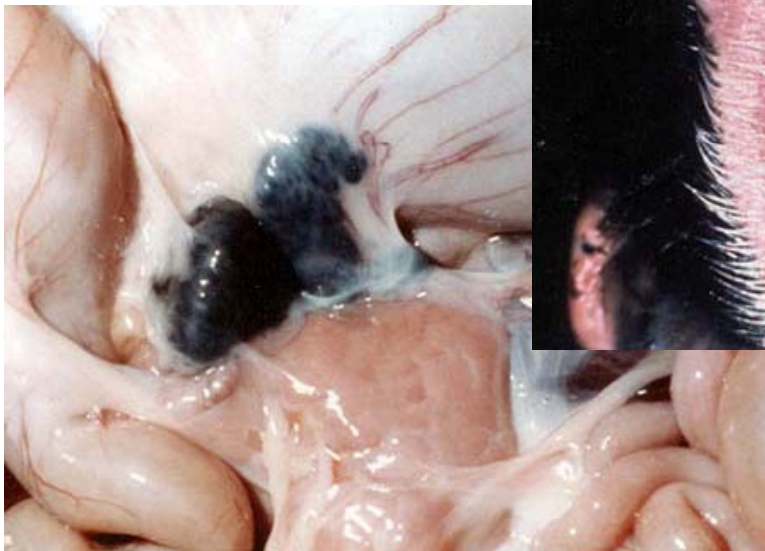
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# Clinical Signs:

## Subacute Form, Moderate Virulence

- Less intense symptoms
- Duration of illness is 5-30 days
- Abortion in pregnant sows
- Death within 15-45 days
- Mortality rate is lower (e.g. 30-70%)



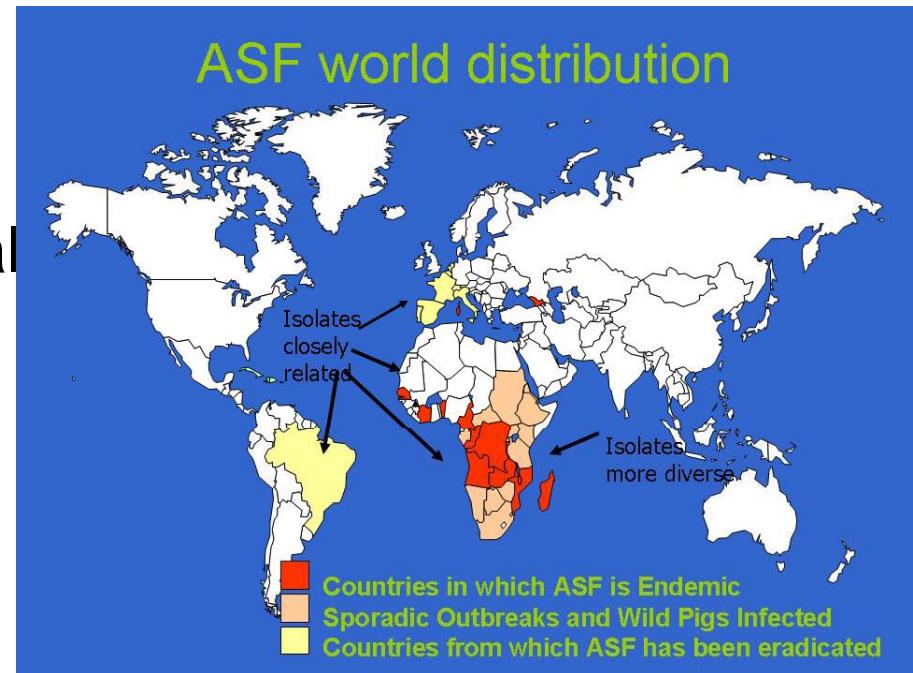
# Clinical Signs: Chronic Infection

- Multi-focal erythema
  - Ears, abdomen, inner thigh
  - May be raised and necrotic
  - Develops over 2-15 months
- Pericarditis
- Low fever
- Pneumonia
- Painless swelling of carpal and tarsal joints
- Emaciation, stunting
- Death (low mortality)



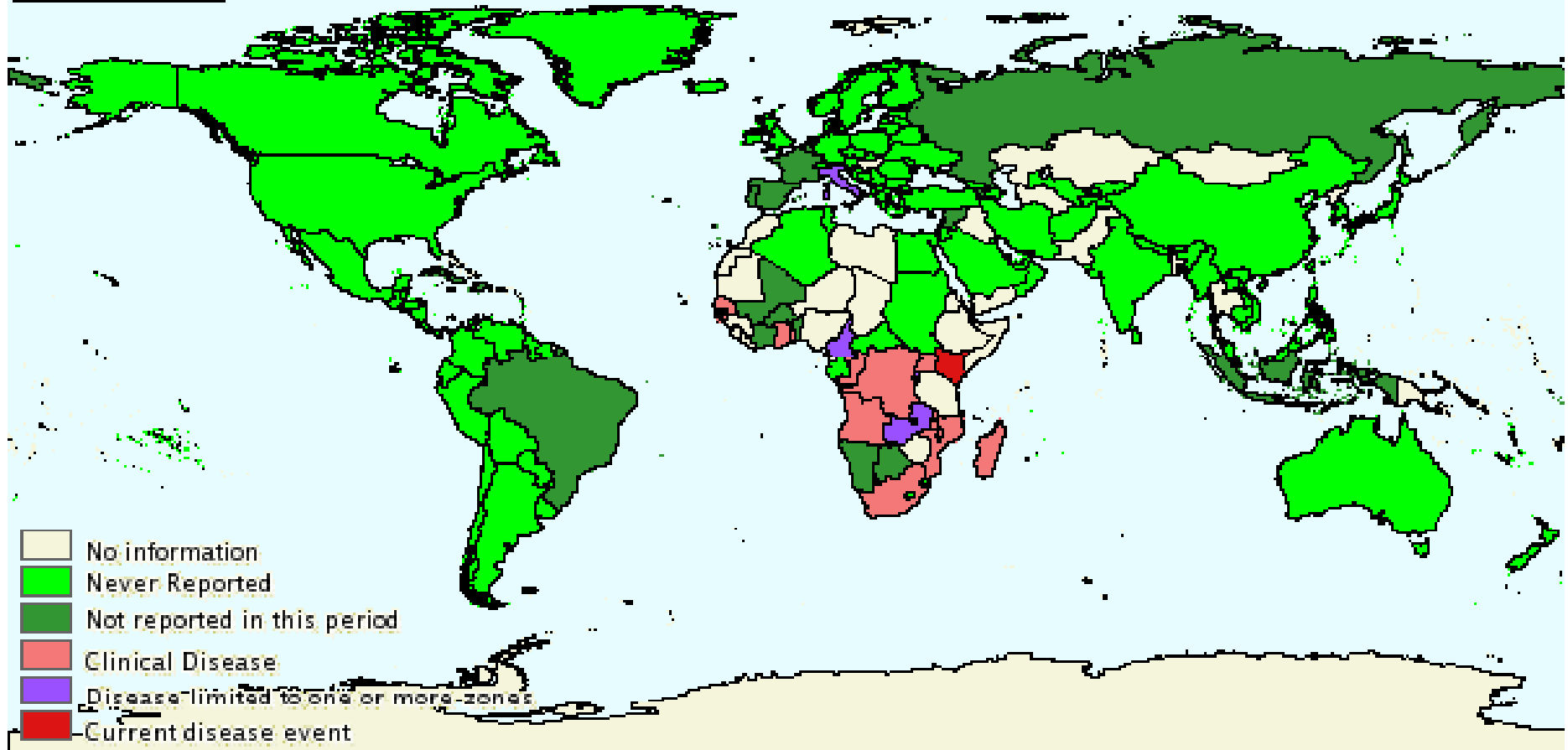
# Geographic Distribution

- Until 1957: Endemic in sub-Saharan Africa (Equator to northern South Africa)
- After 1957: Found in wild boar and feral pigs Sardinia, Portugal, Spain
- 1970's spread to Cuba, Haiti, the Dominican Republic, Brazil
- Spread in Europe 1980's
- Eradicated in most of Europe 1990s



# ASF Distribution 1990-2006

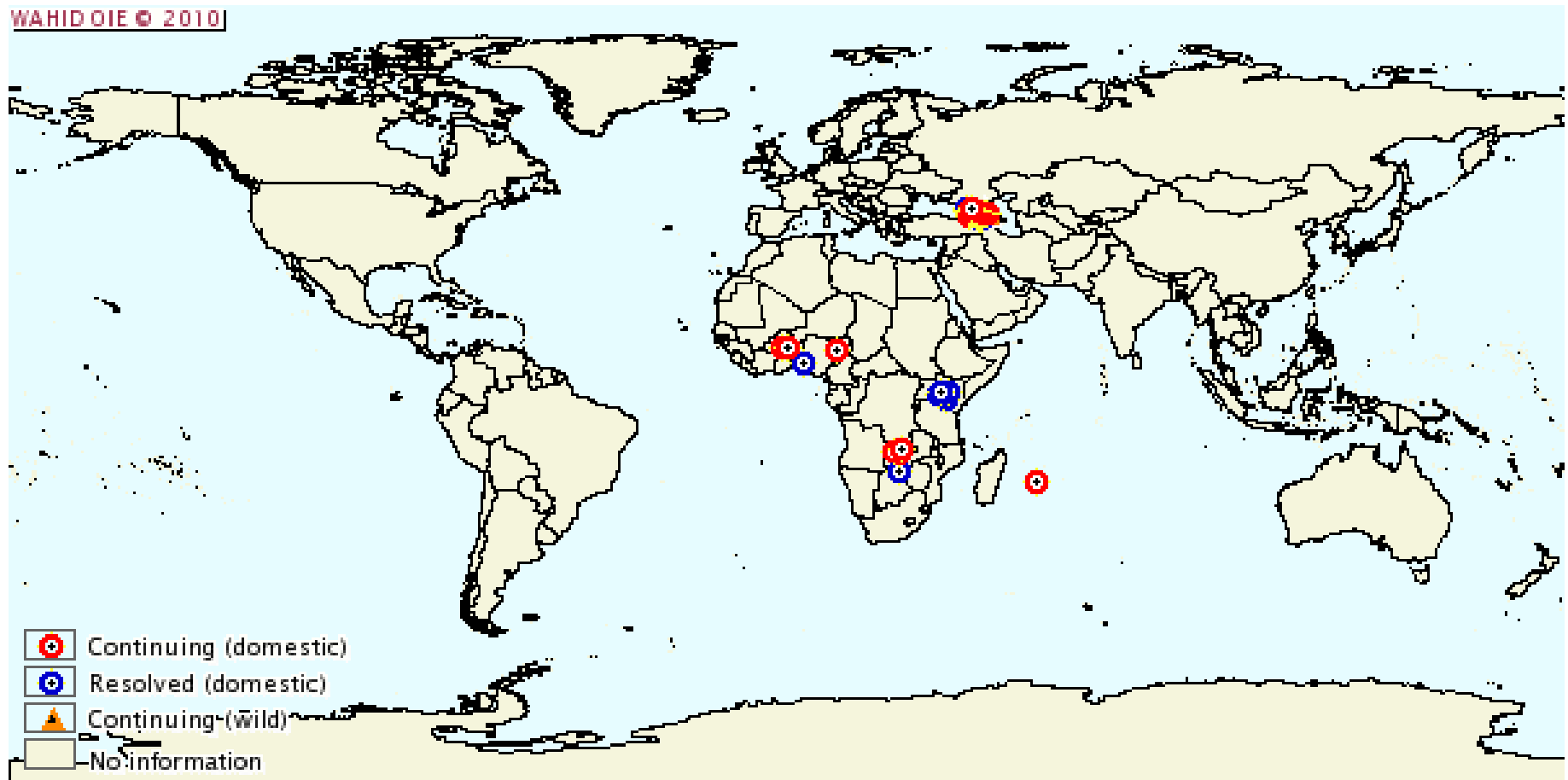
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ASF restricted to Africa and Is. Sardinia

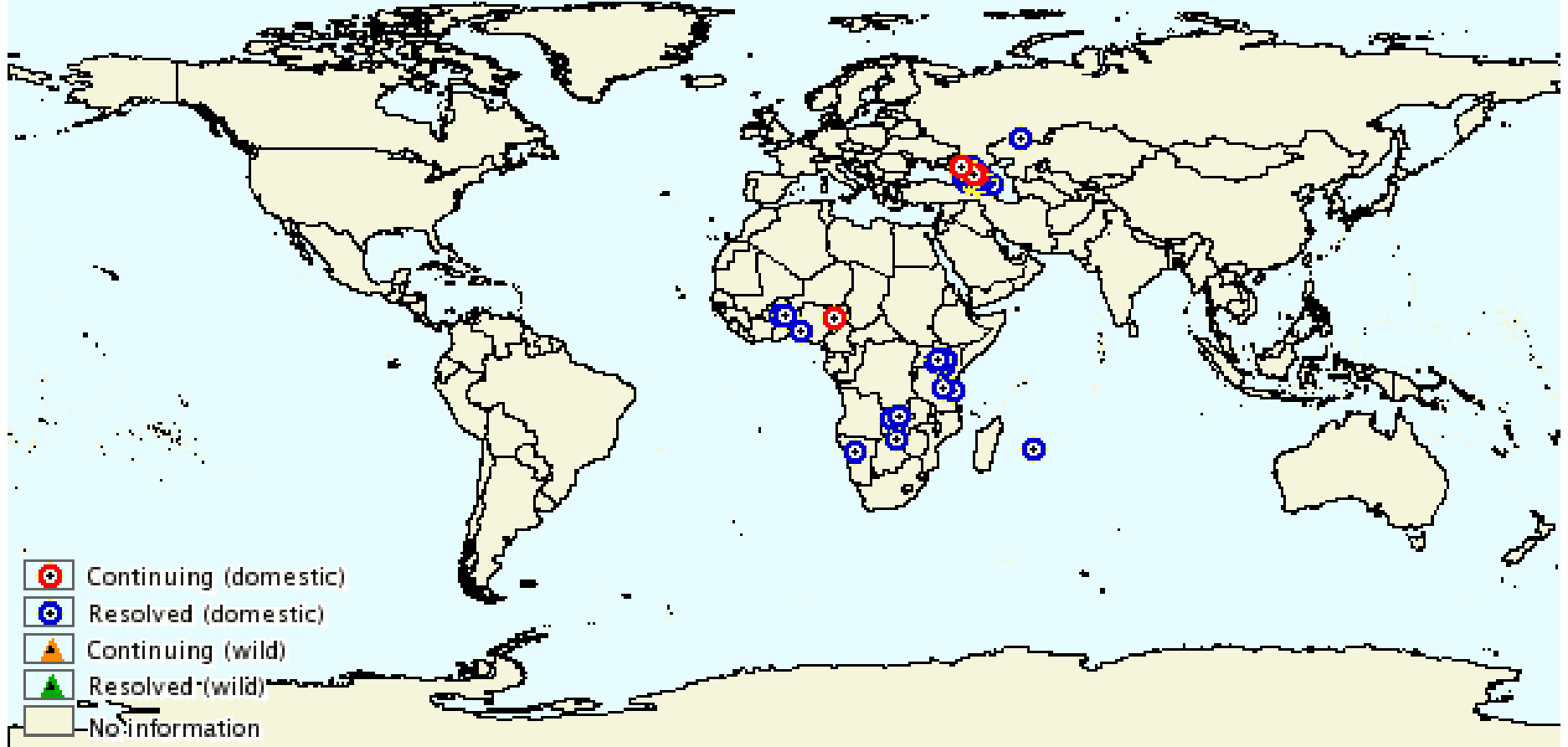


# 2007 ASF outbreak in the Caucasus



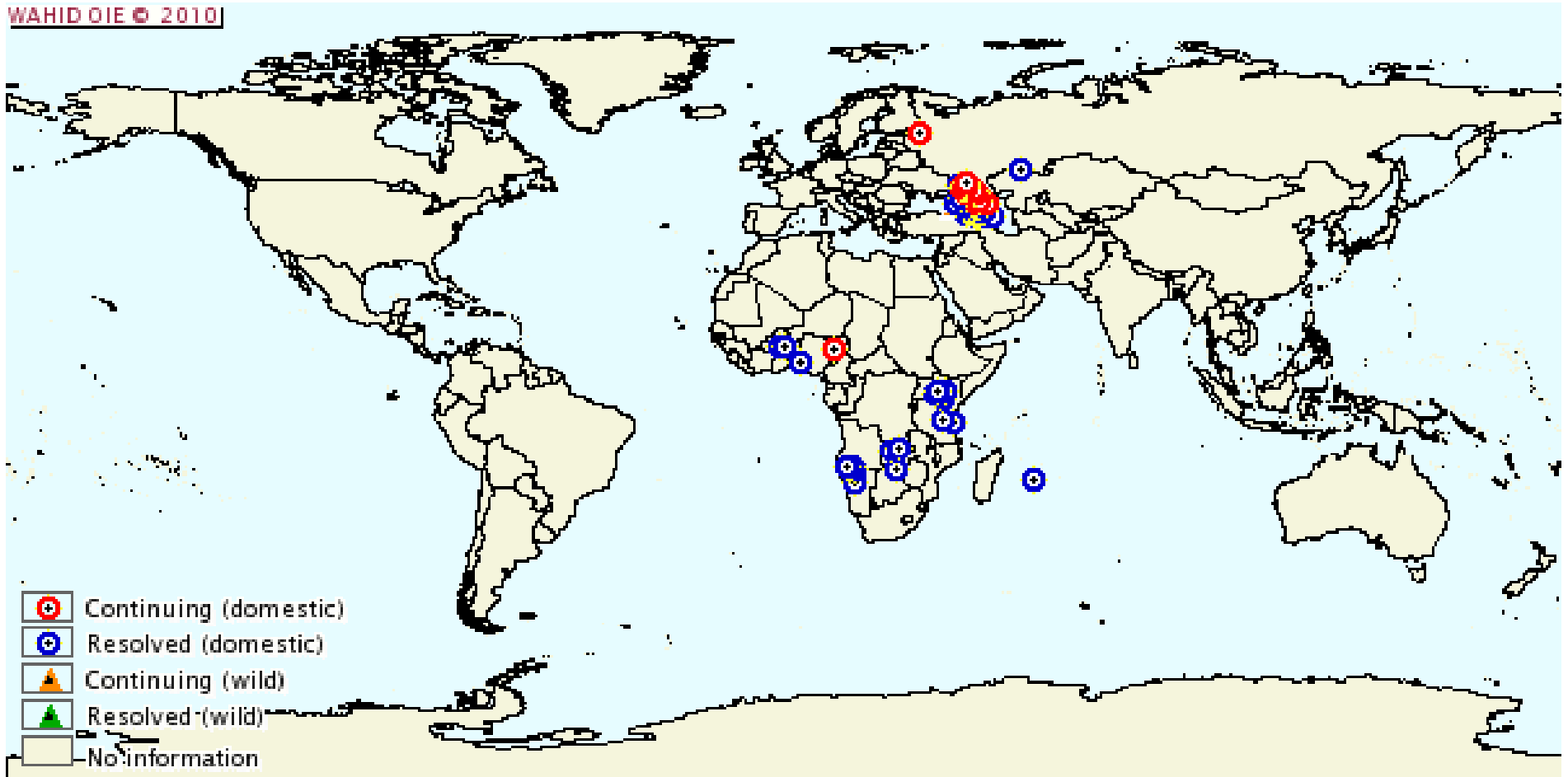
# 2008

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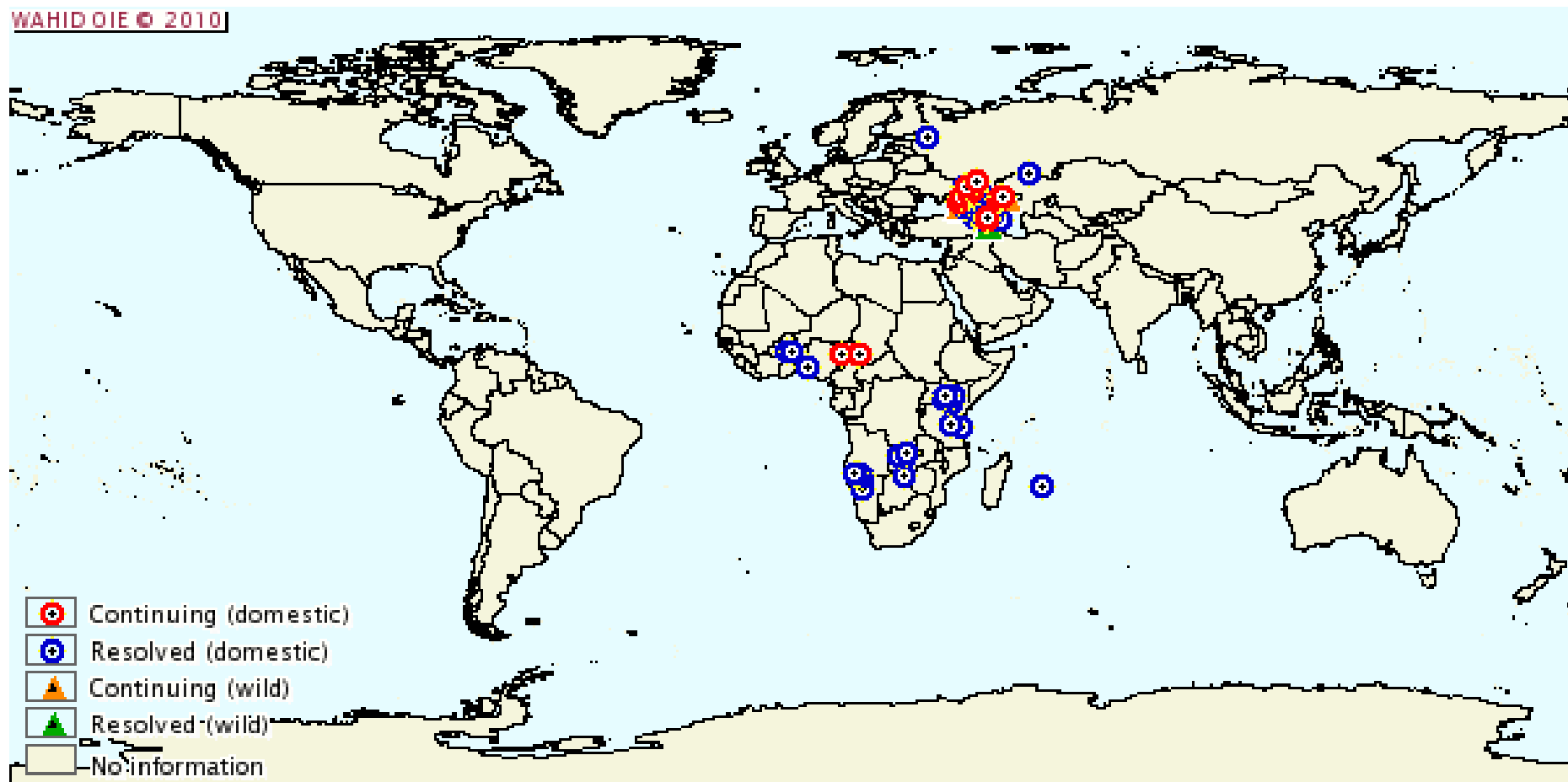
# 2009

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# ASF On The Move 2010



Beginning of 2007 in R. of Georgia and has since spread to the neighboring countries of Armenia, Azerbaijan and Russia

# ARS Mission

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ARS conducts research to develop and transfer solutions to agricultural problems of high national priority.



# ASF RESEARCH GAPS

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- **Pathogenesis:** *viral and host virulence determinants – early events in infection*
- **Virus ecology:** *host tick - virus interactions – role in transmission*
- **Immunology:** *protective immune response: there are no effective vaccines!*
- **Epidemiology:** *transmission cycles – direct vs vector*

# ARS Research Program – until 2004

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- **Protective Immunity to ASF**
- **Viral Functional Genomics**
  - **Virulence/host range genes**
  - **Host susceptibility and/or resistance genes**
  - **Comparative genomics**



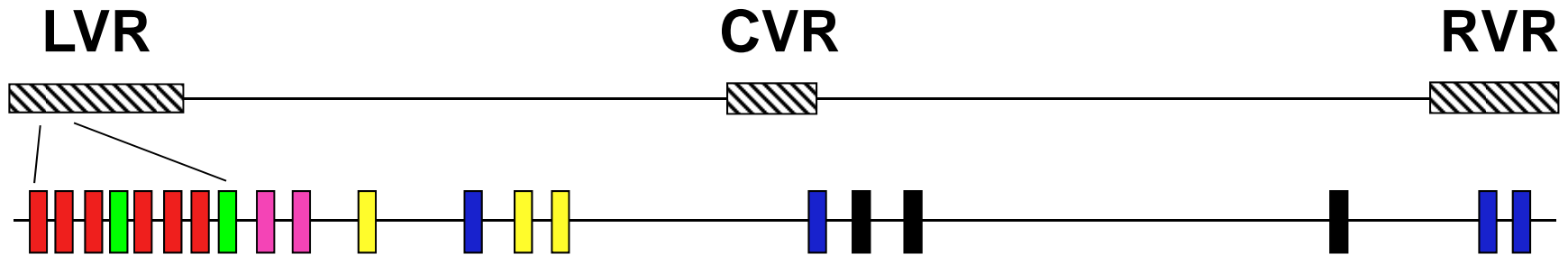
# ARS Research Accomplishments

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- First to determine the genetic content of pathogenic ASF viruses
- First to develop techniques for genetically engineering ASFV genome
- Identified and characterized novel ASFV virulence/host range genes
- First to genetically engineer live-attenuated ASF viruses which protect swine from ASF
- Characterized persistent ASFV infection in tick host
- Described latent infection as sequel to infection in all surviving pigs (carrier animals)
- Defined protective host responses to virus infection
- First to identify viral antigens involved in protective immunity



# ASFV genome – 190 kbp



█ Structural proteins: p30, p72, p54

█ Immune response modulation: 5EL (I $\kappa$ B), 8CR (lectin), 8DR (CD2)

█ Prevention of apoptotic cell death: 5HL (Bcl2), 4CL (iap)

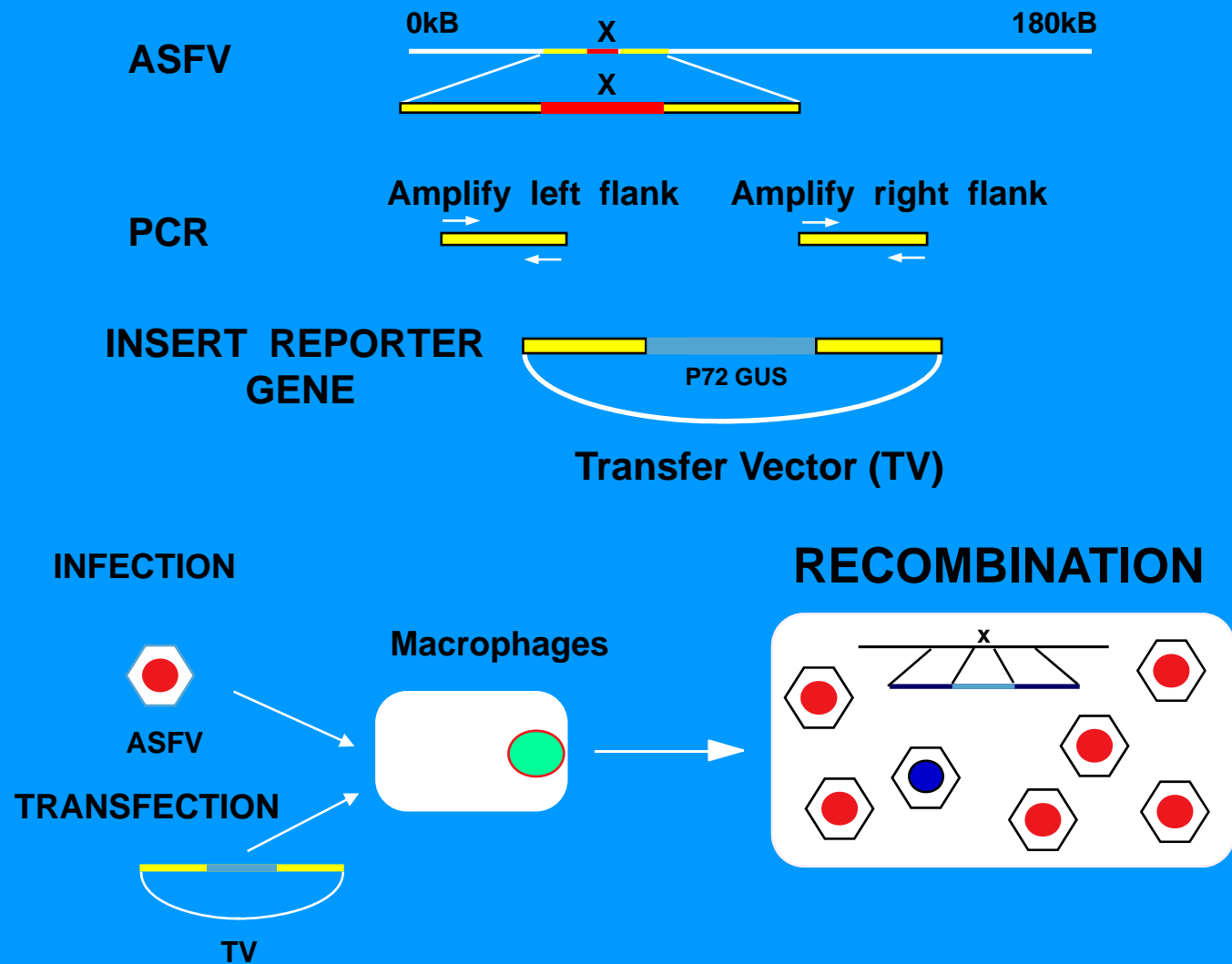
## Host range and virulence associated genes

█ NL, UK, 9GL, TK

█ Multigene family (MGF) 360 genes

█ Multigene family (MGF) 530 genes

# Genetic engineering of ASFV



# ARS Current Research

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- Countermeasures to Control Foreign Animal Diseases of Swine – Dr. Manuel Borca P.I.
  - Develop intervention strategies to control ASFV
    - Identify virus-host determinants of virulence and transmission
    - Develop technologies to enable the development of ASF vaccines that are efficacious against the most prevalent ASF strains





# FADRU Staff

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- 6 Administrative staff
- 8 Senior scientists
- 5 Visiting Scientists
- 10 support scientists
- 5 ARS postdocs
- 15 PIADC-ORISE Research Fellows
- 10 University Cooperators
- 2 Federal Collaborators
- **TOTAL ARS PERSONNEL AT PIADC 60**



# Thank you!

