Knowing the Enemy:

The Role of Genomics in ASF Prevention and Control

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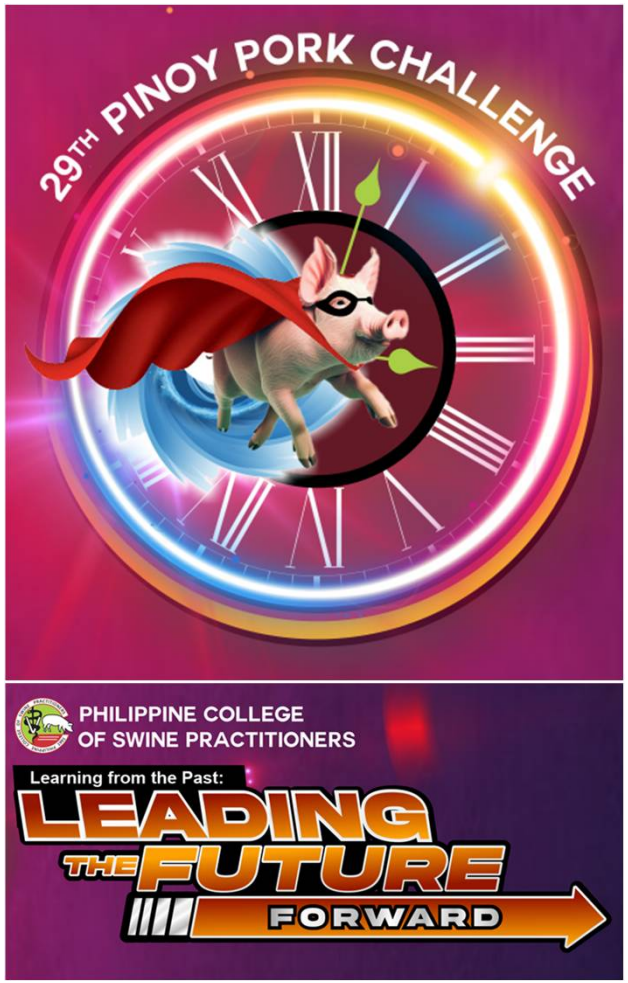
Roselle Falconite-Cudal, DVM



Agenda

I. Knowing the Enemy: A Perspective

I. BioAssets: Who we are?

I. Gap and Solution

I. ASF: Our enemy at a glance

I. Genomics

I. Where we are with ASF Genomics?

I. Summary and Key Points

I. Big Picture and Call to Action

DISCLAIMER: This project was funded by the Philippine College of Swine Practitioners (PCSP)

Knowing the Enemy and Knowing Ourself

Sun Tzu
Chinese Military General
The Art of War

“If you know the enemy and know yourself, you need not fear the result of a hundred battles. If you know yourself but not the enemy, for every victory gained you will also suffer a defeat. If you know neither the enemy nor yourself, you will succumb in every battle.”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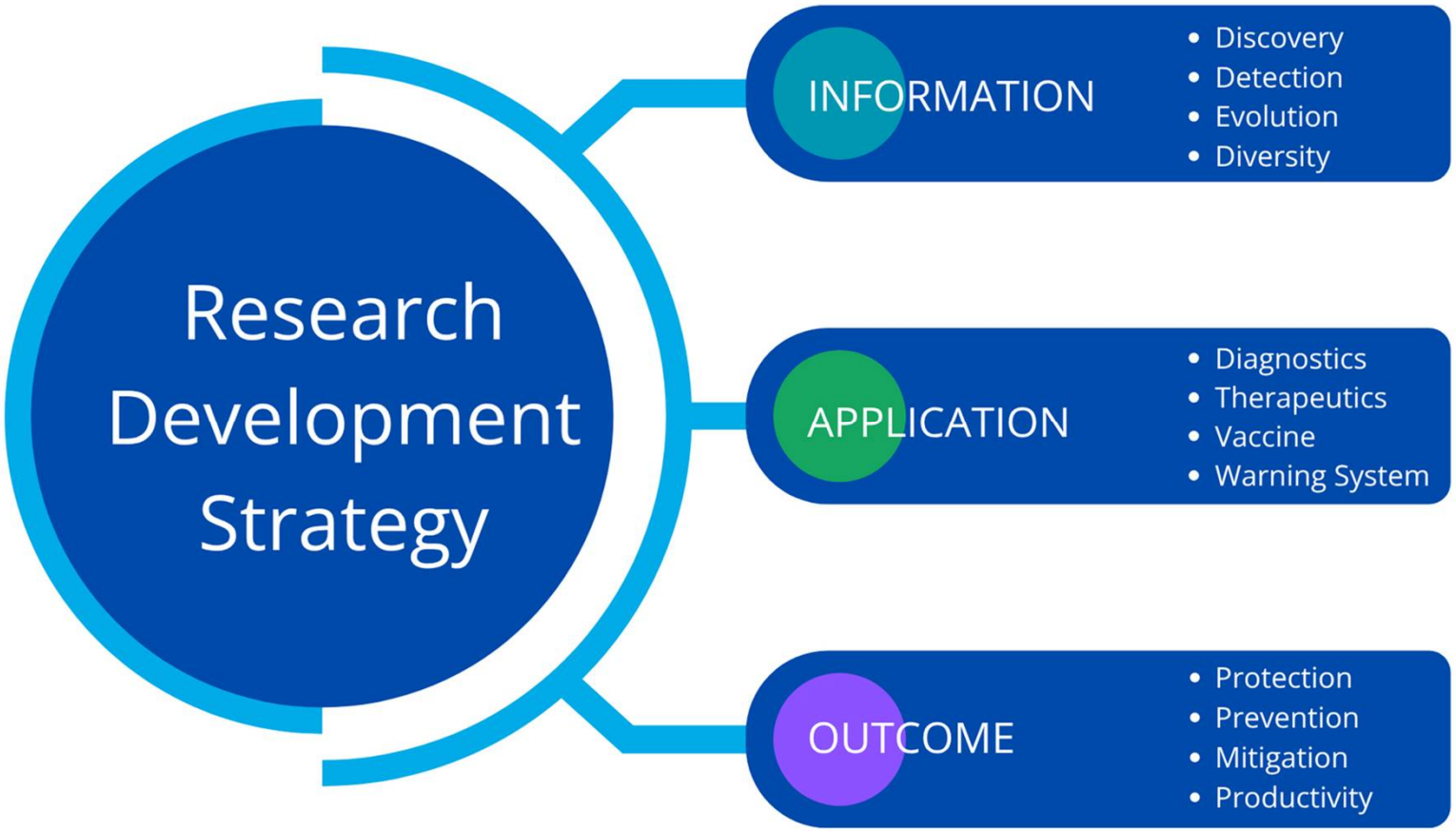

Research Development Strategy
INFORMATION
Discovery
Detection
Evolution
Diversity
APPLICATION
Diagnostics
Therapeutics
Vaccine
Warning System
OUTCOME
Protection
Prevention
Mitigation
Productivity

Gaps	Solution	
How do we respond to outbreaks?	Point of Need Diagnostics	
How well do we know our enemy?	Precision Diagnostics	
Is there a safe and effective vaccine?	Precision Vaccinology	

REACTIVE

DAMAGE CONTROL = COST

PROACTIVE

Animals and Environment

- Serology
- PCR
- Genomics

PREVENTIVE = INSURANCE

- ✓ Diagnostics give meaningful information.
- ✓ Value of information offsets the cost of Dx
- ✓ Information supports sound decision-making.

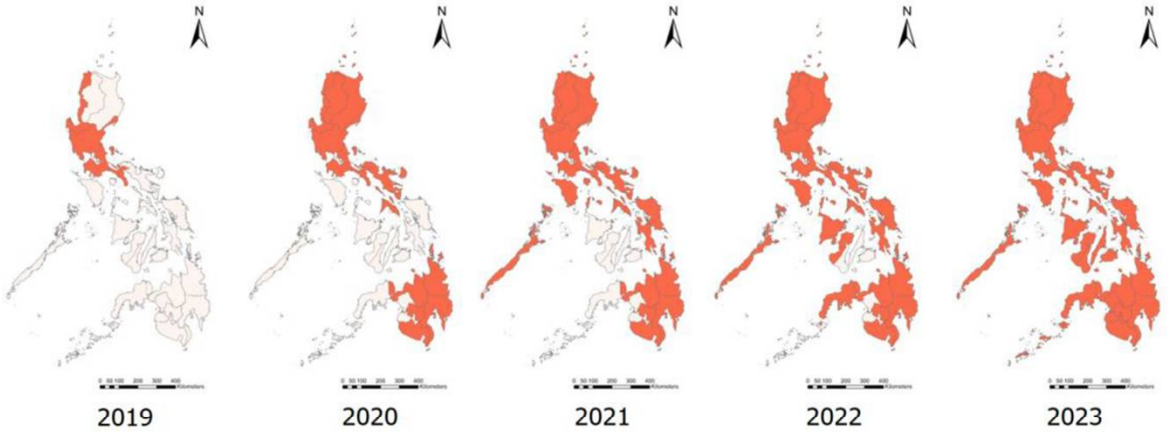
Devastating impact of ASF on the Philippine Swine Industry

The Philippine Swine Industry

Devastating Impact

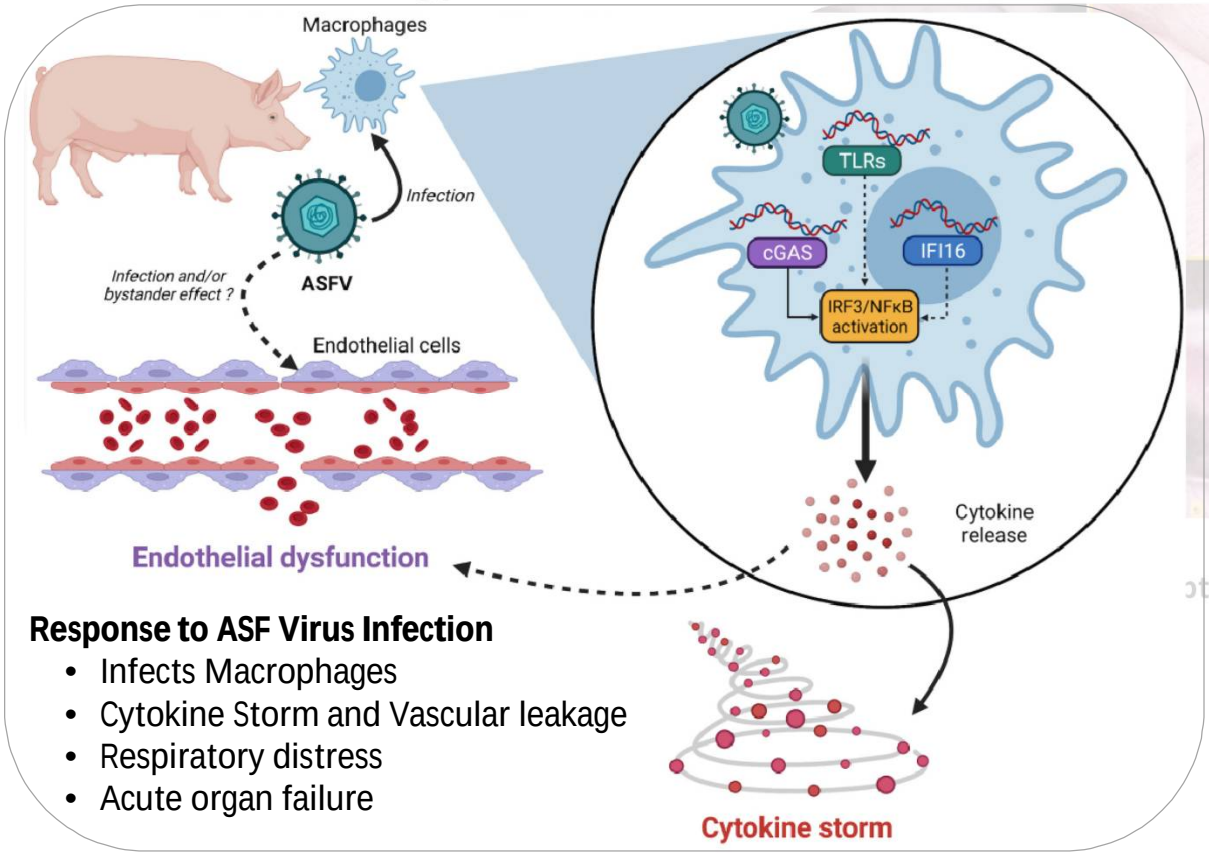
- PhP 200 B industry
  - o *Largest in the animal industry*
- Sudden decline in population
- Increase in Pork Prices

ASF Progression



Year	2019	2020	2021	2022	2023
Cumulative affected regions	3	10	12	15	17
Cumulative affected provinces	6	36	50	59	72

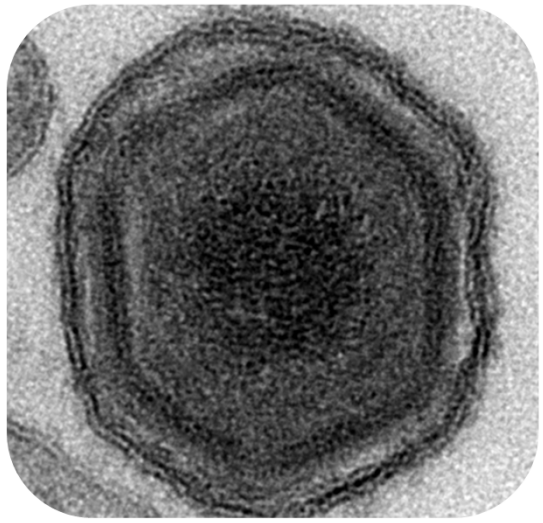
ASF at a Glance



Response to ASF Virus Infection

- Infects Macrophages
- Cytokine Storm and Vascular leakage
- Respiratory distress
- Acute organ failure

The Causative Agent



Large highly complex virus

- 190 kb DNA gnome
- 54 Structural proteins
- 24 genotypes

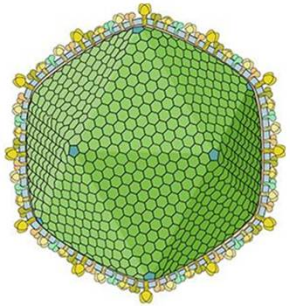
BioAssets

Abrahan Ayanwale et al. 2022. Frontiers in Microbiology
Philippine statistics Authority 2023

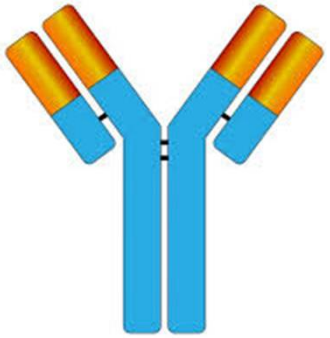
ASF Diagnostics

Lateral Flow

ELISA



Antigen



Antibody

Interpretation:

Presence of virus
Active Infection

Exposure to Virus
Antibody Response

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Image credit to Viral Zome

ASF Diagnostics

PCR

Genomics

DNA

\+
target

\+ target
Identity of gene of interest

\+ target
Identity of the whole virus genome

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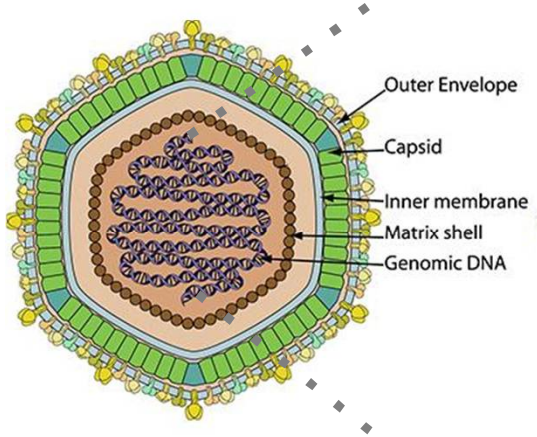
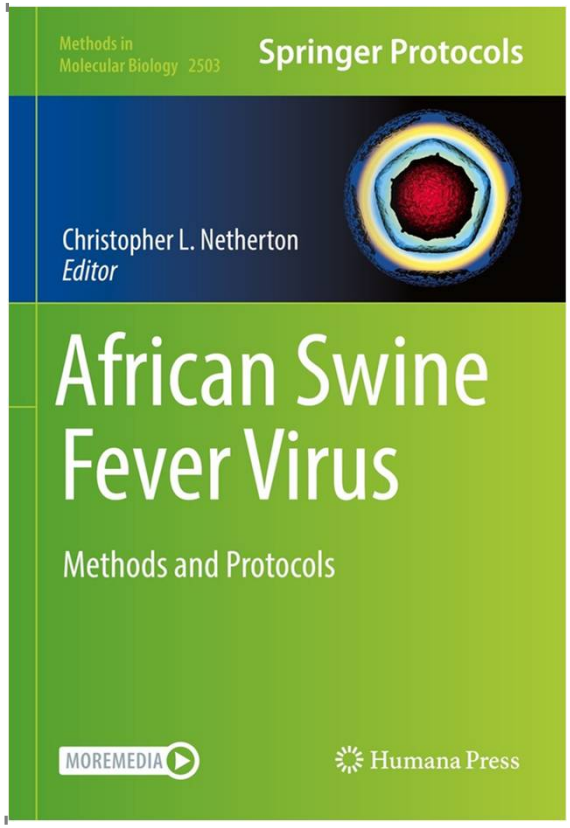
Genomics



DNA



Manual

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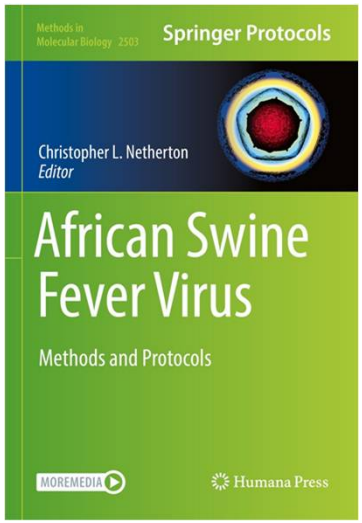
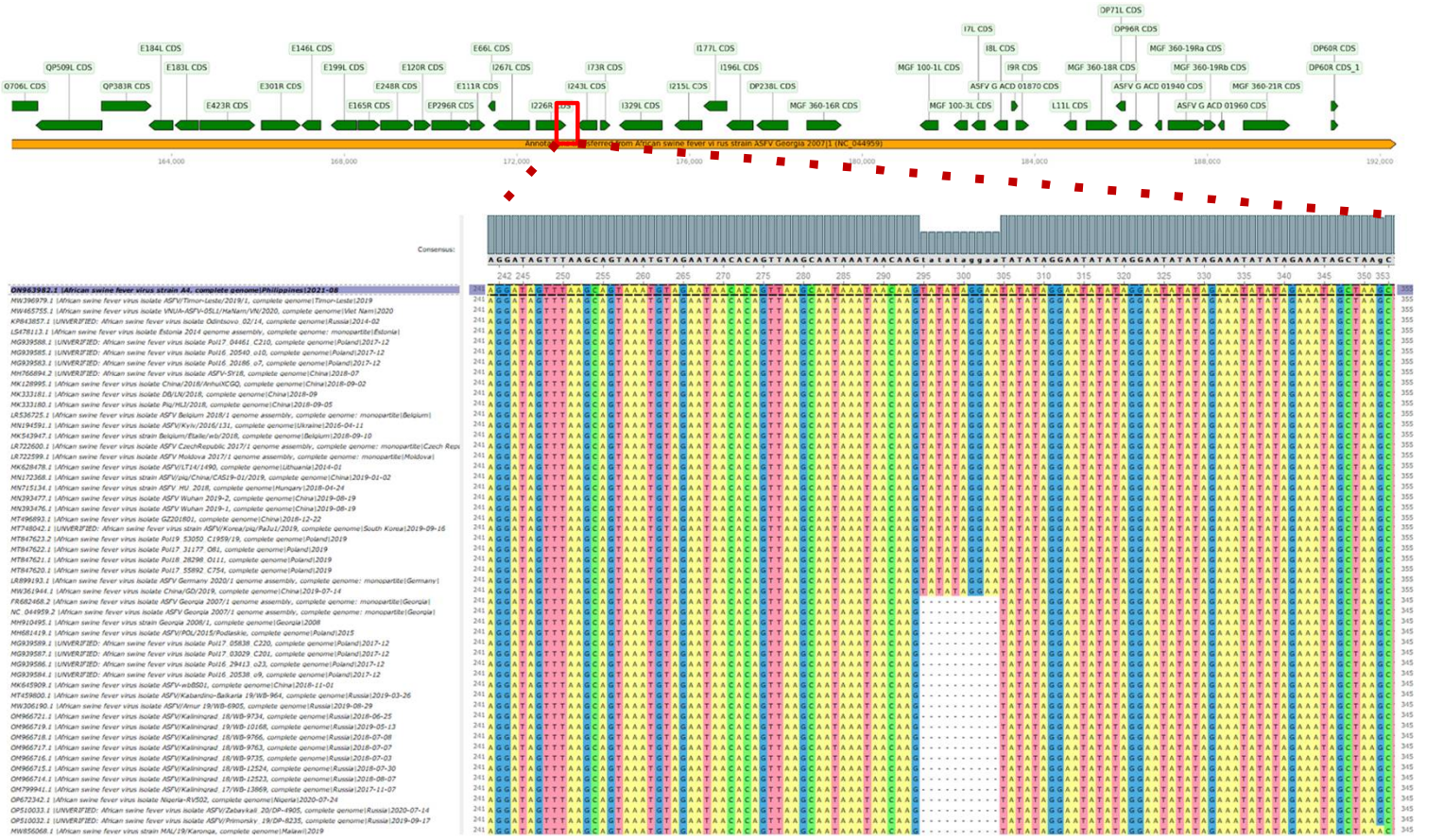
Whole Genome Sequencing





Cover Page

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References

Why Genomics matters for ASF?

Virus
Blueprint

Virus
Evolution

Diagnostics and
Vaccines

Research

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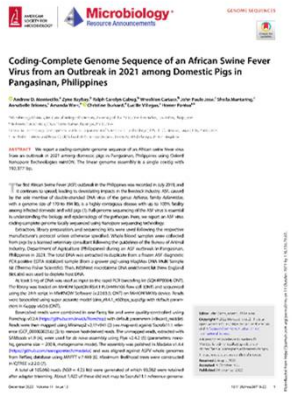
Virus Blueprint:
ASF virus strains clustered together with p72 genotype II (2021 – 2024)


Microbiology Resource Announcements

Coding-Complete Genome Sequence of an African Swine Fever Virus from an Outbreak in 2021 among Domestic Pigs in Pangasinan, Philippines

Maximum-likelihood consensus tree of select ASFV genomes (Asia and Europe) and the genomes of the Philippine strains


viruses MDPI

Genetic Profiles of Ten African Swine Fever Virus Strains from Outbreaks in Select Provinces of Luzon, Visayas, and Mindanao, Philippines, Between 2021 and 2023

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Virus Blueprint:
Genome features of ASFV isolates

Strain	p72 Genotype	CD2v Serogroup	CVR	$IGR_{I73R-I329L}$	$IGR_{A179L-A137R}$	$IGR_{MGF\ 505\ 9R/10R}$	ECO2	O174L	K145R	MGF 505-5R	Bt/Sj	CP204L	J268L
Philippines/BAN20221-4/2022	II	8	CVR1	II	No deletion	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/PAN20211A/2021	II	8	CVR1	II	No deletion	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/BTG2021KSU1-1/2021	II	8	CVR1	II	No deletion	MGF-1	ECO2-I	I - with deletion	I	I	100%	1 base substitution (A-to-G)	1 base substitution (G-to-A)
Philippines/MSR2022S1/2022	II	8	CVR1	II	No deletion	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/NEC20230726003/2023	II	8	CVR1	II	No deletion; with SNPs	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/NEC20230822001/2023	II	8	CVR1	II	No deletion; with SNPs	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/NEC20230929004A/2023	II	8	CVR1	II	No deletion; with SNPs	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/NEC20230929004B/2023	II	8	CVR1	II	No deletion; with SNPs	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/MDR202311F/2023	II	8	CVR1	II	No deletion; with SNPs	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%
Philippines/A4/2021	II	8	CVR1	II	No deletion	MGF-1	ECO2-I	I - with deletion	I	I	100%	100%	100%

➢ Vital information for diagnostics, epidemiology and vaccine research

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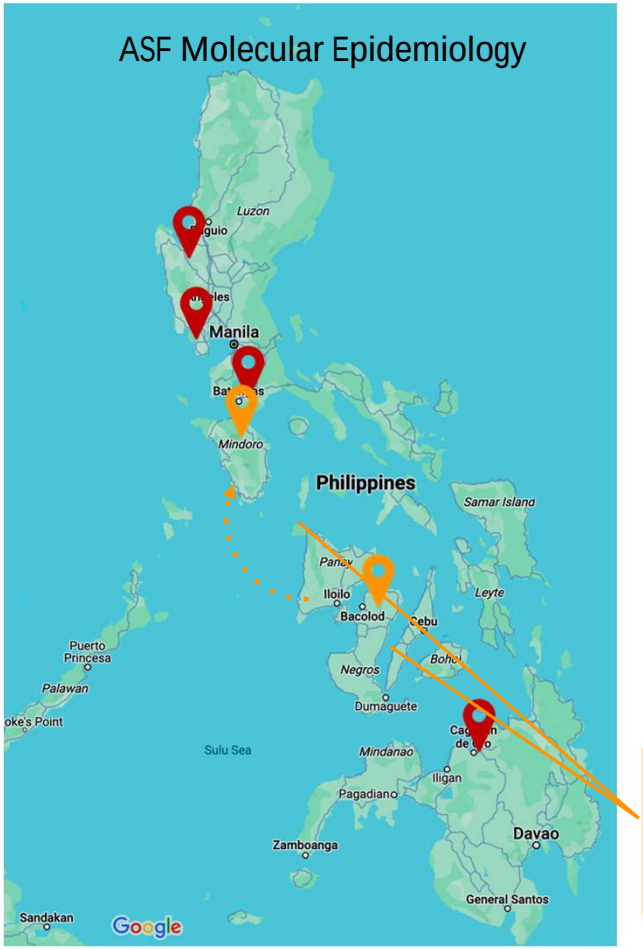
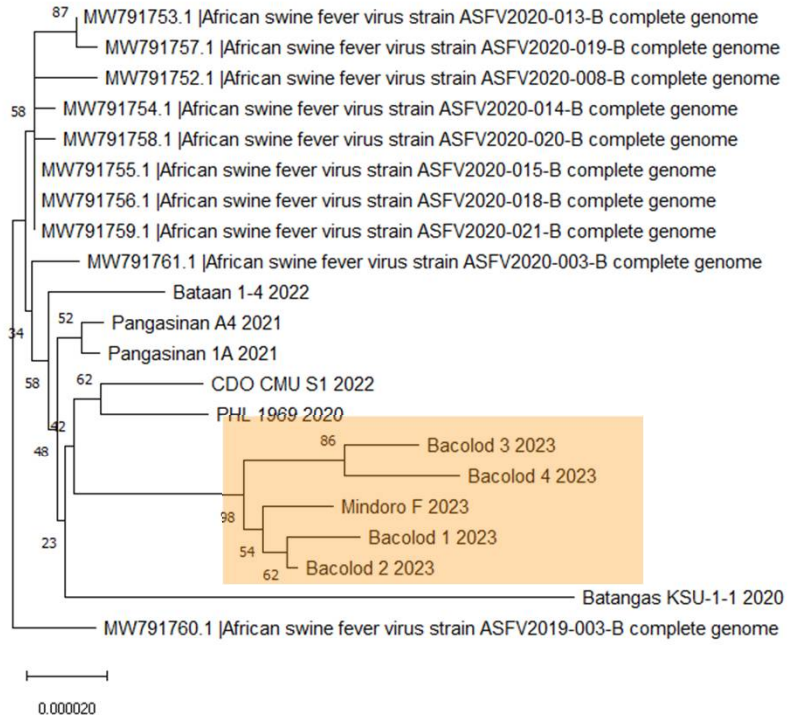
Genomics in Virus Tracking: The case of Bacolod and Mindoro






Genetic Profiles of Ten African Swine Fever Virus Strains from Outbreaks in Select Provinces of Luzon, Visayas, and Mindanao, Philippines, Between 2021 and 2023

- Trade activities
- Virus genome clustering
- Suggestive of spread from Bacolod to Mindoro

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Current Questions

What is the circulating ASF virus strain?

Has the virus evolved into a new strain?

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PCSP Surveillance Initiative

Total samples: 43 animals
Locality: South and North Luzon
Clinical signs: Off-feeding, Fever, Weakness, Seizure, Redding of Skin
Proceeded to WGS: 6 (based on grouping and Ct values)

Sample ID	Sample type	C_t	Genome completeness	Sample type*	Strain ID
01	lung, lymph node	15.4	coding-complete	Field	BA25-0102
02	lung, lymph node, kidneys	16.1	coding-complete	Field	BA25-0103
03	whole blood	17.5	partially complete	Field	BA25-0105
04	serum	25.1	partially complete	Field	BA25-0106
05	whole blood	14.7	coding-complete	Field	BA25-0107
06	whole blood	19.4	coding-complete	Field	BA25-0104

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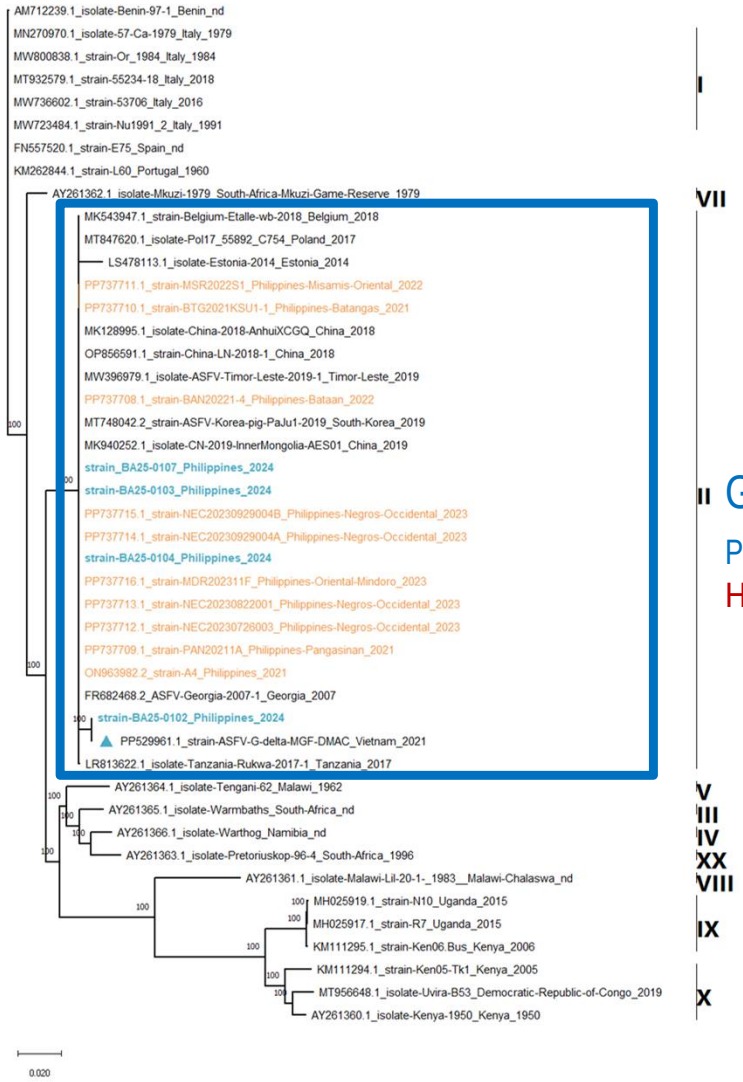
ASF virus strains still clustered in p72 Genotype II (2024)

Implication on the current vaccine candidate?



II Genotype II

PCSP Samples

Historical Samples

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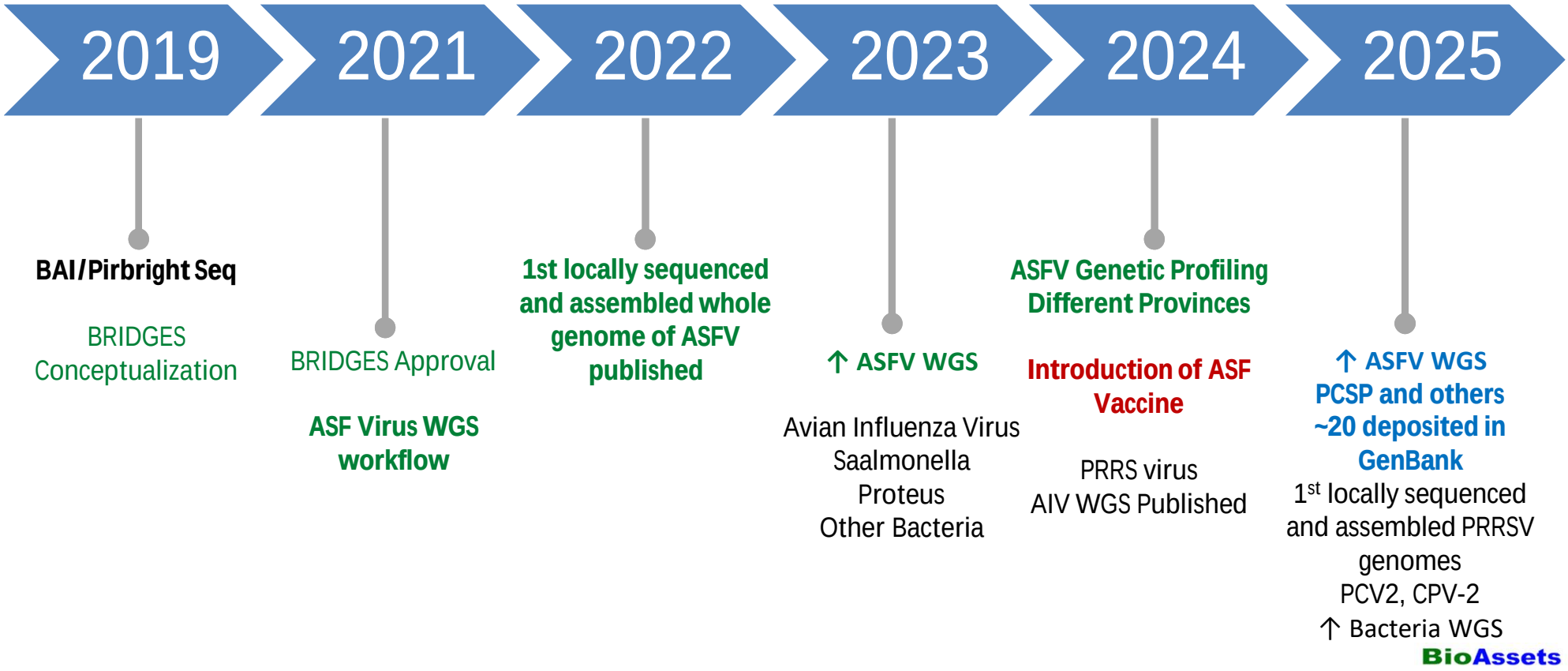
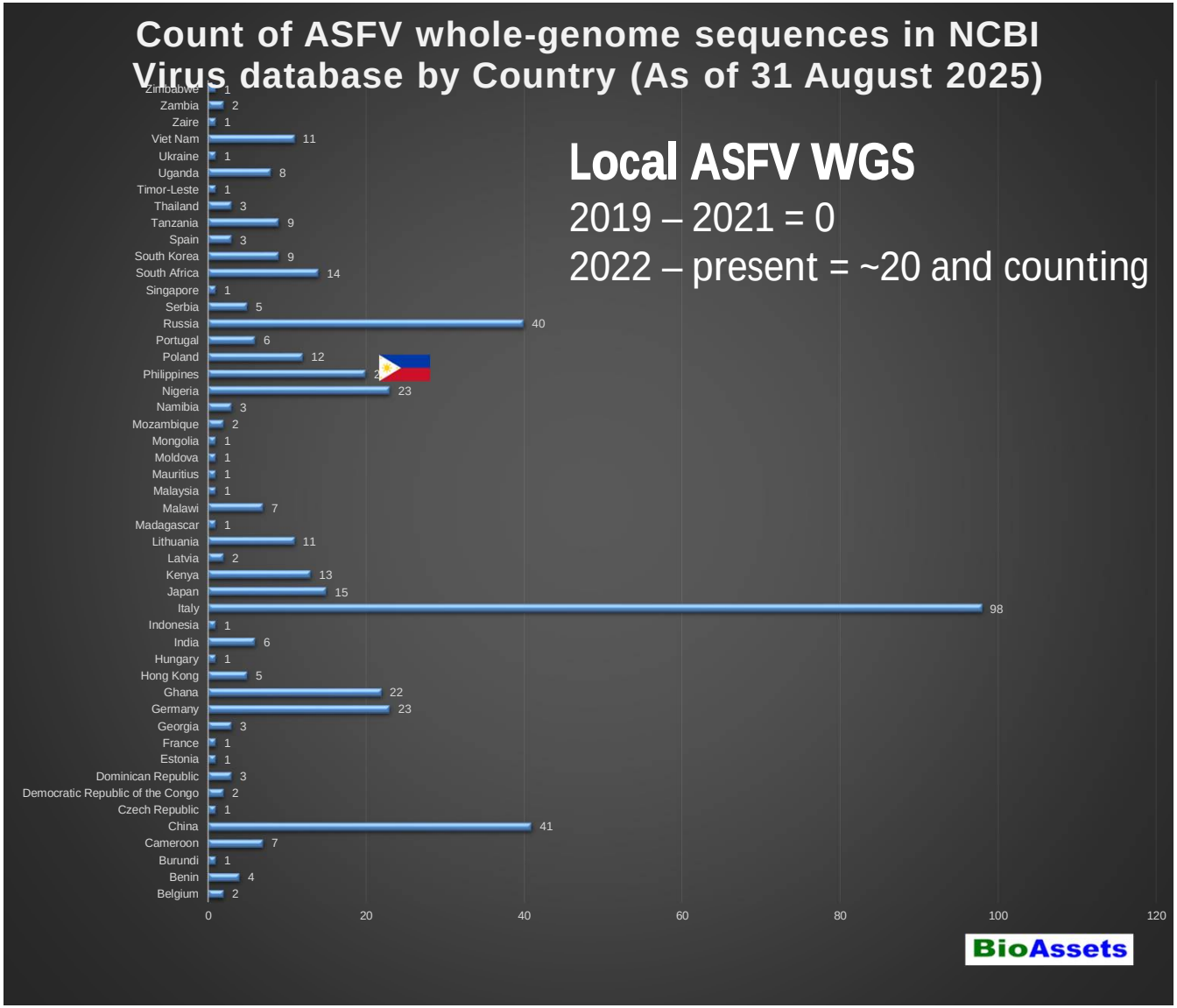
Local Microbial Genomics for Animal Health



Philippines' Contribution to Global ASFV Whole Genome Information



Applications of Knowing your Enemy

Virus Blueprint

Virus Evolution

Diagnostics and Vaccines

Research

APPLICATIONS

Molecular Epidemiology

Surveillance

Vaccine Development

Outbreak Response

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Summary and Key Points

Generated baseline genomic information of ASFV	Vital for prevention and control strategies Sets the foundation for diagnostics and vaccine research
ASFV circulating strain is still clustered within Genotype II	No identified recombinants Candidate vaccine should still be fit Available diagnostics should be effective
Generate more meaningful genomic data	Scale up surveillance and reporting Encourage Data Sharing

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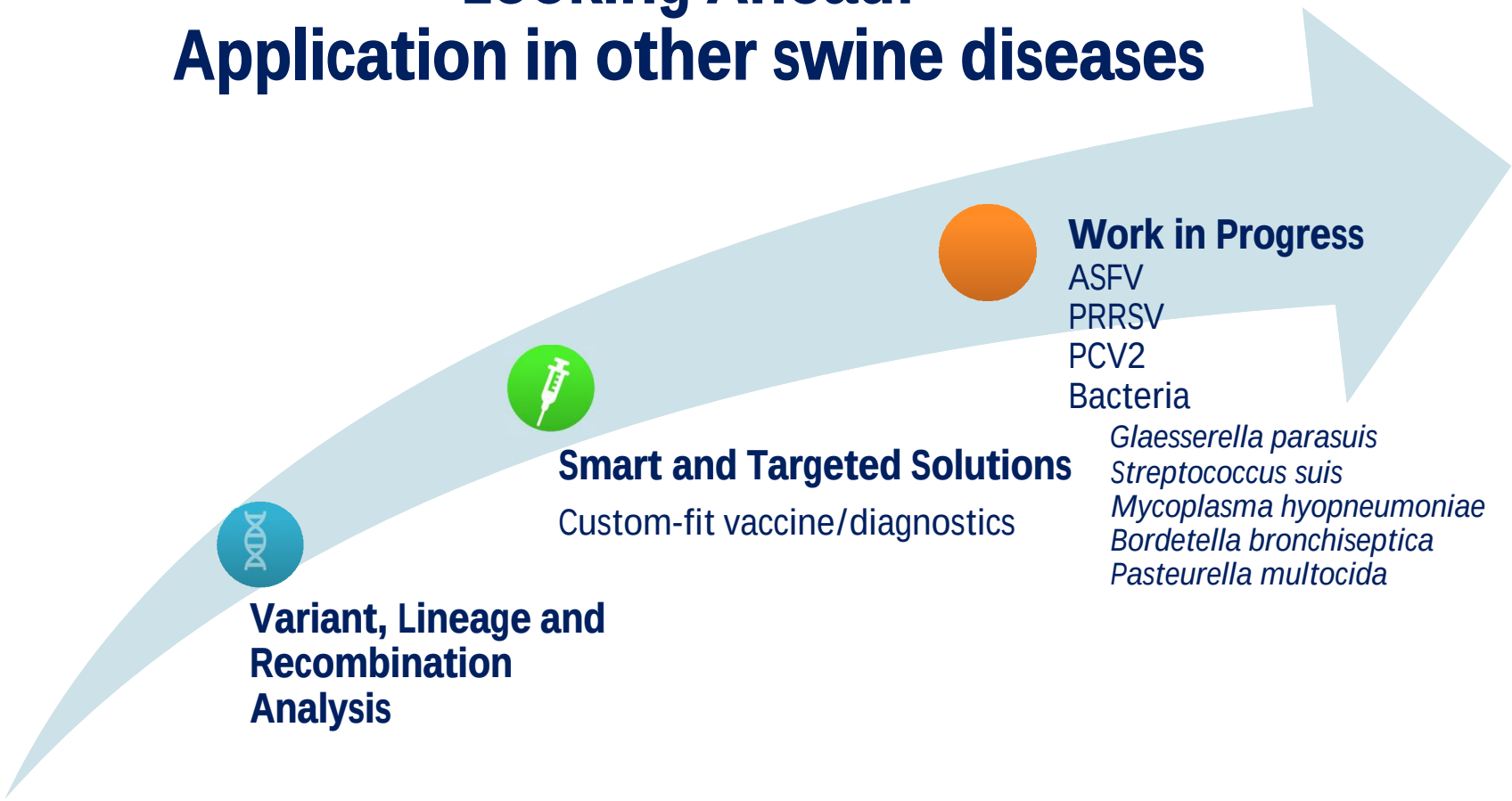
Looking Ahead:
Application in other swine diseases



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Call to Action

Farmers and Veterinarians

- Adopt early reporting
- Participation in Surveillance
- Adopt Biosecurity and Science-driven practices

Scientists and Researchers

- Generate Genomic database
- Data sharing
- Innovate and create

Government

- Support research
- Encourage collaboration
- Craft sound and equitable policy
- Accurate reporting

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Acknowledgement

Dr. Angel Manabat
Dr. Rommel Masilungan
Dr. Danny Silbor
Dr. Roselle Falconite-Cudal
PCSP Members

Jimwel Bryan Christopher Ferrer
Zyne Baybay, MS
Andrew Montecillo, PhD

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Maraming salamat po!

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