University of the Philippines
LOS BAÑOS

Animal Biotechnology in the Philippines: Current Status, CRISPR-Based Vaccine Development, and Regulatory Landscape

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8th International Livestock Biotechnology Symposium

Introduction

Definition of Animal Biotechnology:
Application of genetic and molecular tools to improve livestock, aquaculture, and animal health

Importance:

- Enhancing productivity and disease resistance in livestock
- Improving food security and sustainability
- Advancing veterinary medicine through recombinant vaccines and gene editing

Philippine Context:

- Growing interest in genetic improvement of local breeds
- Government and academic initiatives in biotech research

Current State of Animal Biotechnology in the Philippines

Unlocking the Genetics of Native Breeds

1. **Focus:** Whole genome sequencing (WGS) of native cattle and Darag native chicken.

2. **Insights:** Genetic markers for disease resistance and adaptation.

3. **Applications:** Informed breeding strategies for native breeds.

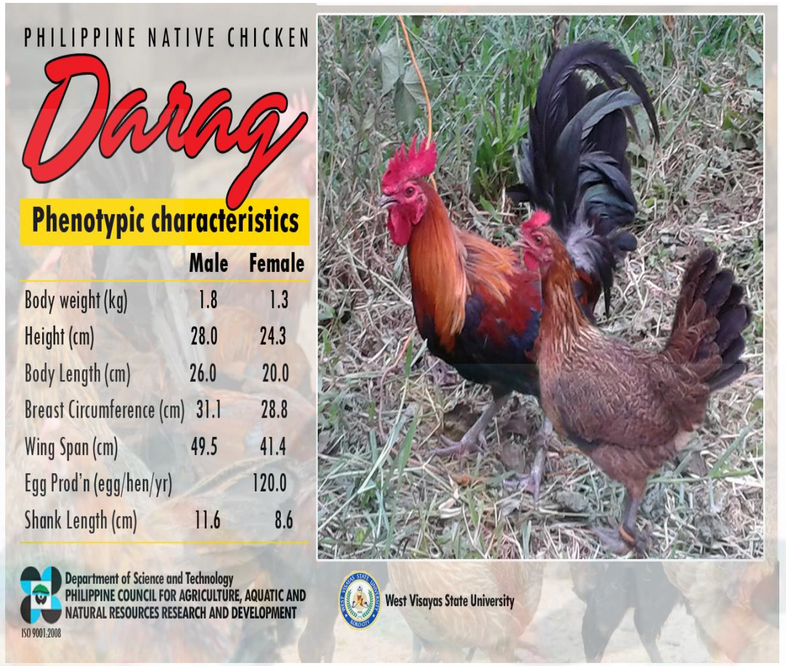
Dr Agapita Salces, Dr Joy Banayo, Ms Katrina Umali, Ms Camille Tenorio, Mr Chucky Yambao, Mr Joshua David Valdez, Ms Kathlyn Manese

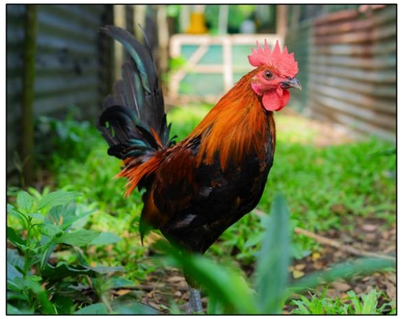
Decoding Genetic Variation with GWAS

1. **Method:** Linking genetic variants with phenotypic traits.

2. **Case Study:** We used the Axiom Chicken 600k SNP chip to perform a GWAS on Darag native chicken for traits associated with egg production

3. **Outcome:** Identification of genetic markers for targeted breeding.





Dr Venerada Magpantay, Dr Consuelo Amor Estrella, Ms Kimberly Bermudez, Ms Ma Christine Ortiguero

LOCAL innovation

iDETECT

A home grown, marker based nucleic acid detection kit developed by **Dr. Joy Banayo** and **Ms. Kathlyn Manese** of the Institute of Animal Science UPLB, meant for species verification of fresh, processed, and comminuted meat products marketed for human consumption.

Institutional Efforts:

- UPLB, PGC-Agri, IAS, BIOTECH, BAI, DA-LBC, DOST-PCAARRD, DA-PCC leading research efforts
- Public-private partnerships for technology transfer

Challenges:

- Insufficient research funding
- Ethical concerns and public skepticism
- Need for infrastructure improvements

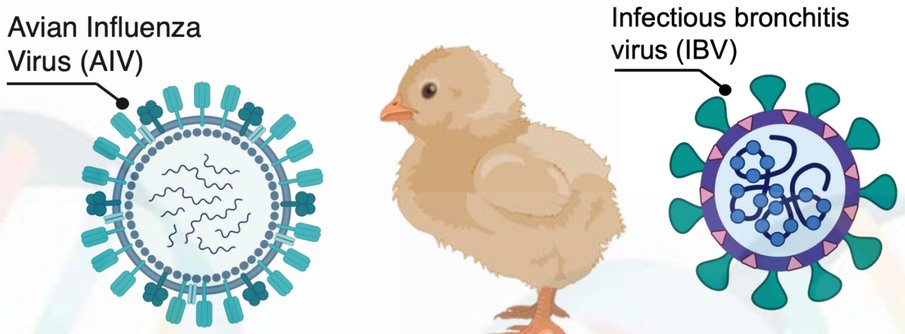
https://ncbp.dost.gov.ph/about-ncbp/
https://www.bai.gov.ph/
https://www.pcaarrd.dost.gov.ph/
https://livestockbiotech.ph/
https://www.pcc.gov.ph/
https://ias.uplb.edu.ph/

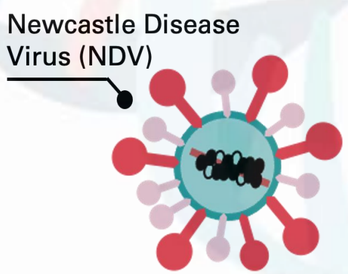
Case Study: CRISPR-Based Vaccine Development

Significance of Vaccine Development

Poultry offers a major food source worldwide

Affects poultry farm production





One of the most important diseases of poultry around the globe

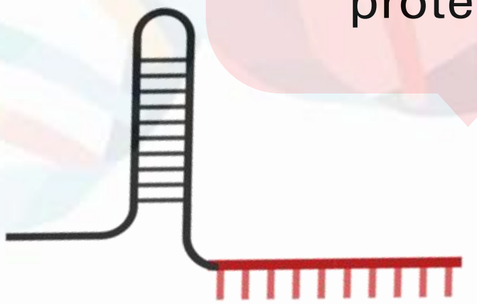
Vaccination: primary means of disease prevention

New Vaccines

- ❑ Emerging Strains
- ❑ Enhanced Immunity
- ❑ Improved safety and delivery
- ❑ Multi-Disease Compatibility

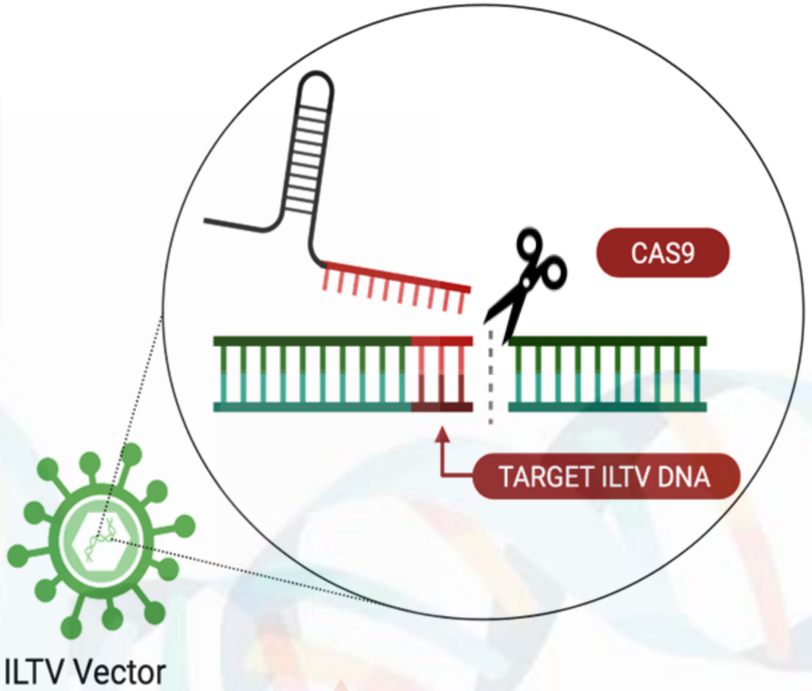
CRISPR/CAS9 WORKFLOW FOR VACCINE DEVELOPMENT

The guide RNA, match the DNA sequence of interest and a scissor protein, Cas9.



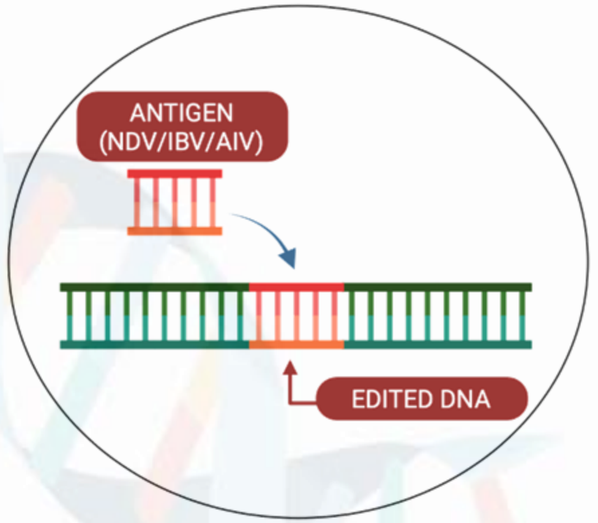
GUIDE RNA

CAS9



The guide RNA searches the viral whole genome for the target section of DNA and transports the scissor protein to it. The scissor protein cuts the ILTV DNA.

The template will be inserted in the cut site, this DNA template is a fragment of another virus.

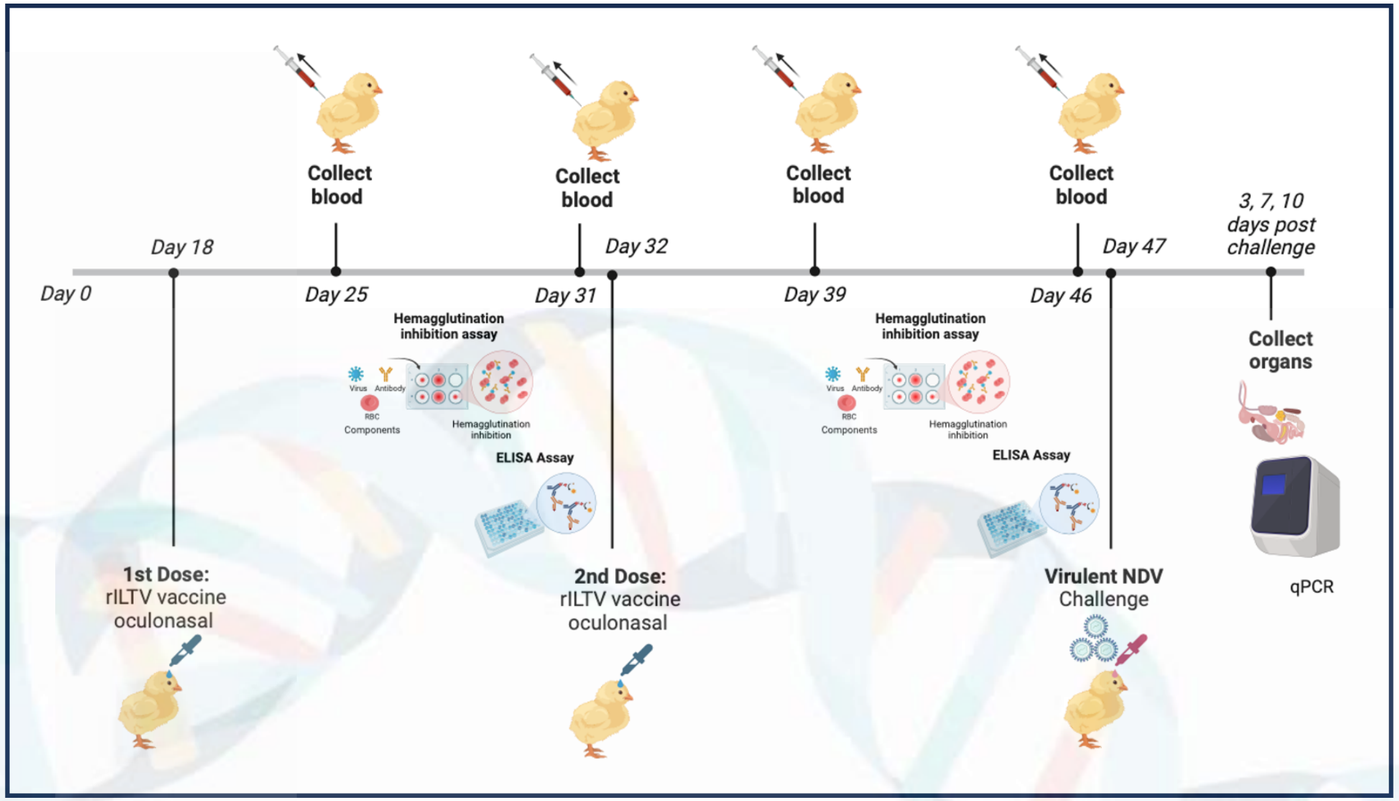


Recombinant viral vector against multiple avian diseases

Animal Trials

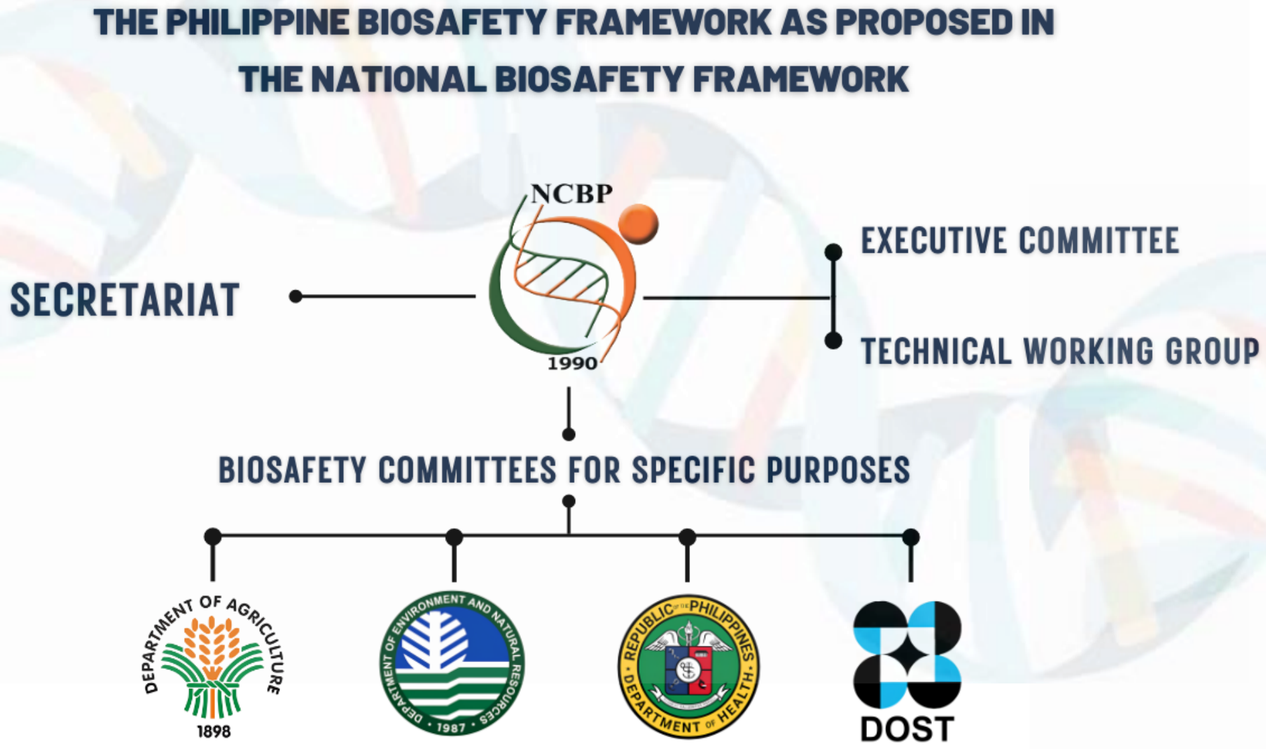
Regulatory Steps for Vaccine Development

1. **Preclinical Trials:** Lab-based validation
2. **In Vivo Animal Trials & Challenge Studies:** Requires biosafety approvals, ethical clearance, and adherence to animal welfare regulations
3. **Field Trials & Commercialization:** Involves BAI, FDA, and DA approvals



Regulatory Framework in the Philippines

Current Biosafety Regulations



NCBP: Oversees biotech research approvals

BAI: Monitors animal health and biotech applications

FDA: Regulates biotech-derived animal products

https://ncbp.dost.gov.ph/about-ncbp/

Current Biosafety Regulations

Scope & Coverage:

Regulates **research, development, handling, transboundary movement, and commercialization** of genetically modified (GM) animals and animal products.

DOST-DA-DENR-DOH-DILG
Joint Department Circular
No. __, series of 2023

Subject: **Rules and Regulations for the Research and Development, Handling and Use, Transboundary Movement, Release into the Environment, and Management of Genetically Modified Animal and Animal Products Derived from the Use of Modern Biotechnology**

Exemptions
Gene-edited animals **without novel genetic combinations** are **not covered.**

Regulatory Authorities
DOST, DA, DENR, DOH, and DILG oversee implementation with respective mandates.

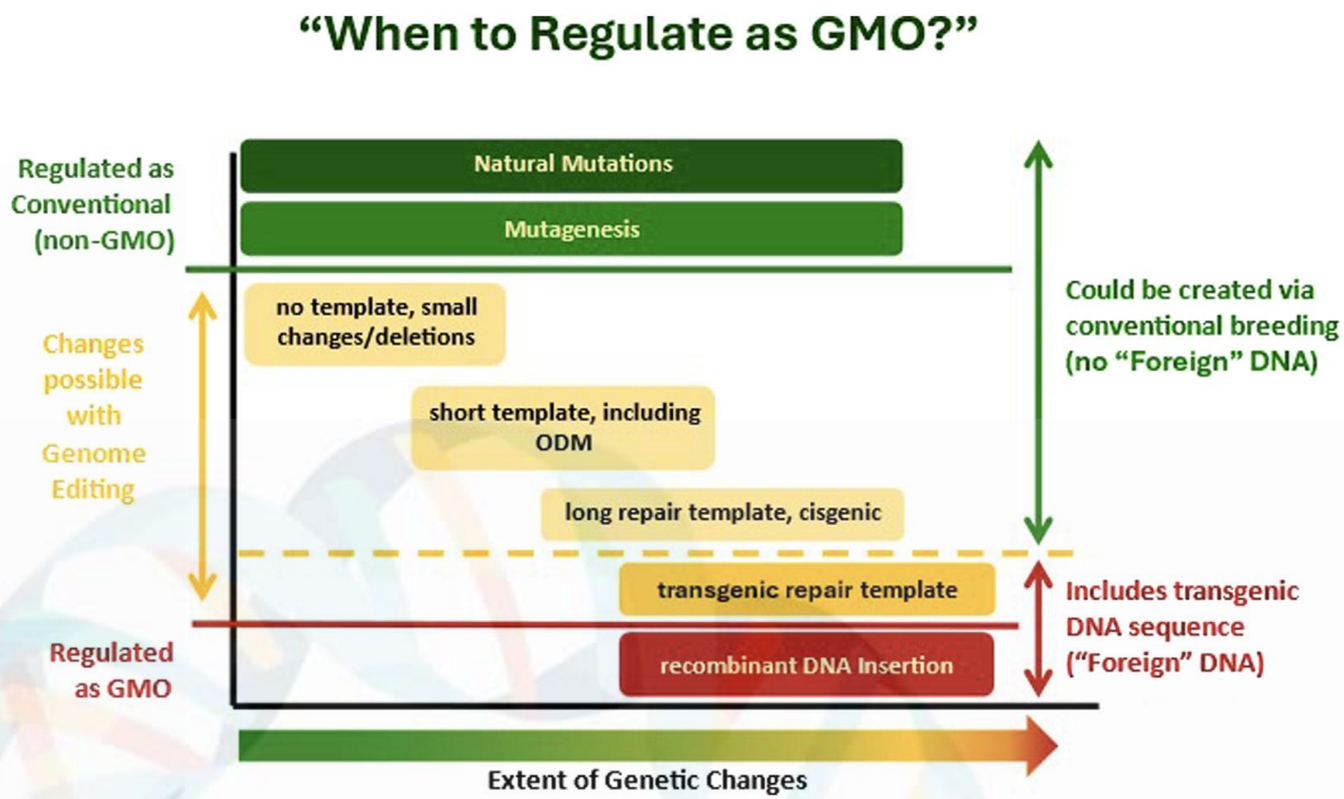
Biosafety Permits
Required for **contained use, field trials (limited release), commercial use (contained & general release).**

How Philippine Regulations Can Keep Up with Innovation?

What Needs to Improve?

- Create specific CRISPR guidelines for livestock applications.
- Streamline approval pathways for biotech innovations.
- Increase public awareness and industry engagement.

International Best Practices: Learning from the US, EU, and other ASEAN countries.



Wray-Cahen D, Hallerman E and Tizard M (2024) Global regulatory policies for animal biotechnology: overview, opportunities and challenges. Front. Genome Ed. 6:1467080. doi: 10.3389/fgeed.2024.1467080

Ethical & Public Perception Issues in Animal Biotechnology

Common Concerns:
GMO safety, consumer trust, and ethical implications of gene editing.

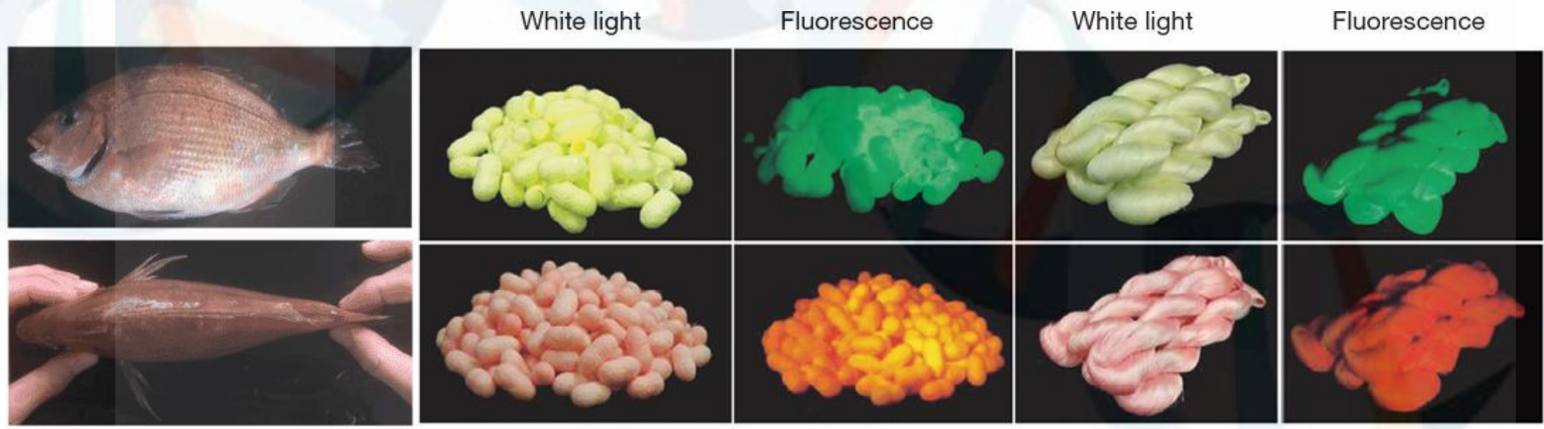
Addressing Misinformation:
Public outreach, education, and transparent risk assessments.

Future Directions & Opportunities in Animal Biotechnology

Promising Areas of Research:

- **Gene-edited disease-resistant livestock** (e.g., PRRS virus-resistant pigs (2023), Canada).
- **Multi-omics integration** (genomics, proteomics, and transcriptomics in livestock health).
- **Advanced vaccine platforms** for zoonotic diseases.

Potential for Industry-Academia Collaboration: Expanding biotech R&D in the private sector.



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https://www.pic.com/pic-prrs-resistant-pig/

Conclusion and Recommendations

Summary of Key Findings:

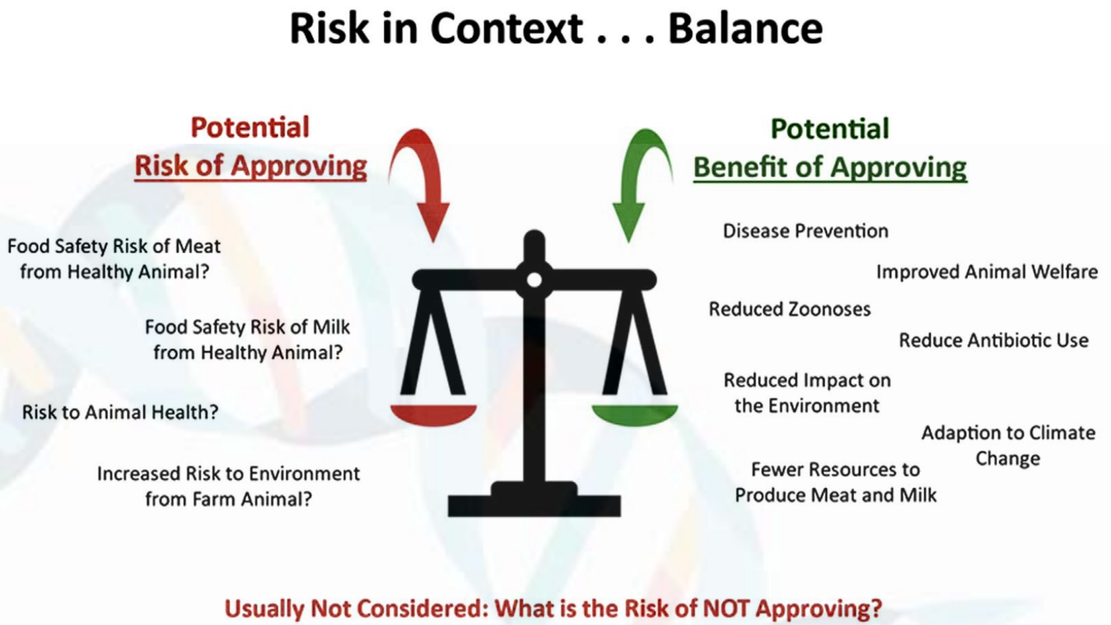
- The Philippines has active research in animal biotechnology
- CRISPR-based vaccines hold promise but face regulatory hurdles
- Regulations must evolve to accommodate new biotech solutions

Recommendations:

- Strengthen policy frameworks to support innovation
- Boost investment in biotech R&D
- Facilitate industry-academia-government collaboration

Future Outlook:

- Enhanced biotech adoption for sustainable livestock production
- Potential for international collaborations in vaccine development



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Gratitude and Collaboration

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Mr Joshua David Valdez,
Ms Kathlyn Manese
Dr Jaime Samaniego
Prof Arian Jacildo
Mr Kaito Furusho

INSTITUTE OF ANIMAL SCIENCE
UPLB-CAFS

PGC
PHILIPPINE GENOME CENTER
PROGRAM FOR AGRICULTURE, LIVESTOCK, FISHERIES AND FORESTRY

Lancaster University

BRITISH COUNCIL

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THANK YOU!!

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