Canadian Food Inspection Agency
Agence canadienne d'inspection des aliments

Canadian Food Inspection Agency

Identification and Traceability of Biotechnology-derived Animals

Harpreet S. Kochhar
T. Lea-Godfrey
D. Trus

Our vision:
To excel as a science-based regulator, trusted and respected by Canadians and the international community.

Our mission:
Dedicated to safeguarding food, animals and plants, which enhances the health and well-being of Canada's people, environment and economy.

Canada

Biotechnology-derived animals (BDAs)

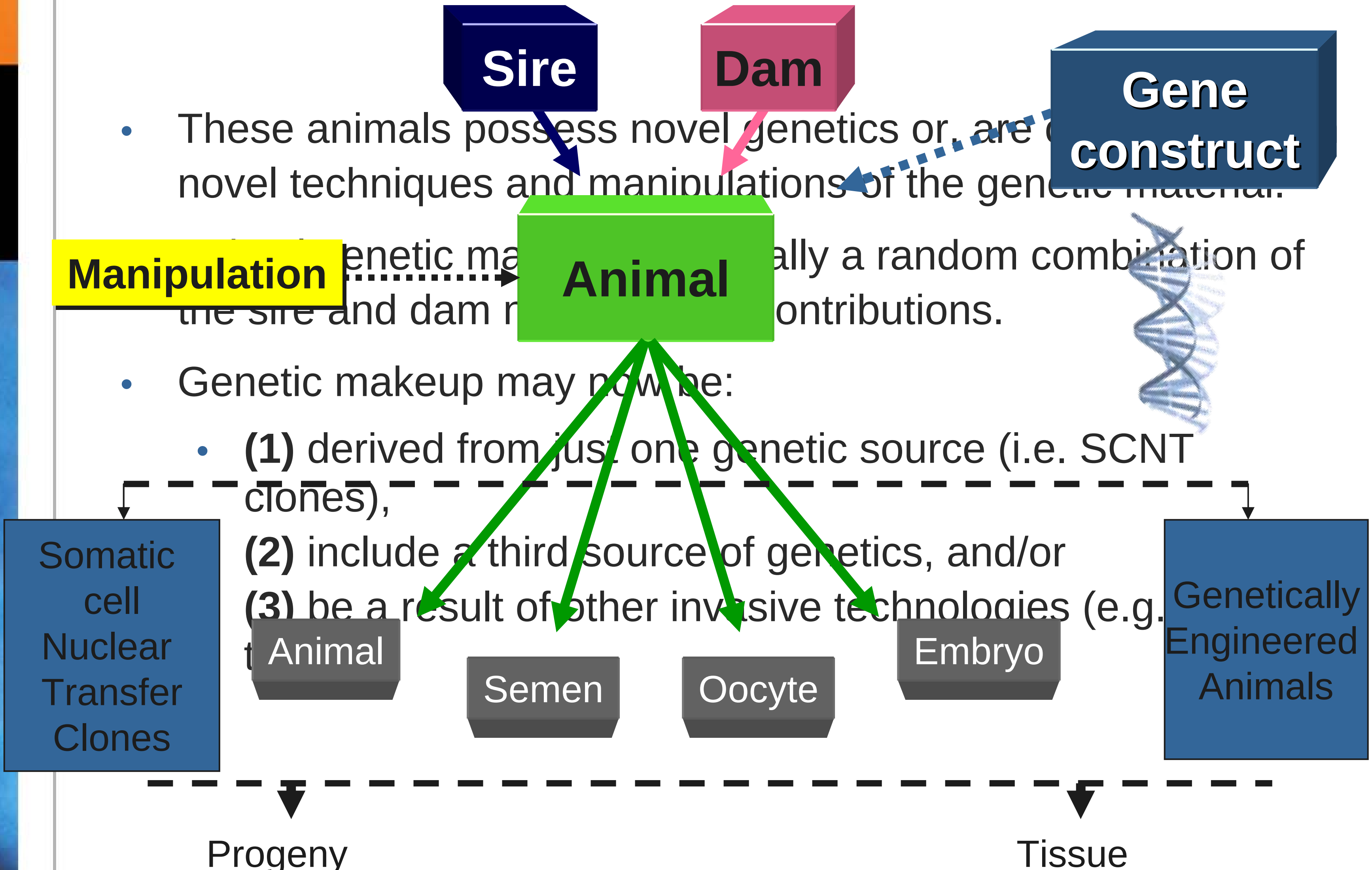
Biotechnology: *“application of science & engineering in direct or indirect use of living organisms or parts or products of living organisms in their natural or modified form”*

OIE definition: *Biotechnology is any technological use of biological systems, living organisms, or derivatives thereof, to make or modify products or processes for specific purposes. In the context of the OIE biotechnology refers to technologies relevant to animal health and production*

Biotechnology-derived animals: *animals generated through biotechnological methods*

Why are these animals different?

- These animals possess novel genetics or, are c… novel techniques and manipulations of the genetic material.
- … genetic ma… ally a random combination of the sire and dam r… contributions.
- Genetic makeup may now be:
  - **(1)** derived from just one genetic source (i.e. SCNT clones),
  - **(2)** include a third source of genetics, and/or
  - **(3)** be a result of other invasive technologies (e.g. t…



Differentiate between Genetically Engineered (GE) animals and Animal clones!

Animal clones

- Micro-manipulation and transfer of nuclear DNA to start embryonic development
- No gene manipulation (addition, insertion or deletion)

GE Animals

- Gene (usually external source) insertions into the genetic material of the animal to propagate the gene of interest
- Micro-manipulations and gene manipulations are part of the process.

Why is there a need to identify and track Biotech-derived animals -BDAs?

- Differentiation of genetic source, to support different breeding goals
- Segregation of product not intended for entry into the mainstream market
- Public confidence and consumer demand
- Address foreign market requirements
- Regulatory requirements (novel product)
- Tracking of performance to differentiate product (product branding; choice)

Tracking of BDAs

Ability to follow all movements or distribution of genetics (i.e. animals and genetic reproductive material).

BDA traceability may be built around:

1. Dynamic tracking systems (i.e. follow all movement)
2. End-point verification back to source
3. Point verification (e.g. marker-based)

Methods 1 and 2 rely upon unique, permanent and reliable animal identification systems

Point verification, if feasible, can be used for traceability or may be used as an audit function

Requirements of a tracking system

- Database system
- Identification tools for Animal clones, GE animals, the genetic material (semen, eggs, embryos)
- Record of animal and genetic material movement (International Embryo Transfer Society –IETS forms)
- Ability to trace forward and trace back in case of need.

Tracking systems for BDAs

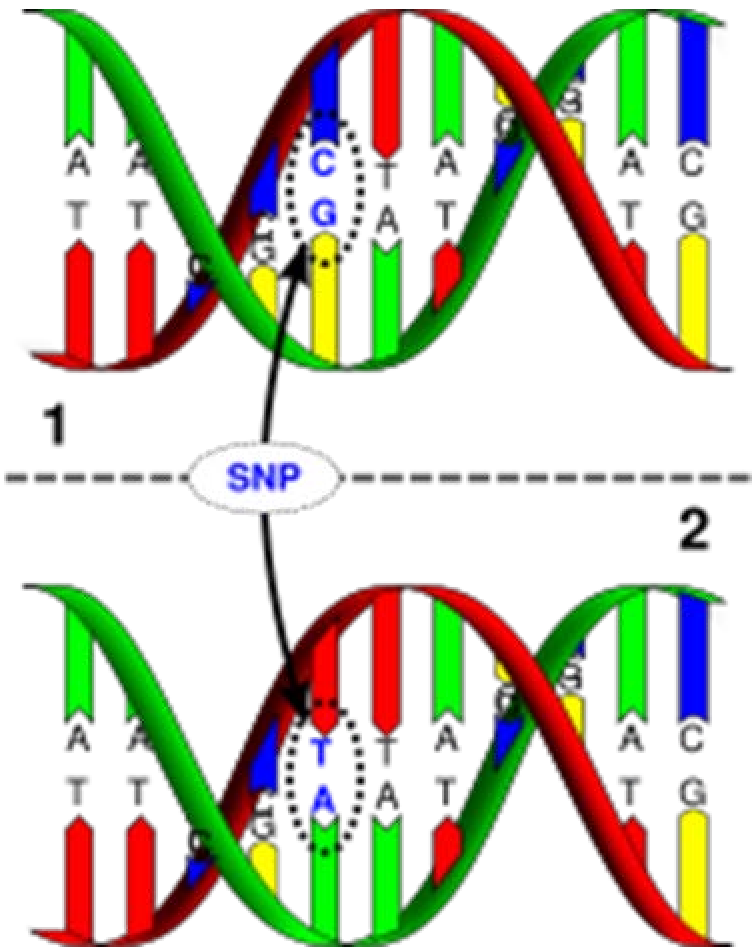
- DNA based Traceability
- Internet tracking
- Radio Frequency Identification (RFID)
- Retinal imaging

DNA based traceability

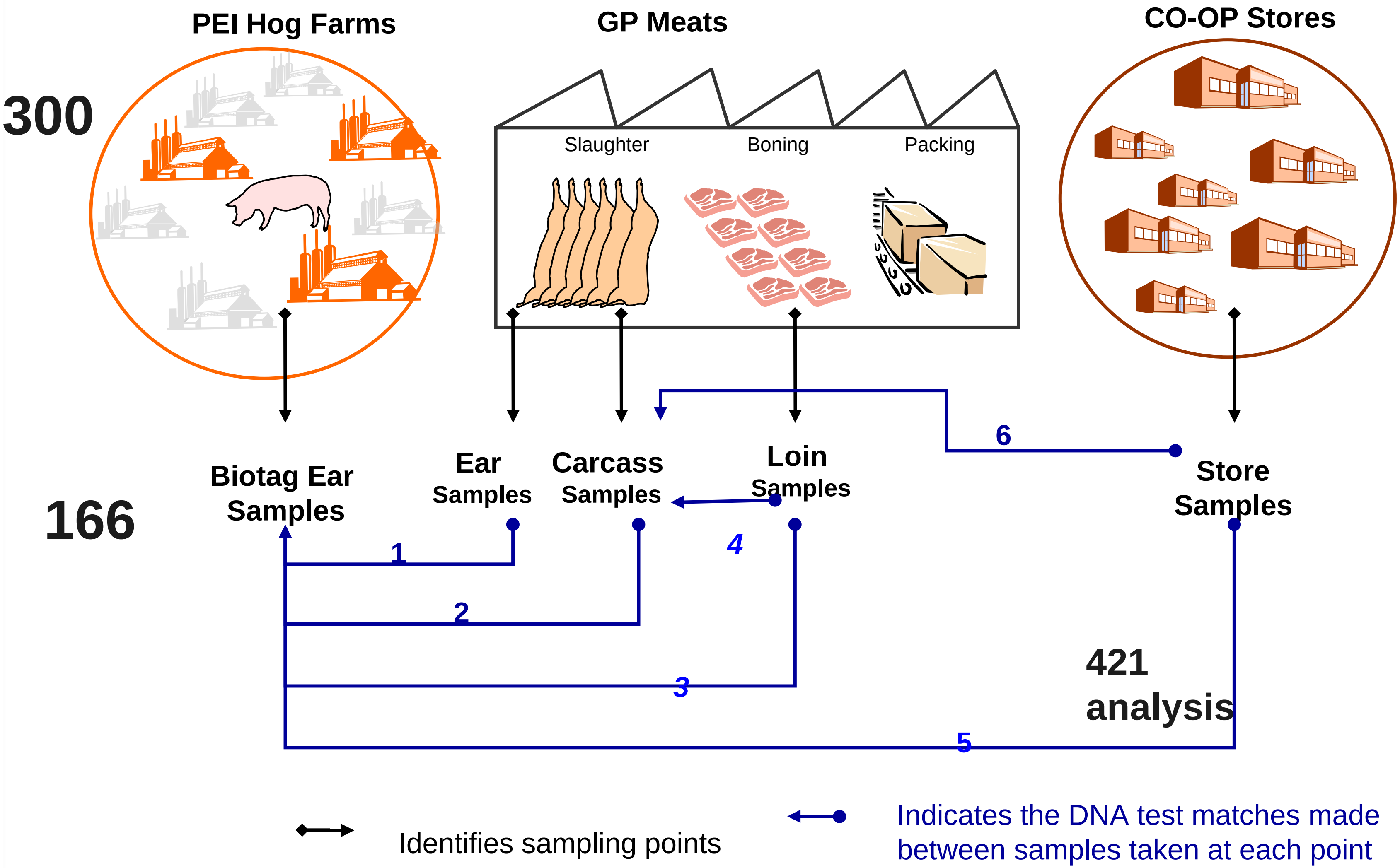
- Most functional as a trace back rather than traceability system
- DNA sampling and analysis steps
- Microsatellite or Single Nucleotide polymorphism based systems
- DNA fingerprints of an offspring can be used to determine sire
- Methylation differences in animal clones from the parent animal may provide hints

Single Nucleotide Polymorphism (SNPs)

- SNPs are DNA sequence variations that occur when a single nucleotide (A,T,C,or G) in the genome sequence is altered
- Two sequenced DNA fragments from different individuals, AAGC**C**TA to AAGC**T**TA, contain a difference in a single nucleotide



Methodology



Results

Reference Sampling – On-Farm

Animals were successfully DNA ear tagged on three separate farms. 166 animals were identified and included in the project.

Farm X=49

Farm Y=22

Farm Z=95

Results

Points 1 & 2

Verification Sampling – Carcass sampling

The carcass samples identified as having come from farm X were all matched to DNA tag samples taken from live animals on the farm. The unique animal identity of each carcass sample was found. These results show a 100% match between animal of origin and the carcass following slaughter.


SUMMERSIDE FARMS
PORK
PORK
PORK
CO-OP Basics
$6.35

Results

Traceability levels were found to be:

100% from farm to slaughter n=300,

97.5% from slaughter to boning n=40 and

96.9% from farm to supermarket (includes a deliberately spiked sample) n=32.

Internet tracking

- Based on assumption that the data is entered by producer in the database and accessible from anywhere
- In outbreaks – tracking of cohorts, potential premises visited etc. can be tracked
- Dependent on other means of tracking (RFIDs) and technical factors as well as reliability of producer

Radio Frequency Identification (RFID)

- Tagging of animals with info allocated from a national database
- Contains of 2 main components: transponder (microchip, tag, bolus) consisting of encoded chip and a reader, scanner
- Visual EID have better success – however have to develop a separate system for animal clones

Retinal Imaging

- Each individual has a unique retinal vascular pattern captured by Optireader
- Tested on sheep clones
- Has disadvantages as well

In summary…

- A new challenge has been posed with the biotechnology-derived food animals being introduced in general animal populations.
- Tracing and segregation of these animals (specifically GE animals) for maintaining consumer confidence and for genetic diversity is needed.
- Combination of traceability tools may be the appropriate approach for the BDAs

Supply Chain Management

Clone Registry

- Ear tags
  - RFID
  - Pork specific
- Database
- Query based

Marketing Incentive

- 2x market value
- Refundable deposit
- Verify disposal