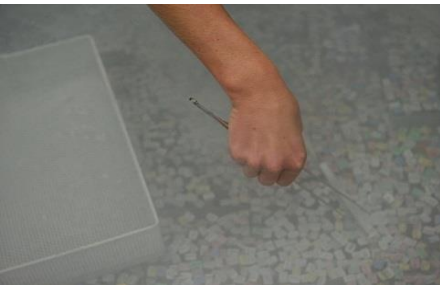


# Impact of Technology on Genetic Gain - Past, Present and Future

Mark Allan, PhD

Director of Genetic Technology

Trans Ova Genetics



# Forward-Looking Statements

Some of the statements made in this presentation are forward-looking statements. These forward-looking statements are based upon our current expectations and projections about future events and generally relate to our plans, objectives and expectations for the development of our business. Although management believes that the plans and objectives reflected in or suggested by these forward-looking statements are reasonable, all forward-looking statements involve risks and uncertainties and actual future results may be materially different from the plans, objectives and expectations expressed in this presentation. All information in this presentation is as of the date marked on the cover page, and Trans Ova Genetics undertakes no duty to update this information unless required by law.

## Mission-Vision



**The Application of Genetic and Reproductive technologies to meet the world's needs for enhancing animal protein production.**

# History

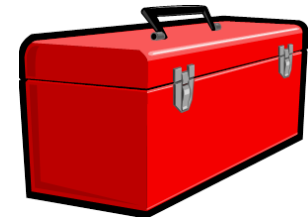
**Trans Ova Genetics established for over 35 years**



**Embryo calves produced by Trans Ova Genetics 1985**

# Selection Information – Genetic Tool box

- Visual appraisal
- Pedigree information
- Pedigree verification
- Performance data
- Progeny values and accuracy
- Economic indexes
- Genetic tests for simple recessives
- Targeted panels
- High density panels
- Genomic enhanced EPDs
- Imputation



ALL BULLS ARE TO SCALE

Modern 7 ~ 60"

Classic 2 ~ 50"

Miniature 003 ~ 40"



# The Toolbox

Sorted Semen

Recipient Solutions

In Vitro Fertilization

Embryo Transfer

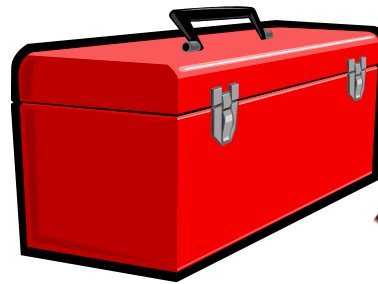
Artificial Insemination

Genetic Resources

ViaGen Technology

Precision Breeding

Gene Editing



**Reproductive Toolbox**

# Why use ART?

Assisted reproduction tools coupled with genomic enhanced selection will accelerate:

**genetic gain 2X – ?X**

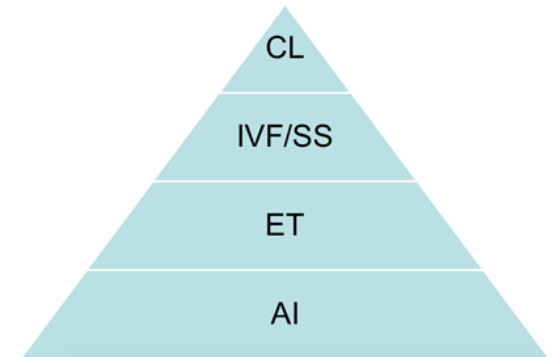
AI started in 1950's

ET started in 1970's

IVF started in 1990's

GP/Cloning started in late 1990's

SS started in 2000's



Hierarchy of ART

# Embryo Transfer – *in vivo, in vitro*

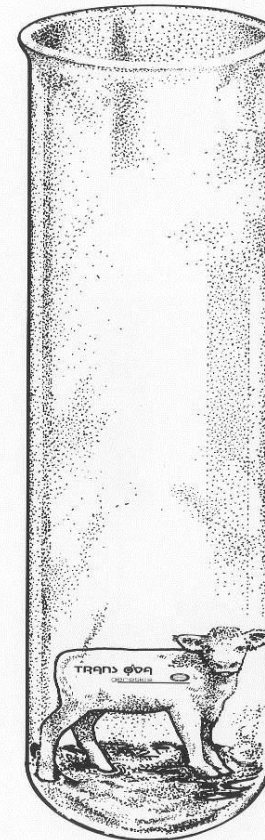
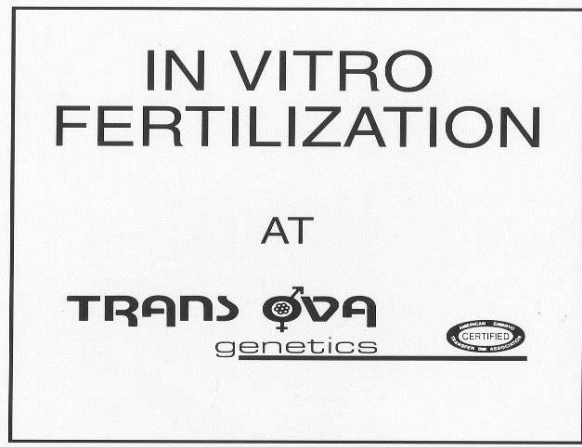
***ET allows you to increase the genetic impact of superior females.***

***More than one calf per year out of those really good COWS.***





# Embryo Production by IVF TOG Early 90's

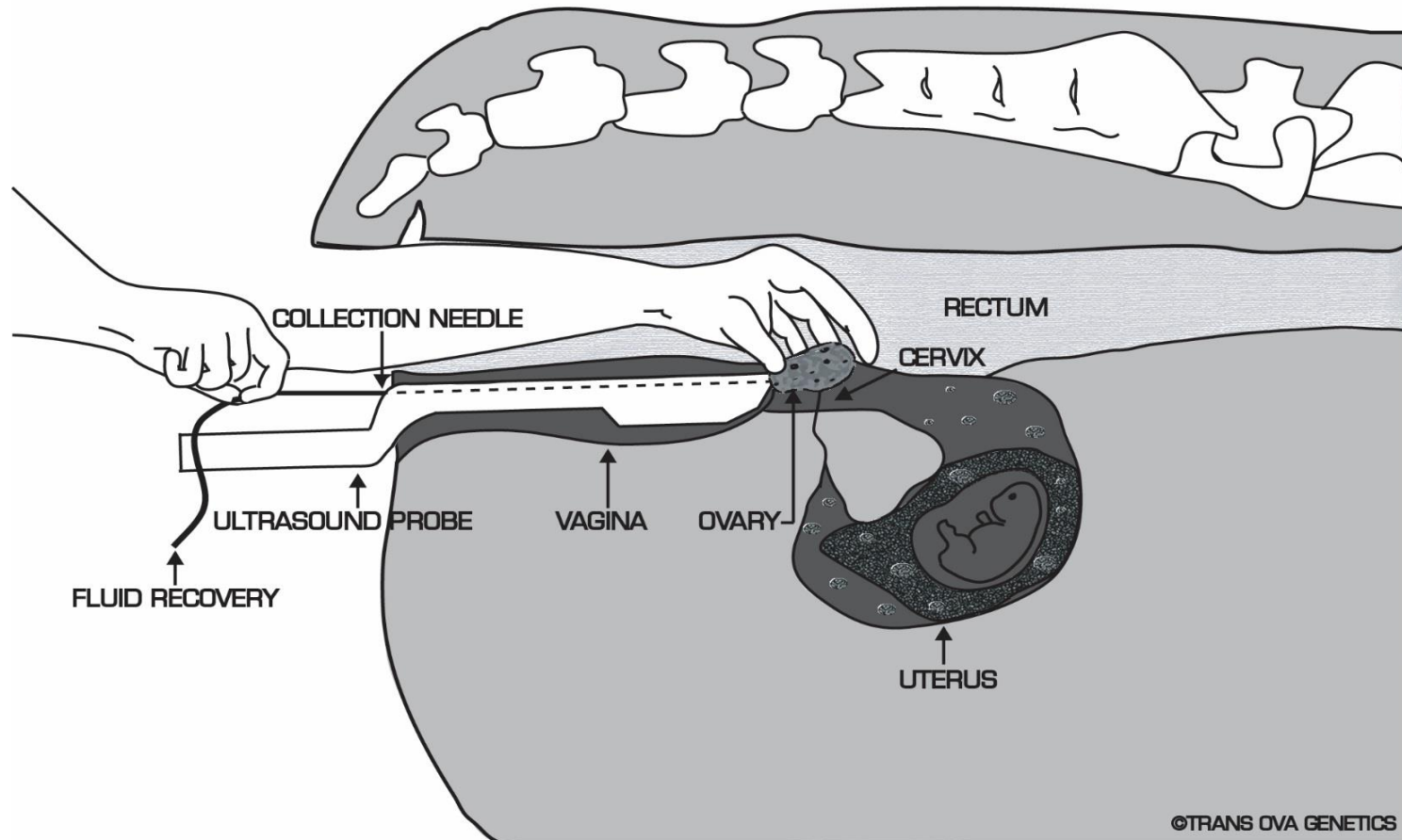


# IVF

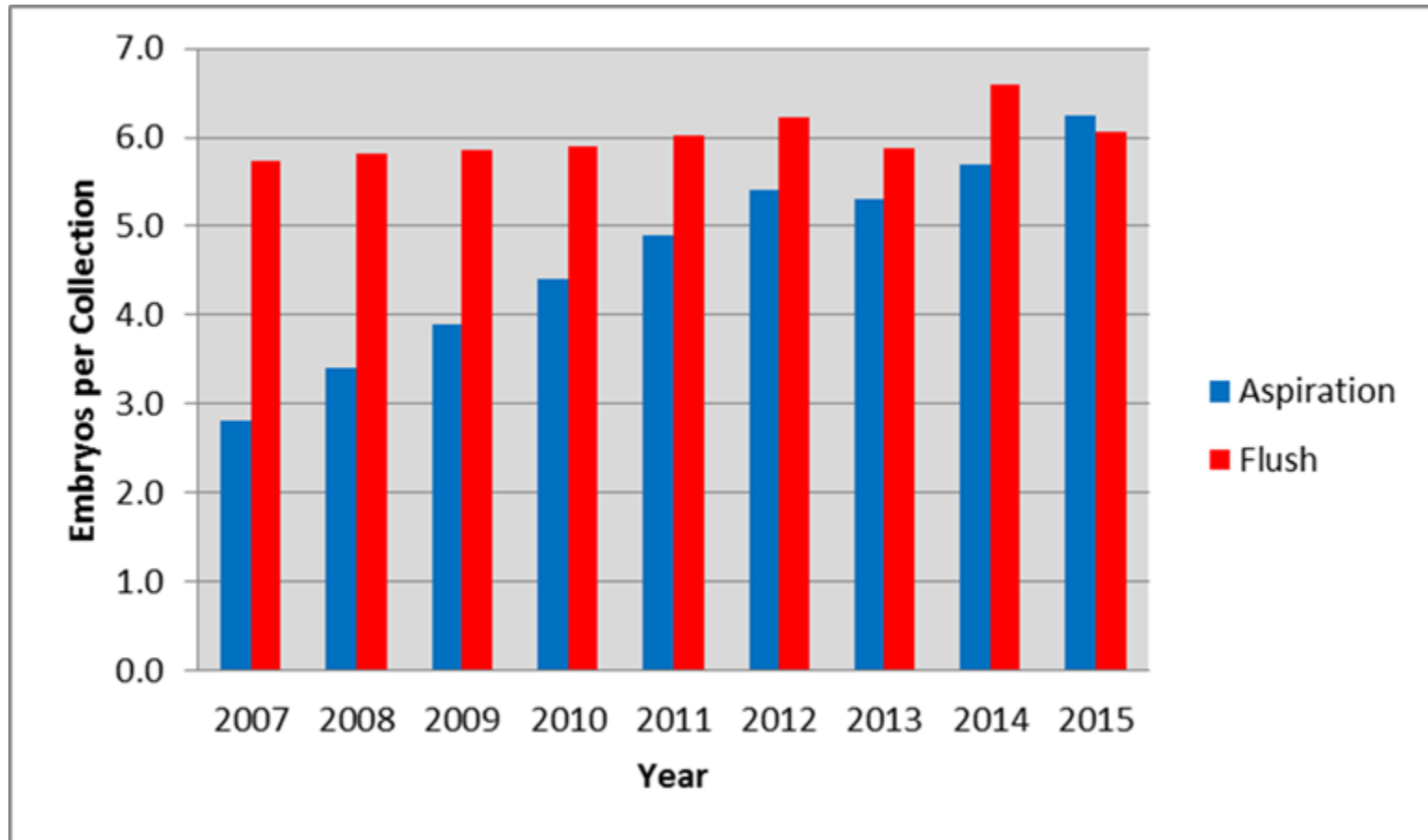


# Transvaginal Ovum Pick-up

## TRANSVAGINAL OOCYTE RECOVERY



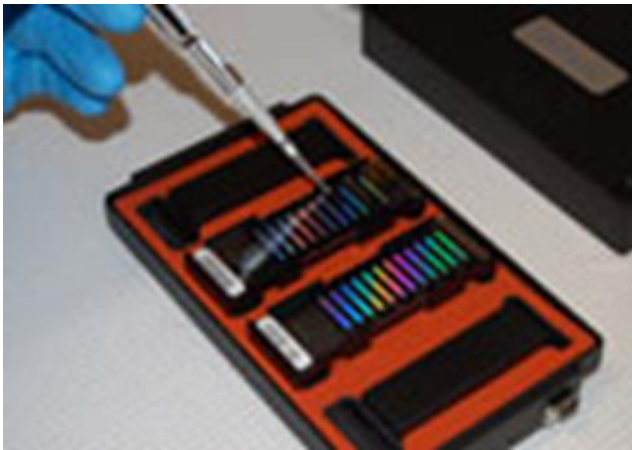
# Embryo averages TOG



# Genetic Gain

Genetic Gain= acc x genetic variation x intensity  
generation interval

- “Race” – genetic improvement  
**Young Animals**



# Today's Elite Genetic Selection



1) Qualify donors via high density genomic chips-GPTAs



3) IVF with sexed/conventional semen

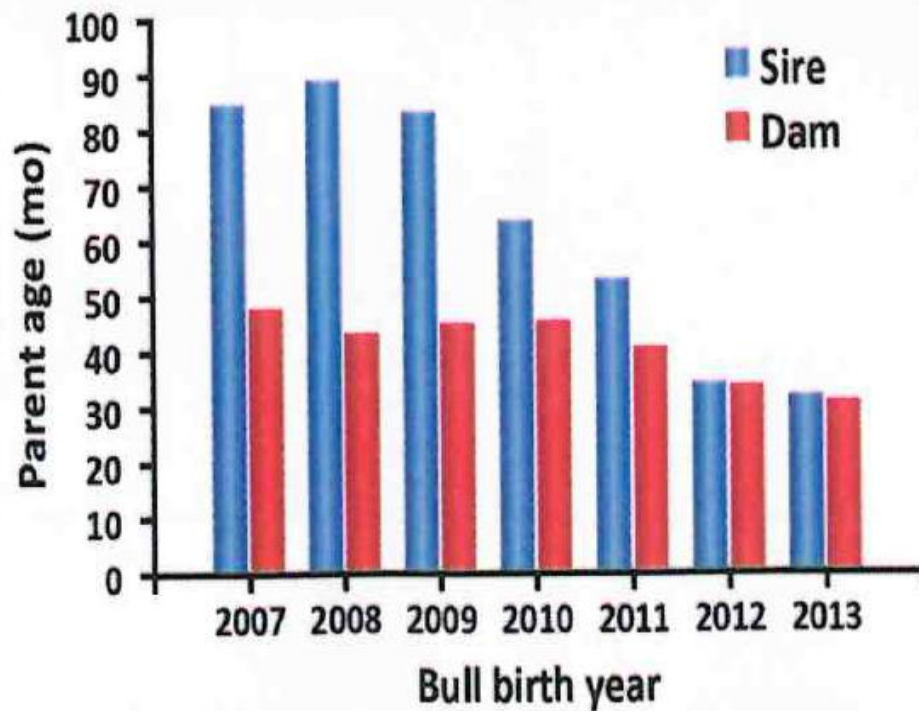


2) Collect juvenile donors

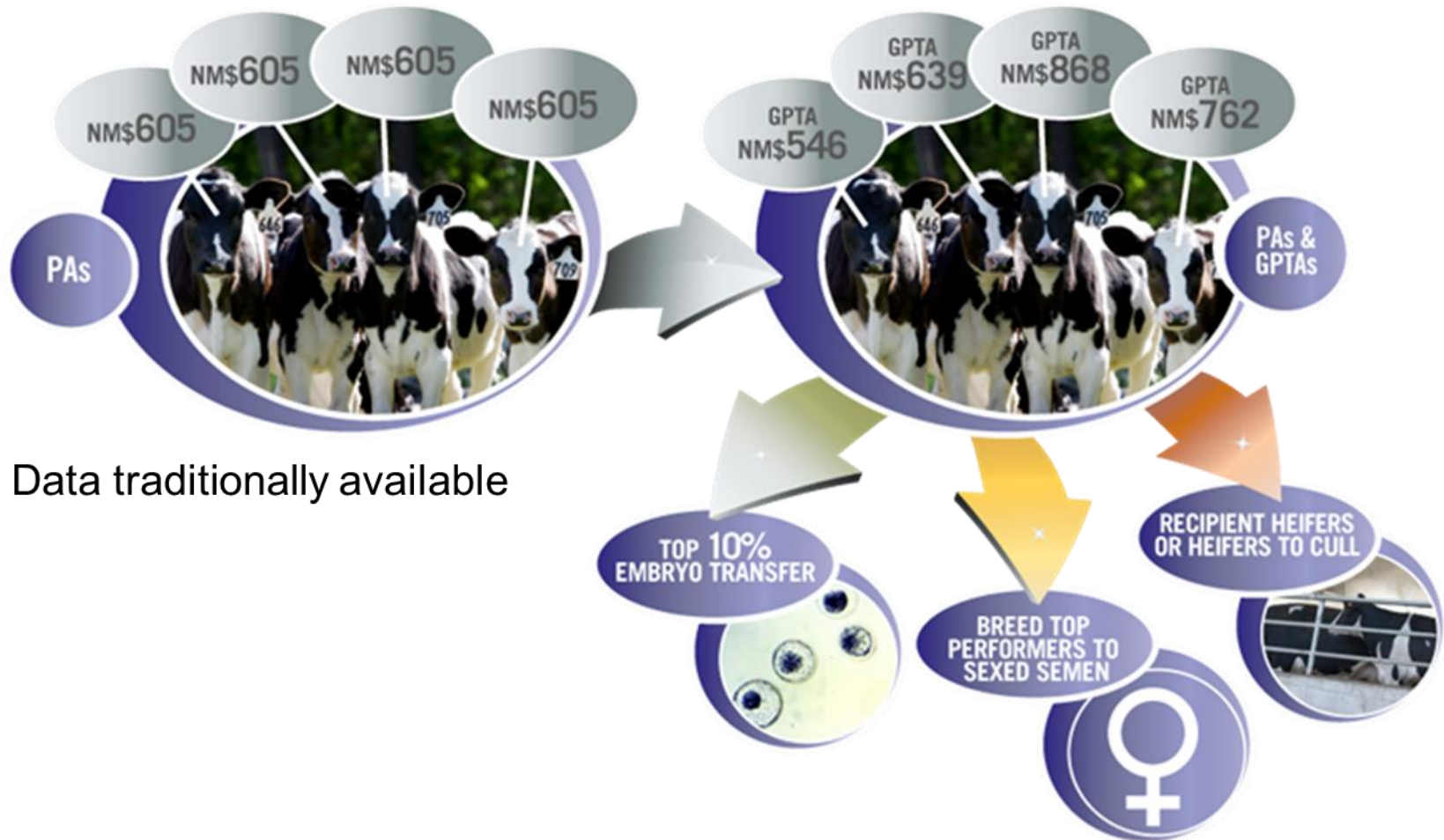


4) Gestate all embryos-Generation interval

## Parent ages for marketed Holstein bulls



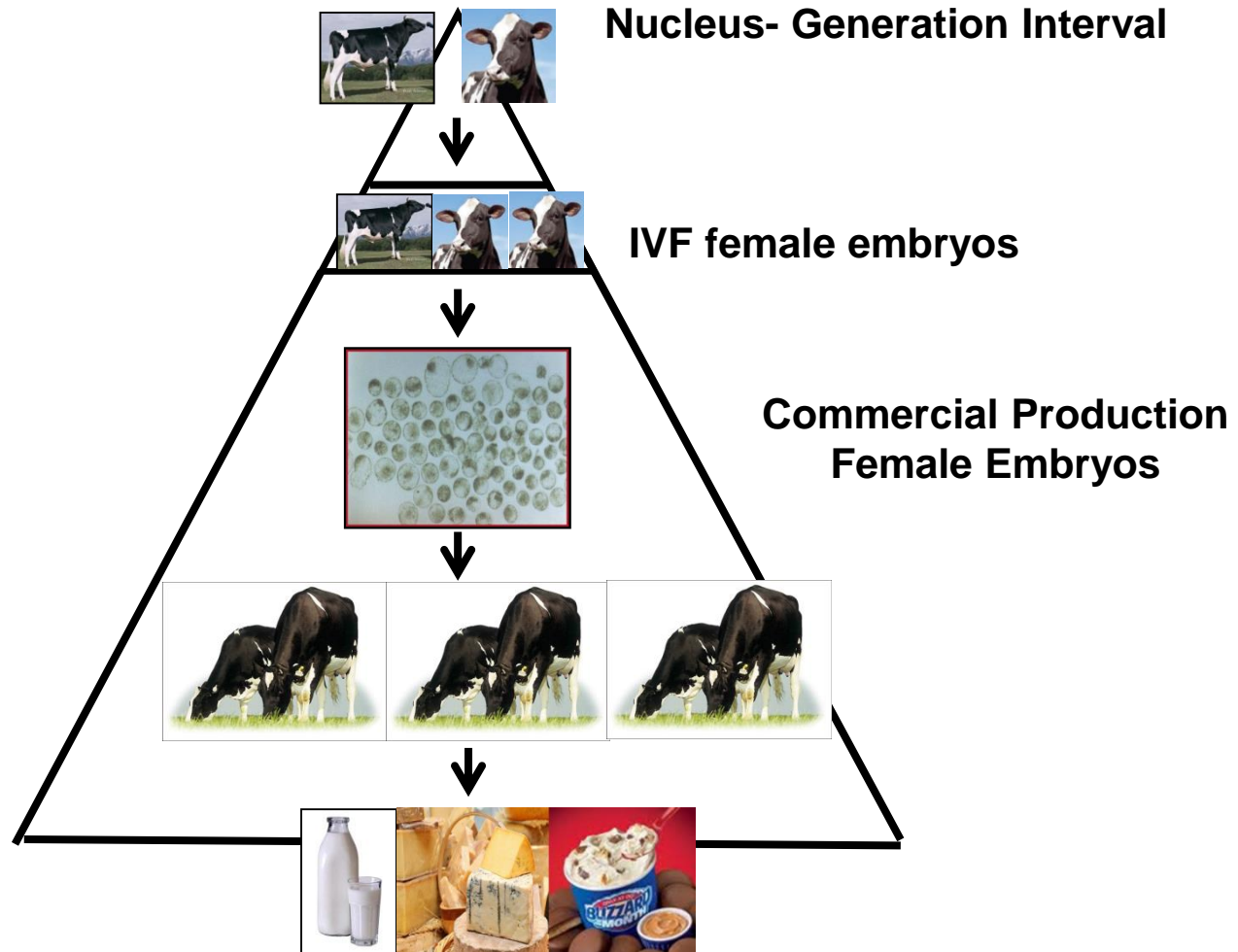
# Different Game



**Dairy Genetic Evaluation - Large portion of data commercial industry progeny test data.**



# Future

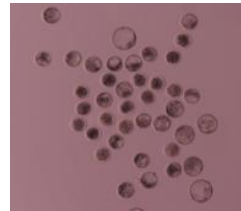


# Implementation to the Industry

Elite sires and Dams



X



**Female progeny**

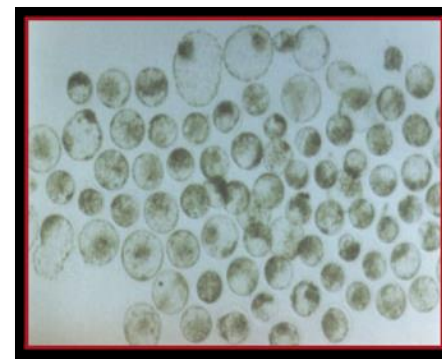
# Genetic Selection – Generation interval reduced

Young female oocyte recovery

Fetal cell line selection

Embryo cell line selection

Biopsy – freeze embryos



**OPEN** Acceleration of genetic gain in cattle by reduction of generation interval

SUBJECT AREAS:  
BIOTECHNOLOGY  
ANIMAL BREEDING

Poohappillai Kasinathan<sup>1</sup>, Hong Wei<sup>1</sup>, Tianhao Xiang<sup>1</sup>, Jose A. Molina<sup>1</sup>, John Metzger<sup>1</sup>, Diane Broek<sup>1</sup>, Sivakanthan Kasinathan<sup>2</sup>, David C. Faber<sup>1</sup> & Mark F. Allan<sup>1</sup>

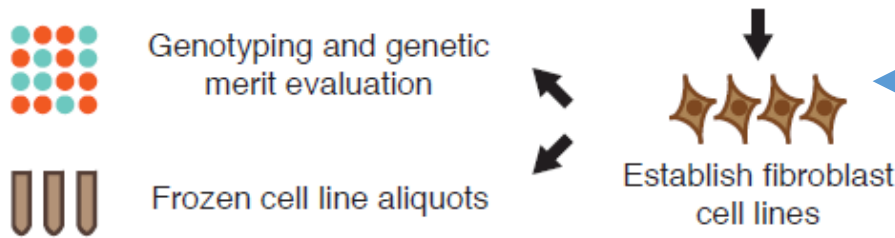


Advanced reproductive technologies



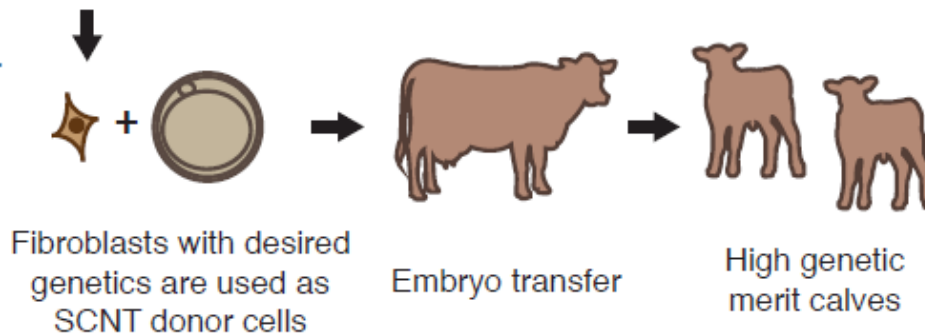
3 weeks

Genomic selection



1-2 months

Somatic cell nuclear transfer (SCNT)



9 months

Fetal cell line selection



# Future- Beef

- Generation interval - younger animals?
- Genetic landscape changing?
- Leveraging commercial data like the dairy industry?
- Impact of technology in commercial sector increases?



THANK YOU

QUESTIONS?

[www.transova.com](http://www.transova.com)

