Keeping the "Genetic Doors" Open between Canada and the U.S.

John Pollak
Cornell University
Director, National Beef Cattle Evaluation Consortium

Genetic Doors

Historically, our two beef industries have strong genetic ties.

This simple fact has led to:
- **Formal ties among the breed associations supporting those industries**
- **Joint genetic evaluations**

Kent Anderson: Collaboration between Canada and the United States — Financial, Data Flow, Analysis

Genetic Doors

These genetic ties have encouraged (perhaps obligated) the scientific community from both countries to work together to:

training graduate students

hold joint scientific meetings

collaborate on projects

Genetic Doors

BIF itself has become an "international meeting" relative to the U.S. and Canada beef industries as evidenced by the attendees in past years and by meetings held in Canada.

So we have had a long history of exchanging germplasm, a central forum in BIF and documented interactions at several levels. The question is then:

Why do we need to keep the genetic doors open?

Why?

We are in the midst of a very important, yet troubling transition in the beef industry.

Today:

Selection based on EPDs supplemented by individual selection for a limited number of animals using DNA tests.

To…

…….. someday

Selection is based on DNA assays containing casual mutations that:

1. **are characterized for their specific action in various combinations (breed background)**
2. **are assessed under different management protocols and environments.**

The Issue

However, we have been behaving, to date, as if we are ***paralyzed by the promise*** of someday!

We could be criticized for our inaction as we experienced the dramatic changes in DNA technology and the tools those changes have created.

The Focus

We should not wait and react to where we will be "someday" but rather plan for:

How we transition from today to "someday?"

At each stage of the transition, there is one simple objective:

Optimize selection decisions based on the information in hand at the time the decision is made.

BIF

BIF has been the forum to address transitions in genetic programs.

BIF was established to address and promote the performance revolution
and

was the central organization through which the EPD transition was discussed, evaluated and supported.

BIF

BIF is the forum to address this transition because the transition requires action from:

Researchers - to create the tools
Extension Specialists - to provide the education
Breed Associations - to maintain the information
Support industries - to deliver the tools
Producers - to use the tools appropriately

BIF

At this year's conference, I encourage us all to think about and discuss the steps needed to make this transition using presentations throughout this program as catalysts.

We should also pay particular attention to opportunities within each group from the U.S. and Canada to collaborate, to avoid duplication and to share resources.

Argues to keeping the "genetic doors" open or even opening them wider.

Collaboration in Research

There are numerous example right now of international collaborations among scientists that will provide a foundation for future opportunities.

Collaborations

International collaboration between the U.S. and Canada on the development of the Illumina BovineSNP50.

iBMAC

Illumina, Beltsville, Missouri, Alberta, and Clay Center

Collaborations

NBCEC validation project for *Igenity* intake markers: international effort with Canada (Lethbridge and Guelph) and Australia (Beef CRC).

(Dick Quaas: Will discuss this project and some results in the Genetic Prediction Committee meeting)

Current Status: Genomics

Current Status: Genomics

Have multiple companies providing services in parentage identification and verification (servicing both US and Canada).

Small, but growing, array of diagnostic tools (some validated internally and others externally).

Growing in two ways, more markers per panel and more traits.

Current Status: Genomics

We have entered the era of large SNP assays

=> provides for genome-wide discovery that should lead to more comprehensive

diagnostic panels.

Emerging Technologies Committee discussion on "Whole Genome Enabled Animal Selection"

Current Status: EPDs

Current Status: EPDs

EPDs are still a very critical tool for selection.

However, let's keep in mind that to achieve EPDs does require a substantial investment in infrastructure for data capture, storage and analysis.

EPDs

As MBVs improve, the emphasis on phenotypes and pedigrees will diminish with regard to routine evaluation.
In fact, we could select based solely on MBV if the amount of variation the panels of markers explains exceeds some threshold.

However……..

EPDs

Our initial efforts in producing MBVs have yet to push us beyond that threshold and will likely not in the near future.

So, well into the foreseeable future, EPDs will continue to play a very important role in selection decisions.

However…….

EPDs

We should not invest heavily in the infrastructure to support development of new EPDs that are not functions of data already in the national databases.

Examples: Healthfulness and animal health

Constraints

These two technologies are currently separate and as such we are not optimizing their use as it would occur in the merger of the technologies.

Steps Towards the Transition

Genetic evaluations:
A very important step in the transition will be to merge DNA marker information with EPDs either within genetic evaluation systems or externally.

Denny Crews: Traditional & Marker-Assisted Evaluation

Steve Kachman: Integration of MBVs into Genetic Evaluation (Genetic Prediction Committee)

Constraints: Data

Information flow:

There is no mechanism for the movement of DNA information from the point of origin to a national database for use in genetic evaluation.

Steps Towards the Transition

Data

We have an opportunity afforded by the newness of the technology.

That opportunity will be to create new infrastructure for beef cattle data capture and analysis.

Steps Towards the Transition

We currently operate under the constraint of too many disparate databases that impede opportunities to deliver new kinds of information (multiple breed evaluations).

I hope we explore unifying datasets for genomic information: across countries, breeds, DNA companies.

Kent Anderson: Collaboration between Canada and the United States — Financial, Data Flow, Analysis
Bob Kemp: Collection and Application of Genetic Information from a Canadian Perspective
Brad Wildeman: Informational Channels: Access to, Benefits from, Enhanced Data

Steps Towards the Transition

US MARC => genotyping 2000 bulls across breeds with the Illumina 50K SNP assay to put genotypes into breed associations databases.

Done with the expectation this panel will be the standard (or the core of the future standards)

The research community currently is using this same panel in multiple projects: U.S. => NRI grants, WGEAS grant, NBCEC projects and US MARC. Here and in Australia.

Steps Towards the Tra

NBCEC has that pedigree for many breeds.

Build (inter)national pedigree file that contains any genotype on any animal from parent identification to diagnostics.

Any time an animal has a genotype done, it is assessed against what is known in the database regarding itself or relatives.

For research projects having a central data base of at least the registration numbers of animals genotyped and for which large panel would help avoid duplication.

The Transition

DNA tests will continue to bring a new array of traits to the selection objective.

Mark Enns: New Trait Development

Many of these traits are expensive to measure, and we will rely solely on the DNA results in the future for selection decisions.

How do we optimize this exploration in

The Transition

We need partnerships among the research community, support industries and producers to create these datasets.

Examples:

NBCEC healthfulness project: Iowa State, Oklahoma State and UC Davis; Pfizer Animal Genomics, Jack Cowley commercial Angus and DuckSmith Farms

University of Alberta and Beefbooster, Inc.

Challenges

Need populations

Need infrastructure

Need programs

We should develop these with as little duplication as possible and in fact capitalize on the newness to think differently about data collection and storage.

Developed with an eye on transition and with the goal of optimizing selection decisions.

Our Charge at BIF, 2008

I again challenge us all to think about how keeping the genetic doors open between the US and Canada, among breed associations and within our research communities to help us navigate this transitional period.