

## Genomics for the Future

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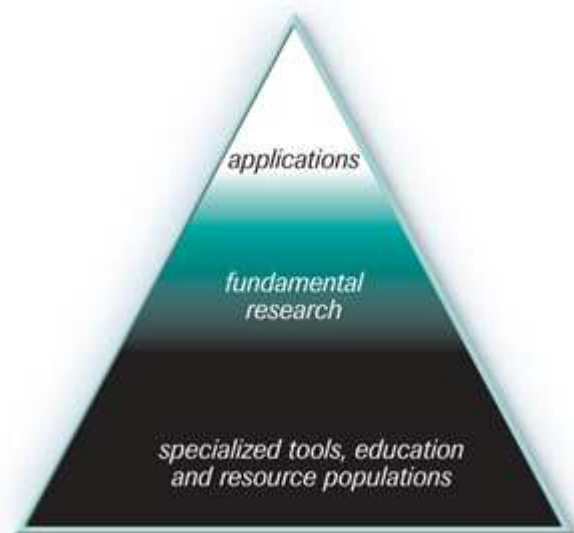
Traditional selection schemes have made tremendous progress in improving the efficiency of meat and milk production in the past few decades. However, there is still a significant need for increased production efficiency. Global demand for milk production continues to increase as population increases and the numbers of farms decrease. Efficient production is key.

### Creating A Model

In 2006 a group of government and university researchers and educators developed a model for future research, education and extension in agriculture animal genomics. The model can be thought of as a pyramid with applications at the top, supported by fundamental research, and based on a solid infrastructure of education and training, specialized genomic and statistical tools, and deeply phenotyped resource populations as well as repositories for cell lines, DNA and RNA collections for all livestock species<sup>1</sup>.

By looking at the three component model you notice it functions as a comprehensive strategy for the future development and applications of genomics. Although industry is an integral part of this model whether talking about the application or the foundation, each artificial insemination (A.I.) organization should implement a similar model.

Does an A.I. company need to put science to practice? Does an A.I. company need to direct certain applications based on mission-oriented research? Does an A.I. company need to educate its employees and customers? If the answer to all three questions is yes, then the national model is needed.



### Where CRI Stands

At CRI, wide steps have been made to aggressively implement the new technology. Our dairy lineup and elite females have been genotyped and a better genetic index has been provided by AIPL (Animal Improvement Programs Laboratory). Plans to adopt the other components of the model are underway; particularly research to support non-traditional traits, to design new programs to improve product quality and to optimize management systems. But the most important component for our future planning is education for us and for producers who take care of the dairy cow.

Education and confidence building for new technologies are highly needed particularly in the business of agriculture. At this critical point in time, many of us are skeptical about full adoption of genomic technologies. The argument of trusting a genomic "number" as a replacement for the traditional breeding value that takes five years to

"make", is still hard to comprehend by many producers, professionals and even scientists in the field of dairy cattle breeding today.

### **A Look to the Past**

Similar apprehension was encountered with the current progeny testing schemes were first introduced. In a 1960 paper by Jay Lush<sup>2</sup>, he makes the following observation.

*"For progeny-tested bulls, accuracy may be anywhere from lower than 30 percent, where the daughters were few and all in one herd and nearly contemporary, to upwards of 70 percent, where the daughters are many and are either scattered through many herds or corrections for herd differences were made almost perfectly. Progeny tests are rarely as accurate as 80 percent though, theoretically, they could approach 100 percent under ideal circumstances."*

It is amazing that Lush, in his paper, was having the same type of exploratory questions about the reliability of progeny testing as we are having today about the reliability of genomic predictions. It is interesting to note that knowledge continued to grow over the past few decades to the extent that the 99 percent reliability, once thought of as only theoretical, has now become commonplace.

### **Genomics for the Future**

Genomics as an innovative technology will create much more opportunities for the business of animal agriculture than progeny testing has ever achieved.

However, evaluating bulls based on the performance of their relatives in general and of their daughters in particular will not cease to exist. Only that more valuable inputs to our genetic evaluation models will now be utilized. Consequently, the need to have to wait for many years before a bull can be reliably used commercially or a bull dam can be selected will diminish and disappear overtime. This will eventually result in great reduction of generation intervals and will dramatically boost genetic progress<sup>3</sup>.

As education is an important part of our genomic planning, CRI will continue to provide genomic education resources. To see our current resources, visit the CRI Learning Center.

#### **References**

[1] Blueprint for USDA Efforts in Agricultural Animal Genomics. 2008-2017. USDA-ARS, National Program Leader, 5601 Sunnyside Ave., Beltsville, MD 20705.

[2] Lush, Jay L. 1960. Improving dairy cattle by breeding. I. Current status and outlook. J Dairy Sci. 43:702.

[3] Schaeffer, L.R. 2006. Strategy for applying genome-wide selection in dairy cattle. J Anim Breed and Genet. 123:218.