Genomics 1-History Part A

For centuries, livestock producers have been selecting for genes whenever they tried to improve or change the appearance or performance of animals: even if for the majority of that time they had no idea of the actual biological systems they were changing. Some of these changes have been easy to direct; breeding large animals to large animals tends to produce large animals. Breeding small animals to small animals tends to produce small animals. Other changes, such as improving milk production or increasing butterfat/protein percentages have been considerably more difficult.

The simple reason for this is that there is a strong correlation between genes that create tall or short animals. Almost of equal importance is that the environment in which the cattle live has limited impact on the relative size in the herd. For instance, you can have a herd that has very low inputs that on average is smaller in size than a herd that has high inputs. If you could do a little experiment and exchange the animals in each herd from one to the other at birth you would find that: The animals that were shortest in the one herd would be the shortest in the other herd, and the animals that were tallest in the one herd would be the tallest in the other herd. When we see a trait like stature that expresses itself in its appearance, or phenotype, in this way, we call it a highly heritable trait. We also now know that the reason for this is that the genes that contribute to stature are a relatively simple group compared to genes that contribute to the expression of other traits.

As a consequence, producers have been able to breed for the size of cattle they have wanted for a very long time. The information that is required to make the selection is easy for anyone to see, the resulting offspring reinforce that the selection criteria work, and so farmers have been able to change the size of their cattle with relative ease.

Other traits are not as simple to select for, fluid milk production being a primary example. The first problem that arose very early in efforts to improve milk production was that, contrary to the simple size-to-size mating decisions for stature, there is this biological reality: Cows produce milk and bulls do not. Where with stature you can breed a tall cow to a tall bull and you are actually selecting for the same genes, how do know what the milk production capacity of a bull is?

Yes, bulls do have genes for milk production but how do you determine what they are? How did dairy producers try to select bulls that would create daughters that would produce more milk? While you may think this is obvious, you may be surprised at the historical reality; you probably would respond “pounds/kilograms of production”; that is not the way farmers historically thought. In general, breeders believed that all traits were like stature; that visible physical traits could be used to select an animal regardless of sex.

A subject that I would like to spend some time researching is the effectiveness and history of selecting for “milk mirrors” or “escutcheon”. This widely applied method was used across Europe and the US as late as the 1930s in judging cows, heifers AND bulls in the show ring and for the choice of bulls to use in a herd. Do you know what a “Milk Mirror” is? Look at your cows from the rear and notice that whorl of hair between the top of the rear udder and the bottom of the vulva. The direction, tightness, size and quality of hair in this whorl was understood to be directly correlated to the ability of a female to milk, or the ability of a bull’s daughters to produce milk. This traits is on all US breeds earliest score card; including Brown Swiss at least in 1908. At that time, all animals, cows, heifers, and bulls could receive the same maximum number of points for the escutcheon, 7 out of a 100.

Another physical trait that you are familiar with, and is still used by judges in the ring today, is “veining” or “milk vein”. We are looking to see if there was ever any actual research done on this trait in relation to production, or if like the “escutcheon” the trait was perceived wisdom with no actual contribution to predicting production. (Personally I agree with Dr. Chris Keim’s view that in general heavily veined udders are meaty, lower-production udders. Hopefully, BSCBA research trait “Udder Texture”, while not the exact same item, will open the door to further research to answer this question.) At least through the 1930s on the Brown Swiss scorecard, all Brown Swiss animals, regardless of sex, could receive a maximum of 6 points out of a 100 for milk veins.

The usefulness of selection for any trait is directly related to how effective that selection is in producing the desired results. Did selection for great “escutcheons” or “milk veins” contribute to choosing bulls that lead to improved production in their daughters over bulls that were “poor” in those two traits? While not well documented, the response would have to be “probably not.” For unlike stature, a trait that is easy to see and understand in offspring, these two tools for improved milk production were not uniformly analyzed nor were records kept of their daughters’ actual production. The best evidence for them not being useful tools is the continuing creation of new tools to try and improve production.

Next time yellow earwax and the Babcock test.

---Dave Kendall