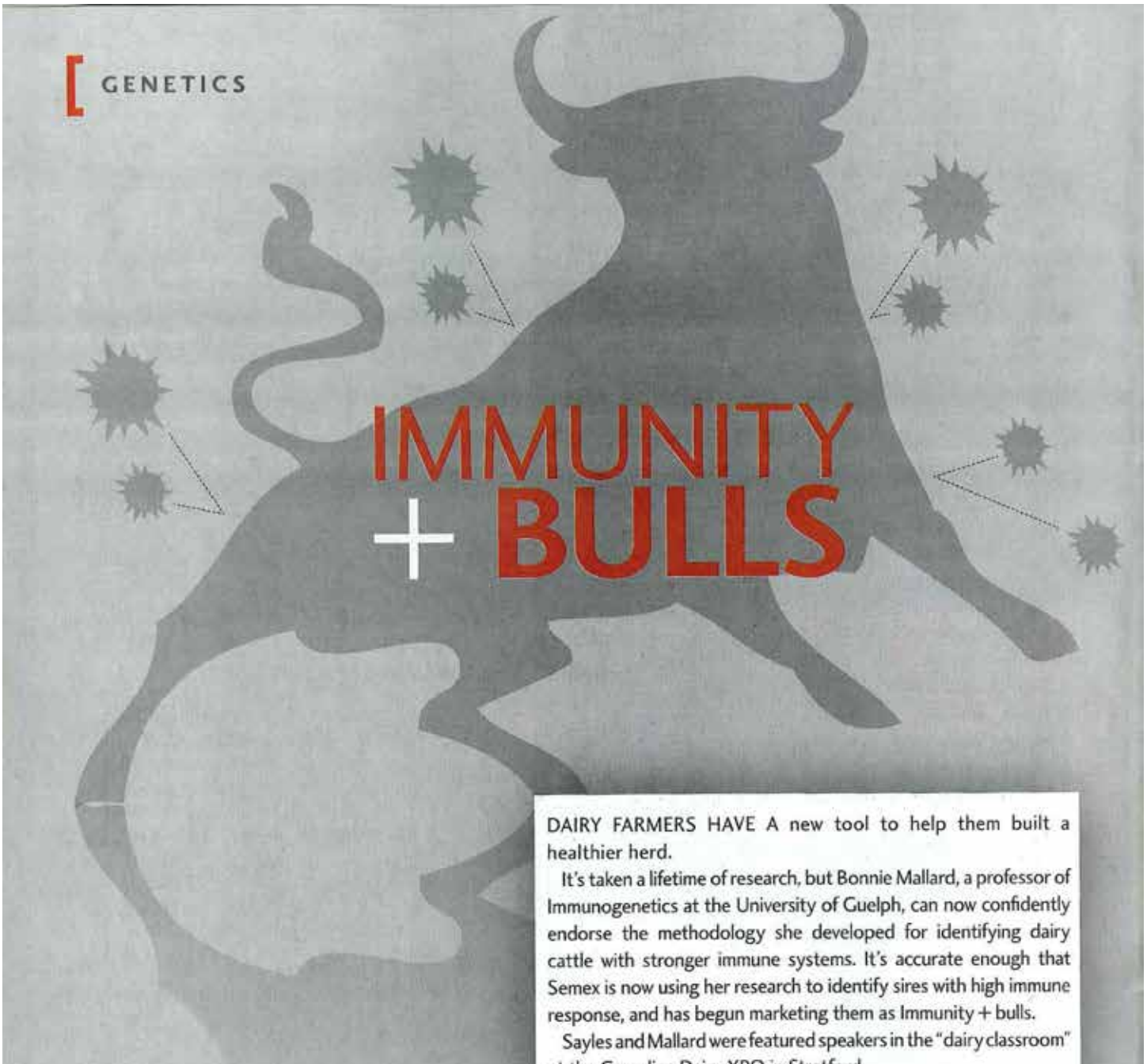

IMMUNITY + BULLS

A U of G professor has developed a methodology for identifying dairy cattle with stronger immune systems

by FRANCES ANDERSON

DAIRY FARMERS HAVE A new tool to help them built a healthier herd.

It's taken a lifetime of research, but Bonnie Mallard, a professor of Immunogenetics at the University of Guelph, can now confidently endorse the methodology she developed for identifying dairy cattle with stronger immune systems. It's accurate enough that Semex is now using her research to identify sires with high immune response, and has begun marketing them as Immunity + bulls.

Sayles and Mallard were featured speakers in the "dairy classroom" at the Canadian Dairy XPO in Stratford.

The Immune Response trait is not like the red and white trait, that is either on or off; it's more like fat or protein, where "a number of genes contribute," explained Brad Sayles, the VP of global marketing for Semex.

The advantage with Immunity Plus semen is that it confers resistance against a spectrum of diseases, and has high heritability relative to other health traits. The heritability of HIR is 25 per cent, which is equivalent to milk fat and protein. (Milk production has the higher heritability at 35 per cent.)

"If you incorporate Immunity Plus and High Immune Response (HIR) technology into your genetic strategy, over time, you will build a herd of dairy cows that is more resistant to disease," said Sayles.

With only the sire contributing HIR, the average daughter will have four to eight per cent less disease than her dam, said Ballard.

Semex is "testing cows in a research capacity and also a BETA

Brad Sayles, VP, Global Marketing, Semex

herd," said Sayles, but it's not yet commercialized.

There are three kinds of immunity: passive, innate, and adaptive or acquired, Mallard explained. Passive immunity is conferred to a newborn calf through colostrum, but it is temporary. The innate immune systems is controlled by about 2,000 genes and "these are non-specific responses". They are not influenced by exposure to disease, but are necessary as the "building blocks" for adaptive response.

The Immunity Plus technology measures the adaptive response system which recognizes a broad range of micro-organisms and "remembers them on subsequent exposure" in order to make a more rapid and stronger response. "It's specific and long-lasting" which is why you can be vaccinated once, and respond for a lifetime, or at least many years, said Ballard.

There are two kinds of adaptive response. In Type 1, which is Cell-Mediated Immune Response (CIMR), the body fights against pathogens like viruses and mycobacterium, which try to live inside the cells. These include paratuberculosis, which causes Johnes Disease.

Type 2 is Antibody-Mediated Immune Response (AMIR) which fights bacterial infections outside the cell, in the blood.

Only the animals that exhibit high levels of both cell-mediated and antibody-mediated (CMIR and AMIR) responses are considered High Immune Responders.

The test for High Immune Response requires three farm visits, but because it tests genetics, which don't change, the animals need only be tested once in a lifetime, said Mallard. The first visit is for immunization. On the second visit, two weeks later, technicians take a blood sample to measure antibody response. Twenty-four hours after, they return to do a final skin test to measure cell-mediated immune response.

Using data from 690 cows in the 58 herds involved in the Canadian Bovine Mastitis Research Network, Mallard was able to confirm that high responders better resist disease. In fact, the top 16 to 20 per cent of animals with high AMIR and CMIR were one standard deviation above the entire population for immunity response.

HIR cattle had a lower incidence of clinical mastitis - just 17 cases per 100, compared to 31 cases per 100 among the low response group –and the HIR cases were less severe. None of the high immune response group had a first case of mastitis after 220 days in milk.

Within a specific herd of 700 cattle, North Florida Holsteins managed by Don Bennink, the high immune responders had 27 per cent less mastitis, 17 per cent less metritis, and 32 per cent fewer retained placentas compared to the entire herd (not just the highs to lows).

When the researchers looked at a particular disease, they found the same effect. Animals with high CIMR were less likely to be sero-positive for Johnes than the average cows.

The HIR animals respond better to vaccination, and their colostrum is higher in antibodies, so farmers banking colostrum should collect it from them first, Mallard said.

Bonnie Mallard, Professor of Immunogenetics, University of Guelph

"It's tremendously important in herd health," she said, putting "very, very conservative" estimate of its economic value at $124 per cow per year.

These results were established using the classic, quantitative approach to genetics, using Estimated Breeding Values. However, genomics "told us the test was hitting the right target," said Mallard. It showed a tower of SNPs (single nucleotide polymorphisms) at chromosome 23 "which is a cluster of genes that regulate immune mechanism."

"It was an independent proof that the technology was working and lets us know that maybe we can do a genomics test in the future."

Sayles said the cost of testing cows for HIR is "not yet known", but a market research company "came back with a cost of about $80."

"There is a positive and significant correlation" between HIR and herd life, said Mallard. "HIR cows tend to be culled less. However, the correlation is "not perfect. There's a lot more than immunity that goes into longevity."

"Otherwise you wouldn't need Identity Plus," added Sayles.

Currently young bulls aren't tested for HIR until they're 12 to 15 months old. They need to be at least two months old, said Mallard.