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Prof. Bonnie Mallard (right) and Semex vice-president Brad Sayles with Dairy Expo innovation award

PHOTO: MARTIN SCHWALBE

# Identifying healthier herds

The immune system, in both humans and animals, is essential for survival due to its ability to destroy disease-causing micro-organisms and pre-cancerous cells. Those individuals with the ability to make robust and balanced immune responses are termed high immune responders, often respond better to vaccines and, overall, are less likely to get sick.

At the University of Guelph, a research team has developed a safe, accurate way to help identify cows with the strongest, most disease-resistant immune response systems.

Led by Prof. Bonnie Mallard of the Department of Pathobiology, this High Immune Response (HIR) technology helps to identify cattle as high, average or low immune responders. High responders are those that have naturally more enhanced and balanced immune responses, capable of defending against the large number of diverse pathogens that commonly infect dairy cattle. These cows also have better-quality milk and colostrum, containing more protective immunoglobulin and other defence molecules.

HIR is a genetic test with high heritability—it need be done only once at any stage of the animal's life from two months of age onward. The high immune response genes are passed on to future generation of offspring to continue to improve herd health.

The test involves three farm visits in which blood or milk samples are taken from the cows and their skin-fold thickness measured. They are also immunized with two different proteins. The animal's ability to respond to the test antigens determines its immune response.

High immune responders have up to 50 per cent lower incidence of

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## Presponse vaccine

# The shipping fever vaccine standard

Bovine respiratory disease (BRD), also known as shipping fever, is the most common and costly problem encountered in feedlot calves. Stress, altered diets and exposure to other calves can harm the immune system, leaving calves vulnerable.

Conventional pneumonia vaccines were not only ineffective; their use was associated with higher risk of disease. University of Guelph pathobiology professors emeriti Patricia Shewen and Bruce Wilkie took a new approach by focusing on the antibodies of the calves that escaped pneumonia.

After extensive research, Shewen and Wilkie discovered that pneumonia bacteria create a toxin and other factors that attack immune cells in the lungs. Their vaccine, known commercially as Presponse, works by inducing antibodies to these factors – something previous vaccines had never been able to do.

After entering the market in 1988, the Presponse vaccine quickly became the most effective method of shipping fever pneumonia prevention. It protects cattle from mortality and morbidity, while reducing the need to use antibiotics and enhancing animal welfare.

A major Canadian innovation in the field of cattle health management, Presponse has become the standard by which other bovine respiratory vaccines are now measured. Shewen and Wilkie revolutionized cattle disease prevention and saved producers millions of dollars. They have been nominated for many prestigious awards, including the Ernest C. Manning Award for Innovation in 2012.

—Anna Wassermann

disease than low immune responders, including important economical diseases such as mastitis and pneumonia.

The HIR test can also be used to identify sires with the best immune responses, and these sires are marketed by the Semex Alliance under the trade name Immunity+. Results of the HIR technology have enabled producers to cull cattle with low-immune response profiles and to select more appropriate bulls for breeding, based on the immune profiles of both sire and dam.

Identifying HIR animals can also greatly reduce veterinary treatment costs.

**—Rebecca Wilson**

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**The research was sponsored variously by grants and contracts to Shewen and Wilkie from the Medical Research Council, the Natural Sciences and Engineering Research Council, Agriculture and Agri-Food Canada, the National Research Council, Langford Laboratories and the Ontario Ministry of Agriculture, Food and Rural Affairs, which shares ownership of the Presponse vaccine with the University of Guelph. The commercial rights to Presponse currently belong to Boehringer Ingelheim Vetmedica Inc.**



# A closer look at animal embryo biotechnology

**Advancements in reproductive technologies form an important component of the University of Guelph's heritage and contributions to livestock productivity and agricultural research.**

Instrumental in driving this research forward is Prof. Allan King, Department of Biomedical Sciences, and his research team at the University's Reproductive Health and Biotechnology Laboratory. Over the years, King has refined in vitro techniques that allow embryos to be studied from their earliest stages.

"We want to understand what makes embryos develop well, while also identifying causes of embryo failure or death," says King. "We found that genes can be uniquely expressed—or expressed at different levels—from the moment of fertilization."

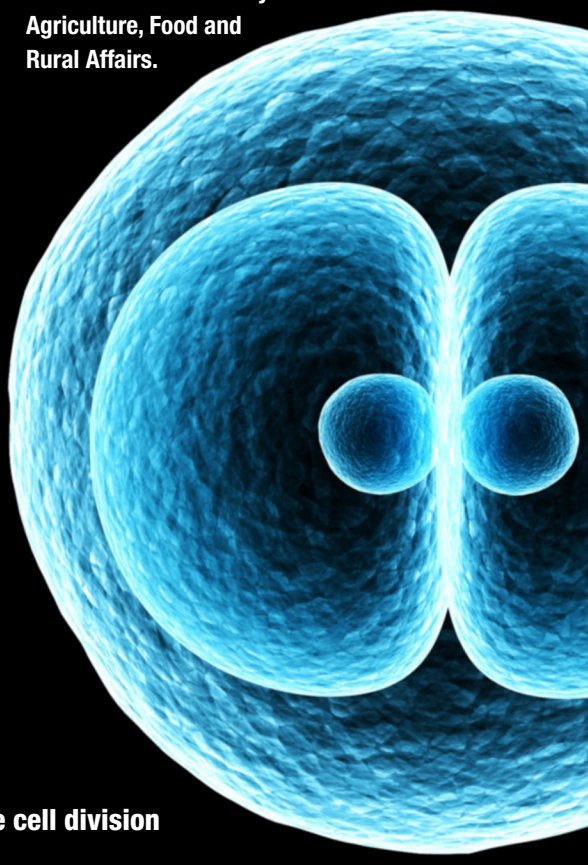
Although his main goal is to improve fertility and reproduction in domestic animals of agricultural significance, King's research also has beneficial implications for human medicine and management of endangered species.

One of King's most revolutionary discoveries was that, from the very beginning, male and female embryos develop differently and have unique patterns of gene expression. For humans, this offers a potential explanation for the differences between males and females in the incidence of certain diseases.

**—Alexandra Sawatzky**

**Current collaborators come from many areas of expertise, including Profs. Jon LaMarre and Pavneesh Madan of the Department of Biomedical Sciences; Prof. Tracey Chenier, Department of Population Medicine; Dr. Gabriela Mastromonaco, curator of reproductive programs at the Toronto Zoo; research associates Dr. Laura Favetta and Dr. Tamas Revay; and lab technicians Elizabeth St. John and Ed Reyes.**

**Major funding sources for King's research include the Canada Research Chair program, the Natural Sciences and Engineering Research Council, the Canadian Institutes of Health Research, Agriculture and Agri-Food Canada, and the Ontario Ministry of Agriculture, Food and Rural Affairs.**



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**Zygote cell division**