

The Animal's Voice

Non-invasive ways to measure animal stress at a molecular level are proving their worth by increasing herd health, decreasing use of antibiotics, producing higher quality meat for consumers, and returning profits to the farm.

Though they lack the capacity for human language, animals can communicate to humans when they're feeling stressed or under the weather. The most common evaluation of animals' stress levels is using a behavioural gauge – are they restless, lethargic, not eating, and so on. Other tests, such as blood sampling, can be done to verify the presence or absence of disease or stress indicators, but these procedures can sometimes be stressful themselves, perhaps making the animal more susceptible to what ails it. This challenge of measuring animal health and well-being prompted the creation of a partnership between Agriculture and Agri-Food Canada (AAFC), Alberta Agriculture, Food and Rural Development (AAFRD), and Alberta Farm Animal Care (AFAC) with the mandate of using the least invasive measures to gauge welfare and then to remedy situations where welfare is potentially diminished.

Drawing on his background in human medicine and stress research, Dr. Nigel Cook, Livestock Welfare Research Scientist with AAFRD, is measuring animal welfare on the molecular level as his contribution to the Alberta-Canada Livestock Welfare Research Partnership. "Stress can be measured through heart and respiration rates, hormone levels in saliva and blood, heat production, growth rate, and something called proteomics – determining molecular markers of disease states or a predisposition to stress," Cook explains. Each of these reactions to stress can be quantified, sometimes with the same techniques developed to measure human health.

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- Alberta Agriculture, Food and Rural Development
- Agriculture and Agri-Food Canada

- Alberta Farm Animal Care
- Alberta Livestock Industry Development Fund



Nigel Cook (pictured at left) has found that supplementing cattle's natural cortisol levels before transport would reduce by 30-50% the weight loss that can occur in animals not generating high enough levels of cortisol themselves.

"Animals strive to maintain all body functions at a normal level. They try to and cope with stress by releasing certain hormones to regulate heart rate, temperature, etc. One of these hormones is cortisol – commonly expressed in blood and saliva if an animal is trying to cope." So, by taking a sample of saliva (which is much easier and less invasive than a blood sample) and measuring the levels of cortisol, you can much more easily determine if the animal is stressed. "Some species, like pigs, appear to actually enjoy the process of taking a saliva sample," he adds.

Evaluating and minimizing stress in livestock is important for several reasons. Not only can animal welfare be improved and maintained, creating peace of mind for farmers and consumers, there is also a positive economic impact when animals are being raised, transported, and slaughtered with the highest regard for welfare.

For instance, Cook's work has found that supplementing cattle's natural cortisol levels before transport would reduce by 30-50% the weight loss that can occur in animals not generating high enough levels of cortisol themselves. "Animals that are stressed can fail to produce cortisol, and then begin to lose weight because they aren't successful at achieving homeostasis – the status quo of body function. We know now that we can give them this hormone and help them to physiologically cope with the stress of transport." Cook adds that this is rather significant, because although 70% of Canada's cattle are processed in Alberta, many of those calves come from out of province, making weight loss an important issue.

Not only do unstressed animals produce higher quality products, they do this on less feed and usually with lower instances of disease. Dr. Al Schaefer, Animal Physiologist with AAFC, has taken that knowledge and applied it to a specific welfare issue – spotting and treating cattle ailments after arrival at a feedlot. To do so, he used non-invasive infrared thermography to gauge an animal's temperature every time it comes to the feed bunk to eat. "This study," Schaefer explains, "combined tracking how much cattle ate as well as their temperature, and was then compared to animals which eventually came down with bovine viral diarrhoea virus (BVDV) – an economically significant ailment."

The study discovered two things: that infrared thermography is a reliable indicator of early incidence of disease; and that by catching sick animals five to seven days earlier (than by using body language as a gauge) and treating only those animals with antibiotics (as opposed to a blanket application of antibiotics), these cattle were helped sooner and at a lower cost, while decreasing the overall use of antibiotics. All of this is possible simply by monitoring a cow's temperature without it even being aware of what is happening. "We're trying our best to find ways to help animals without causing more stress in the process," Schaefer explains. "And we're finding that these measures can then deliver more valuable product for consumers and higher returns for producers."

The newest, and perhaps most exciting type of this welfare work involves the MALDI-TOF/MS instrument, a sophisticated analysis tool that is helping track the very protein patterns of diseases and pain. "This instrument is well-used in human medicine, but we're the only lab using it for animal welfare research. We want to look at the protein structure present in blood when an animal is stressed vs. non-stressed or in pain vs. comfortable. What we're trying to determine is if there is in fact a molecular marker for pain or disease," Cook explains. This technology has proven very useful in human medicine, and Cook hopes to translate that same success to the livestock industry.

Also, at a genomic level, work is ongoing to discover the role genetic makeup plays in how an animal copes with stress. "Working with the beef genome project, we're trying to determine if, by selecting for feeding efficiency, we're not also selecting animals that are more susceptible or resistant to stress," Cook says. "The next step is then to determine why some animals cope better than others. Do they produce too much of some hormone? Not enough? The day may come when we can actually select for animals that fend off stress better than others."

This research into determining how an animal is coping at a molecular level is as close as anyone has ever been to hearing the animal's voice. This research is set to listen to that inner monologue and create situations for Alberta's livestock that eventually produce high-quality products for consumers and real returns for farmers, all the while keeping animals' welfare top of mind.

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