



# Vet Call

► by **Bob Larson**, Kansas State University

## Research and innovation

*Changes in the tools and solutions available to address beef cattle health and production concerns are being driven by both time-tested and new areas of research and innovation. The advances being made in genetics, geographic information systems, nanotechnology and computing power are exciting, and provide researchers with new tools to learn about cattle nutrition, reproduction, grazing, health and behavior. Yet all innovations are built on foundational knowledge of animal husbandry and the daily needs and characteristics of cattle.*

### New tools for research

Genomics and related research areas such as proteomics, lipidomics and other “omics” are used to study the molecules that are inside cells, including DNA, RNA, proteins, fats and carbohydrates. New laboratory tools are being developed to allow animal and veterinary scientists to investigate how different cattle respond to different nutrients, disease challenges and environmental factors at the cellular level. These types of studies were not possible just a few years ago, and it is hoped that learning about what is happening in the cells will help explain differences we see in living cattle.

Geographical Information Systems (GIS) use maps and other data to ask questions about the characteristics of specific places and the animals, plants and environment associated with those places. From GPS and GIS technologies in our cars, phones and farm equipment, “precision agriculture” is changing the way food producers think about using land, animals, labor and other resources so that each square foot of land or each individual animal is managed for its own optimal production, rather than for optimal production at the herd or field level. GIS also allows researchers with different areas of expertise such as soil health, forage production, water quality, plant health, cattle health and growth, meat science, and economics to add “layers” to the information for each area and animal on a ranch so that scientists can study complex trade-offs between different aspects of cattle production.

Nanotechnology and nanoscience demonstrate the use and study of extremely small things (less than 100

nanometers in size) created to serve many different purposes. To understand how small these devices are — there are more than 25 million nanometers per inch, so more than 250,000 of the largest nanodevices could fit in an inch. New microscopes that allow scientists to see things as small as an atom have allowed this area of research and innovation to move rapidly from science fiction to marketable products.

Nanodevices could be used to deliver small doses of drugs to parts of the body that are affected by disease and to avoid parts of the body that could have a toxic reaction. Other nanotechnology will likely be used to deliver nutrients, detect disease and improve meat packaging.

All of these areas of innovation are made possible by rapidly increasing computing power, which takes the relatively simple task of doing math problems and allows scientists to ask deeper questions about nature and cattle production. The amount of numbers that are generated by studies using genomics (and other “omics”), GIS and nanoparticles can only be organized and evaluated using computing speed that was not available until recently. New

ways of collecting and storing data and doing math are being developed to keep up with growing amounts of information generated from innovations that are investigating both smaller and larger environments associated with cattle production.

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### Motivations

It might be easy to become excited, or appalled, by the innovations that are changing the way scientists do research, but as I look at those who are doing the most beneficial projects, I see animal and veterinary scientists who combine an appreciation for cattle and cattle producers

with their knowledge of the latest tools to investigate the mysteries of biology. It seems the more we learn about cattle, the more we realize how much is still hidden. By appreciating how amazing cattle and the rest of biology are, scientists take small steps toward understanding the things we see every day — cattle eating grass, growing muscle, becoming pregnant, being challenged with disease,

recovering from disease, and serving an important and complex role in the earth’s ecosystem.

Although the tools that are the result of and drivers of innovation tend to be complex, the questions that drive cattle research are straightforward and similar to the questions asked by animal and veterinary scientists for generations: How do you best utilize forage resources? How do you meet the nutrient needs of cattle throughout their life? How do you identify individuals with the most valuable genetic traits? How do you grow and harvest muscle tissue that makes the most desirable food? How do you diagnose and treat animals that become sick?

In my opinion, the tools aren’t what make a good scientist; my science heroes have a love for biology, for cattle and for discovery that makes them want to continue learning throughout their life and to serve cattle and cattle producers by finding solutions to life’s everyday challenges.

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**Editor’s Note:** Bob Larson is professor of production medicine at Kansas State University.

