FEATURE

Let's talk about innovation

How could monoclonal antibodies improve veterinary medicine?

By David Haworth

Monoclonal antibodies have been present in research for decades. They've been around in human medicine since 1986, when Orthoclone was approved to prevent kidney transplant rejection. There are over 160 monoclonal antibodies currently approved for use in humans.

In veterinary medicine, the advantages of monoclonal antibodies may even outweigh those in human medicine, but the cost of producing them has mostly kept them out of our hands until recently. Zoetis' introduction of Cytopoint in the European Union in 2017 changed that. Zoetis is now introducing new monoclonal therapies for pain, and Merck has recently received conditional approval for the canine version of its human therapy Keytruda, a $17.2 billion-per-year cancer treatment with approval to be used alone or as an adjuvant in treatments for 17 different types of cancer.

In this article, we will help put this technology in perspective—the mechanism of action, why this platform is so incredibly flexible, why it is uniquely attractive to treat veterinary conditions and what we can expect in the future.

How do monoclonal antibodies work?

When mammalian immune systems encounter a foreign molecule (an antigen), there is both an immediate response that includes the release of cytokines generating fever, malaise and fatigue, and a slower response that involves antibodies. In normal immune responses, these antibodies are "polyclonal," with hundreds or thousands of slightly different types ("clones") targeting slightly different parts of the antigens they bind to.

Monoclonal antibody technology leverages this incredible system to create highly specific therapies to treat and prevent disease. A monoclonal antibody is, put simply, a single "clone" of an antibody that biologically identifies and binds to a highly specific three-dimensional structure on that targeted antigen.

What does this mean in practice? It means that if researchers can determine key antigens in the cascade of a disease, they can also likely identify how to block those antigens with a binding antibody, rendering those molecules ineffective and inhibiting the disease process. So monoclonal antibodies can very efficiently block the progression of illness. Some small-molecule drugs work in the same manner, but nowhere else is it so clear that if you can learn how a disease works at the molecular level, then design a monoclonal antibody that blocks that molecular cascade, you can stop that disease. Beep. Bop. Boop.

Highlights:

- Monoclonal antibodies, which have been around in human medicine for decades, show promise in the veterinary space as researchers develop them.
- While these highly targeted therapies aren't widely used in animal care yet, developers have mitigated efficiency and cost issues, making them increasingly appealing.
- Given monoclonal antibodies have a long duration and are generally safe, they present opportunities for improved patient care and more business for veterinarians.

The potential of monoclonal antibodies in veterinary medicine

Biologically, monoclonal antibodies work the same in animals as they do in humans. Economically, however, they have historically been very expensive to produce at scale, which is the main reason behind slower adoption for the species we treat. That said, there are several companies—PetMedix leading the pack—that have made massive improvements in the cost and efficiency of producing monoclonal antibodies. In order for veterinary pharmaceutical companies to be able to afford the research and development, registration, and marketing costs of these therapies, the cost of producing them must drop to a level that can be tolerated by pet owners and producers. And that appears to be happening.

Cost and efficacy, as important

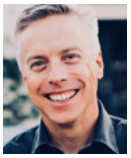
as they are, are not the only exciting aspects of these therapies for veterinary medicine. It's also important to discuss duration, safety and requirements for administration.

Because monoclonal antibodies look like any naturally occurring antibody circulating in the immune system of our patients, they last about a month, pretty much as long as those other antibodies. Unlike small-molecule drugs that are usually seen as toxins and eliminated, or vaccines that are designed to stimulate the immune system and potentiate a future immune response, monoclonal antibodies work incognito inside the body's immune system to stop a disease process. They work just like the patient's own immune system would if it knew to stop that particular antigen.

The second important aspect of monoclonal antibodies is that they cannot practically be administered by the pet owner. Because they are a protein, they cannot be given orally, since the digestive system would break them down like any other protein. They need to be injected, which means they need to be administered by veterinary teams.

And monoclonal therapies are generally very safe. They have side effects, but with human monoclonal therapies, side effects are often associated with them working too well, leading to a massive die-off of cancer cells or too effectively blocking a molecular cascade. Monoclonal antibodies are also generally very safe to administer. This therapy platform is reasonably uncomplicated, but it does require a clinic visit, which has several advantages for our profession.

Zoetis and Merck (undoubtedly followed by other major companies) are developing monoclonal antibody treatments for atopy and pain in dogs and cats. But this is only the beginning. Others will be released for cancer, inflammation, cardiovascular disease and autoimmune disease. When we talk about innovation, monoclonal antibodies are an archetype of these new technologies on the horizon, with extraordinary possibilities once they arrive.



David Haworth, DVM, PhD, is the president of Vidium Animal Health, a veterinary genomics diagnostic provider. His past roles include president of PetSmart Charities, president/CEO of Morris Animal Foundation and numerous roles at Pfizer Animal Health (now Zoetis Inc.). He is and always has been fascinated and inspired by the development and implementation of new technologies in veterinary medicine. David lives in Denver, Colorado, with his wife, Claudia, and their two Golden Retrievers.