Our research priorities include development of vaccines, diagnostics, and immunotherapeutics for prevention and diagnosis of infectious diseases of livestock and companion animals. Immune responses to pathogens are finely tuned interactions between the antigen presenting cells, T cells and B cells. Professional antigen presenting cells include dendritic cells to which antigens can be delivered directly for an optimized response. Our studies are primarily directed at in vivo antigen presentation by dendritic cells following immunization. Toward an optimal response our researchers use engineered antibodies with antigens as payload to target specific antigen receptors on the surface of the dendritic cells. This allows efficient cellular uptake and processing of the antigen for presentation on the cell surface for an efficacious immune response. Furthermore, our studies also include the evaluation of defined dendritic cell activation factors for potentiating the vaccine immunogenicity in outbred species. Project scientists are also evaluating and designing immunomodulating strategies to augment secondary immune responses by induction and maintenance of memory cellular immune responses in outbred species. Importantly, researchers are studying a novel strategy for delivering a single-dose vaccine against multiple pathogens. A faster and more vigorous immune response would be beneficial in case of a disease outbreak. Defining key molecular processes involved in the development and regulation of innate immunity and the influence of these processes on the development of the adaptive immune response are also being studied.

In a disease outbreak, economic losses are usually inversely proportional to the time needed to confirm the nature of the disease. This research is pursuing various platforms, including the use of recombinant antibodies in the development of rapid diagnostic tests for field use. The researchers also produce antibodies (polyclonal and monoclonal) for various pathogens that may be regarded as emerging threats to food production. Immunotherapy is increasingly used for various conditions, including cancers, in humans. This research group intends to develop recombinant antibodies for this aspect of companion animal health. The researchers have developed recombinant antibodies for a disease of neonatal calves and of chicken for use as passive immunoprophylaxis. Furthermore, egg yolk antibodies from immunized hens are used to block enteric pathogens from invading the gastrointestinal tract and causing disease.

Current areas of research: (1) Development of an efficacious, safe, and cost-effective molecular adjuvant for dendritic cell recruitment in cattle; (2) development of a strategy for enhancing efficacy of modified live vaccine against BVDV in neonatal calves; (3) optimization of a vaccination platform for improving priming, expansion, and maintenance of pathogen-specific cytolytic T cells in cattle; (4) development of rapid diagnostic tests for BVDV, avian influenza, classical swine fever, anaplasmosis, and E. coli O157:H7; (5) production of anti-K99 recombinant antibodies in rice to prevent colibacillosis in calves (in collaboration with Dr. Keerti Rathore, Institute for Plant Genomics & Biotechnology, Texas A&M University); (6) development of a platform for vaccine enhancement in poultry by use of antibodies targeting antigen-presenting cells; and (7) production of egg yolk antibodies for the immunoneutralization of toxins and pathogens with intestinal sites of entry.