

USDA Agricultural Research Service
National Program 103
Animal Health
External Panel Retrospective Review: 2016-2020

External Summary

Prepared by:
Carol Cardona, Heinrich Neubauer, Edwin Claerebout, Bryan
Charleston and Alex Morrow

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NPRA NP 103 Executive Summary

Programme 103 is a large and important programme covering a wide range of animal health issues with almost 40 projects based at 9 centres. Stakeholder consultation had been involved in identifying the contents of the seven components of the Action Plan.

Very significant progress has been made across the various components with an extensive list of high-quality publications from the various centres and a significant increase in intellectual property that was protected compared to the previous five-year programme.

The Biodefence Component, which is the largest of the seven components in terms of investment, is essential to maintaining US freedom from the major transboundary animal diseases which is critical to international trade in livestock and livestock products. Major highlights were the speed with which an influenza vaccine was developed in response to the 2014-15 outbreak, the development of an attenuated African Swine Fever candidate vaccine which has been transferred to industry and information on host-pathogen interaction and persistence of FMD infection. In terms of emerging diseases significant work has been carried out with international collaborators to map influenza viruses in swine and how Epizootic Hemorrhagic Disease Virus modifies the behaviour of its *Culicoides* host.

The Component on Antimicrobial Resistance includes very significant work on the development of alternatives to antibiotics, an area in which the US has shown global leadership. This component, although it has some dedicated projects, should be seen as a cross-cutting component with the outputs of some of the other components contributing to it. Important work was carried out on attribution of antimicrobial resistance, especially in relation to MRSA in humans. The work carried out on alternatives to antibiotics covers many of the key areas needing to be addressed, including mechanisms of action of some of the classes of alternatives that are being considered and how antibiotics contribute to enhanced performance.

In relation to Zoonoses, Component 3 focuses mainly on brucellosis, bovine tuberculosis, leptospirosis and Q-fever. In addition to interesting work on host-pathogen interaction in brucellosis, a vaccine was developed for ballistic delivery to wildlife, improved methods for the culture of *Leptospira* and a microparticle based vaccine for delivery of *Leptospira* antigens were developed. Work on bovine tuberculosis focused on host-pathogen interactions and the development of diagnostics and vaccines.

Respiratory Disease (addressed in Component 4) is a major concern to the livestock industries. Significant outputs from work in this area included a computational tool to characterize the antigenic diversity of swine influenza viruses which supports evidence-based decision making in the design and selection of vaccine candidates and the development of promising candidate vaccines against *S. suis* and Infectious Laryngotracheitis Virus of poultry.

Production diseases (Component 5) probably cost the livestock industries more than a major outbreak of a trans-boundary animal disease but generally tend to be neglected. However, with the current emphasis on drug resistance and the need to reduce reliance on antibiotics in animal production more investment is needed for new and improved vaccines and alternatives approaches to use of drugs to control these conditions. Work under the programme included studies on four of the most challenging conditions requiring attention, focusing on the diagnosis of Johne's Disease, Marek's Disease where a vaccine that gives sterile immunity is urgently needed, host pathogen interactions in Necrotic Enteritis and Mastitis.

The parasitic component (Component 6) included significant work on helminth genomics and host pathogen interaction which are likely to be important for future vaccine and drug development. There was also important work on *Eimeria* infection focusing on vaccine development and the detection of drug resistant parasites: new and improved vaccines for coccidiosis are urgently needed. The other important area for US livestock producers was the studies on haemoparasites with work on detection of *Babesia* infection and vaccine development for anaplasmosis and babesiosis.

Classical BSE may be of less concern, but TSEs haven't gone away. Component 7 made significant advances in improved test sensitivity for scrapie in goats and in the prospect of improved ante-mortem tests. There was also significant work on possible interspecies transmission of TSEs and the identification of resistant alleles in goats, the latter being essential for the development of breeding programmes to eradicate scrapie in goats.

Although the accomplishment report tended to feature the more applied or near-market outputs it is apparent from the list of publications across most of the components that this is based on a solid foundation of more fundamental science focusing on pathogen genomics and host-pathogen interactions. It is critical that this balance is maintained otherwise the innovation pipeline will dry up.

Gap analysis was carried out, involving key international experts, for a number of topics in the Biodefence component of the Programme. This has resulted in improved focus of the research activities and increased international collaboration and the Panel were keen that this should be extended to the other components. Moving forward, it would be ideal if in addition to the important disease issues being identified by stakeholders they also identified the required product and gap analysis could then be conducted to identify and map the knowledge gaps needing to be addressed to deliver the required products.

Maintenance of capacity in critical areas is an important function of a national programme and it is encouraging to see the investment in training of staff for the new biocontainment facility in Manhattan.

The report noted formal collaborative activities with various institutions nationally and internationally. However, it was apparent from the publications that collaboration was more extensive than what was presented.

Conclusions

There is much high-quality work especially on pathogen genomics and host pathogen interactions among the publications which is essential and examples were highlighted as accomplishments where this has yielded interesting vaccine and diagnostic candidates. However as a National programme it also has to maintain research capacity in less exciting areas to support policy implementation.

Overall assessment: medium to high.