Scientists launch multi-million dollar battle against African disease killing one cow every 30 seconds

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The Nairobi-based International Livestock Research Institute (ILRI) announced today that a global consortium supported by the Bill & Melinda Gates Foundation has been formed to develop a new vaccine against a disease that's devastating cattle herds in sub-Saharan Africa. This highly advanced cattle vaccine project could also help malaria and cancer research in humans.

The target is East Coast fever, an often-fatal affliction caused by a tick-borne parasite. The disease is spreading rapidly and currently threatens some 28 million cattle in East and Central Africa. Last year it killed more than one million cattle in 11 countries and caused US$300 million in losses. Many of the animals threatened by the disease—which typically kills cows within three to four weeks of infection—belong to poor pastoralist herders and smallholder farmers for whom the loss of even one cow can be disastrous.

"We need to get better control of East Coast fever because there are millions of people in East and Central Africa whose existence depends on healthy cattle, and right now they are losing about one animal every 30 seconds to this disease," said Vish Nene, who leads ILRI's Vaccine Biosciences Program and heads up this "improved vaccines for the control of East Coast fever" initiative.

ILRI has become a hub for development of livestock vaccines against

diseases that threaten farm animals in the developing world. In addition to its work on East Coast fever, ILRI and its partners are shepherding efforts to develop novel vaccines for African swine fever, peste des petits ruminants (goat plague), contagious bovine pleuropneumonia (lung plague) and Rift Valley fever.

The new East Coast fever vaccine project is supported by a US$11 million grant from the Bill & Melinda Gates Foundation (USA), with additional support coming from consortium partners. They include the Centre for Ticks and Tick-Borne Diseases (Malawi); GALVmed, a livestock-oriented non-profit product development partnership (UK); the Institute for Genome Sciences (University of Maryland, USA); the Institute of Tropical Medicine Antwerp (Belgium); the Roslin Institute (University of Edinburgh, UK); the Royal Veterinary College (UK); the United States Department of Agriculture-Agricultural Research Service (USDA-ARS); and Washington State University (USA).

Corralling Cutting-Edge Science for African Cattle-keepers

Currently available are both a drug to treat East Coast fever and a vaccine to prevent it. While both are essential in controlling the disease currently, major shortcomings limit their use.

The drug is too costly for most African livestock-keepers. And treated animals, while they might recover from severe disease, are often weaker and less productive.

The current vaccine, developed by the Kenya Agricultural Research Institute (KARI) with several decades of support from ILRI and many of its partners in the current project, is made essentially by grinding up ticks infected with the parasite that causes East Coast fever. This "first-

generation" vaccine is credited with saving 620,000 cows and a formulation released in 2012 has been in high demand by livestock keepers.

However, like the drug, the vaccine's cost—US$8 to $12 per animal—is too high for many pastoralists and smallholder farmers. Also limiting its wider adoption are its strict refrigeration requirements, its production difficulties—it takes 18 months to make a single batch of vaccine—and the fact that inoculated animals still carry and transmit the East Cost fever parasite.

"Working with this first-generation vaccine has taught us a lot about how animals develop immunity to East Coast fever and we hope to translate this knowledge into a more practical and affordable vaccine capable of protecting cattle and preventing them from spreading the parasite," said Ivan Morrison, an expert in cattle immunology at the Roslin Institute.

To develop a new vaccine, researchers will focus on recent breakthroughs that have isolated proteins in the parasite, called antigens, likely to be crucial in protecting cattle from East Coast fever. Some of the antigens appear capable of stimulating production of protective antibodies. Other parasite antigens could help endow the vaccine with the capacity to stimulate the cow's production of a type of lymphocyte known as cytotoxic or "killer" T cells that are able to target and destroy the cow's white blood cells infected with the parasite.

Meanwhile, the East Coast fever team will devote part of its work to improving the existing vaccine so that it can serve as a more effective interim solution while the new vaccine is in development—a process which could take about 10 years.

Potential Benefits for Malaria and Cancer Research

The novel approaches the researchers will employ to develop a new East Coast fever vaccine could help advance efforts to develop malaria vaccines and inform efforts to develop new ways to treat cancer.

East Coast fever and malaria are both caused by single-celled parasites, which have proven extremely tough to control. Like the researchers working on East Coast fever, malaria vaccine scientists are interested in developing formulations that deliver a similar one-two punch to the malaria parasite by simultaneously prompting the production of antibodies and killer T cells.

Nene said informal discussions are already under way with malaria vaccine experts, who are eager to see their livestock-oriented colleagues test these novel vaccine approaches in the fight against a similar protozoan disease.

East Coast fever also resembles cancer; having invaded the cow's white blood cells, the East Coast fever parasite causes them to proliferate rapidly, which closely resembles the mechanisms of a blood cancer called lymphoma. Nene said understanding how cells infected with the East Coast fever parasite proliferate in cattle could provide a model for work on interventions in human cancers.

"It's exciting to work on a project that offers enormous benefits for poor livestock-keepers while also providing insights for burdensome human diseases," said Jimmy Smith, director general of ILRI. "It's a sort of back to the future benefit," he added, "because it's only been in the last century that human and veterinary medicine have diverged, when in fact, they have a lot to offer one another."

Provided by The International Livestock Research Institute