Protection Against Hemorrhagic Fever with Renal Syndrome

DEVELOPMENT OF A CANDIDATE COMBINATION DNA VACCINE FOR HANTAVIRUS

Hantaviruses are part of the National Institute of Allergy and Infectious Diseases' (NIAID) Category A Priority Pathogens list, identifying them as organisms/biological agents that pose the highest risk to national security and public health. These viruses are carried by persistently-infected rodents and transmitted by exposure to rodent excreta. At least four Hantaviruses are known to cause thousands of cases of hemorrhagic fever with renal syndrome (HFRS) each year. Of significance, HFRS infections tend to increase during times of severe infrastructure breakdown, such as those that might occur during a biodefense emergency because of increased human exposure to rodents. Symptoms of HFRS include intense headaches, back and abdominal pain, fever, chills, nausea, and blurred vision and can progress to acute shock, and kidney failure. Currently, there are no FDA-licensed vaccines for Hantaviruses causing HFRS; rodent control is the primary strategy for preventing infection.

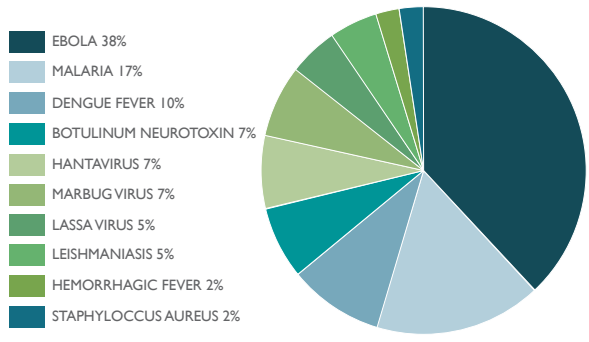
In 2012, Geneva partnered with the U.S. Army Medical Research Institute of Infectious Diseases (USAMRIID) and the U.S. Army Medical Materiel Development Activity (USAMMDA), to launch a research program in response to NIAID's call for a proof-of-concept study to develop a molecular vaccine for HFRS and to test the vaccine through to Phase I clinical studies. The research, led by Geneva Principal Investigator Dr. Amy Shurtleff, PhD, in close partnership with Drs. Connie Schmaljohn and Jay Hooper of USAMRIID, proposed to utilize a combination DNA vaccine as a preventative measure against HFRS.

To enhance and accelerate the immune response, the combination DNA vaccine is administered either intramuscularly (IM) or intradermally (ID) using the electroporation-based (EP) TriGrid™ Delivery System (TDS) investigational device. The TDS is a novel, cross-cutting delivery platform manufactured by Ichor Medical Systems, Inc. that utilizes the application of electrical pulses at the site of DNA vaccine administration. The pulses allow the vaccine to enter the cells more effectively, leading to an enhanced immune response. Additionally, the combination vaccine technology makes it an ideal candidate for protection against four pathogenic hantaviruses endemic to different parts of the world.

Geneva's current study objective is to evaluate the safety and reactogenicity of the combination vaccine as well as to help to further determine if one delivery method (ID vs IM) is more effective than the other. The results from this vaccine trial may open the door for further DNA vaccine targets to be evaluated using electroporation technology.

To date, the DNA vaccine products have been manufactured and nonclinical testing performed to assess the safety of the vaccines administered separately and in combination using the TDS in both IM and ID delivery. Results demonstrate that this vaccine platform technology is safe and immunogenic, with evidence of cross-protection for the four target hantaviruses. Submission of an Investigational New Drug (IND) application to the FDA and initiation of the Phase I clinical trial is anticipated for late 2017.

SPOTLIGHT: **INFECTIOUS DISEASES**



RESEARCH PROGRAMS IN **INFECTIOUS DISEASES** CONTRIBUTE TO **31% OF GENEVA'S TOTAL PROGRAM REVENUE*.**

**Graph depicts research potential value of research programs.*