You've probably heard a lot about bird flu this spring. The national poultry pandemic is ravaging the U.S. waterfowl industry, with 47 million birds affected (nearly 10 percent of the total U.S. flock) across 20 states, according to the U.S. Department of Agriculture (USDA).

The overwhelmingly contagious strain of H5N2 influenza virus has swept across the Midwest at alarming rates. Within months of first being detected in December, the USDA declared thousands of poultry farms as “bio security zones,” leaving infectious diseases experts and the Centers for Disease Control to worry over why this particular strain spreads so quickly and whether it could make the jump to humans.

Additionally, the bird flu strains that have made the jump to infect humans are deadly. H5N1, a close cousin to the H5N2 strain, kills about 60 percent of the people it infects and has infected an estimated 650 people worldwide, according to the World Health Organization. Public health officials are now monitoring H5N2 for human infection and have recommended that an estimated 300 people in Minnesota, Wisconsin, Iowa and South Dakota take Tamiflu as a precaution after exposure to affected birds.

So, what does this have to do with research at Mayo Clinic? Turns out that scientists in the Vaccine Research Group are teaming up with biochemists at the Karolinska Institutet in Sweden to design a next generation of peptide-based vaccines that could help immunize people here and around the world to the H5N1 virus and many other highly pathogenic viruses, including the H5N2 strain.

Bird flu has been of particular interest to the Vaccine Research Group because it currently has no effective vaccines — the only reliable control measures are avoidance and safe handling of infected birds. Seasonal flu shots can’t protect against it.

The collaboration with the Karolinska Institutet has given the group new hope for speeding up the process for developing a successful vaccine to these deadly viruses.

“We are very excited about this partnership because it’s taking our work to a new level and now we will have a vaccine product we can test,” says Inna Ovsyannikova, Ph.D., senior scientist in Laboratory Studies of Mayo’s Vaccine Research Group.

In fact, Dr. Ovsyannikova and her collaborators at the Karolinska Institutet plan to begin testing a new peptide-based influenza H5N1 vaccine in humanized mice before the end of this month. This work is more than 10 years in the making.
The Vaccine Research Group, under the leadership of Gregory Poland, M.D., has spent the past decade refining techniques to isolate and identify naturally processed viral peptides thought to trigger protective immune responses. The Vaccine Research Group has perfected the art of designing and assembling chemical compounds (peptides) that elicit an immune response that is identical to the response seen in humans after the receipt of a weakened virus vaccine.

Benefits to this approach include safer vaccines with fewer side effects. They can be effective in more people than traditional vaccines. The immune response tends to last longer, reducing the need for multiple vaccinations and boosters. They’re easier and cheaper to produce in large volumes and ship around the world. They don’t have to stay refrigerated. The list goes on.

Trouble with bird flu, at least, is that it has proven difficult to convert the peptide sequences into a peptide-based vaccine. A single test tube full of the synthesized peptides could produce thousands of doses of a vaccine, but the active chemical compounds break down in water and blood quickly — too quickly for them to trigger an immune response from the organism.

This is where the Karolinska collaboration comes in.

“We had been looking for a collaborator for a long time to help us develop a mechanism to deliver these peptides in the form of a stable, injection-ready adjuvanted vaccine,” Dr. Ovsyannikova says. “I never actually met my collaborator from Sweden during the Mayo-Karolinska conference here in 2014, but a friend introduced me to his colleague at Karolinska, who knew someone working on a nanoparticle system called Salipro.’

Salipro, a nanoparticle drug-delivery compound, was invented at Karolinska by Dr. Jens Frauenfeld’s group, which co-authored a grant application with Dr. Ovsyannikova at the Vaccine Research Group to the Mayo-Karolinska Institutet Collaborative Awards Program. Thanks to this award, both institutions will have the opportunity to evaluate the effectiveness of their inventions in helping people live longer, healthier lives.

That’s often how team-based science works, and why formal collaborative partnerships and scientific meetings can prove instrumental to improving medicine and advancing medical practice. Two heads are better than one, right?

Should the Salipro-based peptide vaccine against avian influenza H5N1 virus work in mice with humanized immune systems, as Dr. Ovsyannikova expects it will, human studies will follow. The group is already discussing options for translating this same approach into development of new peptide-based vaccines for other aggressive viruses, such as smallpox and chikungunya — and the virulent H5N2 strain of bird influenza.