

A Case of the Flu

By Jeff Mulhollem



H1N1 TYPE A INFLUENZA (SWINE FLU) is no mystery to scientists in the College of Agricultural Sciences who have been keeping a wary eye on the virus in pigs for decades and researching better vaccines to prevent it, methods to limit its spread, and ways to predict and gauge the risks it poses to human health.

The disease in pigs is relatively mild and rarely kills the animals, but when the swine virus combines with genes from human and avian influenzas—as it seems to have done in this year’s outbreak that caused so much anxiety around the world—all bets are off.

“Influenza A viruses are notorious for reassorting and mutating, and based on our understanding of previous outbreaks, this virus may come back with a vengeance this winter, or simply disappear,” says Vivek Kapur, a renowned microbiologist who heads Penn State’s Department

of Veterinary and Biomedical Sciences.

“When a virus such as H1N1 influenza jumps from one animal species to another, it can become a different organism altogether—unpredictable and potentially dangerous,” he says. “Several times in the last 100 years, influenza has proved deadly, and so we must always remain vigilant.”

Kapur points out that influenza, or what is commonly called the flu, annually kills about a million people worldwide (between 30,000 and 50,000 in the United States). Typically, flu is a late fall, early winter phenomenon. “There are probably hundreds or thousands of localized outbreaks that don’t turn into pandemics,” Kapur notes.

However, the involvement of swine influenza and perhaps avian influenza in this year’s H1N1 outbreak could make this flu different, contends extension vet-

erinarian David Wolfgang, who says it is not unusual to have a few pigs suffering with flu. But he is quick to point out that the mixed virus strain identified in the current outbreak has not been seen in pigs in the United States or Pennsylvania (as of press time).

“The real fear, of course, is that this strain will spread rapidly among the human population because people have no immunity to swine and avian flu, and that has the potential to start a pandemic,” he says. “But what we have seen so far is that this flu has a high attack rate—meaning it spreads easily—but it doesn’t seem to have a high mortality rate.”

A high attack rate but very low mortality rate is characteristic of swine flu, compared to a low attack rate with a high mortality rate for the current H5N1 avian flu. It is a lethal combination of the two—a virus strain that

would have a high attack rate and high mortality rate, with human influenza genes somehow rolled in—that keeps scientists up at night.

“In the modern world with people traveling so much, we are always going to have influenza and infectious diseases,” Wolfgang says. “Small reassortments in influenza happen all the time, every day, every year, but most turn out to be insignificant.”

Veterinary scientist Lester Griel has been investigating ways to influence the immune systems of swine to resist influenza. He currently is conducting contract research for a company that is interested in ways to reduce aerosol distribution of influenza and limit the spread of disease among pigs.

“These viruses change rapidly, with mutations and recombinations,” he says. “The reason this was originally called swine flu is that the overall background of this new organism is definitely swine, but it does have elements of human and bird flu.

“These types of influenzas circulate in birds, pigs, and humans,” Griel adds. “The reason many of these new strains originate in places like Southeast Asia and Mexico is that the pig houses and chicken houses are often closely attached to human houses, and there is much more contact between animals and humans than there are in other parts of the world.”

The H1N1 flu outbreak shows how closely linked animal health is to human health, Griel says. “Of the 1,500 diseases that can affect people, about 50 percent of them are transmissible between animals and humans,” he says. “The American Medical Association and the American Veterinary Medical Association have been working on the theme for the last three years, ‘One World, One Health, One Medicine.’ There is not as much difference between animal medicine and human medicine as most people think.

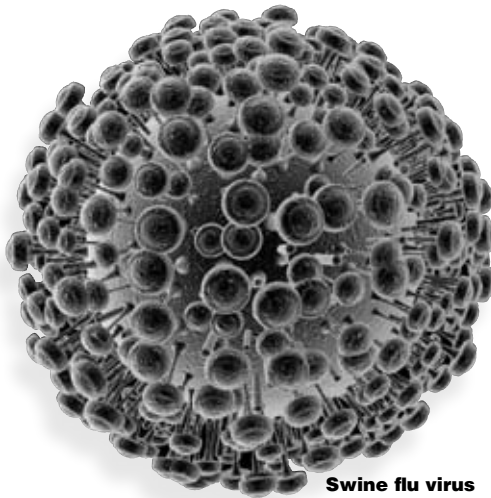
“Because of these zoonotic diseases [animal diseases that can infect humans], a lot of the disease-protection activities that veterinarians are involved in have a significant effect on human health.”

A virologist in the college, Biao He, studies the genetic material of viruses and is working to develop a viral vehi-

cle to deliver antigens in vaccines, mostly targeting the H5N1 avian flu virus.

“Swine are considered to be a reservoir for flu virus where swine, avian, and human influenza combine and reassemble,” he says. The pig is the mixing vessel to create many different kinds of virus. We worry most about a completely new strain emerging to which humans would have no immunity.”

He believes that veterinary scientists play a huge role in protecting human health. The insight and knowledge they



Swine flu virus

provide about flu is critical. “In the college we have people who keep a close eye on what flu strains are circulating,” says He. “If we know what is coming we can prepare. If we don’t do surveillance we will get blindsided.

“So animal diagnostics are vital. One of the difficulties is the time it takes to make vaccine. We need to make hundreds of millions of doses. There is a possibility that this strain will come back next winter, but now we have the virus and we can make the vaccine.”

In the College of Agricultural Sciences, researchers are uniquely positioned to monitor zoonotic diseases, notes He. Obvious examples of human health threats that have proved particularly menacing in recent years are HIV, which came from monkeys, and Ebola, which came from bats. “The odds are that the next emerging disease epidemic will come from animals,” he says. “If a virus only infects humans, we have a chance to get rid of it—like smallpox. But we will never get rid of flu because

there are reservoirs of influenza in animal populations.

“Our college is really at the front line of defending against emerging viruses,” He says. “People traditionally value agriculture from an economic perspective, but perhaps a more important aspect is protecting animal health by minimizing the threat from emerging viruses to guard human health.”

Molecular mechanisms that allow viruses to adapt and thrive in new environments are the focus of biologist Mary Poss’s research. Although she has not worked with influenza viruses, she has considerable insight into how emerging diseases such as swine and avian flu spread because of her work with other pathogens.

Poss notes that epidemiological modeling currently being done in the college will help experts predict the spread and impact of the disease if it emerges this winter in a deadly way, and how susceptible people are to being infected. Because the H1N1 virus has “multiple parentages,” Poss worries it could have a significant effect on the human population.

“Historically, we know that an out-of-season outbreak, known as the Spanish flu, in the summer of 1918 was followed by a severe winter pandemic that proved to be fatal for many thousands of people,” she says. “So perhaps we should not be comforted by the mild nature of this spring outbreak. Only time will tell.

“But this outbreak is a very good example of why we need to study more than just the genes,” Poss adds. “We also must understand wildlife movement such as bird migrations and agricultural practices that involve animals such as swine because we now know that everything we do on this planet is connected and has an impact on human health.”

Faculty and staff referenced in this article are Vivek Kapur, professor and head of veterinary and biomedical sciences; David Wolfgang, extension veterinarian and field studies director in veterinary and biomedical sciences; Lester Griel, professor of veterinary science; Biao He, associate professor of virology; and Mary Poss, professor of biology and professor of veterinary and biomedical sciences.