3Qs: Understanding the potential impact of the H5N1 virus

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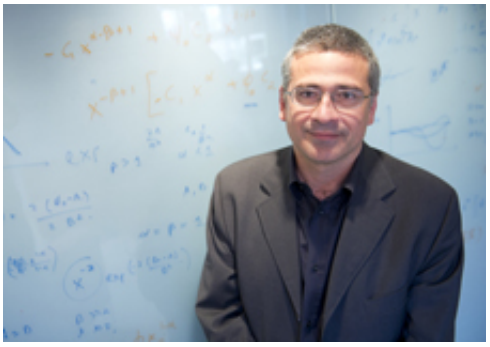

Sternberg Family Distinguished University Professor Alessandro Vespignani of the department of physics discusses the recent controversial research with avian flu virus, H5N1. Credit: Christopher Huang

Last year, in an effort to understand the biology of H5N1, two independent research groups successfully engineered the lethal avian flu virus to be transmissible between mammals, and perhaps among humans. At the end of January, the research community, including the authors of the two studies, agreed to a 60-day moratorium on sensitive H5N1 experiments. In the meantime, the World Health Organization will hold international discussions regarding the future of such research and its availability in the community.

Northeastern University new office talked to network scientist Alessandro Vespignani, the Sternberg Family Distinguished University Professor of Physics, to discuss the motivations for and implications of

research in this area.

What is the H5N1 virus, where did it come from, and why is it being investigated?

Influenza viruses are found in the wild among animal populations like swine, birds or horses. Occasionally they jump between species, and a virus well adapted to spread in the animal population becomes well adapted to spread in the human population.

The highly pathogenic H5N1 is currently only able to spread quickly within the avian populations, periodically infecting humans in vulnerable conditions — for example someone who has a compromised immune system or is overexposed to the virus because he lives in close proximity to poultry farms. H5N1 has not yet acquired human-to-human transmission capabilities.

When it does infect humans, it is currently very lethal, with a mortality rate close to 50 percent, although that number may be skewed due to mild, unreported cases. To put that into perspective, the disastrous 1918 pandemic resulted from a virus whose lethality was somewhere between 2 and 10 percent.

As soon as H5N1 is able to spread between humans we will have a new pandemic. In some cases, when a virus acquires transmission capabilities its lethality diminishes, but it is still unclear why or how this happens. It is also unclear what makes a virus highly transmissible in the first place.

Several scientific groups are studying the H5N1 virus to address questions such as these. Two groups in particular, based in The Netherlands, Japan and University of Wisconsin, recently published results from experiments in which they engineered the virus to have high

transmission capabilities between ferrets. Ferrets are good biological models for humans so it is believed that if the virus is highly transmissible among ferrets, it will also be so in the human population.

What are the safety concerns raised by this research?

Many people oppose the idea that scientists are trying to manipulate in the lab a virus that is very dangerous. These kinds of narratives reaffirm the fictional public idea of the evil scientist in the lab.

But the scientists involved in this work really are driven by truly scientific questions that are for the good of society. They are highly trained experts working in highly safe environments. I'm not scared of the virus spontaneously going out of the lab due to negligence — I'm more concerned about people getting a hold of it because they want to do things like bioterrorism.

People are questioning whether it is even pertinent to do this type of research or not. It all depends on what they were able to achieve. If this research really is a breakthrough and it allows us to better understand viral transmissibility and lethality, it may be great research. Along with close monitoring of real-world viruses, it could allow us to see if a pandemic is approaching.
If those questions are not answered, all we've done is engineered a dangerous virus — it's reminiscent of the dark times of the Cold War when biologists were working to cook up the ultimate biological weapon. You don't want to be in that position, especially in today's world.

How is the community responding?

The results of the two research efforts have been submitted for publication in the journals *Science and Nature*. However the U.S.

National Science Advisory Board for Biosecurity has recommended that the details of the studies (the methods sections) should be restricted.

Last week, one of the investigators published a letter in *Nature* arguing against the recommendation because making the methods available to the community would allow the research community to work on the problem simultaneously, which would be much more efficient and a conduit to new discoveries. Also, simply knowing the results means that sooner or later people will figure out one way or another how to reach the end product, even without the published methods.

So the debate is about whether we can hamper science by restraining publications or restricting certain experiments. But to some extent, this is already happening with other viruses. For instance, small pox has been eradicated for many, many years but there are still two places in the world where it is kept. If you want to work with small pox, you have to submit a very complicated application, because you're managing one of the most dangerous things in the world.

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