

Visualization and analysis of the emergence, evolution, and spread of pathogens.

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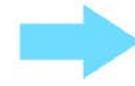
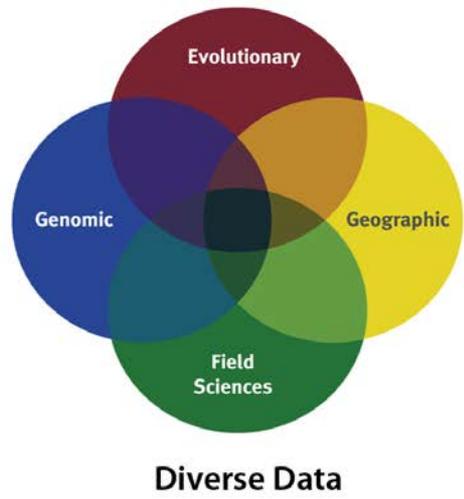
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`http://github.com/supramap`



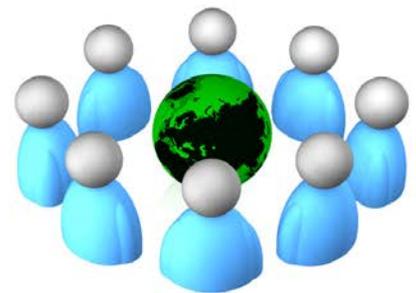
Our goal is to develop means to analyze and share diverse types of data on pathogens



Web Application



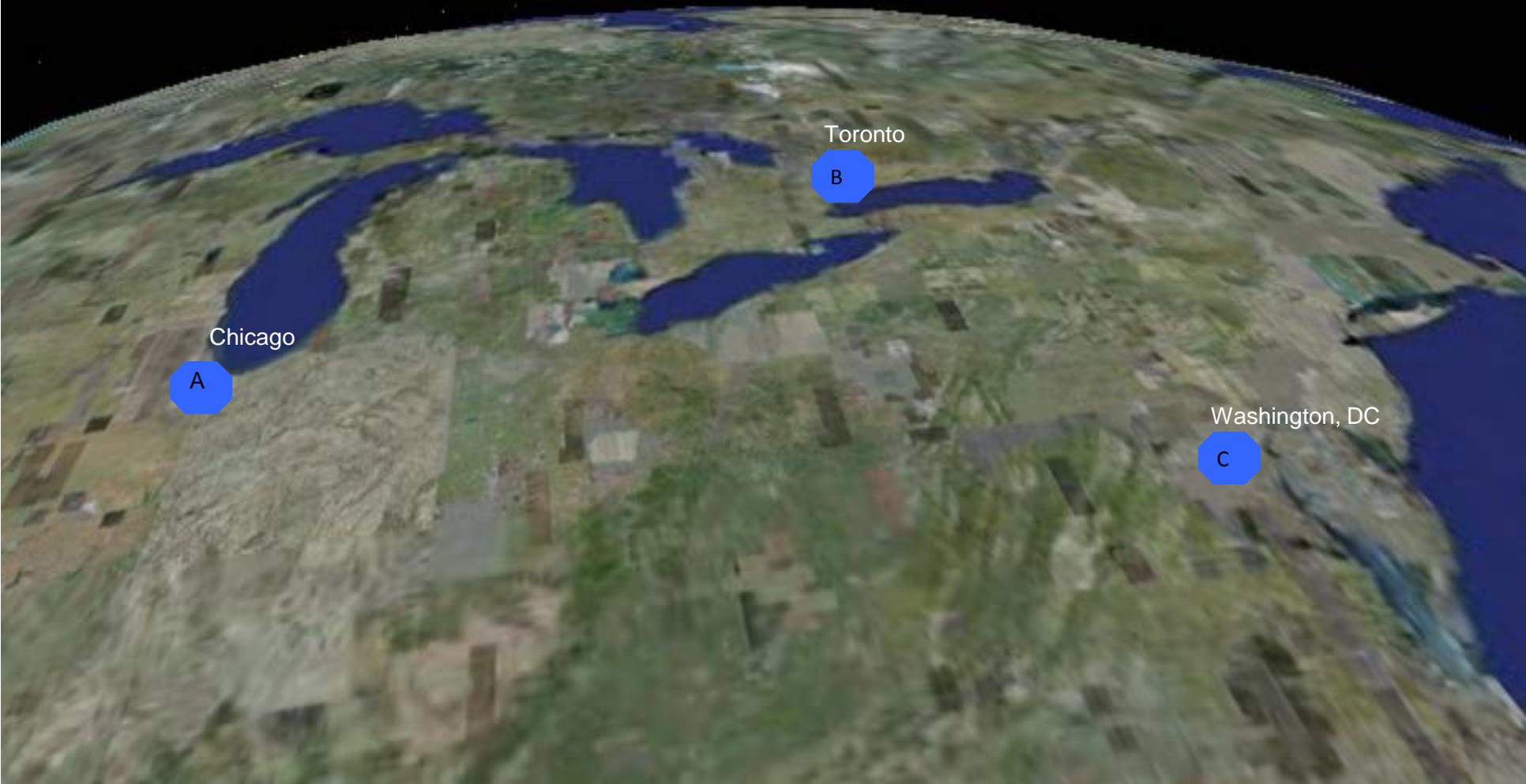
Phylogenetic Mapping



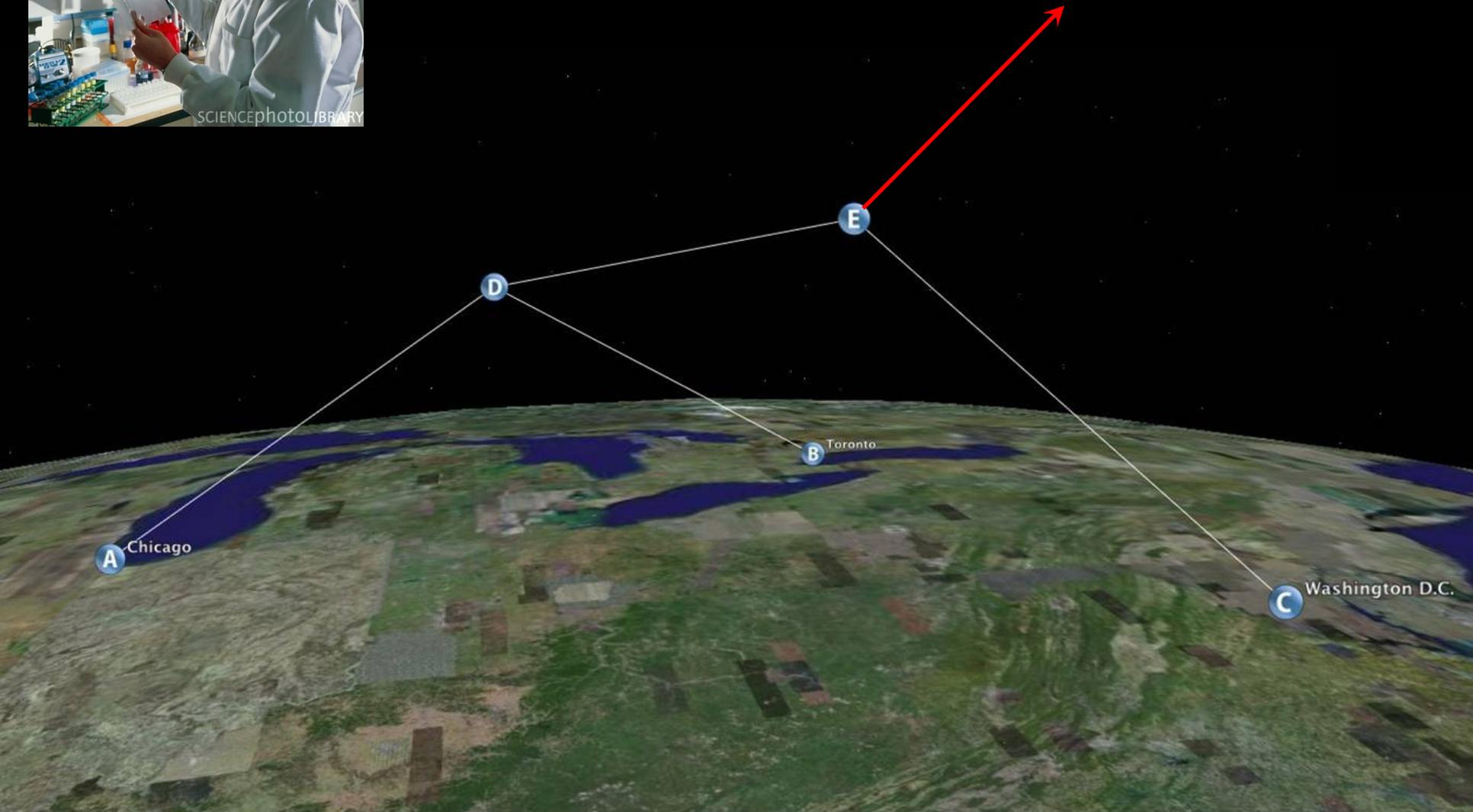
Users



Three cases of influenza like illness



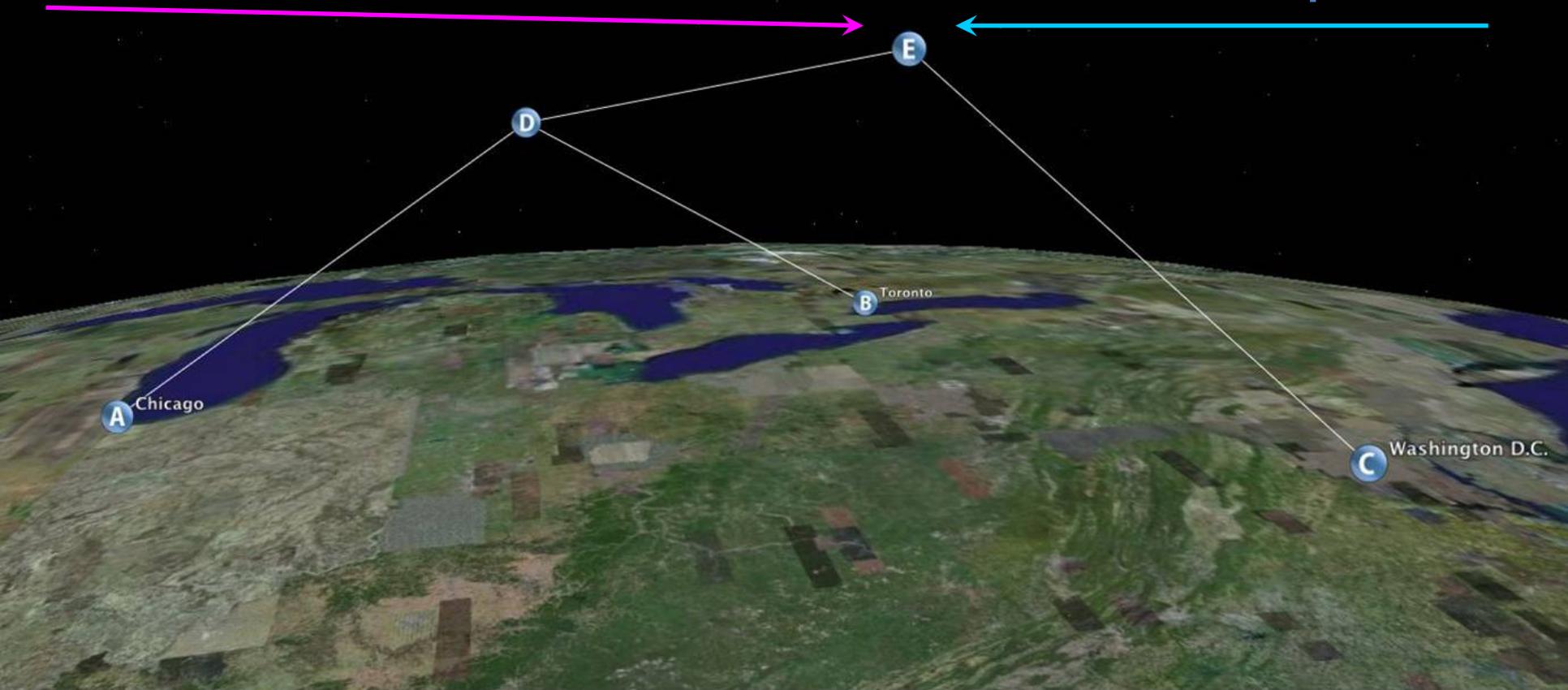
If we sequence the genomes of the pathogens the three outbreaks can be interconnected and understood via their connections to **background data**



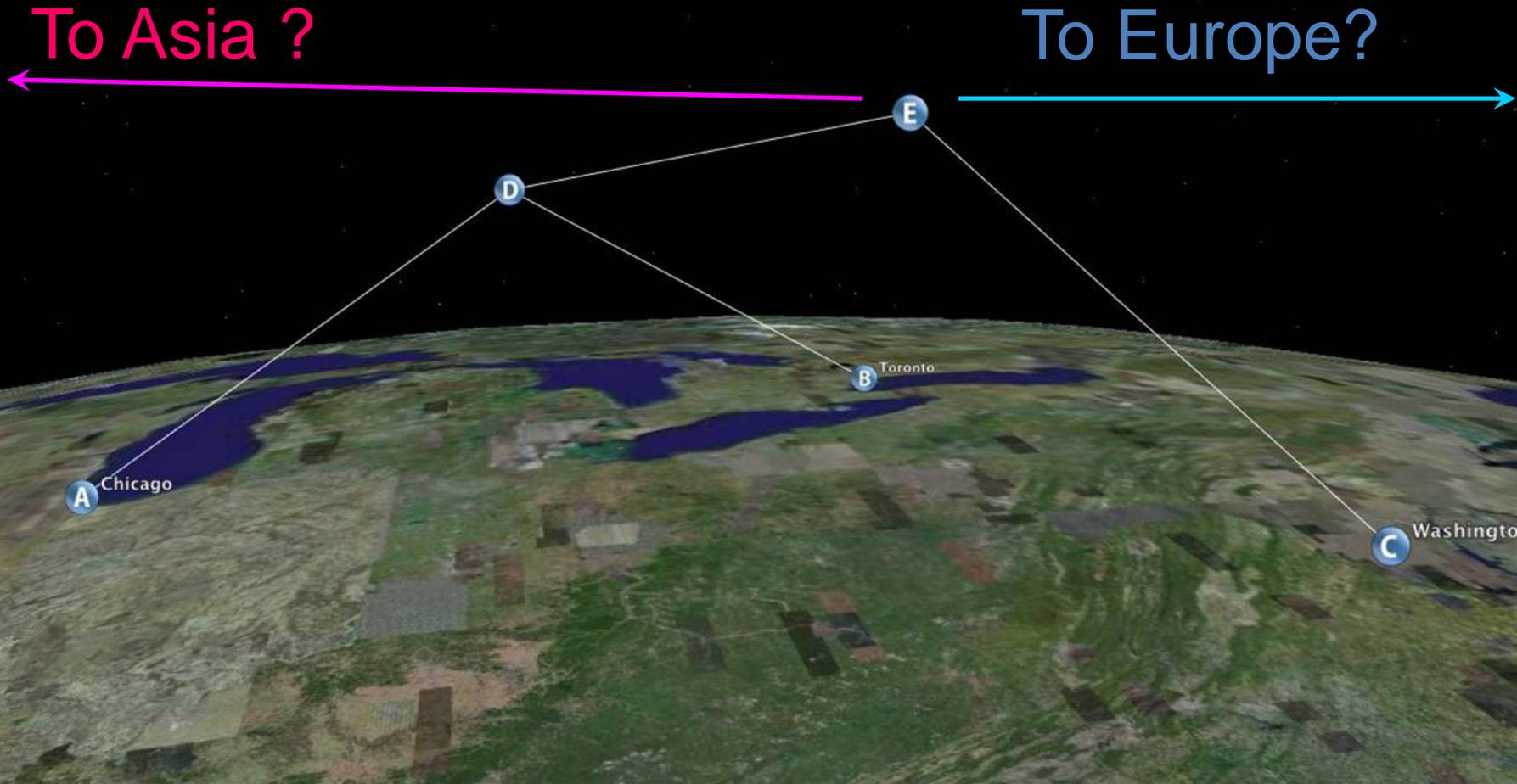
Where did the pathogen originate ?

From Asia?

From Europe?



Or did the pathogen originate in North America and will it spread abroad ?



Which hosts carry a pathogen ?

AVIAN INFLUENZA

Wild Birds Only Partly to Blame in Spreading H5N1

Experts studying the H5N1 avian influenza epidemic have long been at odds over whether wild birds play a major role in spreading the deadly disease. Last week, after poring over the latest surveillance data, a group meeting in Rome reached a consensus: Wild birds play a role in the virus's huge geographic jumps, they said in a statement at the end of the meeting, but the main means of transmission is the commercial poultry trade. With that question at least partially settled, one research group introduced a new puzzle by raising doubts about whether the right sampling techniques are being used in wild bird surveillance programs.

Meanwhile, as human H5N1 cases continue to surface in Indonesia, World Health Organization (WHO) scientists have concluded that although there may have been cases of human-to-human transmission in a family cluster, there is still no evidence that the behavior of the virus is changing.

Much of the attention at the International Scientific Conference on Avian Influenza and Wild Birds, jointly sponsored by the Rome-based United Nations Food and Agriculture Organization (FAO) and the World Organization for Animal Health in Paris, focused on the results of the European Union's wild bird surveillance program. According to FAO, among nearly 100,000 dead and live wild birds tested for the H5N1 virus over the past 10 months, 741 proved positive, all of them dead. The H5N1-infected birds came from 13 European countries, with Germany the hardest hit.

Although the European surveillance program did not find any live birds carrying the

any, form a natural reservoir for the virus. A group from Erasmus University in Rotterdam, Netherlands, presented yet-to-be-published results suggesting that healthy birds can carry the virus and go undetected, as has been suggested by recent studies. They experimentally infected six species of wild ducks with the H5N1 virus and saw a spectrum of responses ranging from quick death to no clinical signs of illness. Perhaps even more significant, they found that the virus is shed far more heavily in an infected bird's pharynx than through its feces. Thijs Kuiken, a veterinary pathologist involved in the study, says this raises questions about the conclusiveness of current sampling techniques that rely on cloacal swabs or the collection of bird droppings. For future

important; so many clues could be clarified," says Slingenbergh.

Separately, WHO is continuing to follow the largest cluster of human H5N1 cases uncovered so far, involving an initial apparent case in a 37-year-old Indonesian woman living in rural Sumatra whose blood and other samples were lab-confirmed as H5N1. "We are members of an external team of infectious disease epidemiologists and virologists. This is an unusual instance of human transmission. We are unable to determine the source of infection, but we can't rule out contamination." A Samaan, the infect



Dead in the water. Wild swans were some of the first victims of H5N1 in Europe.

Doubts hang over source of bird flu spread

The H5N1 avian flu virus has spread to Africa and the European Union for the first time. Attention is focused on controlling the outbreaks, especially in Nigeria, where, as *Nature* went to press, four farms in two adjacent provinces were confirmed as being affected, with further spread suspected. But experts are also urgently trying to confirm the cause of the virus's geographical spread. Although migratory birds have been widely blamed, some believe that the risks posed by the poultry trade are being overlooked.

Host taxa

H5N1 influenza

- Galliformes
- Anseriformes
- Passeriformes
- Charadriiformes
- Human
- Columbidae
- Artiodactyla
- Accipitriformes
- Ardeidae
- Carnivora
- Corvidae
- Arthropoda
- Ambiguous

Indonesia

Korea and Japan

Syst. Biol. 56(2):321–329, 2007
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ISSN: 1063-5157 print / 1076-836X online
DOI: 10.1080/10635150701266848

Genomic Analysis and Geographic Visualization of the Spread of Avian Influenza (H5N1)

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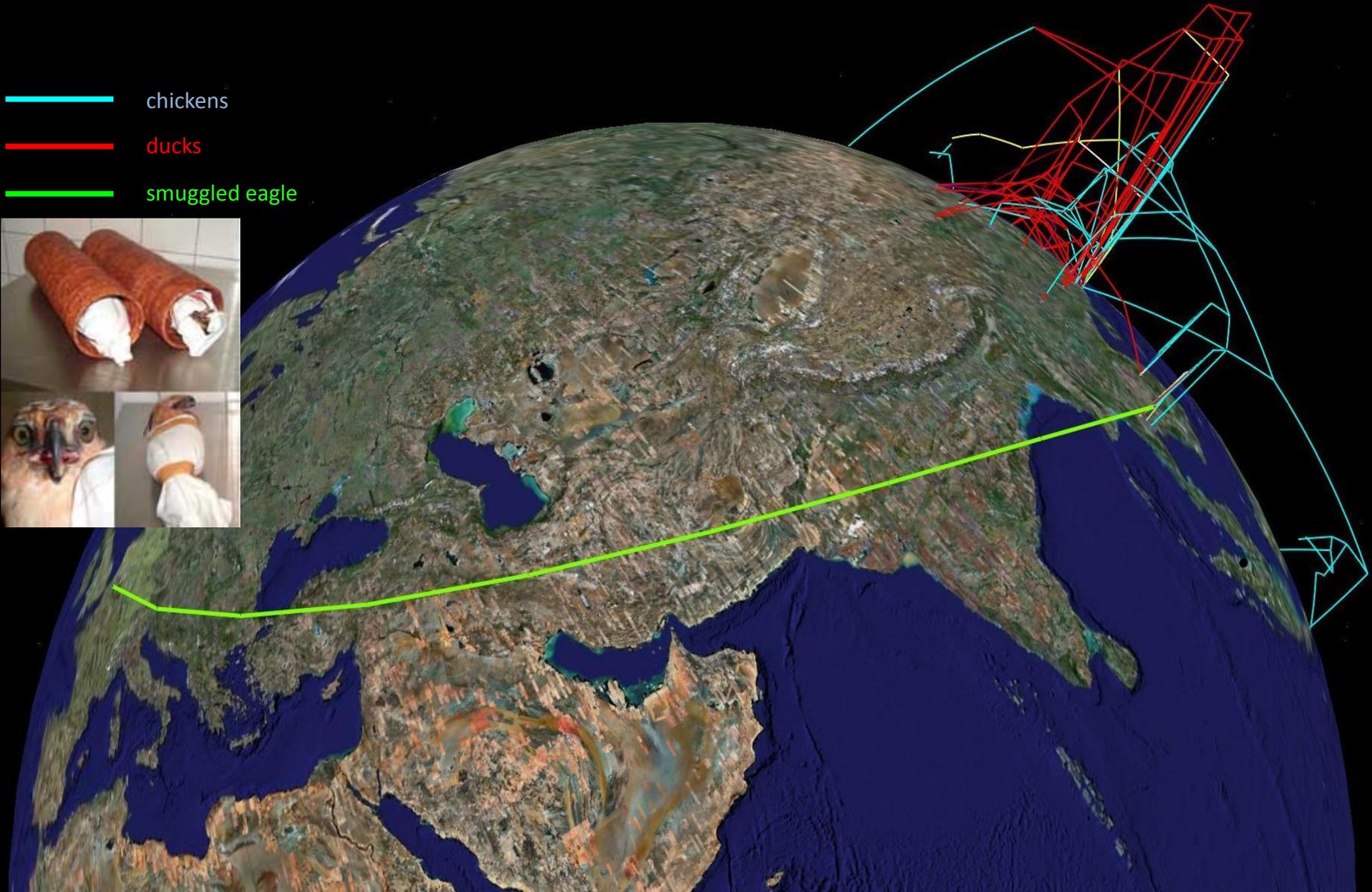
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Which trade processes carry a pathogen?

- chickens
- ducks
- smuggled eagle



Molecular Evolution of the Avian Influenza (H5N1) PB2 protein. This mutation confers increased replication in mammals

peacock_Denmark_60295_06

Family Summary

Anc: 318
Sister: buzzard_Denmark_6370_06

Transformations

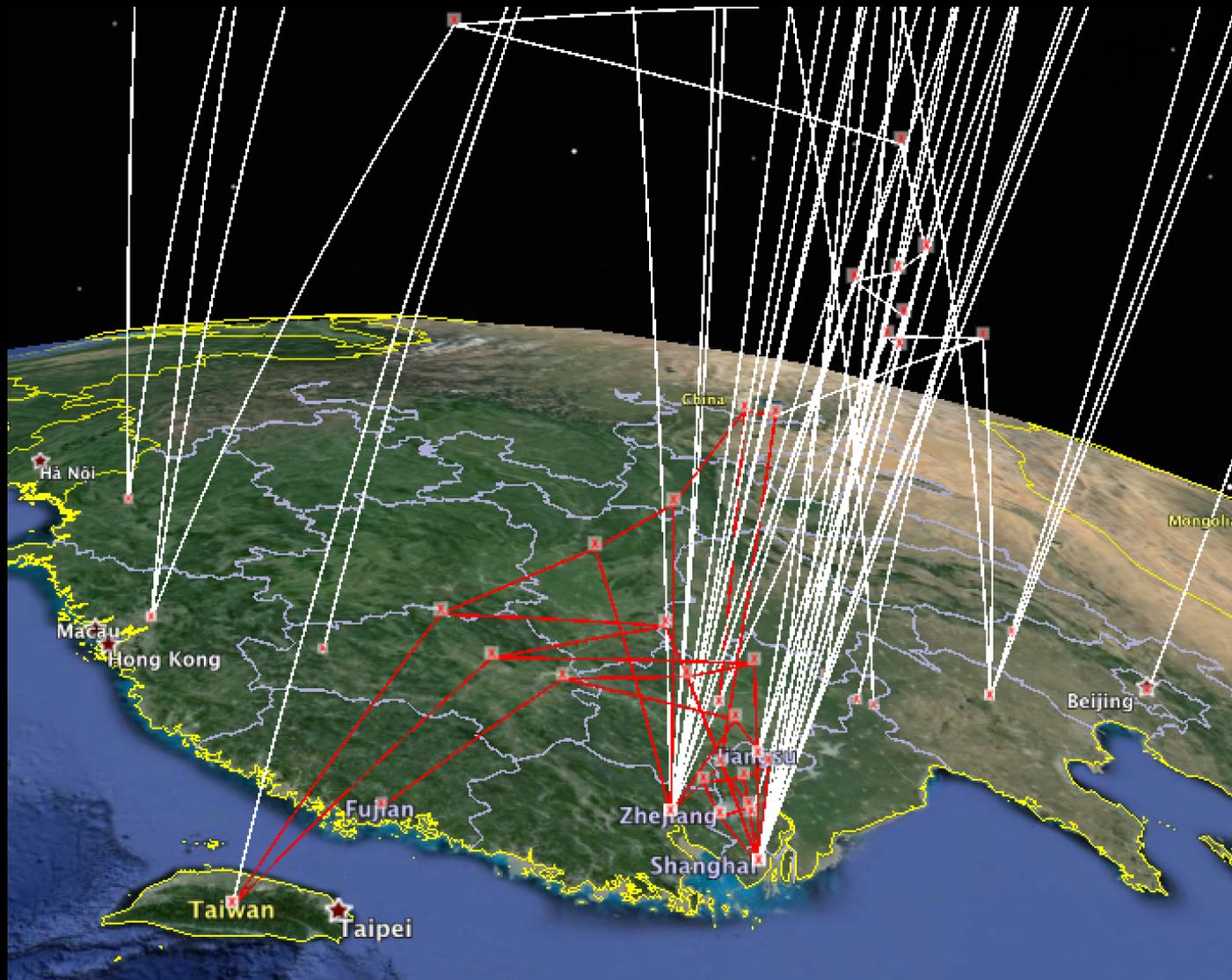
Position	Anc	Desc	Type	Cost
449	T	A	Tv	1
1559	C	T	Ti	1

Directions: [To here](#) - [From here](#)



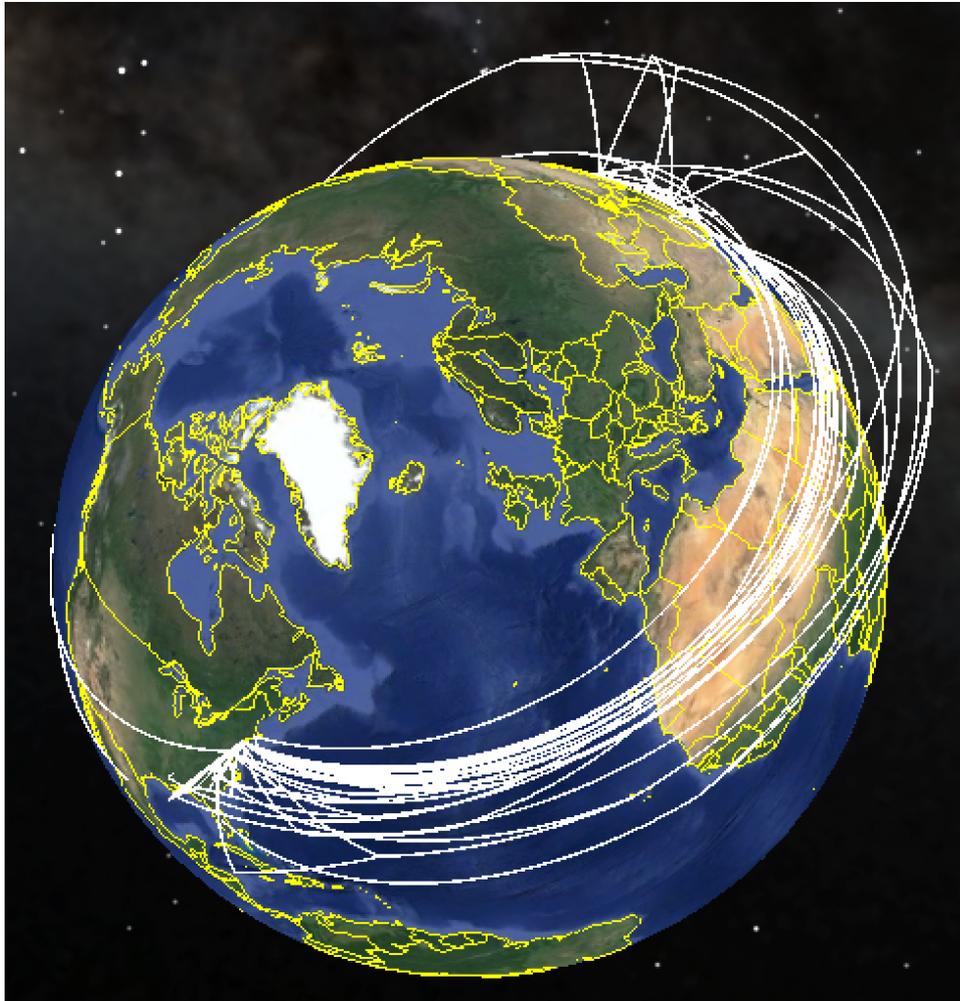
● Glu-627
● Lys-627

H7N9 2013-14 PB2 E627K



This mutation confers increased viral replication in mammals

Salmonella bareilly in frozen raw yellowfin tuna



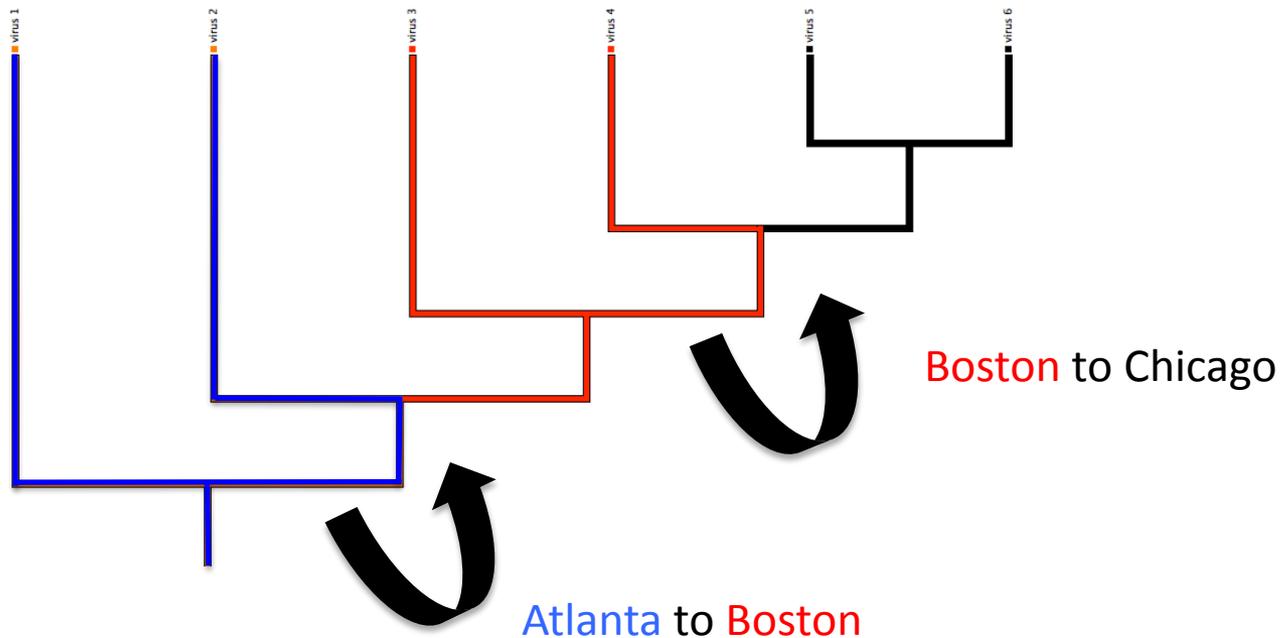
joint work with Maria Hoffman, Marc Allard, Eric Brown et al.,
US FDA Center for Food Safety and Applied Nutrition

<http://minipointmap.herokuapp.com/mainpage/disEarth>

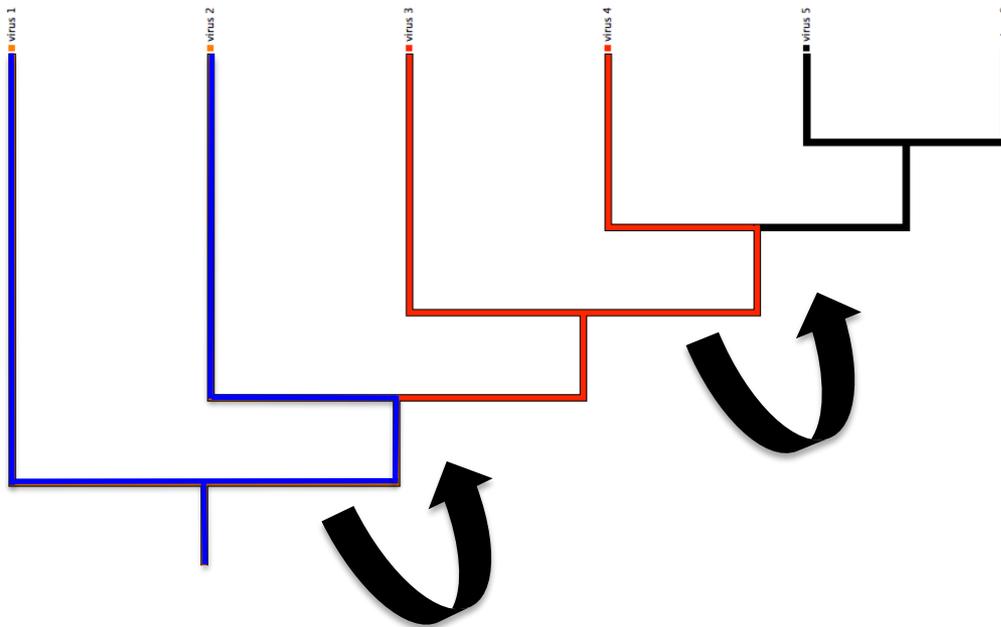
http://www.ncbi.nlm.nih.gov/bioproject?LinkName=bioproject_bioproject&from_uid=159317

Transmission Events

Given a tree generated by phylogenetic analysis of genetic sequences for pathogens, Transmission events are discovered by change in the “place of isolation” character optimized on a tree (e.g., Atlanta, Boston, Chicago).



Quantifying the Transmission Events



Atl	\Rightarrow	Bos	:	1
Atl	\Rightarrow	Chi	:	0
Bos	\Rightarrow	Chi	:	1

Acknowledgements

- GMI organizers
- University of North Carolina at Charlotte: College of Computing and Informatics
- Ohio State University: College of Med and College of Vet
- US Food and Drug Administration: Center for Food Safety and Applied Nutrition
 - US Taxpayers