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The theorist's world is a world of the best people and the worst of possible results.
—Ted Taylor, American physicist

Recently, the world heard that Dutch researchers had mutated the bird flu virus, H5N1, so that lab ferrets became sickened as the virus traveled through the air. (Ferrets are considered a good model for influenza infections in humans.) The public health, science, and government issues this raised were profound. H5N1 had not been transmitted through the air between mammals before; but when humans did contract it by handling infected birds, more than half of those known to have become infected had died. A swirling controversy has ensued about whether these studies should be published. Our own D.A. Henderson has been featured in the press on the subject. (See p. 4.) And now adding to the confusion, the Dutch researcher who led the study has stated that the mutated virus was not as virulent nor as contagious as those first reports suggested.

The issue illustrates how complex science can be, technically, logistically, and ethically. Of course there is good to come from understanding the nature of H5N1. It could help us to prepare for a naturally occurring mutation and to develop effective vaccines and antivirals for this and related viruses. The reconstruction of the extinct 1918 influenza strain in 2005 was a similar case. That synthesis helped scientists understand which genes conferred heightened transmissibility of the virus in ferrets. It allowed researchers to begin to design novel agents to better prepare for future pandemics.

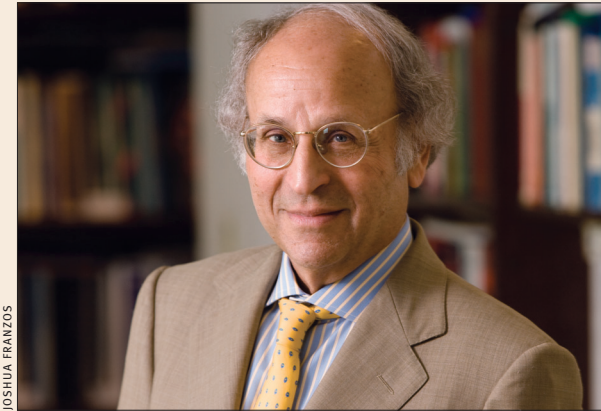
But many observers raised similar concerns then: What if someone with access to the virus or the information used to synthesize or mutate it were to develop it into a weapon? What if the new virus accidentally leaked out of the lab? The original 1918 influenza, one of the most virulent pathogens in human history, killed up to 50 million worldwide.

Ted Taylor, quoted above about “the worst of possible results,” designed small atomic weapons during the Cold War. Looking back on his career, he said his belief in deterrent nuclear military postures had eroded to zero. “I thought I was contributing to a permanent state of peace. I no longer feel that way. I wish I hadn’t done it.”

The H5N1 case is highly nuanced. How virulent would the mutation be in humans? Who should have access to the information gleaned from these studies? What other precautions should be taken? And who decides? A recent *New York Times* editorial pointed out that the first international group charged with determining how to proceed was full of stakeholders (those interested in quickly publishing the results and the researchers who created the virus, among others). Decisions about the uses of science should be weighed carefully by independent, informed, and wise observers. Knowledge confers great power and responsibility.

This H5N1 mutation study reminds us that science and its fruits (nuclear technology, genetically modified food, antibiotics ...) can reap consequences that are unintentional. Moreover, science *qua* science is neither good nor evil, but its uses can be either. (For instance, mustard gas was used as a weapon in WWI; later, scientists noting its inhibition of cell division developed nitrogen mustard as a very successful cancer chemotherapy.)

These notions are at least as old as the myth of Pandora.



JOSHUA FRANZOS

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