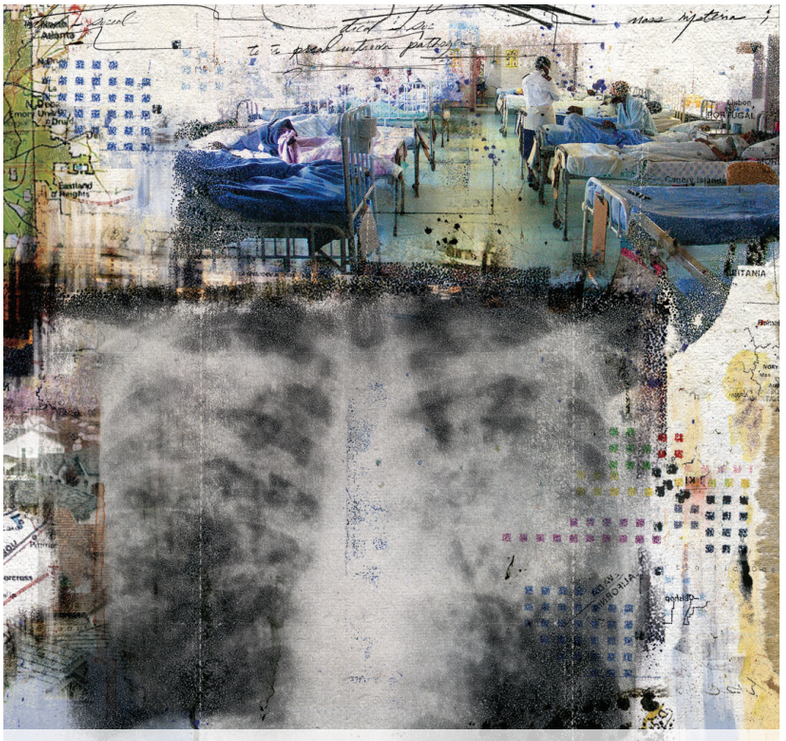
Walt Orenstein, director of vaccine policy and development for the Emory Vaccine Center and former director of CDC's National Immunization Program, is helping Emory prepare for a pandemic of bird flu.

Threats of pandemic flu, bioterrorism, natural disasters: how the university is preparing to cope

By Valerie Gregg • Illustrations by Brian Hubble

In September 1918, a doctor at an Army base near Boston sent a colleague his thoughts:

"These men start with what appears to be an attack of la grippe or influenza, and when brought to the hospital, they rapidly develop the most vicious type of pneumonia. Two hours after admission, they have the mahogany spots over the cheek bones, and a few hours later you can begin to see the cyanosis extending from their ears and spreading all over the face…. It is only a matter of a few hours then until death comes, and it is simply a struggle for air until they suffocate. It is horrible. One can stand it to see one, two, or 20 men die, but to see these poor devils dropping like flies sort of gets on your nerves. We have been averaging about 100 deaths per day…. My total time is taken up hunting rales—rales dry or moist, sibilant or crepitant or any other of the hundred things that one may find in the chest—they all mean but one thing here: Pneumonia. And that means in about all cases, death."



INFECTIOUS DISEASE EXPERTS AGREE THAT IT'S NOT A MATTER OF IF A DEADLY PANDEMIC WILL OCCUR, BUT WHEN, ACCORDING TO ORENSTEIN.

By the next year, the Spanish Flu was everywhere—New York, Atlanta, San Francisco. In Philadelphia, 13,000 died in a matter of weeks. Gravediggers were in such short supply that family members paid funeral homes to dig their relatives' graves themselves.

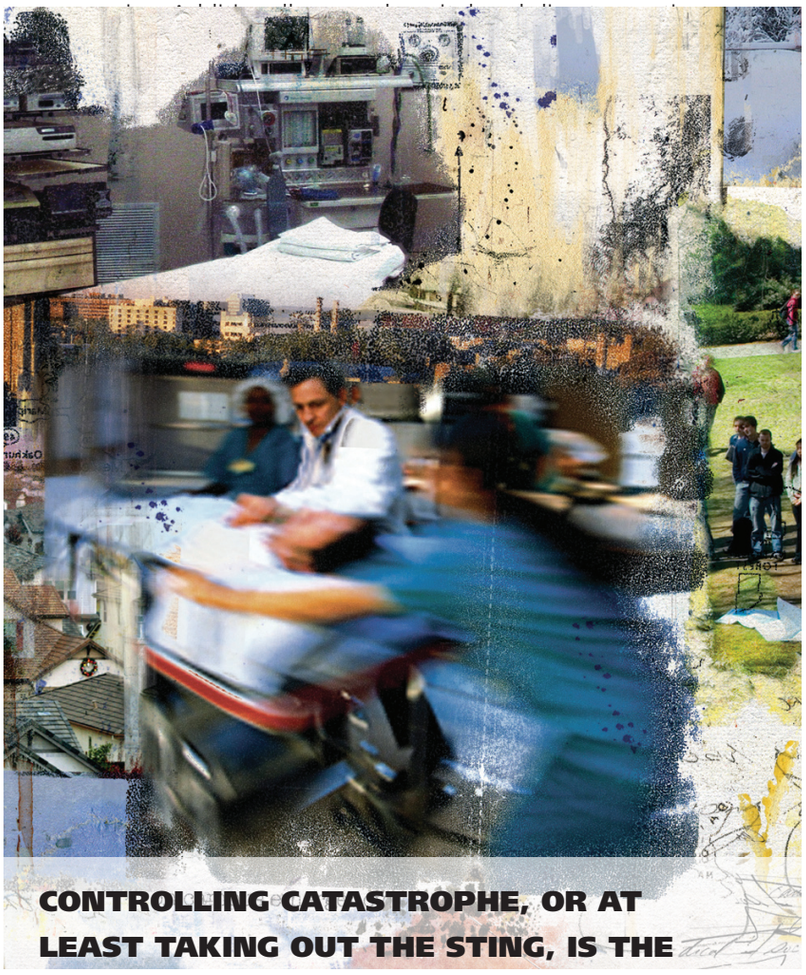
This particularly lethal and contagious strain of influenza infected people on every continent and eventually killed more Americans than World War I. More than 20 million people died worldwide.

While pandemics are rare, they can have devastating consequences. During the 20th century, influenza reached pandemic proportions three times. While pandemics in 1957 and 1968 fell short of the deadly strain of 1918, they still did their fair share of damage.

"Concerns about pandemic influenza have intensified recently because of an unprecedented sustained outbreak of a highly virulent new influenza virus called H5N1 among birds on three continents," says Walter Orenstein, Emory infectious diseases expert. "The virus has led to more than 300 human cases and more than 190 deaths." There is fear that this virus or a variant may adapt to humans and lead to widespread transmission from person to person, resulting in a pandemic.

Infectious disease experts agree that it's not a matter of

if a deadly flu pandemic will occur, but when, according to Orenstein. Estimates from the U.S. Department of Health & Human Services predict that approximately 30% of the U.S. population (90 million) would become ill, with half of those seeking medical attention. Between 865,000 and 9.9 million would need hospitalization, and between 200,000 and 2 million would die.



CONTROLLING CATASTROPHE, OR AT LEAST TAKING OUT THE STING, IS THE GOAL OF THE NEW EMORY OFFICE OF CRITICAL EVENT PREPAREDNESS AND RESPONSE (CEPAR).

Disaster 911

It can be as quiet as a virus taking hold in a person's lungs or as loud as the Twin Towers crashing down in New York City.

Either way, catastrophe is nearly always unexpected. Whether caused by a terrorist, microbe, or cataclysmic force of nature—the punch in the most devastating disasters lies in their ability to catch victims unaware.

Controlling catastrophe, or at least taking out the sting, is the goal of a new Emory Office of Critical Event Preparedness and Response (CEPAR). Born of a task force charged with bolstering Emory's capacity to respond to pandemic flu, CEPAR has a broad challenge. Its charge is to develop plans and responses for all hazards, from public health emergencies such as pandemic influenza to a plane crash that might bring large numbers of casualties to campus.

Fresh after an all-night shift in the Emory Hospital emergency department, CEPAR Executive Director Alexander Isakov offers perspective on the enormity of his mandate. "Emory has a wealth of expertise and resources," he says. "CEPAR will help the university make the best, most efficient use of all these assets during times of great need, and it will facilitate greater collaboration with the broader community."

Those resources at Emory include two disaster preparedness centers, located in the Rollins School of Public Health (RSPH). The Center for Public Health Preparedness and Research—funded by the O. Wayne Rollins Foundation on the heels of 9/11—studies a wide array of current and emerging public health crises and trains students, corporate employees, and public health officials to answer those threats both locally and internationally. The Academic Center for Public Health Practice, which works closely with the state of Georgia, is part of a CDC network to train front-line public health workers to respond to ambulance responder, and Emory's six critical care medevac helicopters.

In times of crisis, CEPAR will coordinate the university's response from an operations center at the former American Cancer Society building on Clifton Road. The university has devoted four full-time positions to the effort, including Isakov, who also directs Emory's pre-hospital and disaster medicine section, and Robert Nadolski, former vice president for Grady's emergency medical services and Level I trauma center, who is CEPAR's senior administrator. They will continue their long-running emergency preparedness work with groups like

Alex Isakov directs the many-pronged efforts of CEPAR to prepare for disasters, including building an infrastructure and collaborating with emergency preparedness partners. Having a hospital emergency department on campus gives Emory an edge in disaster preparedness, he says.

the Georgia Emergency Management Agency's All Hazards Council, the Department of Homeland Security's Atlanta Urban Area Security Initiative, and the state's Regional Coordinating Hospital System.

"CEPAR will be a physical place, but it also will be one centralized source for understanding Emory's activity relative to emergency preparedness. We'll then see how all of our efforts might best be integrated," says Isakov. "It's a concept of operations, and it's also a framework for development of protocols and thresholds for various types of responses."

What if...?

On April 16, 2007, in Blacksburg, Virginia, a shooter blocked the doors to Burrus Hall. No police in. No students out. More time to kill. He went by the moniker Question Mark and had already killed two classmates in a Virginia Tech dorm earlier that morning. He took the stairs to the second floor and opened fire, Columbine-style, into classroom after classroom, killing 32 and wounding 25 before killing himself. The deadliest school shooting in history, this tragedy left students, staff, and faculty on campuses everywhere asking, "What if…?"

Emory had long considered emergency response strategies even prior to CEPAR's creation, says Isakov. However, the events at Virginia Tech gave planners cause to reflect further on those strategies.

"The university already had invested in communications technologies designed to facilitate a more robust emergency notification process," says Isakov. "Obviously, having a hospital emergency department on campus gives us an edge. We also have our own emergency medical first response unit manned by students 24/7, under supervision of the Emory Police Department. It's a unique program, where students can take a course and become state certified as emergency medical technicians."

The unit's average response time is 3.5 minutes to answer calls for a territory including the Emory campus, CDC, Yerkes National Primate Research Center, and Wesley Woods Center. Two quick response vehicles and a reserve vehicle are always on call. The dispatcher handling a particular 911 call will send DeKalb County Fire and Rescue if further expertise or patient transport is needed.

Integrating "gems" like this program into emergency response plans is an important part of CEPAR's role. Emory began an enterprise-wide risk management program more than a year ago, and CEPAR has an integral role in that process, says Isakov.

Ebola for chickens

In 1997, a three-year-old boy died of a strain of bird flu, bringing on the mass slaughter of domestic chickens and geese. Since then, the flu strain otherwise known as H5N1 has killed more than 60 people in Asia.

Scientists have closely followed H5N1, which has been responsible for the deaths of millions of birds on every continent except the Americas. So far, the virus has shown a 50% mortality rate among humans but is actually very difficult

Bruce Ribner supervises a special quarantine and treatment program that Emory runs for CDC employees who become sick with serious communicable diseases in the field.

for people to catch, requiring intense exposure to sick birds. Person-to-person transmission has yet to be confirmed, but scientists are alert for mutations that would allow for easier spread.

Pandemic viruses can arise in two ways. A bird (avian) virus can mutate until it becomes adapted in humans (as happened with the 1918 strain). Alternatively, both an avian and human-adapted virus can infect a host, such as a pig, at the same time. The exchange of genes gives rise to new viruses, which are easily spread from human-to-human and to which virtually all humans are susceptible. This scenario, known as reassortment, led to the 1957 and 1968 pandemics. Future pandemics could arise from a combination of both mechanisms.

Some similarities between H5N1 and the deadly flu strain of 1918 raise concerns. Both are extremely virulent when they infect humans, and unlike annual seasonal outbreaks of flu that tend to more severely impact the elderly, these viruses cause severe disease in young, healthy adults. "What is worrisome about this H5 virus is that it is distributed widely in nature and has mutated and become more virulent over time in birds," says Orenstein, director of vaccine policy and development for the Emory Vaccine Center and former director of CDC's National Immunization Program. "If you're a chicken, it's a real disaster. It's highly fatal and geographically widespread in Asia, Africa, and Europe. The fear is that bird-adapted virus would be carried by wild birds from Siberia to North America. Or it could arrive in North America in the wild bird trade and then come directly to the United States through migration."

The virus has caused severe illness among people in 12 countries and killed people in 11 countries. The greatest number of cases has been reported from Indonesia and Vietnam, but human cases have occurred in places extending from Egypt and Nigeria. The numbers are small thus far because the virus does not reproduce well in the nose and throat. Instead the current H5N1 viruses must get all the way down into the lungs, leading to pneumonia and an ensuing immune "cytokine storm" that often kills victims through acute respiratory distress syndrome and shock.

The virus would have to undergo significant mutations to become more infectious among humans and create a pandemic, Orenstein says. However, because it is now so widespread in birds, those opportunities to mutate are present. "One problem with influenza viruses is that they are not faithful to each other," he says. "They mutate easily."

That's why it's so difficult for health officials to forecast even the next year's form of annual flu, much less pandemic flu. "We can either do nothing and hope we're lucky," says Orenstein, "or we can prepare in ways that will help us anyway, such as establishing a vigorous annual vaccination program. Building vaccine production capacity and the infra-

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structure to deliver vaccine would help tremendously should we need to vaccinate large numbers of people quickly in the event of a flu pandemic."

21 days

This past June, the first quarantine order in 40 years was issued for an Atlanta business traveler diagnosed with extensively drug-resistant tuberculosis (XDRTB). He was transported from Hartsfield International Airport in a special Grady Health System ambulance to a locked isolation unit that Grady operates for the Georgia Department of Corrections. "We have developed a special team to transport people with serious communicable disease in support of Emory, the CDC, and the airport. It's a real community asset," says Isakov, who directs the Biosafety Transport Unit.

Tuberculosis, even XDRTB, is one thing. Marburg hemorrhagic fever is quite another, says Bruce Ribner, hospital epidemiologist and director of a CDC special containment unit at Emory Hospital.

In 2005, a CDC doctor stopped in Johannesburg before flying home from a six-week assignment in Angola, where he had been working on an outbreak of Marburg, one of the deadliest, most contagious, and most feared diseases. When his plane refueled at Cape Verde in the middle of the Atlantic Ocean, the doctor called CDC to report symptoms he knew could land him in hospital isolation for 21 days: diarrhea, vomiting, fever, and chills. All precursors to Marburg.

CDC called Emory.

"CDC pays for us to be in a state of constant readiness in case one of their employees gets sick," says Ribner. "Luckily, this young man turned out to have something like traveler's diarrhea."

CDC has renovated three patient rooms in Emory Hospital with state-of-the-art pathogen-containment capacity. Ribner supervises the operation, which includes a cadre of 21 nurses trained to work in this unit and 20 Grady EMS special operations paramedics trained to transport a sick person to this unit. The unit has served as a prototype for others across the country.

"CDC has about 350 research labs in the city of Atlanta and hundreds of epidemic intelligence officers investigating disease outbreaks with very serious communicable diseases," says Ribner. "They needed an appropriate place for them to be treated and quarantined, if necessary. Before Emory, all they had was a two-bed unit in Fort Dietrich, Maryland. They obviously needed something local."

While the Grady isolation unit locked the XDRTB patient

in, the Emory Special Isolation Unit aims to keep people out. Several layers of doors are alarmed from the outside in. Glass-covered lab facilities are built into the unit's nursing station so patient specimens are impossible to mix with those of the general hospital population, and the air flows directly outside through sensitive HEPA filters.

"Anyone can do airborne isolation," says Ribner. "We already have up to 30 airborne isolation units here for simple contagious diseases. But for extremely contagious, serious infections, we need this unit."

Fighting forgetfulness

The field of disaster preparedness can be difficult because people tend to forget how bad things can get. "Planning fatigue," Isakov, a former Navy doctor, calls it.

Just after 9/11, the skies were empty, commutes were short, and suburban streets were eerily quiet. A month later, weapons-grade anthrax mailed in letters killed three U.S. postal workers and contaminated Congressional offices. A common fear held Americans rapt.

Imagine the country's fear in 1919, at war with the world for the first time and people dying of an influenza that left a blood-tinged foam about their mouths and nostrils. The public was amenable to measures that today might seem draconian. In San Francisco, it was illegal to leave the house without a gauze face mask, and people largely stayed home en masse when told to do so. The threat of death hung all around.

Such public obedience is not likely in this day and age. In fact, drive-thru flu booths are one of the more creative recommendations of Emory's Pandemic Flu Task Force.

Remembering disasters past, taking inventory of what went wrong and what went right in the aftermath, is only the first step. Hospitals and universities can take the lessons learned and place them in context. They must ask the right questions and muster the right forces. Emory Healthcare and Emory University have a leg up, says Isakov.

"We should all recognize Emory's substantial commitment to safety and emergency preparedness. As I like to say, 'There's no billing code for disaster preparedness.' It's not a revenue generator. It requires leadership with vision and acu-

WEB CONNECTION *To listen to an interview with Isakov on disaster planning, visit* **http://www.whsc.emory.edu/isakov_hsmag.html**

Scarier than Hitchcock

CEPAR grew out of the Emory Pandemic Influenza Task Force, which examined the ability of the university and Emory Healthcare to respond to a flu pandemic. The group identified the need for a broad-based "all hazards" group and these key recommendations:

- **Stockpile Tamiflu** and decide who should receive it,
- **Decide which essential personnel** would first receive limited supplies of a vaccine tailor-made for a deadly avian flu—for example, campus security, health care, and certain operational personnel,
- **Define new ways** to handle a projected surge of patients as well as develop new triage and diagnostic tools to separate the desperately ill from the moderately ill and the "worried well,"
- **Develop operations strategies** such as where to house sick students, how to provide food service, and potentially closing the university,
- **Streamline communications** to make sure the right messages get to the right people and develop a "decision-makers" intranet to share confidential information, and
- **Control infection** by limiting the spread of disease: stockpile masks and respirators for the health care providers and isolate the ill.