The Ebola Web

“The number of health-care workers who have died in this outbreak is substantial, and particularly nurses,” El-Sadr says. “Nurses are very precious — they provide the care.” Many on the frontlines have died, and those who haven’t died have watched their colleagues die. Even before Ebola, there were about two nurses for every ten thousand people in Sierra Leone.

Yet ICAP found that the prevailing assumption — that there were too few nurses to staff the new care centers — was incorrect. Organizations working in Sierra Leone could identify nurses who were ready and willing to respond, including unemployed and retired nurses.

“As we rush to find trained health workers, it is essential that we keep them safe,” Strasser says. “Buddy systems and on-site supervision are helping, but we need more. We’ve seen a situation spin out of control due to poor health systems. Nurses are at the forefront of these systems, and they’re the ones most at risk.”

On February 26, 1969, John Frame ’66PH, a doctor in the Division of Tropical Medicine at Columbia’s school of public health and the medical director of a network of Christian hospitals in East Africa, received a call from Nigeria. The caller was Jeanette Troup, a doctor at the missionary hospital in the town of Jos. Troup told Frame that a mysterious illness had broken out at the hospital. Two American nurses, Laura Wine and Charlotte Shaw, had developed fevers that progressed to nausea, hemorrhaging, organ failure, and death. Antibiotics were ineffective. Troup had performed an autopsy on Shaw, with help from the hospital’s head nurse, Penny Pinneo. The autopsy revealed multi-organ devastation.

Now, a week later, Troup said, Pinneo had a fever and mouth ulcers. Frame ordered Pinneo flown to New York immediately. The fifty-two-year-old nurse was evacuated from Nigeria, along with blood specimens from her fallen colleagues. While Pinneo was being transported, Frame contacted virologist Jordi Casals at Yale, and told him to expect some blood samples.

At JFK Airport, Frame met the ailing Pinneo and drew her blood. An ambulance took Pinneo to Columbia-Presbyterian Hospital. There, she was placed in isolation. Frame sent all the blood samples to the Yale lab, where Casals and his colleagues set to work to identify the pathogen. Pinneo was acutely ill. At one point, her temperature reached 107 degrees. Somehow, she survived. By early May, after nine weeks in the hospital, she was released.

A month later, Casals, who lived on Manhattan’s Upper West Side, began to feel sick. He thought his symptoms were unrelated

An Unusual Virus

“One striking feature of Ebola is that, unlike most viruses, it replicates in a lot of tissues,” says Vincent Racaniello, a Columbia professor of microbiology and immunology who runs Virology Blog. “You can take the virus in through your mouth, nose, eyes, or skin, and it can spread throughout your body and grow in many different types of cells — in your respiratory tract, gut tract, skin, muscle, liver. That’s unusual for viruses. Usually, they’re restricted to just a few places, like influenza [respiratory tract] or polio [intestinal tract and nervous system]. We call that tropism: the cells and tissues where the virus replicates. Ebola is interesting because its tropism doesn’t seem to be regulated in any way.”

Like many scientists, Racaniello thinks that Ebola’s natural host is a fruit bat.

“All the viruses that we recognize in humans originated in animals,” says Racaniello, who in 1981 was part of the team at MIT that sequenced the poliovirus genome. “Influenza originates in birds, for example. Polio originated in animals, but now it’s strictly a human infection: it goes from person to person. But Ebola is not a human virus: every outbreak starts with the virus going from an animal to a human, and then it goes human-human-human, until we’re able to stop the transmission. The virus is then gone. When another outbreak happens, it’s from another animal entry,” probably from touching or eating an infected animal.

Once inside the human body, the virus enters by entering a cell and then taking over the cell’s machinery to reproduce itself, making more Ebola proteins, which then break out of the cell and infect other cells.

“This is an RNA virus,” explains Columbia epidemiologist Stephen Morse. “Many viruses — Ebola, influenza, polio — have RNA genomes, and they all need their own special enzymes to copy themselves, because our body doesn’t know what to do with them. That’s why there are so many mutations in RNA viruses — those copying mechanisms are very sloppy. We don’t normally copy over RNA in our own bodies. DNA viruses like herpes simply use the DNA-copying machinery of our own cells.” Despite the profuse mutations caused by the RNA-copying process, neither Morse nor Racaniello see any real chance of the virus becoming airborne, as some people fear. “We have been studying viruses for over a hundred years,” Racaniello says, “and we’ve never seen a virus in humans change the way it is transmitted.”

As for the ghastly hemorrhaging — a result of damage to the cells that line the blood vessels — Morse says, “About 40 percent of cases get these dramatic Hollywood effects. So if you’re looking for that, very often you’ll miss the diagnosis.”