

1918 FLU EPIDEMIC

A setback for scientists digging into past

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

A team of researchers that has traveled to this remote Arctic town with the hope of unraveling the mystery of the 20th century's worst epidemic has hit an unexpected snag.

The team had planned to exhume the bodies of seven victims of the 1918 flu, hoping the corpses would hold within them frozen and preserved pieces of the virus that killed up to 40 million people. Such a find might show what made the flu strain such a killer and help scientists head off another worldwide pandemic.

But the first week of digging handed the team an unanticipated setback:

The bodies they have found are not frozen.

Years of planning and research had led the team to think that the bodies of seven miners had been buried in a pit blasted 6 feet into a steep hillside by their mining company employer. That would have put the victims 3 feet into eternal permafrost.

But on the group's first day of digging, the shovels they were using to clear the first few feet of soggy tundra thumped unexpectedly on a wooden object. By Tuesday afternoon, six more had been uncovered: seven coffins, lying side by side as predicted, but only 10 inches below ground, in a portion of the ground that thaws every summer.

No markings on the coffins identified them as the flu victims, but Alan Heginbottom, the team's geophysicist, said

Wednesday morning, "We found seven bodies in the (grave) where we expected to find seven bodies. If these are not the burials from the 1918 Spanish flu deaths, it is a remarkable coincidence."

The team --- 15 scientists and technicians from Canada, England and the United States --- had hoped this 1,200-person town on the Svalbard archipelago, where current daytime temperatures range from 30 to 50 degrees,

might be the one place on the planet where bodies had been kept cold enough to preserve intact the 1918 virus.

Their

leader, Kirsty Duncan of Toronto, had searched Siberia and Iceland without success; partially frozen bodies unearthed in Alaska by American scientists have yielded only fragments of the genetic material of the 1918 flu.

But the team insisted Wednesday that the decayed state of the one body sampled so far is not a disappointment and declared intentions to proceed as planned. Asked whether she's dismayed by the finding, Duncan, 31, a geographer, said firmly at the grave site, "We are delighted. We are extremely excited by what we have found, and

we are certainly looking forward to the next few days of work."

Dr. Robert G. Webster, chief of virology and molecular biology at St. Jude Children's Research Hospital in Memphis and holder of the team's \$150,000 grant from the National Institutes of Health, quickly backed her up.

“We have been planning this for five years; to begin to get samples was really thrilling,” he said. “But the experiment for me in a sense doesn’t start until we get back into the lab. We have the tools to get answers from these samples, but you are going to have to be patient with us, because it will probably take months.”

Team members acknowledged that the virologists they have recruited to analyze the miners’ tissues may be able to find only broken segments of the 1918 flu’s genetic blueprint rather than the complete genetic code they had hoped for. Still, with the approximately 100 grams of material they took late Tuesday, the team can perform a sophisticated genetic copying technique known as polymerase chain reaction, or PCR. “We have enough to do PCR from now till kingdom come,” said Dr. Rod Daniels of the National Institute for Medical Research outside London.

The body whose coffin was opened late Tuesday --- and cannot be identified by marks on the coffin or by features of the corpse --- was so obviously decayed that the group decided to forgo the elaborate infection precautions they had planned on, at least for now. Last week, they laboriously unloaded high-level protective gear from the two 40-foot containers at the base of the cemetery hill: complete “spacesuits,” self-contained air supplies and sharp-edged biopsy tubes specially designed by Daniels’ laboratory.

Instead, the autopsy team agreed to wear only eye protection, masks, gloves and splatter-proof Tyvek suits “rather than the full Monty,” Daniels said.

The team’s agreement that opening the bodies poses no risk of releasing live virus may change its plans for the samples once the trip is completed.

Previously, the researchers had recruited highly secured and safe labs in England, the United States and Canada to do the work, with some samples being shared with Norwegian health authorities in Oslo. Now, they said, such caution might not be necessary.

“We’ll have to wait and see what we get,” said Webster, who had planned to take his samples to Memphis before taking them to Fort Detrick outside Washington. “We can’t decide before we have all the answers.”

Meanwhile, the team has rearranged the next few days’ plans to accommodate the surprising discovery. Though the members have partially unearthed all seven coffins (one of which they agreed not to open in deference to surviving relatives), their next step will be to switch gears: They will continue excavating until they penetrate the permafrost, looking for where other evidence -- possibly even more coffins -- may lie.

Since they have promised not to remove the coffins, that will require tunneling down at an angle through the sodden ground, in a channel wide enough to admit the jackhammers necessary to tackle the lower frozen sections.

With new discoveries come new hurdles for pathologists

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

The pathologists who came to the Arctic to autopsy victims of the 1918 flu were expecting obstacles: a possibly living disease organism, cumbersome protective gear, the difficulty of cutting safely into 80-year-old frozen human flesh.

With the discovery that the bodies lie close to the surface, a fresh set of hurdles has taken their place.

“We’re on our hands and knees in a ditch that keeps filling up with icy water,” said Dr. Charles Smith, a Toronto forensic pathologist who leads the autopsy team. “There’s three of us down there, the opening is so narrow only one of us can get a hand in at a time, we’ve got miners’ lamps strapped to our heads, and the water keeps filling our boots.”

The body Smith found when he opened an unlabeled coffin late Tuesday afternoon had been reduced by time and the flow of glacial meltwater through the coffin to fragile, spongy bone with some tissue --- “soft, black, goopy material,” according to Smith --- still attached.

The team came to Longyearbyen with a long list of body sites from which they would take samples: Lungs, heart, trachea, abdomen, brain. But no individual organs can be identified in what remains of the tissue.

“All the bones are there, so we know that when we are taking tissue around the ribs or along the vertebral column, we are where the remnants of lung tissue would be,” Smith said. “We’re dealing with an acid environment, so the bones have started to decalcify. If you applied a bit of pressure to a flat bone such as the pelvic bone, you could bend it.”

All seven of the dead miners are known to have been young, strong men, still in their 20s and used to spending much of the year outside as farmers or fishermen. One confirmation of their health, Smith said, is that the teeth of the newly discovered bodies were intact and have survived demineralization and decay.

“We have archived some of the teeth, so that if they were needed for DNA studies, for instance, we will be able to use them,” he said.

The team is using standard field autopsy tools: scalpel, trowel and spatula. Its members have removed the lid from the upper half of the coffin, but since the sides have collapsed from ground movement and water pressure, that has given them only a narrow slot in which to work.

The most surprising discovery, Smith said, was that the body initially appeared shrink-wrapped: not with a fabric shroud, as would have been customary, but with newspapers that have softened and become incorporated into the flesh. Few whole sheets remain, he said, but some of the fragments are legible.

“To us, it may just be hunks of wet newspaper,” he said, “but to archivists and people who can retrieve the information from such material, it may be a gold mine.”

ScienceWatch

KID GLOVES for a KILLER

Scientists hunting the deadly 1918 flu virus think the risk is low --- but they're taking no chances.

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

An international team of scientists that began exhuming the bodies of victims of the 1918 influenza pandemic here this month, in an effort to understand why the virus was such a killer, has been preparing for more than a year.

Yet despite all its research, the team was unable to answer one key question: How risky is this project?

Could the exhumations place the researchers at risk of being infected with the long-entombed deadly flu strain, which killed up to 40 million people worldwide in 1918, or could its release back into the world pose a larger public health risk?

They knew from the work of rival scientists that viral fragments can be found even in badly preserved bodies. This week they found seven such bodies in Longyearbyen's cemetery; keeping to agreements they made with family members and authorities, they took tissue samples from six.

The chance of releasing a still-infectious virus appeared low enough that they relinquished the high-level protective gear they'd brought as a precaution. But because the full risks are unknown, plans to send the samples to labs with the highest levels of biosafety protection still stand.

Participating in those decisions was a team member uniquely equipped to estimate the chances and risks to the scientists and the public.

"The risk is very small," said Dr. Peter Lewin of Toronto. "But it is not zero."

Out of the 15 expedition members, who include pathologists and experts in viral behavior, Lewin may be the best qualified to make that guess. He is one of relatively few world experts in medical archaeology, which analyzes the diseases and causes of death of long-dead bodies. As early as 1985, he predicted in a medical journal that viruses in bodies buried and frozen for generations could pose a threat today.

By training, the burly, strong-featured doctor is a molecular biologist and pediatrician; his office in Toronto's university district, decorated with Inuit art and his many honorary degrees, is full of books and toys to distract nervous young patients. Those he sees in his off-hours seldom need such calming: Most of them have been dead for centuries.

Lewin, now 63, was born in Jerusalem when it was still a territory of the British Empire and was raised in Alexandria, Egypt, the intellectual capital of the pre-Christian world; his father was a captain in the Royal Army Medical Corps. It was an upbringing seemingly designed to foster a fascination with the ancient world and its problems, but Lewin didn't indulge his interest until 1966, seven years after graduating from medical school at

the
University of London.

He was offered the chance to examine, under an electron microscope, skin from the mummified hand of a young Egyptian girl. To his surprise, he found that the outer structures of skin cells had survived the millenniums; if inner components such as mitochondria and nuclei were intact, he argued, the girl's DNA might be recoverable. (And he was right: In 1985, a Swedish scientist named Svante Paabo successfully cloned DNA from the skin of a mummified baby dead for 2,400 years.)

Lewin went on to apply the newest medical technologies to ancient medical problems. In 1977, he was the first to use a CT scan on a mummy, proving that a 14-year-old boy named Nakht, who died 3,200 years ago from cirrhosis of the liver, was infested with pork tapeworm --- a disease that no longer exists in Egypt because Muslim dietary laws forbid the eating of pigs. In 1979, along with researchers at the Centers for Disease Control and Prevention, he proved that skin eruptions on the mummy of Pharaoh Ramses V, who died in 1145 B.C., contained fragments of smallpox. And in 1994, he and several colleagues used a three-dimensional computer portrait, made from more than 300 CT scans, to solve the death of a priestess named Djedmaatesankh whose body lies in the Royal Ontario Museum. The reassembled image, created without removing the mummy from her elaborately painted case, revealed a gaping hole in her upper jaw --- a massive dental abscess that probably spilled infection into her bloodstream and caused her death.

Lewin's work attracted the attention of Kirsty Duncan, the driven young Canadian professor who organized the Longyearbyen expedition; she asked Lewin to join the team. And his research had whetted his appetite for an encounter with a bug that might, as he predicted 13 years ago, still prove a present threat.

"The chance is very small" that the 1918 virus will still be infectious, Lewin said. "But it is possible. So we will not take any chances."

The team hopes that any virus it finds has not been broken apart by chemicals that cells release at death; the key to understanding the 1918 virus' virulence lies in the original arrangement of its amino acids, which no scientist has ever seen because flu viruses weren't identified until 1933. But while the scientists want the virus to be intact, they also want it to be dead --- that is, no longer capable of infecting cells to reproduce. A viable virus is unlikely but not impossible; smallpox, for instance, has survived both freezing and drying.

So have some types of bacteria, which could prove vital to understanding the 1918 pandemic. Lewin is working on a hypothesis that the flu's vicious effects may have been caused by simultaneous infection with bacteria --- possibly *Haemophilus influenzae*, which was originally but incorrectly thought to be the cause of flu, or another, still unidentified bug.

"Even if we cannot recover the flu virus, I think some of these bacteria may be viable" in the Longyearbyen bodies, he said.

If Lewin is correct and the bodies contain both bacteria and flu virus, that finding will do more than explain the mysteries of 1918 or help scientists prevent a similar worldwide flu epidemic --- the primary goals of the

expedition. By demonstrating the degree to which viruses and bacteria can persevere through burial, freezing and decay, the effort will provide a present-day warning. "It will tell us that there is a danger of infectious agents surviving in permafrost," he said. "Because with global warming, cemeteries in Siberia and the Canadian Arctic are rising and bodies are being exposed. And they may become a public health danger."

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Search for 1918 virus particles has quick conclusion Unexpected findings: Decayed bodies and a collapsing trench compromised safety.

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

Less than a week after they began digging, scientists searching for the cause of the 1918 flu in bodies buried in a cemetery here have ended their exhumation efforts and begun filling in their trench.

The international team of researchers this week found seven bodies where they expected to find them, but far closer to the surface than they'd hoped. They had intended to continue digging beneath those coffins in case other burials lay below. But they abandoned that plan Friday after taking samples from six of the seven bodies, when the sides of the pit they had dug began to collapse.

"We said we would do this safely, and we could no longer do it safely," said Kirsty Duncan of Toronto, the 31-year-old team leader, who hoped the bodies would hold the virus that caused the worldwide influenza pandemic of 1918, the century's worst epidemic. "The climatic conditions were against us."

Duncan and the other expedition members --- a mix of American, Canadian and British virologists, biologists and experts in forensic pathology --- came to this remote archipelago in hopes of excavating the bodies of seven flu victims from the permanently frozen ground that underlies most of the Arctic. Their hope was that particles of the virus might remain frozen and preserved in the bodies, giving scientists the opportunity to study it.

Earlier this week, they achieved some of that goal: They found the bodies within the confines of a grave blasted into the hillside by dynamite late in 1918. But instead of being six feet below ground and embedded in the permafrost the bodies were only 10 to 12 inches below the surface; instead of intact, they were substantially decayed.

Duncan challenged the perception that finding the bodies close to the surface and partially decayed was a disappointment to herself or her team.

"They weren't in the permafrost, but they were in the active layer" the portion of the ground that thaws and refreezes each year, she said. "The aim of this project was (retrieving) soft tissue samples. We recovered soft tissue samples. We are so excited that now we can move into the next, laboratory analysis phase."

The samples will go to London and Washington laboratories, with the highest levels of safety protection, as originally planned, said John Oxford, a London virologist on the team. Although the virus may have broken into inert fragments during the bodies' decomposition, researchers hope they will be able to subject it to the genetic analyses necessary to help understand what made the strain so virulent.

That process, however, will require making millions of copies of the virus' genetic material. And that may increase the risks of handling it, so researchers are continuing to handle the material carefully.

The team's own observations of the soil texture this week, as well as surveys done last year with ground-penetrating radar, suggested the pit went much deeper than the level at which the coffins were buried. On Thursday, the group had said they planned to keep digging, indicating that they hoped another layer of coffins might lie beneath the ones they had found. But they had promised surviving relatives of the dead men and local authorities that they would not move the bodies --- requiring them to tunnel alongside and beneath the coffins at one end of the grave. The work, which required electric jackhammers to break open the cement-hard permafrost, proved so difficult that the team made a special request Friday morning to the archipelago's governor that the prohibition against moving the dead men be relaxed. But by the time the team returned from the meeting, 20 inches of icy glacial meltwater had filled one end of the five-foot-deep trench.

"At that point, it was clear the only thing to do was backfill," said Alan Heginbottom, a Canadian permafrost expert who supervised the digging. "The seepage from the glaciers and the permafrost is terrific; one coffin was undermined. . . . If we had not filled it in, the entire set-up might have collapsed, and then we would have had a disaster on our hands."

The second level of the excavation never went deep enough to prove for sure whether additional bodies lie below --- a key point, since the coffins found cannot absolutely be identified as belonging to the seven dead miners who fell victim to the 1918 flu.

However, team members confided Friday that they have fresh evidence that the shallowly buried bodies are the seven miners. The last sample taken from the last body on Thursday evening yielded a newspaper fragment with a legible date: 1917.

"At least it wasn't 1919, or 1920," said Berry Blenkinsop, the project's chief autopsy technician. And Dr. Charles Smith, the chief pathologist, added: "The papers were from the mainland; they would have taken months to get here, and they would have been in circulation for months more. For the bodies to be who we think they are, this date is just fine."

Filling and tamping down of the trench, which measures approximately 60 feet by 6 feet on the surface, could be completed by tonight, said Heginbottom. Friday evening, as low clouds masked the surrounding mountains and crept within several hundred feet of the tent, workers from Necropolis Co., a British company specializing in exhumations, began trundling wheelbarrows of saved soil into the tent. Standing on the gravel road below the cemetery, dressed in mud-splashed leggings and a T-shirt bearing a sketch of a flu virus, Duncan looked pole-axed --- thrilled to have reached her goal of five years, but stunned by the week's very rapid events.

"I want to go home and see my family. I want a chance to have my life back," she said. "But first, I want to get some sleep."

Norwegian town an oasis of culture in frozen north

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

The high Arctic valley that has played host for two weeks to the 1918 flu research team is a peculiar place to search for one of the world's worst killers.

The university campus boasts the northernmost Internet server on the planet. A restaurant in this town of 1,200 belongs to the Chaine des Rotisseurs gourmet society; its wine cellar offers a premier cru Sauternes and \$450 Chateau Margaux. The hotel in which the flu team is staying was built for the U.S. delegation to Lillehammer, then moved to this island; its TV system runs "Seinfeld" --- in Norwegian --- and "Tales From the Crypt."

Two mountain passes south of town gleam white with glaciers. The daily breakfast buffet includes caviar, three kinds of herring and mushroom-brown, chewy smoked seal. And one week after the end of the midnight sun, the street lamps have just been turned on again; at 1 a.m., the sky is so bright, car headlights are not needed.

Except, perhaps, to give early warning to wildlife on the road. Traffic signs bearing the international symbol for caution depict the profile of a polar bear. Several years ago, a university student was killed by a bear on the plateau above the town. Since then, no one leaves the town borders --- or in winter, walks the half-mile between upper town and lower --- without a rifle slung over one shoulder.

The weather itself is also life-threatening: changing quickly from balmy 50-degree sunlight to bone-chilling 30-degree fog. The conditions posed a challenge for the expedition. The dig's uniform, peeking out at almost every wrist and neckline, is a navy wool undershirt.

Except for expedition leader Kirsty Duncan, who is so well-known residents offer her rides to the dig, the crew has little contact with town society.

"People support what they are doing, but people are mostly quite busy," said Marianna Andersen of Svalbard's tourist bureau.

Flu study team remains optimistic

International scientists are still hopeful Arctic research will help them combat future epidemics.

By M.A.J. McKenna/Staff

Longyearbyen, Norway -

Members of the 18-person team that spent two weeks here searching for the 1918 influenza virus began packing up and heading home Tuesday. But in many ways, the real work of the expedition --- and the process of determining how successful it has been --- lies ahead.

In freezing temperatures and gale force winds, expedition leader Kirsty Duncan and chief pathologist Dr. Charles Smith left for the Norwegian mainland and then for home, following virologists Dr. Robert Webster of Memphis and Dr. John Skehel of London. Despite their departure, work has not ended at the graves where the bodies of seven flu victims were unearthed. Six were sampled for evidence of the virus that killed them, along with 40 million people. (The seventh body was left intact at the family's request.) The five-man digging crew and several key scientists remain behind. So does the prize this expedition came to the top of the world to win: two blue stainless-steel barrels, each the size of a beer keg, standing in a household freezer inside a padlocked steel shipping container.

Inside --- frozen to 5 degrees below zero and packed in three layers of plastic and frozen shipping pellets --- are 113 samples of tissue and other materials taken from the coffins of the victims of the century's worst epidemic.

Today and Thursday, they will be loaded on separate flights and shipped to the National Institute for Medical Research in London, where they will be analyzed, divided and shared among collaborating labs: Fort Detrick in Maryland, the University of Oslo in Norway and a new lab being built by the Canadian Health Ministry in Winnipeg, Manitoba.

There, the tissue samples will be analyzed for particles of the 1918 flu virus. Scientists will also try to determine the genetic makeup of the flu strain. That information, which could take months, might help scientists understand what made the strain so virulent and combat future killer flu epidemics.

The team leaves on a note of elation, an attitude that is hard for the watching press to understand. Duncan spent years searching for unembalmed preserved flu victims before hearing of burials on this archipelago within the Arctic Circle. She came in hope of finding frozen bodies; the bodies she found, were cold, but not frozen.

"It is not as though this is a temperate climate; if that were acceptable, there are 12 flu burials in Toronto I could have pursued," she said before leaving. "The preservation here was still superior to what I could have gotten in the rest of the world."

Smith, a forensic pathologist in Ontario, added: "I'm disappointed by the perception that this was a failure. There are parts of this that were phenomenally successful. . . . We have material that we can work on, that is in much better shape than we expected when we opened the graves."