flooded in 2012's Hurricane Sandy, it still harboured DNA from bacteria associated with cold marine environments and fish, Mason said. However, most of the bacteria in the subway were harmless *Acinetobacter* species and others associated with human skin.

In his talk, Huttenhower described a survey of Boston's transit system that yielded similar flora. "Everything is covered in skin," he said. He noted that metal poles on the trains, which riders commonly consider hygienically suspect, actually retain much less bacterial biomass than the system's upholstered seats or plastic hand grips.

Microbiomes in houses tend to match those of the homes' human inhabitants — and quickly morph after a change in occupancy, said environmental microbiologist Jack Gilbert of Argonne National Laboratory in Illinois. He and his colleagues described results from a survey of ten homes, which found that they become populated with new residents' microbes within 24 hours.

Rodents are under study, too. White-footed mice (*Peromyscus leucopus*) in New York City carry more *Helicobacter* and *Atopobium* bacteria — associated with stomach ulcers and bacterial vaginosis in humans — than their suburban counterparts, but are totally free of tick-borne pathogens, reported biologist Alyssa Ammazzalorso of the Albert Einstein College of Medicine in New York City. The city's rats carry a number of bacteria known to cause problems in people, said epidemiologist Ian Lipkin, director of the Center for Infection and Immunity at Columbia University in New York. He and others have found pathogenic *Escherichia coli*, *Clostridium difficile*, *Salmonella enterica* and the Seoul strain of hantavirus, which can be fatal when transmitted to humans (C. Firth *et al. mBio* **5,** e01933-14; 2014).

Sewage samples from New York City's 14 wastewater-treatment plants turned up a disturbing number of genes for resistance to antibiotics, reported genomicists Susan Joseph and Jane Carlton of NYU's Center for Genomics and Systems Biology. As a rich human-derived soup spiked with antibiotics, sewage provides an ideal niche for the growth and spread of resistance, Joseph said. Martin Blaser, director of the Human Microbiome Program at the NYU School of Medicine, said that as populations of resistant microbes and their defensive tools become more diverse, the diversity of human-associated microbes in general is declining. He told how he and his colleagues have found that people in the West carry fewer protective bacteria than isolated human groups such as the Yanomami of the Amazon rainforest.

"We may have lost as much as half of our diversity already," said Blaser, "just as we are beginning to realize how important it might be." ■

The fungus that causes white-nose syndrome eats into bats' wings.

US FWS/RYAN VON LINDEN, NY DEPT ENVIRONMENTAL CONSERVATION/SPL

ECOLOGY

Bacteria may help bats to fight fungus

As white-nose syndrome spreads, researchers are trialling ways to stop colonies from collapsing.

BY NALA ROGERS

The bats at Marm Kilpatrick's two Illinois field sites perished right on schedule. The mines sheltered nearly 30,000 bats before white-nose syndrome, a deadly fungal disease, arrived in late 2012. By March 2015, less than 5% remained.

Kilpatrick, a disease ecologist at the University of California, Santa Cruz (UCSC), and his colleagues chose the mines because they lay right in the path of the fungus, which has spread from Europe through 26 US states and 5 Canadian provinces since January 2007.

Although researchers are currently helpless to halt the spread of the fungus, there is reason for cautious optimism: treatments could soon be available that will help the bats to keep the infection at bay, for a season at least.

The goal, says Chris Cornelison, a microbiologist at Georgia State University in Atlanta, is to ensure that when researchers find long-term solutions for the disease, "there are still bats to treat".

The fungus (*Pseudogymnoascus destructans*) grows on bats while they hibernate in winter, digging into their noses, ears and wings. Animals that survive until spring usually clear the infection as their bodies warm; some species do it year after year. But the pathogen causes other species to repeatedly rouse from hibernation, which burns up fat reserves and can cause the animals to starve to death. Some even flee their roosts in a futile search for food.

"They come out of caves in the winter, and they try to get into people's homes or churches or schools," says Jeremy Coleman, national coordinator for white-nose-syndrome research at the US Fish and Wildlife Service in Hadley, Massachusetts. "They're dead and dying on the ground."

Kilpatrick and his colleagues have discovered that a bacterium found on bats' wings may help them to combat infection. In April, the scientists published a paper in *PLoS ONE* showing that two strains of the bacterium *Pseudomonas fluorescens* kill white-nose fungus in cell culture (J. R. Hoyt *et al. PLoS ONE* **10,** e0121329; 2015). Last winter, the researchers applied the treatment to bats in the lab. They have not released their results, but Kilpatrick hopes to test the bacteria in the wild soon.

Others are examining whether volatile organic compounds produced by *Rhodococcus* bacteria, which are found in soils, can kill white-nose spores. During a field trial in Missouri last winter, Cornelison and his colleagues treated bats with such compounds for 48 hours before returning the caged animals to their cave for 4 months to finish hibernating. On 19 May, the researchers released the bats that were free of disease — prompting media coverage of a potential 'cure'.

Cornelison cautions against such

celebration. His team is still analysing the data from the trial, and has not revealed how many bats were treated and released or how the controls fared. And even if this or the bacterial treatments are effective, they will be only short-term solutions. The fungus lingers on cave walls during the summer, and bats do not seem to develop immunity to it — so researchers would need to treat the animals every year to keep them from getting sick.

STOPGAP SOLUTIONS

Long-lasting solutions remain elusive. Some scientists hope to develop a vaccine, but have yet to work out how to trigger the animals' immune systems to destroy the pathogen, says Ken Field, an ecoimmunologist at Bucknell University in Lewisburg, Pennsylvania. Bats naturally produce antibodies to the fungus, but there is no evidence that these can help them to survive.

Other researchers are promoting a more radical long-term solution: altering airflow in mines where bats hibernate to make the sites less hospitable to the white-nose fungus. Places where bats survive infection tend to be relatively cool and dry. By opening new routes to the outside, researchers could cool and dehumidify the air in mines that are too warm and wet.

There is a chance that manipulating airflow could drive bats to abandon the habitat, says Kate Langwig, an ecologist at the UCSC. But she argues that it is worth a try, because at some sites the white-nose fungus kills about 90% of the bats present. In the first 5 years that it was present in the United States, the pathogen claimed more than 5.5 million animals.

In the meantime, the United States and Canada are developing and implementing strategies to coordinate work by scientists and by local and national governments — ranging from laboratory and field studies to efforts to prevent people from inadvertently spreading the fungus to pristine caves.

The plight of the bats is "stark — it's demoralizing", says Winifred Frick, an ecologist at the UCSC. "But I have hope in terms of the amount of creative energy and sense of dedication that people are putting forth on this problem. If there are solutions, we will find them." ■

SPACE

First glimpse of primordial stars

Astronomers claim to spot generation that seeded Universe.

BY ELIZABETH GIBNEY

Some of the first generation of stars, whose explosions breathed carbon, oxygen and other elements into the Universe, may have been glimpsed for the first time. The possibility comes as a pleasant surprise to astronomers, who did not expect to be able to spot these primordial objects with existing telescopes.

Primordial stars are theorized to be hundreds of times larger than the Sun, and made up only of pristine hydrogen, helium and traces of lithium left over from the Big Bang. The earliest specimens formed during the first few hundred million years of the Universe, living for only a few million years before exploding in supernovae that laid the seeds for the more element-rich stars to come. But they have never been seen.

A team led by David Sobral, an astronomer at the University of Lisbon, now reports that it may have spied a late-blooming cluster of such stars, in the brightest distant galaxy yet observed. The stars, seen as they were when the Universe was around 800 million years old (a mere 6% of its current age), seem to be primordial in composition — but, strangely, they also seem to reside in the same galaxy as some second-generation stars.

"Until now, work on these stars has been completely theoretical," says Sobral. "For the first time, we're starting to get observations that can test the many theories about these stars and begin to understand how they formed." His team's report has been posted on the preprint server arXiv and accepted for publication in *The Astrophysical Journal* (D. Sobral *et al*. Preprint at http://arxiv.org/abs/1504.01734; 2015).

Seeing these ancient stars involves observing very distant galaxies. Their light takes billions of years to reach us, and so shows the Universe in its earliest days. But the light is faint, making it difficult to spot. The short lifetimes of the first stars also makes them hard to find.

Artist's impression of galaxy CR7.

ESO/M. KORNMESSER

The surprise discovery emerged after Sobral and an international team of astronomers made a wide sweep of the sky using the Subaru Telescope on Mauna Kea in Hawaii. They used three further telescopes to peer into particularly bright galaxies, and found an intriguing signal from one that they named COSMOS Redshift 7. (The name was chosen so it could be abbreviated as CR7, to echo the nickname of Portuguese footballer Cristiano Ronaldo.)

The spectrum of light from CR7 showed evidence of ionized helium, which suggested that the source of the light was extremely hot. At such temperatures, any carbon and oxygen present should also have ionized, says Sobral. But there was no sign of these elements in ▶

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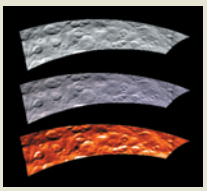

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