


# Cystic Fibrosis Patients Turn to Experimental Phage Therapy

Phages have not been approved by the Food and Drug Administration, but there is growing interest in the treatment for cystic fibrosis.

 Give this article



 33

By Abby Ellin

May 17, 2019

Mallory Smith was diagnosed with cystic fibrosis, a genetic disease affecting the lungs and digestive system, at age 3. She was living on borrowed time, and she knew it: Cystic fibrosis puts patients at an increased risk of serious infection, and the average life expectancy is about 37, according to the [Cystic Fibrosis Foundation](#).



Mallory Smith in September, 2016  
Danielle Jonas

When she was 12, the bacteria [Burkholderia cepacia](#) colonized Ms. Smith's lungs, a common problem in patients with cystic fibrosis. Over the course of her life, she was hospitalized nearly 70 times as a result of the infection.

"It doesn't go away," said her mother, Diane Shader Smith, of Beverly Hills. "Antibiotics can't cure it."



But Ms. Smith was determined to live as best she could, for as long as she could. She surfed, played volleyball and water polo, and graduated from Stanford University, where she majored in human biology.

In July of 2016, doctors told them that the antibiotics were no longer working, and that Ms. Smith would need a lung transplant. On Sept. 11 the following year, Ms. Smith underwent a double lung transplant at the University of Pittsburgh Medical Center. Initially she was getting better, and the family celebrated her 25th birthday at the hospital with hope. But the residual infection in her lungs led to pneumonia, and her organs began to fail. She needed treatment quickly, or she would die.

Her father, Mark Smith, a lawyer, had heard of [bacteriophage](#) (or [phage](#)) therapy, and had been trying for years to secure some for his daughter. Bacteriophages — Latin for “bacteria eaters” — are viruses that infect and kill bacteria, including those that are drug resistant. Though phages were discovered over a hundred years ago, they have been used therapeutically to treat bacterial infections only sporadically in certain countries, including the former Soviet Union and France.

“Not a lot of medical groups use phages clinically,” said Dr. Robert T. Schooley, co-director of the Center for Innovative Phage Applications and Therapeutics at the [University of California](#), San Diego, the nation’s first phage therapy center, which opened in June 2018. “That’s in part because there hasn’t been a source of safe phage to give. There’s also a general perception that phages are some mystical creation of the early part of the 20th century.”

That perception may slowly be changing. A 2014 [study](#) in the journal *Antimicrobial Agents and Chemotherapy* found that phages helped reduce *B. cepacia* infection in immune-suppressed mice. Phages also helped save an Israeli man’s leg from amputation, according to [a paper published in March](#).



And a [case study published in May in Nature Medicine](#) found that phages helped save a teenage girl with cystic fibrosis who had a double lung transplant and a disseminated bacterial infection.

“It’s pretty clear that the patient would not be with us if not for the phage intervention,” said the senior author, Graham Hatfull, a professor of biological sciences at the University of Pittsburgh.

But phages hadn’t been approved by the Food and Drug Administration, and they’re not easily accessible.

With his daughter quickly running out of time, Mr. Smith got F.D.A. approval to use phages as an [Emergency Investigational New Drug](#). Then he just needed to find them.

So he reached out to Steffanie Strathdee, an epidemiologist at the University of California, San Diego. Dr. Strathdee’s husband, Tom Patterson, [became infected with a drug resistant bacteria in Egypt](#) 18 months earlier and had been in and out of a coma for eight weeks. Doctors were ready to take him off life support, but Dr. Strathdee and her colleagues managed to secure some phages for him by cold-calling researchers in the United States who were studying phages that worked with his particular infection. A researcher at Texas A&M found phages that matched, and the F.D.A. gave Dr. Strathdee permission to use them as an experimental treatment.

“The F.D.A. put us in touch with the Navy, who agreed to conduct a phage hunt as well,” said Dr. Strathdee, whose book on the ordeal, [“The Perfect Predator,”](#) came out in February. “We ended up with two phage cocktails that arrived in the nick of time to save Tom.”

After receiving Mr. Smith’s call, Dr. Strathdee retweeted a request for phages 432 times, and she managed to secure some for Ms. Smith.



By the time the phages finally arrived, Ms. Smith had been without oxygen for too long and was brain dead. “The doctors advised us to make the gut-wrenching decision to remove life support,” Ms. Shader Smith said. Ms. Smith died on Nov. 15, 2017, at age 25.

Her parents are determined to educate the world on phage therapy. A memoir, “[Salt in My Soul: An Unfinished Life](#),” based on Ms. Smith’s journals from ages 15 to 25, was published in March, and Ms. Shader Smith has been on an extensive speaking tour at universities and corporations across the country. All of the proceeds are going to various nonprofits. They raised \$5 million during Ms. Smith’s lifetime, and more than \$800,000 through [Mallory’s Legacy Fund](#), established after her death for phage therapy research.

Its impact has already been felt. In addition to the phage center at U.C.S.D., a [phage directory](#) was launched two days after Ms. Smith’s death, and the [F.D.A. recently approved a clinical phage trial](#).

Ms. Smith’s story has also resonated on the individual level. Benjamin Chan, a researcher at Yale University, has used phages to successfully [treat](#) an 80-year-old Connecticut man with a deadly infection, and a [Texas woman](#) with cystic fibrosis.

In January, he treated Ella Balasa, a 27-year-old microbiology lab manager at Virginia Commonwealth University, in Richmond. Ms. Balasa was given a cystic fibrosis diagnosis at 18 months old and has ongoing infections caused by the bacterium [Pseudomonas aeruginosa](#), for which she takes antibiotics.

Ms. Balasa inhaled phages once a day for a week. After a second round the following month, she was able to quit taking her antibiotics. While she still has only 22 percent lung function and expects to have a lung transplant soon, she believes phage therapy has helped her.



Dr. Chan has since shifted his focus to primarily treating cystic fibrosis-associated infections, and he credits Ms. Smith and Ms. Balasa, among others, for inspiring him. His lab was recently awarded a \$275,000 grant by the nonprofit [Emily's Entourage](#), whose co-founder, Emily Kramer-Golinkoff, 34, has cystic fibrosis and was close with Ms. Smith.

As for Dr. Strathee, who is now co-director of the phage therapy center at U.C.S.D., she often thinks about Ms. Smith, whom she never got to meet.

Phages managed to save her husband, but they weren't there for Ms. Smith. "In Mallory's case, we were a few days too late," she said. "It still haunts me."