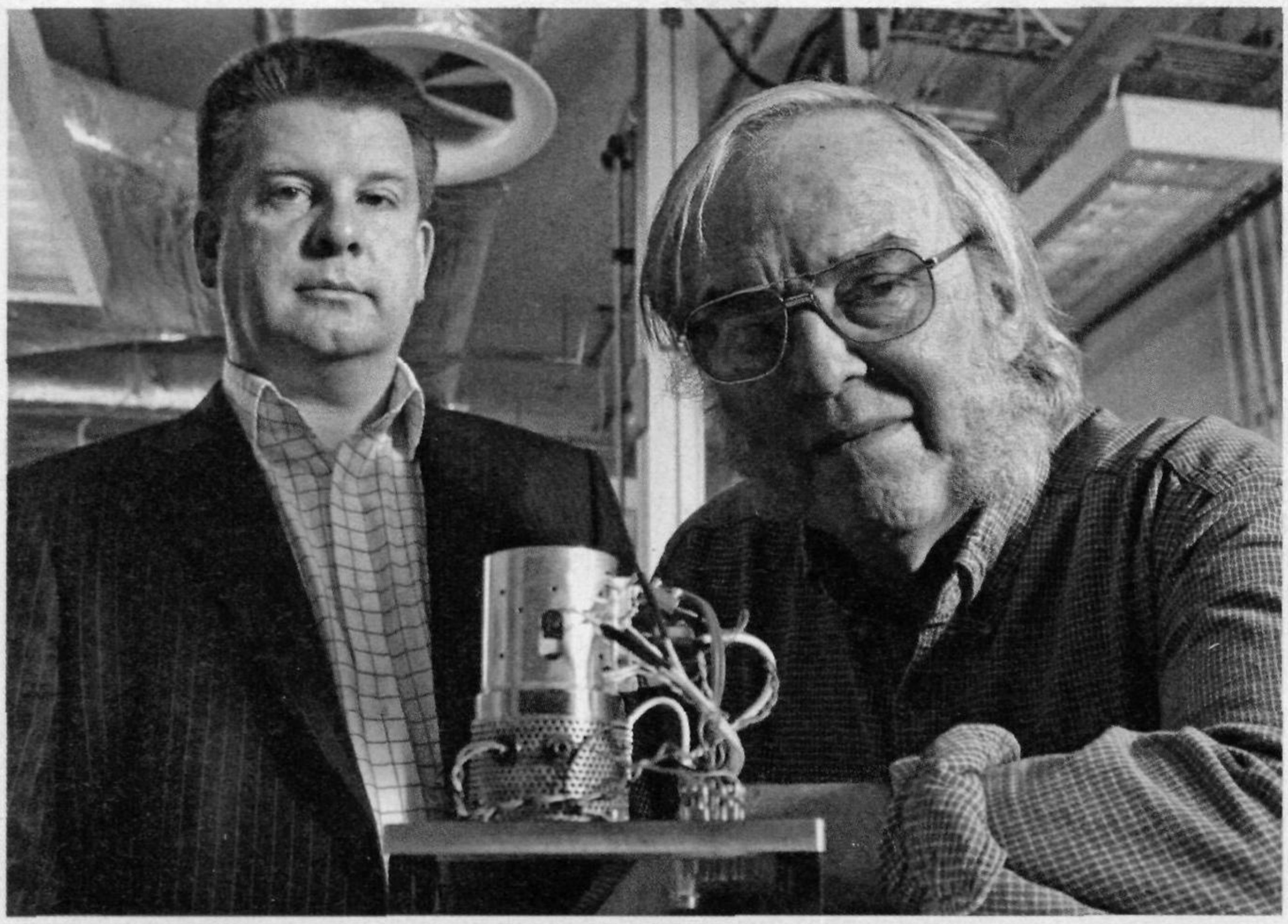


Down to earth *Morgan, at left, and Pillinger developed a mass spectrometer that detects TB*

SCIENCE

Back to the Future. How a failed space venture gave rise to a medical device that may save countless lives

BY LAURA BLUE

FIVE YEARS AGO, BRITISH SCIENTIST COLIN Pillinger convinced the world's biggest medical-research charity, the Wellcome Trust, to bet on a project far beyond its usual scope: a probe to find life on Mars. Detecting life on other planets, he argued, would be a giant leap for mankind toward understanding the origins of life back on earth. But in 2003, the Beagle 2 probe—worth tens of millions of dollars, and carrying a gas-analysis unit bankrolled by Wellcome—disappeared without a trace into the Martian atmosphere. Four years later, scientists and funders alike are delighted, if a bit bewildered, to find that technology developed for Beagle 2 offers hope for a significant medical breakthrough, despite the spacecraft's untimely demise.

At the Open University's Planetary and Space Sciences Research Institute in Milton Keynes, England, Pillinger and his colleague Geraint Morgan have built upon research they originally did for the Beagle project in order to create a diagnostic tool with the potential to save countless lives. Their device—about the size of a microwave oven—may not look like much, but it detects tuberculosis (TB), the highly infectious, hard-to-diagnose disease that often infects the lungs and kills more than 1.5 million people worldwide each year.

Turning space technology into a clinical tool took some ingenuity. Starting in the 1990s, Pillinger, Morgan and other researchers from the institute have worked to shrink a sophisticated piece of lab equipment used to identify and analyze matter: a gas chromatograph mass spectrometer (GCMS). Their challenge was to make the device—sometimes the size of a small car—light enough and sturdy enough to be sent into space. Pillinger always planned to look for terrestrial applications of the mini GCMS once their space research was done, and at Wellcome's request, Morgan began in 2005 to design a version that could detect TB. The device they have come up with requires little maintenance and should be much cheaper than full-sized GCMS models, which can cost millions of dollars.

That's good news for anyone trying to control tuberculosis, which has proven particularly difficult to track in the poorest parts of the world, where medical equipment has to be both affordable and robust. Where clinic staff lack the advanced lab resources to culture TB samples, they test for TB by smear microscopy—a laborious and often ineffective process in which a patient coughs up some sputum and a technician looks at the sample under a microscope, trying to pick out the bacteria by eye. That method "is very good at finding people who are infectious," says Liz Corbett, a clinical researcher from the London School of Hygiene and Tropical Medicine who works with TB patients in Zimbabwe. But a patient can have active, even lethal, TB without being very infectious. Using the standard smear-microscopy method can be acutely frustrating: sometimes a patient must be tested three, seven, even 10 times before a positive diagnosis can be made. If patients are weak—if, for example, they have HIV—TB can kill them before diagnosis is possible.

The GCMS researchers are confident that their device will diagnose the disease more effectively. It works by breaking apart a sample into ions, which it can then precisely identify based on their mass. Morgan and Pillinger's device is designed to search for particles from the distinctive waxy coating on the TB's cell wall.

The U.K. researchers still need to fine-tune their technology so it can be mass-produced cheaply. They also need a better method for treating sputum so it's ready for GCMS analysis. In 2009, Corbett will run a preliminary trial for them with 1,200 Zimbabweans suspected of having TB. If that evaluation goes well, the Wellcome Trust has said it will find a company to mass-produce the machine.

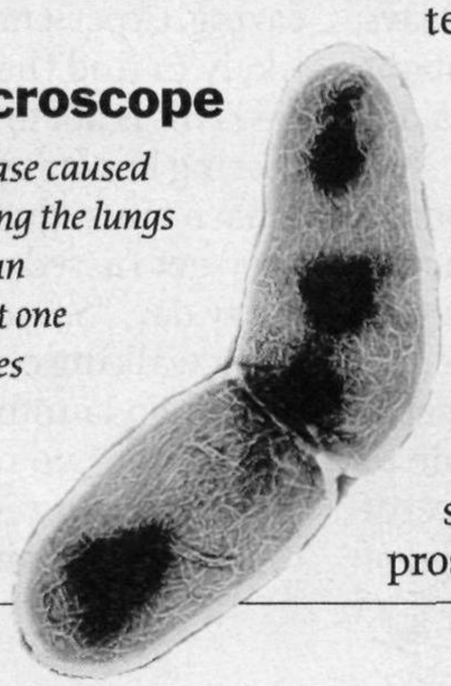
A life-saving device spawned from space design could also help planetary researchers justify their funding. "People always tell you space missions produce spin-offs," says Pillinger. But, in reality, they yield few applications in everyday industry. With portable GCMS, "Everywhere we go, people say, 'I can see an application for it.'" Indeed, Morgan and his team are now building GCMS units to test for drugs in breath samples, bladder cancer in urine samples, pollutants in reservoir water, and more. And Pillinger? He's cut back on work since being diagnosed in 2005 with progressive multiple sclerosis. But his eyes have never left the sky. "I still want to be the person who finds life on Mars," he says. Until then, he's satisfied by the prospect of saving lives on earth. ■

TB: Under the Microscope

WHAT IT IS *An infectious disease caused by bacteria, commonly affecting the lungs*

HOW MANY IT KILLS *More than 1.5 million per year, making it one of the world's deadliest diseases*

MOST AFFECTED NATIONS *80% of all cases are found in 22 countries, mostly in South Asia and Africa*



PHILIP HOLLIS FOR TIME; KWANGSHIN KIM—SCIENCE PHOTO LIBRARY