

Early controlled use of fire may have led to emergence of tuberculosis

July 26 2016, by Bob Yirka



This photomicrograph reveals *Mycobacterium tuberculosis* bacteria using acid-fast Ziehl-Neelsen stain; Magnified 1000 X. The acid-fast stains depend on the ability of mycobacteria to retain dye when treated with mineral acid or an acid-alcohol solution such as the Ziehl-Neelsen, or the Kinyoun stains that are carbolfuchsin methods specific for *M. tuberculosis*. Credit: public domain

(Phys.org)—A small team of researchers with the University of New South Wales and Monash University, both in Australia, has developed a theory that suggests tuberculosis may have evolved into a disease as a

result of the use of controlled fire by early humans. In their paper published in *Proceedings of the National Academy of Sciences*, the team describes how they came up with the theory and then tested it using mathematical modeling in conjunction with evolutionary genetics, epidemiology and paleontology.

[Tuberculosis](#), commonly known as TB, has been killing people for thousands of years and still continues to do so today—as the researchers note, it kills more people than any other type of [bacterial infection](#). It is also unique in that scientists believe it is one of the few diseases that started in humans rather than other animals. But how it did so has remained a mystery. In this new effort, the researchers suggest it might have evolved from a simple microbe that lived in the soil to one that could kill people because humans learned how to control fire.

Their idea is that sitting around an open fire meant breathing in a lot of smoke, which is known to weaken the immune response to pathogens in the lungs—any microbe that made its way in—via blowing dust, for example—would find a relatively safe place to live. Controlled fire also allowed early people more social time, as it provided light after the sun went down, which the researchers suggest may well have contributed to more physical contact—and that could have allowed the bacteria to become more transmissible. Taken together, the two factors offer a plausible explanation for the evolution of a harmless, soil-dwelling microbe into *Mycobacterium tuberculosis*.

To test their theory, the researchers used modeling to simulate evolving soil bacteria and found that under normal circumstances, it would be very unlikely to become a transmissible disease. But when they added the conditions under which people lived with controlled fire, the odds increased dramatically. They note that living near fire on a regular basis would also increase the frequency of coughing, which is, of course, the way that TB is transmitted.

More information: Rebecca H. Chisholm et al. Controlled fire use in early humans might have triggered the evolutionary emergence of tuberculosis, *Proceedings of the National Academy of Sciences* (2016).

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Abstract

Tuberculosis (TB) is caused by the *Mycobacterium tuberculosis* complex (MTBC), a wildly successful group of organisms and the leading cause of death resulting from a single bacterial pathogen worldwide. It is generally accepted that MTBC established itself in human populations in Africa and that animal-infecting strains diverged from human strains. However, the precise causal factors of TB emergence remain unknown. Here, we propose that the advent of controlled fire use in early humans created the ideal conditions for the emergence of TB as a transmissible disease. This hypothesis is supported by mathematical modeling together with a synthesis of evidence from epidemiology, evolutionary genetics, and paleoanthropology.

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