

Study finds an unexpected link between farming and immune system evolution

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Batwa children play on the outskirts of the Bwindi Impenetrable Forest in Uganda. The immune systems of adult Batwa hunter-gatherers showed more signs of positive natural selection, in particular among genes involved in the response to viruses, when compared to those of their farming neighbors in a new study. Credit: University of Chicago Medical Center

Researchers have long theorized that cultural shifts thousands of years ago from hunting and gathering to agriculture and living in permanent

settlements spurred an increase in diseases like smallpox and measles. Compared to hunter-gatherers, farmers stayed put, living close to one another and their animals.

This, it's hypothesized, made it easier for viruses and bacteria to spread among humans or from animals to people. Consequently, it might be expected that the immune systems of people from these farming populations would show more signs of positive natural selection through adaptation to these pathogen conditions.

A new study published in *Nature Ecology & Evolution* by University of Chicago Medicine genetic researcher Luis Barreiro, Ph.D., shows that the opposite is true when comparing farmers and hunter-gatherers in southwest Uganda. Instead, the immune systems of hunter-gatherers showed more signs of positive natural selection, in particular among genes involved in the response to viruses.

"It's the complete opposite of what we expected based on the long-standing hypothesis that the advent of agriculture increased selective pressures imposed by pathogens in [human populations](#)," said Barreiro, the study's senior author and an associate professor in the university's section of genetic medicine.

Researchers studied the blood of the Batwa, a rainforest hunter-gatherer [population](#) from southwest Uganda, and compared it to the blood of their Bantu-speaking agriculturalist neighbors, the Bakiga.

White blood cells from the two groups were isolated and exposed to Gardiquimod, which mimics a viral infection, and lipopolysaccharide, which simulates a bacterial infection.

The authors observed increased divergence between hunter-gatherers and agriculturalists in their immune responses to viruses, compared to

that for bacterial infections. A significant proportion of these differences were shown to be under genetic control and affected by recent positive natural selection.

"These findings suggest that differences in viral exposure may have been key contributors to the divergence in immune responses between the Batwa and the Bakiga populations," said co-author George Perry, Ph.D., an associate professor of anthropology and biology at Penn State.

This study, published July 29, marks the first time the immune systems of [hunter-gatherers](#) and farmers have been compared to help researchers understand how agriculture may have impacted our immune system. The team spent three years establishing connections and discussing mutual research interests with the Batwa and Bakiga prior to collecting any blood samples. The Batwa have lived in settlements along the edges of the Bwindi Impenetrable Forest since 1991, after being displaced from the rainforest. As a result, the researchers limited their Batwa [blood](#) samples to individuals born before 1991 who had actually lived in the forest.

Since collecting the [blood samples](#), Barreiro, Perry and other team members have returned to Uganda multiple times to present the results of their research with these communities.

The researchers cautioned that the Batwa and Bakiga populations likely diverged more than 60,000 years ago, long before the origination and spread of agriculture in Africa.

They hope to soon begin similar follow-up studies on additional pairs of hunter-gatherer and farming populations in other areas of the world.

More information: Genelle F. Harrison et al. Natural selection contributed to immunological differences between hunter-gatherers and

agriculturalists, *Nature Ecology & Evolution* (2019). DOI: [10.1038/s41559-019-0947-6](https://doi.org/10.1038/s41559-019-0947-6)

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