

Tiny fungi may have sex while infecting humans

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A fungus called microsporidia that causes chronic diarrhea in AIDS patients, organ transplant recipients and travelers has been identified as a member of the family of fungi that have been discovered to reproduce sexually. A team at Duke University Medical Center has proven that microsporidia are true fungi and that this species most likely undergoes a form of sexual reproduction during infection of humans and other host animals.

The findings could help develop effective treatments against these common global pathogens and may help explain their most virulent attacks.

"Microsporidian infections are hard to treat because until now we haven't known a lot about this common pathogen," says Soo Chan Lee, Ph.D., lead author and a postdoctoral researcher in the Duke Department of Molecular Genetics and Microbiology. "Up to 50 percent of AIDS patients have microsporidial infections and develop chronic diarrhea. These infections are also detected in patients with traveler's diarrhea, and also in children, organ transplant recipients and the elderly."

Of the 1200 species of microsporidia, more than a dozen infect humans. Their identity had been obscured because these tiny fungi cannot live outside of an infected host cell and they have a small number of genes which are rapidly evolving.

The Duke scientists used two genetic studies to show that microsporidia

apparently evolved from sexual fungi and are closely related to the zygomycete fungus in particular.

They found that microsporidia share 33 genes out of 2,000 with zygomycetes, which the microsporidia did not share with other fungi. This genomic signature also shows that microsporidia and zygomycetes likely shared a common ancestor and are more distantly related to other known fungal lineages.

In addition, these two types of fungi have the same sex-locus genes – and in the same order – in their DNA. Other genes involved in sexual reproduction are also present. The findings suggest that microsporidia may have a genetically controlled sexual cycle, and may be undergoing sexual reproduction while they infect the host, Lee said.

Lee said the next step is to explore the sexual reproduction of these species, which may cause more severe (more virulent) infections because they use the host's cellular environment and machinery as a safe haven in which to reproduce.

"These studies resolve the enigma of the evolutionary origins and proper placement of this highly successful group of pathogens, and provide better approaches to their experimental study," said senior author Joseph Heitman, M.D., Ph.D., director of the Center for Microbial Pathogenesis and director of the Duke University Program in Genetics and Genomics.

The team will pursue further studies with Duke genetic researchers Raphael Valdivia, Ph.D., and Alejandro Aballay, Ph.D., using cultured cells and *C. elegans*, a worm that researchers recently found is a natural host for microsporidia. "Using this roundworm may prove to be a useful way to study microsporidia genetics in a living creature," Heitman said.

Source: Duke University Medical Center

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