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Ploidy predicts lifestyle

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Parasites are more likely to be haploid, while host organisms are more likely to be diploid, according to results of a study in Proceedings of the National Academy of Sciences USA this week that seeks to explain the variety of ploidy found among eukaryotes (*Proc Natl Acad Sci USA* 2004, DOI:10.1073/pnas.0403151101).

Scott L. Nuismer and Sarah P. Otto, at the Universities of Idaho and British Columbia, respectively, integrated host-parasite coevolution into existing models of lifecycle evolution in order to generate testable predictions about whether a particular eukaryote should be haploid or diploid. Preexisting models focused only on the effects of mutation on an organism, but could otherwise make no predictions on levels of ploidy, according to the authors.

"It makes perfect sense in hindsight," Otto told us. Host-parasite interaction is selecting for a host that can recognize as many pathogens as possible, making it better able to clear itself of infection. On the other hand, in many types of interaction, a parasite is trying not to be recognized by a host. For the parasite, haploidy is therefore favored, Otto said.

"I think it's a very clever idea - and might be right," said Loren H. Reiseberg, at Indiana University. "I'm not completely convinced though, for a number of reasons." Reiseberg, who was not involved in the study, said that the idea correctly predicted that there should be a much larger number of genes involved in host resistance than in the elicitory antigens - molecules that elicit a response from the host - in parasites.

While this is seen in a typical mammalian or plant genome, Reiseberg said he felt there would be a much easier way of going about it than whole genome duplication. "It seems like there are more cost effective ways... There's been a whole lot of gene duplication that has nothing to do with polyploidy and genome duplication."

"This is not going to happen every day, obviously, that a genome duplicates," Otto replied, "but I agree with the essence that it is a longer-term process."

Otto said that their results also suggested that if an organism had a particular ploidy level, then that might suggest what sort of lifecycle it might have. "If an organism is diploid, then it is more likely to be able to evolve to be a host, and if haploid it is more likely to be able to evolve to be a parasite," she said.

"If diploidy is good for resistance, it seems to me that these models suggest that triploidy and tetraploidy and heptaploidy and so forth would be even better for a host," added Reiseberg. Otto agreed. "It's kind of diminishing returns, though. At one point, if you've already recognized and cleared your parasite, then having even more genes doesn't help you that much more. And there can be costs to having higher ploidy levels," Otto argued.

"I agree with the idea in general," Clifford Zeyl, from Wake Forest University, Winston-Salem, told us. But the relationships between the organisms are not well understood, he said, making it difficult to say where and when in evolutionary history something switched from being haploid to diploid. "Pinning down those switches is what is needed in order to be able to test the theory accurately. It's definitely

doable and that sort of systematics is going ahead more and more now with molecular tools," said Zeyl, who wasn't involved in the study.

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