Invasion of genomic parasites triggered modern mammalian pregnancy

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Genetic parasites invaded the mammalian genome more than 100 million years ago and dramatically changed the way mammals reproduce -- transforming the uterus in the ancestors of humans and other mammals from the production of eggs to a nurturing home for developing young, a new Yale University study has found.

The findings published online Sept. 25 in the journal *Nature Genetics* describe in unprecedented detail the molecular changes that allowed mammals to carry their developing young within the safety of the womb rather than laying them in nests or carrying them around in pouches.

"In the last two decades there have been dramatic changes in our understanding of how evolution works," said Gunter Wagner, the Alison Richard Professor of Ecology and Evolutionary Biology (EEB) and senior author of the paper. "We used to believe that changes only took place through small mutations in our DNA that accumulated over time. But in this case we found a huge cut-and-paste operation that altered wide areas of the genome to create large-scale morphological change."

The Yale team studying the evolutionary history of pregnancy looked at cells found in the uterus associated with placental development. They compared the genetic make-up of these cells in opossums — marsupials that give birth two weeks after conception — to armadillos and humans, distantly related mammals with highly developed placentas that nurture developing fetuses for nine months.

They found more than 1500 genes that were expressed in the uterus solely in the placental mammals. Intriguingly, note the researchers, the expression of these genes in the uterus is coordinated by transposons — essentially selfish pieces of genetic material that replicate within the host genome and used to be called junk DNA.

"Transposons grow like parasites that have invaded the body, multiplying and taking up space in the genome," said Vincent J. Lynch, research scientist in EEB and lead author of the paper.

But they also activate or repress genes related to pregnancy, he said.

"These transposons are not genes that underwent small changes over long periods of time and eventually grew into their new role during pregnancy," Lynch said. "They are more like prefabricated regulatory units that install themselves into a host genome, which then recycles them to carry out entirely new functions like facilitating maternal-fetal communication" Lynch said.

Provided by Yale University

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