A study on biological roles of GPI-anchor synthesis in the germline development of the nematode Caenorhabditis elegans

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Summary

Glycosylphosphatidylinositol (GPI)-anchor attachment is one of the most common posttranslational protein modifications. Using the nematode *Caenorhabditis elegans*, we determined that GPI-anchored proteins are present in germline cells and distal tip cells, which are essential for the maintenance of the germline stem cell niche. We identified 24 *C. elegans* genes involved in GPI-anchor synthesis. Inhibition of various steps of GPI-anchor synthesis by RNA interference or gene knockout resulted in abnormal development of oocytes and early embryos, and both lethal and sterile phenotypes were observed. The *piga-1* gene (orthologue of human *PIGA*) codes for the catalytic subunit of the phosphatidylinositol *N*-acetylglucosaminyltransferase complex, which catalyzes the first step of GPI-anchor synthesis. We isolated *piga-1*–knockout worms and found that GPI-anchor synthesis is indispensable for the maintenance of mitotic germline cell number. The knockout worms displayed 100% lethality, with decreased mitotic germline cells and abnormal eggshell formation. Using cell-specific rescue of the null allele, we showed that expression of *piga-1* in somatic gonads and/or in germline is sufficient for normal embryonic development and the maintenance of the germline mitotic cells. These results clearly demonstrate that GPI-anchor synthesis is indispensable for germline formation and for normal development of oocytes and eggs.