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Coevolution of Female and Male Reproductive Tract Anatomy in Cetaceans

Female cetaceans exhibit unusual vaginal morphology that varies in complexity across species. Multiple transverse folds typically project from the walls of the vagina into its lumen. The function of these folds and associated fornices is unknown. They may serve to exclude the entry of seawater into the female reproductive tract or affect the ability of the male to gain access to the cervical os during copulation. Transverse vaginal folds are present in some terrestrial artiodactyls, such as pigs, and in the hippopotamus, a species that appears most closely related to the Cetacea. However, transverse folding is notably absent in non-ungulate mammals, including other species that mate in the water (e.g. otters, a sea lion, and amphibious rodents examined to date). We report details of vaginal anatomy for 21 species representing 15 genera of cetaceans and explore the possibility that complexity has been influenced by sexual selection. Based on variation in the number, shape, width and depth of the folds, we constructed a vaginal complexity index and tested for a correlation with residual testes mass among species. Larger relative testes sizes are indicative of sperm competition in cetaceans, as in many other mammals. Using phylogenetic comparative methods, we found that more complex vaginas tended to be associated with larger relative testes across the cetacean phylogeny (PGLS $F_{1,19}$=7.42, p=0.01). These comparisons provide a framework within which the anatomy of additional species can be integrated to address the question of whether sexual selection has influenced the evolution of complex vaginal morphologies.