

Sex Wars: Correlated Evolution of Female Reproductive Traits and Manipulative Male Ejaculate

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Darwin (1871) tells us that mate choice is primarily about physical traits, such as weaponry, ornamentation and even vocalization. Providing the opposite sex with an external indication of fitness, these traits then form the predominant basis of which mate to choose; this is called **sexual selection**. In this sense the shape and structure of genitalia has seemingly little importance in terms of selection, or is at least secondary to the above. But nature is anything but straight forward, what if the sexes competed with each other? This is **sexual conflict**, seemingly ubiquitous and the consequence of particular traits evolving to enhance one sex's fitness whilst being costly for the other. Bed bugs show an extreme example of physical harm to females during mating. The fitness diminishing effects on females from mating are somewhat reduced by the female evolutionary response or resistance to male mating manipulations. Seed beetles also show a striking example of this in the form of male genital spine evolution, with female response being a thickening of the reproductive tract. Due to differing levels of investment, males and females usually differ in their strategies to maximize reproductive success, promoting the aforementioned process of coevolution and bringing a possible Darwinian oversight, to the forefront of importance – selection on the structure and function of genitalia.

A striking example of conflict cost is the manipulating effect of the male housefly (*Musca domestica*) on its mate. Cytological and radiolabeling studies have shown the migration of male seminal fluids, via holes in the wall of the reproductive canal of the females, directly into the female's body cavity, and thereafter to the brain, eliciting a response of resistance to re-mating. Suppression of re-mating behaviours may be counter to the females own interests – what does female evolution say about this?

We looked for correlated evolution between the male and female traits of seed beetles, which would indicate an evolutionary response to male manipulative ejaculates, and indeed the predicted arms race between the sexes. My study shows that the processing of, and therefore the attributes of male ejaculates by receiving females, does show correlated evolution with the female internal reproductive tract. This means there are selective and possibly divergent properties in the form of counter adaptations to male manipulations in females. Therefore, and in effect, highlighting the female internal reproductive tract as an arena for sexual conflict, and a stage for divergent coevolution. This highlights genitalia as the arena where sex wars are fought, an arena of rapid, divergent and intensely selective evolution occurs...

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