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“Call and Response”: A Case of Behavioral-Molecular Copulatory Dialogue?

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In sexually reproducing organisms, assessment of potential reproductive partners can influence not only whether a reproductive event (hereafter “coupling” to include both internal and external fertilizers) occurs between two individuals but also the quantity and quality of offspring it generates. In response to variation in phenotypic traits, reproductive partners may alter the composition, transfer, or retention of ejaculate components, or of eggs produced^[1]. These changes can affect the reproductive outcome including, in some cases, by affecting the behavior and/or physiology of the recipient long after coupling is over.^[2] “Cryptic choice” after the beginning of coupling can result from assessing phenotypes before the coupling, or assessing physical, behavioral, or chemical traits during coupling (e.g., body weight or size, vibrations or stroking, pheromones, or reproductive tract secretions).^[1] Although there are numerous studies of the male’s copulatory behaviors in this context, far less is known about the female’s.

In many species, each sex displays stereotypical movement patterns during coupling. Male behaviors during coupling include those systematically documented in arthropods such as: tapping and stroking females with legs or antennae, and thrusting and squeezing with the genitalia.^[1] These behaviors are hypothesized or demonstrated to associate with male reproductive success. Female arthropods’ behaviors during coupling include stridulation, shaking, and wing vibrations. For example, mating female spiders’ bursts of vibrations, produced by rapidly moving their pedipalps, are associated with changes in male behavior and post-copulatory reproductive success.^[3] Peretti and colleagues proposed that this “copulatory dialogue” impacts male competitive fertilization success, but little is known about the components and consequences of copulatory dialogue in most species.

In a new hypothesis paper, Kerwin and von Philipsborn^[4] extend the copulatory dialogue to include molecular and behavioral components. These authors recently investigated wing vibrations (hereafter “female song”) by female *Drosophila melanogaster* fruit flies during copulation.^[5] Their data were consistent with the idea that females evaluate males based on seminal fluid molecules (SFMs), some of which stimulate female song. In turn, exposure to

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Conflict of Interest

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female song during copulation may increase the amount of SFMs transferred by the male, as it caused females to have a longer latency to remating, consistent with receipt of more remating-inhibitory molecules from the male. The authors propose this as an example of both cryptic female choice (singing or not) and cryptic male choice (adjusting SFM allocation), mediated by a behavioral-molecular copulatory dialogue. If the authors' hypothesis is correct, it adds a new dimension to traits assessed by a female during coupling to advantage potential sires of her offspring: a rapid real-time assessment by her SFM receptors triggering her nervous system to generate or adjust her song, and by the male, in adjusting his SFM allocation in real time in response to the song.

The authors' hypothesis and their previous empirical paper increase attention on how female behavior during coupling can modulate reproductive success. They suggest that much like precoupling communication, dialogue during coupling could occur in different modalities, in this case involving both behavioral and molecular communication. Identification of these dialogues in the highly tractable *Drosophila* model system allows the use of its extensive genetic resources to mechanistically explore the causes and consequences of each part of the dialogue. For example, do variants of rapidly evolving SFMs differentially affect the likelihood of females to sing during copulation and/or females' expression or release of particular reproductive tract molecules? Do nonchemical triggers, such as stroking by the male's legs, also impact the female's song or associate with the male's response? Do recently mated females have a different propensity to sing than previously unmated females? This research, and similar studies in other taxa, could add another dimension to our understanding of the ongoing conversation between the sexes.

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