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Epigenetic maternal effects on caste development in Polistes wasps

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Caste differences in most social insects result from differences in environmental input, such as nutrition and exposure to pheromones. Recent evidence for *Polistes* wasps suggests that maternal vibrational signaling influences caste development. Early in the season, queens frequently perform antennal drumming on the nest. Larvae subjected to this drumming develop into adults with low, worker-like fat stores. Later in the season, when drumming is rarely performed, larvae develop into gynes (reproductive females), with high levels of fat. What is less understood is the extent to which this maternal drumming behavior influences caste-biased gene expression in the developing larvae, or division of labor among newly emerged adults. To test these effects, we subjected late-season nests, in which natural drumming had ceased, to three experimental treatments: (1) simulated drumming at a constant, low vibrational frequency; (2) vibration events at random frequencies; (3) no vibration (control); all received food ad libitum. We predicted that larvae experiencing vibrations that simulated drumming, but not random-frequency vibrations or no vibration, would exhibit worker-like gene expression related to fat metabolism and heat shock, and develop into adults that performed higher rates of colony-maintenance tasks. Our results confirmed these predictions, suggesting vibrational signals may be an epigenetic factor that can affect caste-related gene expression. This is the first study to show the potent influence of the maternal environment on the development of plasticity in adult behavior, physiology, and gene expression.