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The important role of predator-prey relationships in evolution

Complexity of predator/prey relationships play a key role in Darwinian evolution. Choanoflagellates, the closest unicellular relative to bodied animals, surprisingly contain genes needed for full body assembly. Bodybuilding genes involved in cell adhesion, cell communication, and the extracellular matrix can all be found within choanoflagellate organisms (Shubin, 2009). Because of these genes, unicellular choanoflagellates can attach to one another and form colonies (Koehl, 2020). It is thought that choanoflagellates form colonies to fare better against protozoan predators. In addition to being harder to eat, colonies also produce stronger currents moving in the water and capture more prey in the process. However, the downside to producing stronger water currents is a higher chance of being detected by motile protozoan predators. Choanoflagellates are thankfully flexible in their formations, forming colonies or remaining undetected unicellular creatures depending on the predators present (Koehl, 2020). Predator-prey interactions between choanoflagellates and protozoa therefore heavily influenced the important evolutionary transition from unicellular to multicellular life. Without flexibility and plasticity on the part of the choanoflagellates, multicellular life may not have been able to come about, and the struggle for dominance between choanoflagellates and protozoans may have resulted in a different fate.

Predator-prey relationships also play a role in the development of biochemical toxins, including venom. Animals have acquired the ability to use venom to capture prey, and because of this, prey have developed different forms of venom resistance over time. This predator-prey interplay has led to an “evolutionary arms race” between predators and prey, where gene duplication has contributed to the positive selection of new, novel venom types. However, using venom requires a lot of energy. In the absence of resistant prey, a few snake lineages have lost the ability to use venom altogether, opting for constriction or other non-chemical means to control its food source. Similarly, some scorpions have developed a metabolically inexpensive and defensive pre-venom mechanism to protect itself, saving its most potent venom for the most threatening of situations (Casewell, et al., 2013). Because both predators and prey face challenges, selective forces are at play on both sides and continue to influence the long-term trajectory of evolution. It is even thought that the predator-prey dynamic between snakes and mammals has led to humans developing a visual system ripe for detecting snakes more quickly than other animals in the environment (Isbell, 2006) (Kawai, et al., 2016). Understanding the complexity of predator-prey relationships is important because they so heavily play a role in how novel traits arise.

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