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Crustacean Pain

Commentary on **Crump et al** on *Decapod Sentience*

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Abstract: This commentary discusses the target article's methodology, the relevance of the claim that crustaceans lack a neocortex to the thesis that they feel pain, and the evaluation of the results of some trade-off experiments done with hermit crabs.

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1. Methodology. Crump et al (2022) propose a general framework for evaluating animal sentience and then apply it to decapods. Their framework strikes me as a good one overall and the application as sound. Recent (and not so recent) scientific discussions of whether fish feel pain have had a lot to say about the absence of a neocortex in fish, with some concluding that this shows that fish do not feel pain (Key, 2016). But, as Crump et al. point out, this pattern of argument is too fast. In the case of crustaceans, it would obviously be a mistake to conclude that they don't see because crustacean eyes are very different from mammalian eyes, so why should we conclude that crustaceans are not sentient because their brains are physically very different from mammalian brains? It is known that pain in humans typically causes a complex pattern of behavior (guarding, withdrawal, protection, trade-offs). It is also known that for pain to do this, information must be integrated and evaluated appropriately, for example, information about where the body has been damaged, the costs and benefits of responding in various ways, and decision making about the best course of action. Typically pain is also caused by tissue damage, which is registered by receptors (nociceptors) distributed throughout the body. Hence, if certain animals are found to have nociceptors and, in addition, to exhibit the relevant patterns of behavior associated with pain in mammals, that is evidence that they feel pain even if there are notable differences between their brains and those of mammals. The target article cites additional considerations that would strengthen the case for the presence of pain, but these seem to be less useful for making decisions in controversial cases, since these additional criteria would probably not be met (and do not in general need to be met for an animal to feel pain).

2. Absence of a neocortex. It might be replied that the absence of a neocortex in fish is valid evidence that fish cannot feel pain because a neocortex is necessary for consciousness in mammals. But there is also counterevidence, from Merker's (2007) review of consciousness in decorticate children. By the same token, the absence of a neocortex in crustaceans does not rule out pain in crustaceans.

3. Trade-off behavior. The target article raises a question about whether Elwood's work on trade-off behavior in hermit crabs (Elwood and Appel 2009, Magee and Elwood 2016) provides good evidence that crabs feel pain. The worry Crump et al. have is that while hermit crabs clearly do prefer some shells to others and will stay in the preferred shells even while receiving electric shocks there, they aren't less likely to leave a shell, if shocked, when there is a predator odor in the surrounding water. So, they don't trade off shock avoidance with predator avoidance. However, they are more likely to stay in their shells when exposed to predator odor than when exposed to a neutral odor. One explanation of this result is that in the latter case, in the presence of predator odor, there is only fear influencing the crabs' behavior and this causes them to stay put, whereas in the former case, in which there is both pain from the shocks and fear of a predator outside, the second of these does decrease the crabs' capacity to react to the first. (Think of being given stronger and stronger electrical shocks in a Milgram-style experiment (Milgram 1963). Once the shock reaches a certain level, the pain you feel causes you to press a red button which will stop any further shocks. In the first version of the experiment, you are given soothing instructions about the experiment as it proceeds; in the second version, you are not reassured, with the result that your fear in this case is higher. It could turn out that this makes no difference to the outcome: there is a certain level *L* of shock in both versions of the experiment such that the pain you feel in response to *L* is sufficiently intense that you immediately press the red button.) Crump et al. also find it curious that the crabs are as likely to stay in their shells in the presence of a high-concentration mussel odor as in the presence of the predator odor. One explanation of this might be that the crabs do not like the mussel odor if the concentration is high, and want to stay away from it. This dislike may have the same effect as fear in the case of the predator odor.

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