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## Pain in parallel

Commentary on [Key](#) on Fish Pain

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**Abstract:** Key's (2016) arguments against the view that fish feel pain can be shown to be fallacious by considering some damage-related behaviors in invertebrates. Pain may have different neural bases in different organisms, so the absence in fish of the cortical structures that might underlie pain in mammals does not settle the question of fish pain.

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Key (2016) holds that once we work out the neural basis for pain in mammals, some questions about pain in other animals can be fairly readily answered:

*"If 'fish pain' existed it would need to be consciously processed using at least the minimal neural architecture described above. Thus, in the absence of this architecture, fish cannot feel any sort of pain" (Key 2016).*

I will accept, for the sake of argument, all the claims Key makes about mammals. To assess how these claims bear on fish, I'll put on the table some other animals from further afield. In a 2012 study of hermit crabs, Elwood found that they could be induced to leave their shells by electric shock, but were surprisingly particular in how they did this, trading off the quality of their present shell with the intensity of shock, along with whether olfactory cues suggested that predators were about: "[I]t is clear that hermit crabs trade-off competing demands in their responses to electric shock in a way that cannot be explained by a nociceptive reflex response." He also reports "prolonged abdominal grooming at the site of a shock in hermit crabs that evacuate their shells" – grooming of a kind not seen when crabs are removed from their shell by other processes. A recent study Alupay, Hadjisolomou, and Crook (2014) showed that a crush of an arm in the octopus *Abdopus aculeatus* led to a family of wound-directed responses, some of which are familiar – grooming and protecting the damaged site, sensitization, long-term decreased thresholds for escape responses – and some more unusual: amputation of the arm.

Did these experiences feel like anything for the octopuses and crabs? It's very hard to know. Elwood and Alupay et al. are cautious. They note that in studies of other animals, long-term tending and grooming behaviors are often taken to be somewhat indicative of pain. Set that issue aside for a moment, though, as some conclusions can be drawn from this work without considering questions about the feel of pain.

The nervous systems of octopuses, crabs, and mammals all have different architectures. The most recent common ancestor of all three of these (the protostome/deuterostome common ancestor) probably lived over 600 million years ago (Peterson et al. 2008). This animal is unknown, but probably had a worm-like body-plan and a simple nervous system. Complex nervous systems have seen parallel evolution in several lines since then. Whatever the neural architecture underlying wound-tending and flexible protection of injured areas in mammals might be, it is almost certainly not homologous to the architecture subserving that function in octopuses. (Alupay's paper does not offer a view on what the neural basis might be, and notes that a plausible candidate, the vertical lobe, does not seem to be the relevant place.) Neurons themselves are present in all these animals, and almost certainly existed in their common ancestor, but the organization of these neurons into complex nervous systems occurred independently. These animals share flexible wound-tending behaviors, but do not share the neural organization that makes those behaviors possible. (The common ancestor probably had nothing resembling limbs, either.) So even before we consider subjective experience, we have learned that flexible, non-reflexive, and adaptive responses to damage and other noxious stimuli do not require the "neural architecture" (in Key's words) found in mammals. They do not require a brain with a mammalian architecture at all.

Let's now turn to the more difficult questions about subjective experience. How does this relate to Key's argument that fish do not feel pain? Like Elwood and Alupay et al., I don't profess to know whether crabs and octopuses feel pain. As a candidate hypothesis, though, suppose that the capacity to feel pain is present when an animal has a neural organization that mediates adaptive responses to damage-related stimuli in a flexible and non-reflexive way, including long-term modification of behavior in the light of the stimulus, perhaps also with some of the integration of information exemplified by the trade-offs in Elwood's crabs. That theory is a one-sentence place-holder (see also Klein 2015), but it will do for my purposes here. We know that this sort of capacity can be achieved by means of different neural architectures. It is "multiply realizable," as philosophers say. If so, then finding that the architecture that subserves these functions and hence underlies pain in animal X is not present in animal Y does not tell you that animal Y does not feel pain. It might have different mechanisms subserving that function, and pain might result both ways. Perhaps animal Y does *not* feel pain, because of subtle differences. That question will be hard to answer. But it is not answered by simply noting that the neural basis for pain in animal X is not found in animal Y. Key, however, wants to make an inference of that simple form in the case of fish. Even if the right story about pain is quite different from the place-holder I used above, the same questions will arise, and the invertebrate work shows that the neural bases for quite complicated responses to bodily damage can exist within different architectures.

Someone like Key might object to all this as follows: "Fish are vertebrates, as mammals are. Even if some arthropods and molluscs have a different neural basis for pain, fish lack the structures that are relevant *in vertebrates*. If you are a vertebrate, then in order to feel pain you need to have the same sort of thing that mammals have. Clearly you won't have the neural basis for pain seen in arthropods." But those considerations show nothing about whether there might be a somewhat different neural architecture underlying pain in fish. The category "vertebrate" is not sacred. Might fish have pain via different mechanisms? That is an interesting question, and I don't know the answer. But this is the sort of question that Key refuses to even address; he simply dismisses it.

I emphasize again that Key's claims about the cortical basis of mammalian pain were accepted here only for the sake of argument; other commentators are more qualified than I to assess this issue. Lastly, Key draws an analogy between erring on the side of generosity in our views about fish pain and an error made in a different context.

*"[A] scientific research article was published that purportedly linked measles-mumps-rubella (MMR) vaccination causally to autism. Although this link was subsequently disproven, many people continued to accept at 'face value' the causal association between MMR vaccination and the development of autism in children....This caused parents not to have their children vaccinated and subsequently led to a public health crisis. Thus, while initially accepting the idea that MMR vaccination causes autism may be considered a safe way to proceed (even if it is not true), it can cause catastrophic effects" (Key 2016).*

The irrelevance of this comparison is total. One could as well say that Key's position is akin to the views of those who were tardy in recognizing the dangers of thalidomide (a drug that causes birth defects when taken by pregnant women), as it took a while for its dangers to become completely clear. Key might reply that any comparison between his stance and that of a dilatory drug company is outrageous, and so it is, but his analogy with the MMR vaccine case is entirely on a par.

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