Stress must not be confused with pain

Our article "Stress is not pain" was a critique on a study by Elwood & Adams who exposed crabs to electric shocks and concluded that their study '. . .fulfils the criteria expected of a pain experience'. However, legally, the ability to feel pain often is used as a criterion to distinguish among species that require welfare laws or regulations from those that do not. Our concern is that policy-makers may make inappropriate decisions about crab welfare based on errors in this study.

The authors confused the terms 'stress' and 'pain'. Stress and pain involve two separate pathways in all animals – pain involves detection by specialized receptors called nociceptors and a conscious emotional response to that detection. Stress, on the other hand, is assessed by measuring hormonal or biochemical changes to the normal physiological state of an animal as it tries to adapt to changing environmental conditions. When we constrain an animal in a net, for example a racoon or a fish, the animal is stressed but it is not in pain. When a student is worried about an upcoming exam they may be stressed but they are not necessarily in pain. When we have a headache we may be in pain but are not necessarily stressed. Most stimuli used to study acute pain responses, including electric shock, do not result in a stress response. Stress and pain are two distinct independent systems.

Elwood & Adams measured levels of a chemical (lactate) in the blood of the crab (crab blood is referred to as hemolymph) and this chemical is sometimes used as an indicator of stress in crabs and they suggested that some of the crabs were stressed. However, elevated lactate in crabs occurs in many other conditions, for example, during any muscular activity or with an increase in water temperature. Other studies have shown the lactate levels measured by Elwood and Adams are within the normal range for the crab species studied. Furthermore, other studies have reported lactate levels that were 10 times higher than those reported by Elwood & Adams when crabs were exercised. It also is known that exposure to sudden stimuli (like electric shocks) can stop the heartbeat and breathing of crabs for short periods as a normal anti-predator response. Such responses would increase lactate levels, but none of the above would trigger nociceptors and hence by definition, they cannot be painful even if crabs could consciously and emotionally respond to nociceptor activation.

In summary, the methods used by Elwood and Adams could not distinguish between normal stress responses and pain, and there are reasonable alternative explanations for the elevated lactate that they reported. That is, alternative explanations for their results apparently were not considered and certainly were not tested experimentally. Their criteria used to define pain in crabs were inadequate. Thus, their paper was potentially misleading, resulting in a need to highlight these problems to policy makers.

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