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Do fish feel pain?

Can fish experience pain? This review summarises the findings from neurological, pharmacological and behavioural studies which suggest that fish can feel pain. Much remains to be learned about the mechanisms of pain perception in fish and, in particular, about the types of stimuli that fish find painful.

It is important to know whether or not fish can experience pain because that influences our views on how we should manage these animals. The anatomical, physiological and behavioural evidence that has contributed to our understanding of pain perception in fish is reviewed. Its implications for the marine fishing and fish farming industries have already been described (Farm Animal Welfare Council, 1996; Gregory, 1998).

Do fish experience pain?

There are three ways of trying to determine whether or not fish can experience pain.

It is necessary to establish whether or not fish possess the neurotransmitters, neurone types, and brain structures which are known to mediate or influence pain in other species. This approach does not give a precise answer, but if the conventional pain pathways are absent, it can be concluded that pain perception does not occur through those routes.

A second method is to inflict on fish stimuli thought to be painful, assess their physical responses, and determine whether those responses can be suppressed with analgesic drugs which in turn are blocked with analgesic inhibitors. A practical difficulty lies in determining, beforehand, the appropriate doses of analgesic and anti-analgesic likely to be effective in fish.

The third way is to condition fish to a potentially painful stimulus and examine whether they show aversion to the conditioned stimulus. One difficulty lies in distinguishing between pain and other forms of unpleasantness. This difficulty can, however, be overcome by examining whether the response is absent when the fish is pretreated with an analgesic which specifically inhibits pain without affecting motor control.

By collating observations from all three approaches, it should be possible to decide whether or not fish can feel pain.

Neuroanatomical evidence

Central nervous system

LaChat (1996) argued that, since the brains of fish do not have structures comparable with the human neocortex, they are unlikely to be able to consciously experience pain. This assumes that the neocortex is essential for pain perception and that the equivalent structure in fish and birds, the telencephalon, does not and cannot participate in pain perception. The basis for that assumption is not clear. There is little doubt that the telencephalon has sensory and higher functions such as learning and thinking. For example, Overmeir and Papini (1986) showed that avoidance learning in fish depended on a functional telencephalon. The absence of a true neocortex does not, therefore, mean that fish cannot perceive sensory and nociceptive stimuli.

Peripheral nervous system

In mammals two types of neurone relay nociceptive signals to the brain; those with myelinated axons and large cell bodies (A fibres), and those which are unmyelinated (C fibres). During evolution there has been a progression towards myelination of sensory neurones in vertebrates. This is important because it probably influences the type of pain that different species can experience. The initial sharp pain that occurs during an injury is mediated by the rapidly conducting myelinated A fibres , whereas, delayed aching pains are mediated by the slower unmyelinated C fibres. Neurones in the skin and viscera mediate pain signals and connect synaptically with ascending spinal neurones in the dorsal horn of the spinal cord. These are one of the first relay sites for a pain-provoking signal. The axons in the dorsal horn neurones are arranged in laminae. The outermost laminae (lamina I and II) include unmyelinated and myelinated neurones which respond to algogenic stimuli and project to the thalamus.

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This issue contains the Facts Sheet on Pain — assessment, alleviation and avoidance in laboratory animals. The Facts Sheet is also available as an offprint.