

Anaesthesia in fish larvae and nonpharmacological methods to immobility

The anaesthetic and analgesic protocols that are adequate for larval fish are usually not the same as those that are appropriate for adults, which is outside the scope of this review. In general, anaesthetics are only delivered to larvae via immersion. As larvae do not yet have fully developed gills, most of the absorption of the anaesthetic agents occurs exclusively through their cutaneous surface and yolk surface, which show a higher tolerance to immersive substances.¹

Most anaesthetics can be used to reduce stress, and some of them provide analgesia; however, non-pharmacological measures, such as refinement techniques, can also be used to manage stress. Tonic immobility is a technique that is used widely to induce the loss of muscle tone and immobilize elasmobranchs (i.e., sharks, skates and rays). It is mainly achieved by inverting the fish ventral side up. This method has shown benefits over chemical anaesthetics as it avoids the risk of overdose, does not require the uptake of chemicals and induces a minimal disruption of respiration, thus providing immediate full recovery. However, some studies reported a violent arousal from this state and additional research is needed to establish whether this is truly a non-stressful event.² Gradual cooling³ and electricity⁴ are other non-chemical methods that have been used to calm and/or immobilize fish; however, these techniques do not allow the achievement of a real anaesthesia state as they do not completely block nerve conduction, and fish may be able to feel pain.⁵ Moreover, the safety margins are narrow,⁶ and the animal's physiology may be affected.⁷ Researchers may consider these non-pharmacological methods depending on the experiment, but they will not be discussed in this review.

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