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## General anesthetics: from their modes of action, to cytotoxicity in a developing brain to healing

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Most surgical procedures necessitate the use of general anesthetics however, the precise modes of their actions and potential cytotoxic effects have not yet been fully investigated. Recently, concerns have risen regarding the potential side effects of clinical exposure of pediatric population to inhalation anesthetics and their impact on learning, memory and cognition in young and elderly patients.We have used both invertebrate and vertebrate neurons at the level of single pre- and postsynaptic neurons to define precise sites of anesthetic actions on ion channels, synaptic physiology and plasticity. We have also demonstrated that clinically used concentrations of anesthetics affect cellular viability and neurite outgrowth of developing neurons. We will present evidence that rat cortical neurons when exposed to clinically used concentrations of sevoflurane and desflurane affect neuronal viability and connectivity of synaptically connected neurons. Interestingly, these effects involved perturbation of mitochondrial function and structures. We further demonstrate that a mitochondrial division inhibitor Mdivi-1 not only protects mitochondrial integrity, but also plays a neuroprotective role against anesthetic-induced structural and functional neurotoxicity. This study highlights the importance of identifying anesthetic agents with the least toxic effects on developing brain networks and help design strategies that will mitigate their potential harmful effects, especially in young children.

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