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Differential Effects of 2,6-dichlorobenzonitrile and Methimazole on Olfactory Epithelium Neural Progenitor Cells

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The herbicide 2,6-dichlorobenzonitrile (DCBN) and the antithyroid drug methimazole (MMX) are both olfactory toxicants. However, the two toxicants differ in their cytotoxic sites within the olfactory epithelium (OE) and in their ability to cause irreversible olfactory receptor neuron (ORN) degeneration. Thus, DCBN causes destruction mainly at the dorsal medial meatus; the damaged tissue is not replaced by normal OE even at 6 months after the exposure. In contrast, MMX induces widespread destruction, but the tissue damage can be repaired within 4 weeks after exposure. The aim of the present study is to test the hypothesis that the differential recovery after exposure to the two toxicants is partly due to their differing effects on olfactory neural progenitor cells. To test this hypothesis, we determined whether the two types of olfactory stem or progenitor cells – horizontal basal cells (HBC) and globose basal cells (GBC) – are differentially impacted by the two toxicants. We discovered that, at 24 h after a single DCBN injection, the HBCs disappeared from the dorsal medial meatus, although they appeared to be intact in other parts of the OE. In contrast, at 24 h after a single MMX injection, the HBCs remained intact throughout the OE. For both compounds, the loss of GBCs accompanied the OE detachment in both dorsal and other parts, but there were no obvious compound-specific differences in the extent of the loss. These results suggest that the destruction of HBCs may contribute to the failure of the ORN regeneration after DCBN exposure.