**Olfactory toxicity in zebrafish**

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According to the German Federal Environmental Agency in Germany about 43.000 t of pesticides are sold and 2.5 kg of active ingredient are applied per hectare agricultural surface each year. By avulsions following heavy rain or via drainage systems these pesticides can find their way into the aquatic environment. Due to the fact that they often exhibit a lack of target specificity, they could negatively affect the aquatic flora and fauna.

For fish the olfactory system is of great importance, as it mediates a variety of essential activities and behaviors, for instance food detection, kin recognition, homing, the predator response and mating habits. Consequently, an impairment of olfaction can affect individual fish as well as whole populations.

The olfactory epithelium of fish is located in two pits, through which the surrounding water is flowing constantly. The olfactory receptor neurons, which are responsible for the detection of odorants, are situated within the olfactory epithelium and are only separated from the surrounding water by a thin layer of mucous. In such an exposed situation dissolved xenobiotics can interact with them as easily as natural odorants do.

Previous studies have shown that several metals and pesticides are able to influence the olfactory system of fish in environmentally relevant concentrations. However, underlying mechanism predominantly still remain unknown.

Therefore, the present study aims at understanding the toxic mechanisms, which lead to an impairment of olfaction by analyzing various endpoints at different levels of biological organization. Furthermore, suitable endpoints for the application in the risk assessment of chemicals are to be determined and evaluated. In accordance to the “3R” idea, aiming at the replacement, reduction and refinement of animal experiments another objective of this project is to investigate the suitability of zebrafish early life stages as alternative test organisms to adult fish.

As test substances the organophosphate chlorpyrifos and the pyrethroid permethrin are used. At the beginning the ability of exposed zebrafish larvae to smell and react to a food stimulus is analyzed using DanioVision, a system designed for high-throughput tracking of small organisms. In previous studies it was shown that zebrafish are able to detect certain amino acids and react to them with an increased swimming activity as early as 96 hours post fertilization.

In the following, changes in gene expression of both olfactory proteins such as the olfactory marker protein (OMP) and proteins related to oxidative stress, for instance peroxiredoxin 1 (PRDX1), are investigated in order to discriminate between specific olfactory toxicity and rather unspecific cytotoxic effects.