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Behavioral Effects of Oxidant and Reduced Chemorepellent on Mutant and Wild-Type Tetrahymena thermophila

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Abstract : Tetrahymena thermophila is a single-cell, eukaryotic organism that belongs to the Protozoa Kingdom. Tetrahymena thermophila is often used in signal transduction pathway studies because of its ability to model sensory input and the effects of environmental conditions such as chemicals and temperature. The recently discovered G37 chemorepellent receptor showed increased responsiveness to all chemorepellents. Investigating the mutant G37 Tetrahymena gene in various test solutions, including ferric chloride, ferrous sulfate, hydrogen peroxide, tetrazolium blue, potassium chloride, and dithiothreitol were performed to determine the role of oxidants and reducing agents with the mutant and wild-type cells (CU427) to assess the role of the receptor. Behavioral assays and recordings processed by ImageJ indicated that ferric chloride, hydrogen peroxide, and tetrazolium blue yielded little to no chemorepellent responses from G37 cells (<20% ARs). CU427 cells were over-responsive based on the mean percent of cells (>50% ARs). Reducing agents elicited chemorepellent responses from both G37 and CU427, in addition to potassium chloride. Cell responses were classified as over-responsive (>50% ARs). Dithiothreitol yielded unexpected results as G37 (37.0% ARs) and CU427 (38.1% ARs) had relatively similar responses and were only responsive and not over-responsive to the reducing agent test chemical solution. Ultimately, this indicates that the G37 receptor is more interactive with molecules that are reducing agents or non-oxidant compounds; G37 may be unable to sense and respond to oxidants effectively, further elucidating the pathways of the G37 strain and nature of this receptor. Results also indicate that the CSF most likely contained an oxidant, like ferric chloride. This research can be further applied to neuronal influences and how specific compounds may affect human neurons individually and their excitability as the responses model action potentials and membrane potential.

Keywords : tetrahymena thermophila, signal transduction, chemosensory, oxidant, reducing agent
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