**Miniaturized electrochemical detection platform for label-free evaluation of acetylcholinesterase inhibitor activity**

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Alzheimer's disease (AD) is a debilitating neurodegenerative disorder marked by impairments to cognitive domains related to learning, language and memory. Current FDA-approved AD treatments have focused primarily on restoring pathologically reduced levels of the neurotransmitter, acetylcholine, through the implementation of inhibitors that modulate activity of the enzyme, acetylcholinesterase (AChE) (1). Ellman's method is the standard colorimetric assay for evaluation of cholinesterase inhibitor (ChEI) activity. However, this detection method utilizes an extrinsic colorimetric agent, which suffers from a number of disadvantages including limited pH range and spontaneous non-specific chemical decomposition (2).

In the presented work, we addressed the limitations of Ellman's method by utilizing a low-cost, miniaturized electrochemical detection platform capable of measuring AChE activity by direct oxidation of the enzymatic product, thiocholine (TCh), on a gold nanoparticle (AuNP)-modified screen-printed electrode in connection with a miniaturized potentiostat (3). The clinically established ChEI, Donepezil, was used as a model inhibitor for validation between electrochemical and colorimetric systems. Measurements were performed by differential pulse voltammetry (DPV). The $IC_{50}$ values determined for Donepezil *in vitro* were comparable between detection methods (28 ± 7 nM by DPV; 26 ± 8 nM by Ellman's method). Sample selectivity on the gold surface was evaluated comparing peak potentials of a range of thiol-containing biological molecules including: glutathione, cysteine, homocysteine and methionine. Direct electrochemical oxidation of TCh is presented here as a highly effective alternative method of screening ChEI treatments for AD.

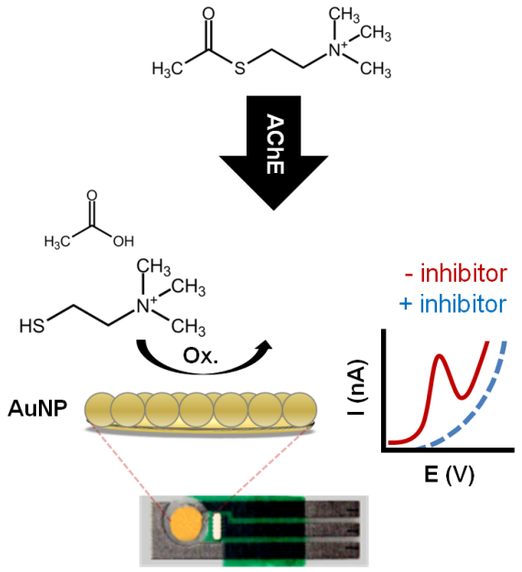


**Figure 1.** Scheme for the detection of AChE hydrolytic product, TCh, on a AuNP-modified screen-printed electrode.

**References:**

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