Title: Effects of high hydrostatic pressures on secondary structure of acetylcholinesterase with and without carbachol

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Abstract: Ultra-high hydrostatic pressures (to 13 kbar) were applied to acetylcholinesterase (AChE) in the presence and absence of 1 mM carbachol (a muscarinic agonist) by means of a piston-and-cylinder system designed for use with Fourier transform infrared spectroscopy. At normal atmospheric pressure, carbachol decreased the number of intramolecular hydrogen bonds and the anti-parallel beta-sheet structure. In the absence of carbachol, pressure dramatically increased the number of intermolecular hydrogen bonds but decreased the alpha-helical, beta-sheet, and anti-parallel beta-sheet segments. In the presence of carbachol, pressure had the opposite effects, decreasing the number of intermolecular hydrogen bonds and increasing the alpha-helix: beta-sheet ratio. Thus in the absence of an attached ligand, the enzyme molecule was vulnerable to pressure-induced distortions that would most likely impair its function. These effects were observed in the absence of a lipid component, indicating that pure proteins are vulnerable to pressure-induced changes in configuration that could affect function.

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