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Expansion of Possible Cellular Functions of Protein Interactome of Escherichia coli Glutaredoxin 3

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Abstract : In all living organisms, antioxidant defenses are orchestrated by the thioredoxin (Trx) and glutaredoxin (Grx) systems. The Trx system of Escherichia coli (E. coli) is comprised of Trx1 and Trx2, both reduced by thioredoxin reductase (TrxR). The Grx system consists of four Grxs (Grx1, Grx2, Grx3, and Grx4), all reduced by glutathione (GSH) except for Grx4, which is reduced by TrxR. Under normal conditions, the GSH reductase of the Grx system keeps GSH at its reduced state. NADPH+ provides the electrons for all reductions in the Trx and Grx systems. Although the role of the E. coli Trx system is widely known, the function of the Grx system reflects the main property of Grx1, which is the reduction of ribonucleotide reductase Ia (RRIa). E. coli Grx3 (encoded by grxC) may also reduce RRIa in vitro but with slow kinetics. The molecule may account for up to 0.4% of total soluble protein and has been the subject of extensive structural studies. Its biological function, however, remains unknown. Herein, affinity chromatography with monothiol Grx3 serving as bait was used to detect the interactions of Grx3 with other proteins. Different types of interactions were identified (covalent, weak, and strong non-covalent) that suggested novel functions for Grx3. In silico approaches were employed to validate selected interactions. In addition, total protein extracts from the null mutant for grxC and the wild-type strain were compared. The overall findings suggest that Grx3 is involved in various metabolic processes, protein synthesis, and stress responses, expanding the recognized functions of Grx3 beyond the possible reduction of RRIa.

Keywords : escherichia coli, glutaredoxin 3, interactome, thiol-disulfide oxidoreductase
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