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Free Radicals during the Oxidation and Reduction of Methylglyoxal-Modified Protein

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Protein glycation was studied with bovine serum albumin (BSA) as a model protein and methylglyoxal, a 3-carbon α-ketoaldehyde. Methylglyoxal reacted with BSA, forming a radical as observed in the reaction of methylglyoxal wtih L-alanine or *N*-acetyl-L-lysine. The radical signal was markedly increased upon reaction with cytochrome *c* and decreased when reacted with ascorbic acid. Glycated BSA was oxidized upon contact with cytochrome *c*. Oxygen did not participate in this process. The reduction process was biphasic and the initial rapid reduction was due to modified lysine residues. Lysine residue was mainly responsible for the browning and fluorescence of the glycated BSA. Glycation of BSA with methylglyoxal induced protein-cross-link. Furthermore, glycated BSA could still cross-link with cytochrome *c*, in the absence of free methylglyoxal, and this cross-linking reaction proceeded independent of cytochrome *c* reduction. Glycated BSA had an ability to catalyze the degradation of ascorbic acid, which is mediated by oxygen. Addition of SOD reduced the degradation rate of ascorbic acid.