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Reversible Inhibitory Effect of Hg^{2+} on the Microsomal H^+-ATPases

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H^+-ATPases play major roles in various cellular physiology. In order to characterize the effects of heavy metal ions on the activity of H^+-ATPases, microsomes were isolated from the roots of tomato grown hydroponically. The activity of microsomal H^+-ATPase was measured by an enzyme-coupled assay. Hg^{2+} inhibited the activity of microsomal H^+-ATPase as a dose-dependent manner, Fe^{3+} and Zn^{2+} inhibited the activity although they also blocked the activities of enzymes used in the assay, and Cs^+ and Ba^{2+} showed no significant effect. The effects of Hg^{2+} were evaluated to be inhibitory on the activities of both the nitrate-sensitive and the vanadate-sensitive microsomal H^+-ATPases. The Hg^{2+}-induced inhibition was reversible since the addition of dithiothreitol completely suppressed the inhibitory effect of Hg^{2+}. In the dose-response of Hg^{2+}, the total activities of microsomal H^+-ATPases were inhibited at the concentration of Hg^{2+} above 10 μM and completely inhibited by 1 mM Hg^{2+}. Apparent Ki values of Hg^{2+} on the nitrate-sensitive and the vanadate-sensitive microsomal H^+-ATPases were 58 μM and 80 μM, respectively.