

Photophysical Properties of Cytochromes c-553 and c3 and their iron-free forms

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The electron carrier proteins cytochromes c3 and c-553, a tetraheme and a monoheme protein respectively, extracted from sulfate-reducing bacterium *Desulfovibrio vulgaris*, Miyazaki were studied under fluorescence and UV/visible absorption spectroscopies as well as their iron-free forms over wide pH and temperature ranges in comparison with cytochrome c, hemin and microperoxidase-9.

The fifth and sixth axial ligands of the heme-iron, histidines or histidine and methionine for cytochromes c3 and c-553 respectively, were found to greatly influence the UV/visible absorption characteristics of the cytochromes. After removing iron atoms from the cytochromes c3 and c-553, most of the photophysical characteristics became the same. The different pH dependent fluorescence spectra for cytochromes c-553 and c3 were attributed to the fact that the microenvironment polarity around the heme is different. The cytochrome c3 showed higher tendency of protonation than c-553. Also at neutral pH, the coexistence of two components of the iron-free cytochromes c3 and c-553 were observed, which were attributed to the protonated and deprotonated forms.

It was clarified that spectroscopic properties of cytochromes c-553 and c3 together with their Fe-free forms were controlled by several factors such as the spin state of the iron heme, polarity of microenvironment, conformation, and protonation mainly through ligands. The present results may contribute a great deal to develop novel optoelectronic protein devices such as photochemical hole burning.