INVESTIGATION INTO THE ROLE OF THE IRON-SULFUR CLUSTER IN FAMILY 4 URACIL DNA GLYCOSELASES

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Hydrolytic deamination of cytosine to uracil is the second most frequent type of DNA damage. Uracil DNA glycosylases (UDGs) are the enzymes responsible for repairing this type of damage. The unique feature of the recently discovered Family 4 of these enzymes, is that most of the enzymes contain a [4Fe-4S]2+ cluster and a conserved pattern of cysteine residues, which are believed to serve as ligands to the cluster. The role of the iron-sulfur cluster in these enzymes is unknown, although it has been suggested that it has only a structural role. In order to investigate the role of the cluster in Family 4 UDGs, the four cysteine residues of the enzyme from the hyperthermophilic archaeon, Archaeoglobus fulgidus, were mutated. Steady state and single turnover conditions were used to examine the kinetic behavior of the WT enzymes and these mutants. Spectroscopic studies were also done to explore the nature of the cluster and its ligand environment. Studies of the alanine and serine mutants at position 17 indicate that the cluster serves more than a strictly structural role in Family 4 UDGs. We suggest an indirect role for the cluster in influencing the activity of the enzyme, such as a role in damage recognition and binding.

PRODUCING A BETTER EXPORTER: A COMPARATIVE STUDY OF BLENDER-OSG LIGHTING MODELS

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In 3D computer graphics, mathematical representations known as lighting or illumination models approximate the physical laws governing the interaction of light and matter. A lighting model calculates the color of a surface based on the characteristics of the scene illumination and the reflective properties of the surface. It is not uncommon for graphical software packages to use different sets of lighting models. However, a problem emerges when multiple software applications are being used in conjunction with each other and each application is executing a different model. The inconsistency in the lighting structure can generate unexpected results in the final rendered images.

Blender and Open Scene Graph (OSG) are 3D graphics packages that are used jointly to develop high performance graphics applications. Blender’s model objects are exported into OSG for higher level scene graph representation and rendering. Currently, there is a visible disparity between Blender and OSG renderings. To reduce the differences, the study first compares the lighting models of both applications. Second, based on the analysis, the study then presents a process for translating between the two models with the objective of generating renderings in OSG that are analogous to Blender’s final render. The result is a Blender exporter that allows a user to export a set of objects and their material properties from Blender into OSG resulting in the same material appearance in both applications, thereby enhancing Blender’s compatibility with OSG.