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Cholesterol Oxidase: A New Look at Flavoenzyme Catalysis at Atomic and Sub-atomic Resolution.
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Cholesterol oxidase from *Streptomyces sp*. (SCOA) is a 56 kDa protein with a non-covalently bound flavin adenine dinucleotide (FAD) prosthetic group, known to be reversibly deactivated at pH > 7.5. To understand the effect of pH on cholesterol oxidase activity, six structures (within the range of pH 4.5 – 9.0) were determined at atomic resolution. Diffraction data was also extended to 0.82Å, revealing electron density features not visible in lower-resolution structures.

The significant increase in data available at sub-Ångstrom resolution enables a more complex approximation of atoms than the more routinely used Indepentent Atom Model. At atomic resolution, atoms are modeled as anisotropic ellipsoids, while at sub-atomic resolution the multipole atom model can be used. Important features, such as catalytically significant hydrogen atoms and resonance electron density become apparent. This level of detail results in a more accurate description of key structural features that facilitate efficient catalysis for the enzyme. This presentation will address the various approaches to ultra-high resolution refinement and its contribution to the understanding of enzyme catalysis and, specifically, redox chemistry.