BRIDGES
Mathematical Connections
in Art, Music, and Science

Molecular Sculptures

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Biological macromolecules are essential for life but are too small to be seen by the unaided eye. While this year marks the 30th anniversary of the use of computer networking to link the science (crystallography), the data base (Protein Data Bank) and the graphics display that makes it possible to visualize models of molecules, graphical images are inherently two-dimensional and are generally ephemeral.

We here report initial efforts to create scaled molecular models in natural materials (wood, stone, metal, etc.). Previous results include *bas relief* and 3-D models of amino acids and enzyme active sites atoms (http://www.tamu.edu/struct/research/molecular-sculptures degrades organophosphate nerve gasses and pesticides /acs-examples/examples.htm) and especially a scaled model of the active site of an enzyme which degrades such toxic compounds: (http://www.tamu.edu/struct/research/molecular-sculptures/acs-OPH/oph-wild.htm).

Over the next few months we shall be constructing scaled models of the active site of two enzymes, prostaglandin synthetase and insect cellulase: For several hundred years it has been known that an extract of willow tree bark (aspirin) helps relieve pain and reduce fevers. This is also the 30th anniversary of the discovery of the mode of action of aspirin, which covalently blocks access to the active site of the enzyme, prostaglandin synthetase. We have been commissioned by the Boston Museum of Science to construct a scaled model of this enzyme:
http://www.tamu.edu/struct/research/molecular-sculptures/scaled-models/acs-models

For most of the last century, "conventional wisdom" has held that termites rely on symbionts to supply the enzymes (cellulases) needed to decompose wood cellulose. It is not widely known nor appreciated, but scientists in Australia and Japan have demonstrated that termites produce endogenous cellulase. We have determined the structure of the first insect (termite) cellulase, from *Nasutitermes takasagoensis*, to 1.4Å resolution. This model will be used to help teach high school chemistry classes.
The methods used to construct these models have been briefly described:
http://www.tamu.edu/struct/research/molecular-sculptures/acs-process/process.htm

The inherent beauty of molecular architecture inspires us to abstract and depict atoms in wood and stone, *e.g.*, the trinitatis series. Future work will include exploring other materials and depicting atomic interactions in eye-pleasing forms.

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