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IN FOCUS

Inorganic protein scissors

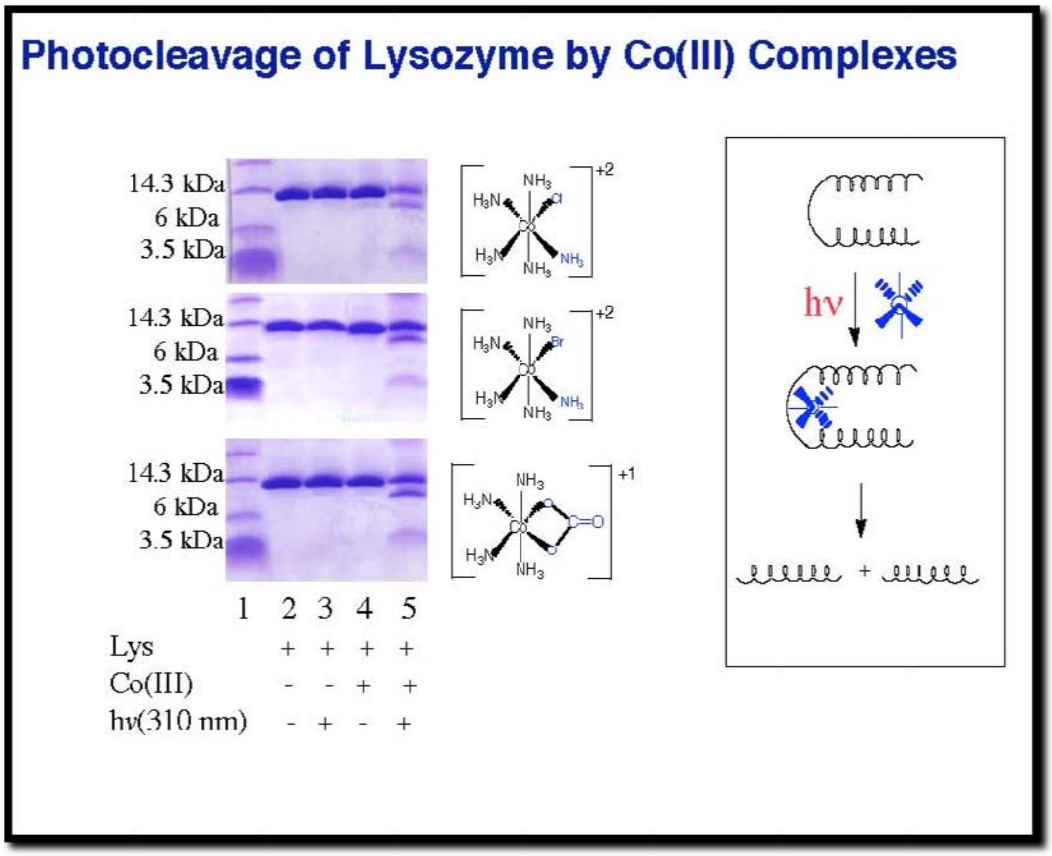
Think selective cleavage of peptide bonds and the first few names that come up are trypsin, chymotrypsin and pepsin. That the same function is performed by an inorganic complex produced by the gram every year in chemistry labs around the country could be news to many.

Tetraaminecarbonatocobalt (III) nitrate and other related cobalt complexes cleave chicken egg white lysozyme into two fragments on irradiation at 310 nm, as shown by two sharp bands in SDS-PAGE. Product yields increased with irradiation time and complex concentration. N-terminal sequencing of the fragments indicates that the larger fragment consists of the N-terminal of lysozyme while the smaller fragment was shown to be VAXRN, i.e. cleavage occurs between Trp 108 and Val 109.

Irradiation of lysozyme at 310 nm followed by $[Co(NH_3)_6]^{3+}$ treatment in presence of Mg^{2+} gave product bands of lower intensity in SDS-PAGE, indicating that $[Co(NH_3)_6]^{3+}$ and Mg^{2+} compete for a common binding site.

Selective cleavage by Co (III) complexes is tipped to be a promising methodology to locate magnesium binding sites on proteins.

Ref: Kumar C. V., et al, *Inorg. Chem.*, 44, 825 (2005)



Successful vitrification of pure Germanium metal may open a new window to our understanding of glass-formation...

Over the last fifty years, scientists have debated on the factors that dictate the fate of a fluid that is being cooled – crystallization (long range order) or vitrification (disorder). While metal oxides and chalcogenides have been preferentially vitrified, stable glass-phases have not been obtained for pure metals. The stress on pure metals is laid because vitrification of single component, mono-atomic fluids could offer useful insights into the factors governing glass-formation.

It has been known that a fast rate of cooling of the fluid may help bypass crystallization. Conversely, the time taken for crystal nucleation may be increased by lowering the melting point and thereby ensuring that atomic motion remains sluggish and slight disorder is maintained at the fluid-glass transition point. One way of reducing melting point of a substance is by increasing the pressure. However, this is true only for substances that experience a decrease in volume on melting, e.g. Si, Ge, Se, H_2O, etc.

Molecular simulations involving modification of interaction potential lowered diffusivity of an atomic liquid, Stillinger-Weber silicon, led to non-crystallization. However, failure to vitrify Silicon in experiments led the team of researchers to focus on Germanium. As reported recently pure Germanium metal has been successfully vitrified over a range of high pressures, when cooled quickly.

CHEMCOS THE CHEMICAL SOCIETY, IIT DELHI April 2008 Issue I

The study, however, does not report the structural details of the as-obtained glassy state.

Further studies on this issue may involve investigations on how changes in local orientations of fluid molecules lead to crystallization or glass-formation.

Ref: Bhat M. H., et al, *Nature*, 448, 787 (2007)

Mechanism of nerve dependence of limb regeneration unveiled

The nervous system is usually associated with the task of carrying information from nerve cells to their sensory and motor targets. However, stem cell researchers are waking up to the crucial role that nerve cells play in regeneration of amputated limbs in Salamander (amphibians with slender bodies and long legs; see figure alongside). Humans can regenerate certain parts of the liver, muscles and bones. However, human regeneration is limited and pales in comparison to that demonstrated by Salamander. The latter can regenerate limbs, parts of their heart, retina and even the eye lens!

The nerve dependence of limb regeneration was discovered in 1823 and gained momentum in the 1940s. It was demonstrated that both motor and sensory nerves supported regeneration; and nerve conduction and neurotransmitter release were not necessary. It was reasoned out that nerves played an important role because the regenerated limb was to be adequately supplied with nerves in order to function normally thereafter. However, a firm mechanism of action still eluded researchers, who then started seeking the growth factor (a protein) that communicated between the nerve cells and the regenerating tissue.

Anoop Kumar and colleagues[1] claim to have identified the crucial protein that rescues denervated stem cells and induces regeneration. This n(ewt)AG protein is expressed by Schwann cells (a variety of glial cells that provide insulation to axons) on amputation, and found in the epidermis at the tip of the amputated region. nAG induces proliferation of isolated stem cells taken from the tip of the amputated limb. On injecting plasmid DNA that encodes nAG and passing appropriate current across the limb, missing glands reappear and the limb regenerates. It will be interesting to allow an amputated limb to regenerate and then knock out the gene encoding nAG in order to investigate the exact function of nAG.

Ref: Kumar A. et. al., *Science*, **318**, 772 (2007)

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