Silica particle sparks life in protein

Tiny formless particles in water solution take on a well-ordered and functional structure as soon as they come into contact with nanoparticles of silica. A unique breakthrough by researchers at Linkoping University in Sweden creates new potential in medicine and biochemistry and at the same time provides a new piece of the puzzle in theories about the origins of life.

Normally, inorganic materials like silica are unwelcome in biological systems, since they disrupt the form and function of proteins.

“We wanted to reverse the thinking and try to design proteins that take on their function only after encountering an inorganic surface,” says Bengt-Harald Jonsson, professor of molecular biotechnology.

He directs the research team that is now presenting its findings in *Angewandte Chemie*.

The team designed a peptide (a short protein) with a specific distribution of positive charges. The peptide was mixed into a solution of spherical silica particles, about 9 nanometers (billionths of a meter) across. When the peptide was free in the solution it had no structure whatsoever, but when it connected with the negatively charged silica ball it assumed the form of a helix. The result was a complex of a silica particle and a functional protein.

When the researchers added amino acids to their peptide, the complex took on the properties of a catalyst, a function similar to that of enzymes in living cells.

The method has several possible fields of application:

-- recognition of organic molecules
-- catalyzing of chemical reactions with precise control
-- target-seeking particles for medical uses

But the Linköping University scientists’ successful experiment may also shed light on the eternal question of the origin of life. Particles of clay containing silica in the ‘primeval soup’ may have attracted unstructured peptides with amino acids attached and given rise to the first functional proteins.

“We know that RNA (which plays a decisive role in the transfer of information in cells) can bind with clay particles whose surfaces have negative charges. The probability of peptides with amino acids having formed well-defined structures with the clay at an early stage of development is considerably greater, since they are more diversified than RNA is,” says Bengt-Harald Jonsson.

Citation: M. Lundqvist, P. Nygren, B.H. Jonsson, and K. Broo: Introduction of structure and function in a designed peptide upon absorption on a silica nanoparticle, *Angewandte Chemie* 2006, 45.

Source: Linköping University