Università degli Studi di Torino
Dipartimento di Chimica
Via P. Giuria, 7 10125 Torino Italy

chimica

Prof Gianmario Martra
phone: +39 0116707538
mobile: +39 3388573863
e-mail: gianmario.martra@unito.it

AVVISO DI SEMINARIO

Prof. Jean-Francois Lambert

del Laboratoire de Réactivité de Surface, Sorbonne Université - Parigi

"Protometabolism on mineral surfaces: selective peptide formation and other studies"

Lunedì 26 novembre, h. 14.30, Aula Disegno

Among the scientific questions related to the origin of life on Earth, the emergence of metabolism is particularly puzzling. One possible answer is the hypothesis of « metabolic continuity ». It states that currently extant metabolic pathways are essentially homologous to their prebiotic precursors. While this hypothesis is in competition with other scenarios, it is in principle testable and offers the advantage of parcimony (in the sense of Occam's razor).

Many elementary steps in the construction of complex biomolecules are condensation reactions, wherein elementary building blocks react through bond formation between two functional groups accompanied by the elimination of one water molecule: amino acids condensation to peptides (reaction of a carboxylic acid with an amine moiety), phosphorylation and nucleotides polymerization to DNA (phosphoric acid with sugar alcohol), but also analogues of nucleobase synthesis (amines and carboxylate of an amino acid with carbamate molecules). The crucial factor in carrying out such reactions outside of the framework of a living cell is to be able to impose conditions of low water activity so that water elimination can draw the reaction equilibria towards condensation. This can easily be accomplished by simple drying when the participating molecules are adsorbed on the surface of minerals such as silica or alumina.

While the occurrence of prebiotic condensations on surfaces has been demonstrated several decades ago, their true potential depends on a thorough understanding of their mechanism. This raises several questions, two of which will be discussed in more detail:

- Can selectivity be achieved when starting from a more or less complex mixture of biomolecules? This question will be illustrated by recent results on the co-condensation of amino acids on silica, especially with the (Glutamic acid + leucine) and (aspartic acid + valine) systems. In particular, these systems may induce the formation of long linear oligopeptides that may later develop self-organising properties.
- How general is the observed reactivity? It will be shown that nucleotide synthesis from its components, nucleotide condensation, and dihydroorotic acid condensation (a step in biochemical pyrimidine synthesis) can all be accomplished on surfaces. Another, related question is: what minerals are able to induce "interesting" condensations, and what are the crucial surface properties to be sought?

The in-depth study of such systems is not only relevant to origins of life studies, but more generally to assess the prospects for self-organisation in chemical systems.

Il Direttore
del Dipartimento di Chimica

Prof. Marco Vincenti

Il responsabile
scientifico

Prof. Gianmario Martra