

DEPARTMENT OF MOLECULAR SCIENCE AND NANOSYSTEMS

Seminars of the PhD Programme in Chemistry

Copying vs self-assembly: What's the fundamental difference?

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Abstract

Producing copies of molecular polymers is an essential process within life, occurring during replication, transcription and translation, the three key steps of the central dogma of molecular biology. In such a process, monomer units (eg. nucleotides or amino acids) assemble into a specific sequence determined by the sequence of a template polymer. An apparently related, and also biologically relevant process, is self-assembly. Here, monomer units such as capsid proteins come together to assemble into a well-defined structure (such as a virus capsid).

In recent years, synthetic self-assembling systems of remarkable complexity have been demonstrated using nucleic acid nanotechnology. In the process, important underlying design principles have been identified. However, a synthetic system that produces polymer copies in an autonomous way is yet to be developed - suggesting that our understanding of such vital systems is incomplete. In this talk I shall explain the fundamental differences between copying and self-assembly in terms of key aspects of the underlying thermodynamics. These differences impose profound constraints on copy processes, and shape the design space of basic copiers that we might wish to engineer.

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