# DESIGN AND APPLICATIONS OF DIGITAL POLYMERS

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## ABSTRACT

Information-containing macromolecules are polymers that contain a message encrypted in their comonomer sequences.[1-2] The archetypal example of such a polymer is DNA, which stores genetic information in living organisms. However, DNA is not the only polymer that can contain molecular information. In principle, a string of information can be created in any copolymer using predefined monomer alphabets. For instance, binary information can be written in a polymer using two monomers defined intentionally as 0- and 1-bit. Yet, such polymers have to be monodisperse and perfectly sequence-defined. In addition, the message stored in their chains should be easily and rapidly read.

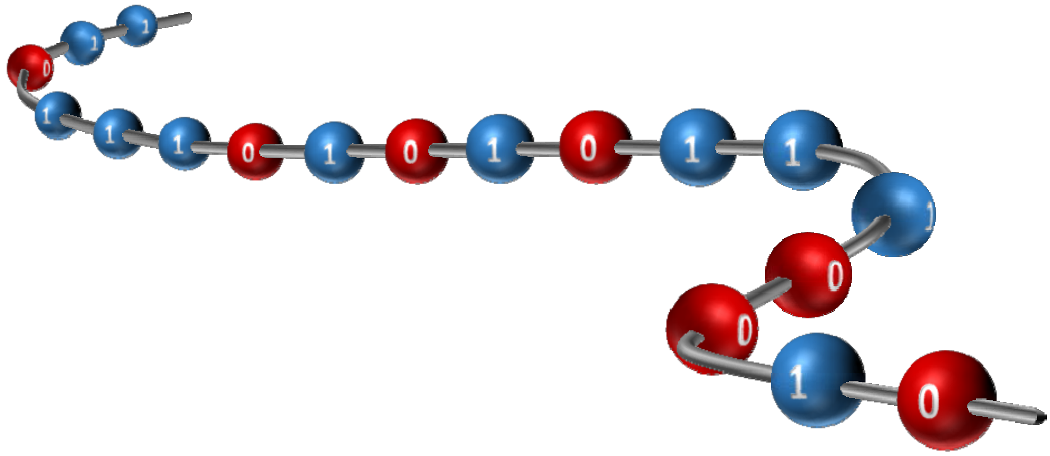

**Figure 1.** Schematic representation of an information-containing macromolecule that stores a monomer-encoded binary message. Blue and red spheres represent digital monomer units.

In this lecture, I will present recent achievements obtained in my laboratory for the synthesis of digital polymers. Recent progress in the field of sequence-controlled polymers allows synthesis of non-natural macromolecules with precisely controlled primary structures.[3-6] For example, uniform sequence- coded polymers, such as poly(phosphodiester)s, poly(triazole amide)s, poly(alkoxyamine amide)s, poly(alkoxyamine phosphodiester)s and polyurethanes can be prepared by solid-phase chemistry.[7] In addition, the sequencing of digital polymers by tandem mass spectrometry or using nanopores will be discussed. Examples of applications will be also presented in this lecture, for example the development of oligomer barcodes for traceability and anti-counterfeiting applications.

**References**:

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