

# Preface

Inorganic polymers are a relatively small group of molecules as compared to the large group of organic polymers. They comprise both short-chain polymers and long-chain polymers with one type of atom or two or more types of atoms in the polymer backbone. Examples are homochain polymers, e.g., polysilanes, polygermanes, polystannanes, and polysulfides, and heterochain polymers, e.g., polysilazanes, polyphosphazenes, polyborazylenes, and polythiazyls. Many of these polymers are not soluble or not stable in water, but some of them can be formed in aqueous solution even by enzymatic reactions, for example, inorganic polyphosphates and polysilicates. Previous studies on the biological effects of polymeric compounds mainly focused on organic polymers. Recent results revealed that also inorganic polymers may possess biological activity. Much effort on the study of inorganic polymers focuses on the application of such polymers in nanotechnology or, in the field of biomedicine, on their application in drug delivery, e.g., of silica. Inorganic polymers which are biologically active can be formed by living organisms, e.g., arsenicin A, a polyarsenic compound isolated from a marine sponge, or polymeric silicate ("biosilica") formed by diatoms and siliceous sponges, or polyphosphates that have been identified in numerous organisms, from bacteria and yeast to plants and humans. These polymers often have multiple functions, for example, inorganic polyphosphates can be used as antimicrobial compounds, as a source of energy-rich phosphate, as a modulator of gene expression, as a chelator for metal cations, or in mineralization of bone tissue and in blood coagulation and fibrinolysis, and silica as skeletal element with unique property combinations (mechanical stability and light transmission). The research on these compounds is currently in a rapid development. Several European consortia are concerned with the investigation and development of products made of such polymers, in particular polyphosphates and polymeric silica. In this volume of the series "Progress in Molecular and Subcellular Biology" recent developments in the state of knowledge on selected inorganic polymers are summarized. These polymers

include poly(arsenic) compounds, inorganic polyphosphates, polyoxometalates, polyvanadates, and polysilicates (biosilica). The biocompatibility, bioactivity, and stability of the latter polymers even allow a possible application in rapid prototyping procedures for the production of customized implants in surgery and dentistry.

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Biomedical Inorganic Polymers

Bioactivity and Applications of Natural and Synthetic

Polymeric Inorganic Molecules

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2013, X, 303 p. 91 illus., 50 illus. in color., Hardcover

ISBN: 978-3-642-41003-1