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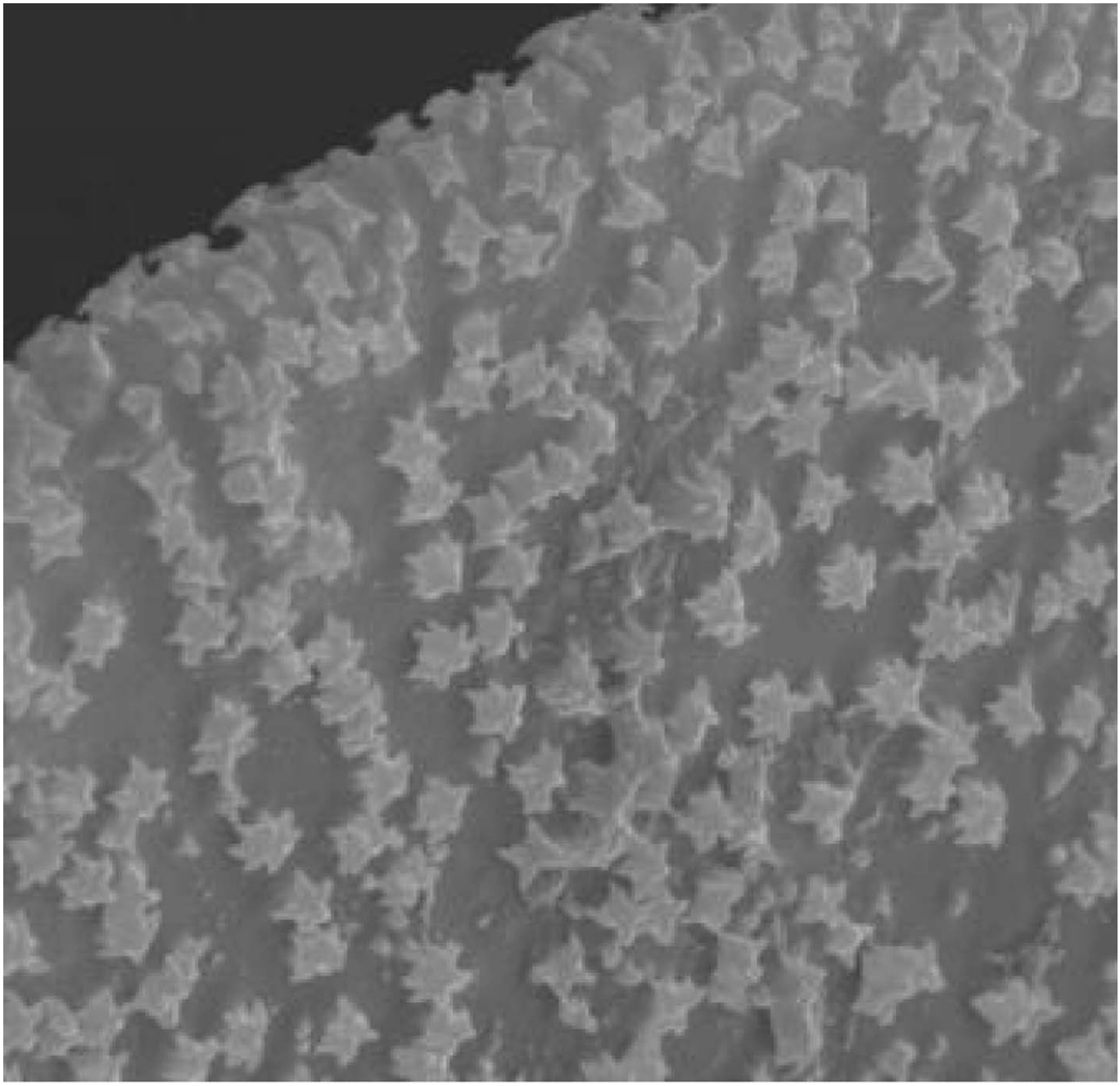
Editorial and preface

First TMS symposium on biological materials science ☆



☆ Picture: Soft corals and tunicates are marine invertebrates that have flat plates (apidasters) and spiny structures (spicules). Picture shows an apidaster with small star shaped features. Courtesy Evelyn York, Scripps Institution of Oceanography.

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This volume contains the proceedings of the First Symposium on Biological Materials Science, held during the Annual Meeting of TMS (February 13–17, 2005, San Francisco, CA). This inaugural symposium marked the entry of TMS into this exciting new field and is the first event hosted by the newly formed Biological Materials Committee. The symposium was cosponsored by the EPMD and SMD Divisions of TMS, and partially supported by TMS funds. The principal theme of this symposium was the interaction of materials and biological systems, an area that is emerging as a new frontier in Materials Science and Engineering. The Biology-Materials connection is a fertile field of research with limitless possibilities.

The structures and properties of biological materials have an unmatched breath and complexity. The structure–property relationships in these materials are only starting to be established at the present time. Present thrusts toward developing novel biomaterials with unique tailored properties and improved biocompatibility are yielding exciting concepts. *Biomimetics* is a newly emerging interdisciplinary field in which lessons learned from biology form the basis for novel material concepts. This new field of biomimetics investigates biological structures, establishing relationships between properties and structures in order to develop methods of processing and microstructural design for new materials. It is giving rise to new materials concepts, including multifunctional and hierarchically structured materials, and new materials synthesis/processing approaches.

Many properties of biological materials are far beyond those that can be achieved in synthetic materials with present technologies. Biological organisms produce complex composites that are hierarchically organized in terms of composition and microstructure, containing both inorganic and organic components in complicated mixtures. These totally organism-controlled materials are synthesized at ambient temperature and atmospheric conditions. The unique nano and microstructures in biological composites and the resulting properties have been, until recently, unknown to Materials Scientists, but are now beginning to stimulate creativity in the development of future synthetic materials.

The symposium proceedings encompass the following themes:

- Biological materials
- Biomaterials (Bio-implants)
- Biomimetics.

The symposium was structured around three keynote lectures, two of which appear in the present proceedings as introductory chapters. These are the lectures delivered by Profs. Suresh (MIT) and E. Arzt (MPI):

- S. Suresh, MIT: Mechanical properties of blood cells
- E. Arzt, MPI: Adhesion mechanism in geckos.

Following these two keynote chapters, there are the following ten invited contributions:

- Robert Ritchie, UC Berkeley (Mechanical properties of bone and teeth)
- Jim Earthman, UC Irvine (Implant materials)
- Kalpana Katti, North Dakota State U. (Nacre-Finite Element Modeling)
- G. Mayer, Univ. of Washington (Bioinspired composites)
- Henry Rack, Clemson (Titanium alloys for biological applications)
- A.P. Thomsia, Lawrence Berkeley Lab. (Teeth)
- M. Snead, USC. (Protein self-assembly)
- C. T. Lim, National University of Singapore (Cell biomechanics)
- S. Jin, UC San Diego (Nanotubes for bone growth)
- R. Narayan, Georgia Tech (Hydroxiapaptite).

These, are, in turn, followed by twenty contributed papers. Thus, we feel that this volume represents an extraordinarily broad group of contributions that are authored, in many cases, by leading researchers in the field.

We are grateful to Mr. Hussam Jarmakani for having patiently and competently managed the entire and extensive editing process. At the end, and as a result of this effort, thirty-two contributions resulted from this effort. We thank Professor Paul Calvert, MSEC editor, for accepting these proceedings into the journal. We also thank the generous eleventh hour support by Dr. John Prater, US Army Research Office. We owe you a significant volume of a biological fluid originating from complex reactions involving water, hops, and wheat. All manuscripts were thoroughly reviewed and many were substantially modified as a consequence of this process. We hope that this document is both timely and important. We thank the participants, authors of the papers in these proceedings, and reviewers. Their collective effort resulted in a most impressive volume which should contribute significantly to the advancement of this field.

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Marc A. Meyers*
Sungho Jin
UC San Diego, United States
E-mail addresses: mameyers@ucsd.edu (M.A. Meyers), Jin@ucsd.edu (S. Jin).
*Corresponding author.

Roger Narayan
Georgia Tech, United States
E-mail address: roger.narayan@mse.gatech.edu.