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The Rational and (Sometimes) Irrational Design of Biomaterials for Medical Applications

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(Cooper Union for the Advancement of Science and Art, NYC)

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Room Natta, Bulding 6
Piazza Leonardo da Vinci, 32 Milano

live | online link will be emailed to registered participants

Registration Form

Info: www.cmic.polimi.it

Hip implants, synthetic heart valves, and drug eluting wafers for the brain. What do these all have in common? Each one is a biomaterial that is designed to interact with a biological system. Physicians often seek to cure ailments or improve a patient's quality of life by employing biomaterials. Classically, the process of biomedical device innovation is driven by clinical demand in which a patient or physician defines a need, which provides a basis for an invention. Yet, it is here that the development of new biomaterials diverges. The first path to synthesizing a new biomaterial includes clearly defining a medical need and then rationally designing the material based on the need. This has resulted in the development of common products such as modern contact lenses and biodegradable surgical sutures. The second path involves developing unique materials that are biocompatible and do not elicit an immune response; however, these materials often do not have clearly defined medical applications or have failed in their original application. From this latter path, the material characterization and understanding of its inherent properties allows for the exploration of potential therapeutic biomaterials in irrational applications in which they were not initially intended. For example, our current rationally designed, modern contact lenses came about because one physician noticed that the eyes of his patients, who were WWII veteran aviators, had no long-term adverse effects from embedded pieces of shattered plastic windscreens from their fighter jets. As another example, the field of modern tissue engineering stemmed from one physician taking left over biodegradable surgical suture off the operating room floor post-surgery, fraying the threads, and growing cells on this 3D scaffold. This talk will cover the creation of biomaterials throughout the speaker's career that were rationally designed for a specific medical application and then repurposed for a completely different, sometimes irrational, application.

Dr. Jennifer Weiser is an Associate Professor of Chemical Engineering at the Cooper Union for the Advancement of Science and Art in New York City. Her research focus is on drug delivery, wound healing, and developing polymeric biomaterials for medical applications. Professor Weiser earned degrees in Chemical Engineering (B.S. 2006, Rensselaer Polytechnic Institute) and Biomedical Engineering (M.S. 2010, Ph.D. 2012, Cornell University). In the industrial setting, she has experience working as an exploratory medicinal chemist at Wyeth Pharmaceuticals and as a research associate at the startup iFyber funded through a National Institutes of Health (NIH) STTR grant. Additionally, she has training through a NIH Ruth L. Kirschstein NRSA postdoctoral fellowship in Biomedical Engineering (2014-2017, Yale University). This postdoctoral fellowship work led to her appointment as a Visiting Assistant Professor in the Department of Surgery at the Yale School of Medicine (2017-2018). Since joining the full-time faculty of The Cooper Union in 2017, Professor Weiser has had research collaborations with several medically oriented departments in the NYC area. Past projects include work with the Department of Cardiology at the Columbia University Medical Center at Columbia University, where she was appointed an Assistant Professor of Clinical Medical Sciences (2018-2019), and the Department of Neural Science at NYU. Currently, Professor Weiser's focus is on collaborative research projects with the Department of Orthopaedics at the Icahn School of Medicine at Mount Sinai, the Department of Biomechanics at the Hospital for Special Surgery, and the Department of Chemical Engineering at Rowan University. Professor Weiser recently received a Fulbright Award to be the 2024-2025 Fulbright-Graz University of Technology Visiting Professor in Graz, Austria.