POLYMER INTERFACES AND BIOPHARMACEUTICALS: CHEMISTRY, DESIGNS AND CHALLENGES

David W. Grainger, Department of Pharmaceutics and Pharmaceutical Chemistry, Health Sciences
University of Utah, USA
david.grainger@utah.edu

The complex interactions between biological components and polymer materials has an extensive technical history. Virtually every surface property has been invoked as being important to biological interfacial response: texture, roughness, topology, porosity, hydrophilic, hydrophobic, polar, apolar, (non)-wettable, non-fouling brushes, surface mobility, rigidity, flexibility, crystalline versus amorphous, aspect ratio. Few surface properties alone, however, provide consistent, global technical solutions to vexing biomedical technology problems, particularly with cell culture, blood, plasma, microbial milieu, and protein solutions. Bio-interface materials performance must therefore be tailored specifically to each application. Short-term contact use (minutes/hours) has different materials interface requirements than long-term (days) use; globular proteins have particularly difficult needs not readily satisfied by any materials solution. Viable biologics interfaces (i.e., fresh blood harvests, cell cultures) must also consider selective gas permeability, leachables, and sterilization issues. Film properties, lamination, cutting, chemical stability, sealing and handling issues are additional considerations for single-use materials. Lastly cost-of-goods and materials economics must be considered, especially for single use technologies. No one-size-fits-all surface solutions currently satisfy all bio-interface materials needs.

This talk will review design principles, dogma and actual polymer chemistries to modulate, modify and manipulate polymer surfaces in contact with biological components. Several polymer surface properties will be discussed with regard to their physical chemistry in aqueous media. Traditional and recent developments in non-fouling interfaces and polymer approaches and their hypothesized influences on biophysical interactions with proteins and cells will be presented.