Novel Photoinitiated Nitric Oxide Releasing Compounds for More Biocompatible Coatings on Blood and Tissue Contacting Medical Devices

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Biomedical devices that contact blood and tissue universally inspire a host response that often compromises the function of the device (i.e., intravascular sensors become coated with thrombi, artificial vascular grafts become occluded with thrombus formation and neointimal hyperplasia). Nitric oxide (NO) has been shown to be a potent inhibitor of platelet adhesion and activation and has been implicated in mediating the inflammatory response and promoting wound healing. We are currently developing NO-releasing compounds based on S-nitrosothiols derived from substituted aromatic compounds that utilize light as an external on/off trigger capable of releasing precisely controlled surface fluxes of NO. The level of NO generated is dependent on the wavelength and intensity of light shown on the compounds. Data will be presented that show the synthesis and NO-release properties of three novel compounds, S-nitroso-2-methoxybenzene, S-nitroso-3-methoxybenzene and S-nitroso-2-chlorobenzene. Ultimately, these compounds will be tethered to the surface of polymer fillers that will then be blended into hydrophobic polymers and used as coatings on biomedical devices. A model system that will be used to demonstrate the utility of this approach will be a multi-element fiber optic sensors that will contain sensing elements capable of measuring blood gases and NO-releasing fibers that locally generate enough NO to inhibit clot formation on the sensor surface, thus allowing the sensor to function reliably in vivo.

Robotic Scrub Nurse for Otolaryngology-Integrating an Assistive Robot in the Operating Room

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Over the past year we have studied the challenges that must be overcome before we can introduce assistive robots in an operating room. We consider top among the issues a human-robot interface and an instrument-robot interface. In order for an autonomous mechanism to serve up instruments it must have domain specific knowledge about the instrument nature. The robot must be able to track the state of each instrument under its management. To this end we examine technical requirements of an instrument server. The second area of interest, and the one more unpredictable, is the problem of interaction between a human and a machine. In the past we have looked at the human speech as a medium of communication with the robot. Going beyond that we also examine the interaction that occurs at the haptic level. Here we would like to know what precisely could be conveyed to the robot and frmo the robot just by a touch? In microscope is undesirable and touch becomes a valuable means of communication.