Research at Langer Lab

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Research at Langer Lab
Our work is at the interface of biotechnology and materials science. A major focus is the study and development of polymers to deliver drugs, particularly genetically engineered proteins and DNA, continuously at controlled rates for prolonged periods of time. Work is in progress in the following areas:

Investigating the mechanism of release from polymeric delivery system with concomitant microstructural analysis and mathematical modeling.
Studying applications of these systems including the development of effective long−term delivery systems for insulin, anti−cancer drugs, growth factors, gene therapy agents and vaccines.

Developing controlled release systems that can be electrically, magnetically, ultrasonically, or enzymatically triggered to increase release rates, including novel drug delivery microchips.
Synthesizing new biodegradable polymeric delivery systems, which will ultimately be absorbed by the body.
Creating new approaches for delivering drugs such as proteins and genes across complex barriers in the body such as the blood−brain barrier, the intestine, the lung and the skin.

Our interest in drug delivery systems has extended to situations where drugs may serve a potentially useful purpose and then cause toxicity. In such cases, it would be useful to have a selective drug or substance

removal system. Examples include removal of heparin, bilirubin, and cholesterol. All of these studies involve reactor design, understanding

biomaterials with respect to blood interactions, and modeling of in vivo
situations.
In addition, we are developing drugs that specifically inhibit the process
of neovascularization but do not interfere with existing blood vessels.

Neovascularization is critical to the progression of several diseases, including cancer, and many diseases, which cause blindness. The projects involve biochemical purification and tissue culture studies.

Finally, we have been involved in creating approaches to engineer new tissues. In particular, we are synthesizing new biodegradable polymer systems to be used in mammalian cell transplants to create liver, cartilage, and nerves and are developing bioreactors for these purposes. We are also studying how materials interact with stem cells and other cells, and how this can be used to control cell behavior.
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