**Biomedical and Pharmaceutical Materials (BPM)**

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<tr>
<th>Investigator</th>
<th>Department</th>
<th>Expertise</th>
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<td>Ron Siegel (Director)</td>
<td>Phm(^1)/BME(^2)</td>
<td><em>hydrgels, biosensors, drug delivery systems, microfabrication</em></td>
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<tr>
<td>Effi Kokkoli</td>
<td>CEMS(^3)</td>
<td><em>bioadhesion and drug targeting</em></td>
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<td>Jayanth Panyam</td>
<td>Phm</td>
<td><em>multifunctional nanodelivery vehicles</em></td>
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<td>Wei Shen</td>
<td>BME</td>
<td><em>bioactive materials</em></td>
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<td>Calvin Sun</td>
<td>Phm</td>
<td><em>drug crystal and particle engineering</em></td>
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<td>Raj Suryanarayanan</td>
<td>Phm</td>
<td><em>solid state properties of drugs, stability of drug/biomaterial formulations</em></td>
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<td>Bob Tranquillo</td>
<td>BME/CEMS</td>
<td><em>fabrication characterization of bioartificial artery, cardiovascular valve, myocardial patch</em></td>
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<tr>
<td>Chun Wang</td>
<td>BME</td>
<td><em>bio-molecular materials, polymer-based DNA and drug delivery,</em> protein-based tissue scaffolds*</td>
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**Affiliated Investigators:** Chris Macosko (CEMS), Marc Hillmyer (Chem\(^4\)), Theresa Reineke (Chem), Tom Hoye (Chem), Victor Barocas (BME)

\(^1\)Pharmaceutics; \(^2\)Biomedical Engineering; \(^3\)Chemical Engineering and Materials Science, \(^4\)Chemistry

- *Biomaterials for drug delivery, medical device coatings, and tissue engineering*
- *Drug/medical device combinations, characterization of drug/materials interactions*
- *Cell-based fabrication of bioartificial tissues*
- *Novel tissue mechanical testing and analysis methods*
Inert Biodegradable Surfaces with “Artificial Mucus”

Ron Siegel + Chun Wang: Wenshou Wang, postdoc

Biodegradable matrix (PCL)

Medical device surface

Active nanostructured particles

Biocompatible surface coating

Hydrophilic core (HA)

Hydrophobic graft (PCL)

1 week

TCP

PCL

PCL/(1% HA-g-PCL)

PCL/(3% HA-g-PCL)

Cell count

1 week

4 weeks

0 20 40 60 80 100 120

TCP | PCL | PCL/1% HA-g-PCL | PCL/3% HA-g-PCL

1 week

4 weeks

Cell count

0 20 40 60 80 100 120

TCP | PCL | PCL/1% HA-g-PCL | PCL/3% HA-g-PCL

Graph showing cell count over time for different materials.
**PR_b Targeted Delivery to Cancer Cells**

PR_b-functionalized pH-sensitive stealth liposomes show increased binding and intracellular uptake by colon cancer cells compared to non-targeted pH-sensitive stealth liposomes and inert (targeted or non-targeted) formulations.

**PR_g Peptide-Amphiphile Hydrogels for Tissue Engineering**

PR_g gels outperform PEG gels functionalized with fibronectin (FN) protein and commercially available peptide hydrogels (PuraMatrix) in terms of cell adhesion and other cellular phenomena.
Integrin ligand
Growth-factor-mimetic

Enhance endothelial differentiation

UCB-derived CD34+ cells
uptake of acetylated low-density lipoprotein (Ac-LDL)

Biomimetic substrate

Cell

α β

Integrin ligand

Growth-factor-mimetic

(1) Synthetic and biomimetic materials to define cell microenvironments for regulation of cell fate.

(2) Modular assembly of cell-laden porous hydrogels for tissue regeneration.

Perfusable construct having interconnected pores.

Wei Shen
Crystal structure

Mechanical properties

Tableting performance

Calvin Sun

CryEngComm, 2010

[Graph showing mechanical properties and tableting performance against crystal structure]

[Graph showing indentation hardness and tensile strength against compaction pressure]