

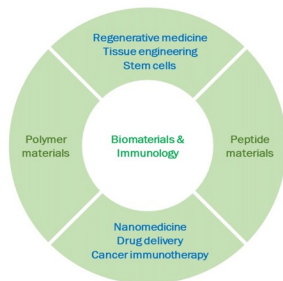
Biomaterials for Regenerative & Precision Medicine Drug Delivery for Cancer Vaccines & Neurological Diseases

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JIANG LAB

Introduction

From Basic to Translational Research
- Integrating Science, Engineering and Medicine



Functional biomaterials
(Immunomodulatory or targeting)

↑

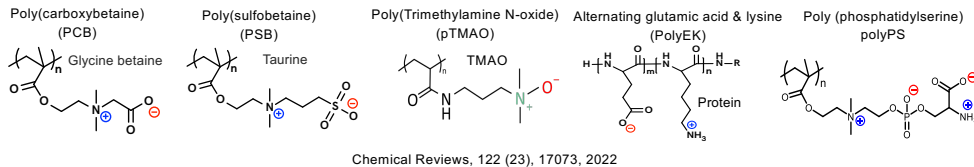
Inert biomaterials
(Nonfouling or low-immunogenicity)



Zwitterionic Materials

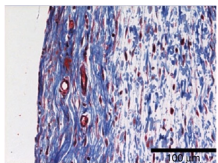
Highly Hydrated Zwitterionic Materials are Invisible to Immunosurveillance

□ Zwitterionic and Mixed Charge Materials



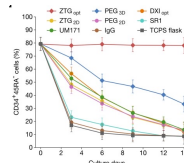
Chemical Reviews, 122 (23), 17073, 2022

□ Medical Implants
- No Capsule Formation



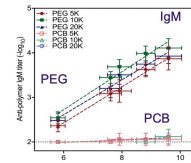
Nature Biotechnology, 31, 553 (2013)

□ Stem Cell Expansion
- No Differentiation



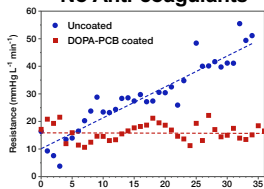
Nature Medicine, 25, 1566 (2019)

□ Protein-polymer Conjugates
- No Antibodies



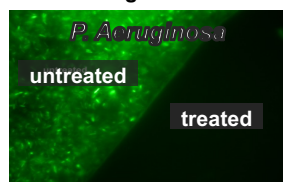
Nature Chemistry, 4, 59 (2012)
PNAS, 112, 12046 (2015)

□ Blood-contacting Devices
- No Anti-coagulants



Acta Biomaterialia, 92, 71 (2019)

□ Medical Devices
- Nonfouling/Antimicrobial



Biomaterials, 28, 4192 (2007)

□ Marine Coatings
- Long-lasting



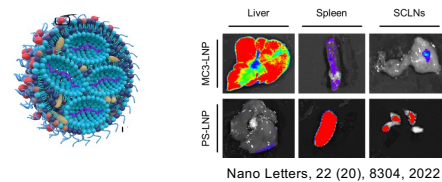
ACS Cent. Sci. 6, 1644 (2020)

Drug & Gene Delivery

• Targeted, effective & safe delivery of mRNAs, DNAs, proteins and small molecules

Lipid Nanoparticles (LNPs) for mRNA delivery

Phosphatidylserine LNPs Promote Systemic RNA Delivery to Secondary Lymphoid Organs



Nano Letters, 22 (20), 8304, 2022

Collaborators and Projects

Cancer vaccines

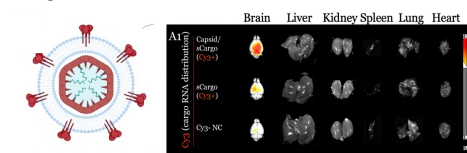
- Steve Lipkin, Weill Cornell Medicine (WCM)
- Vivek Mittal, Nasser Altorki & Timothy McGraw (WCM)
- Uri Tabori, University of Toronto/SickKids
- Ming You, Houston Methodist/WCM

Infectious disease vaccines

- Yung-Fu Chang, Cornell Vet Medicine (CVM)

Extracellular vesicles (EVs) for mRNA delivery

Engineered EVs Deliver mRNAs across the Blood-brain Barriers into the Brain In Vivo



Nature Biomedical Engineering, accepted, 2013

Collaborators and Projects

Neurological disease

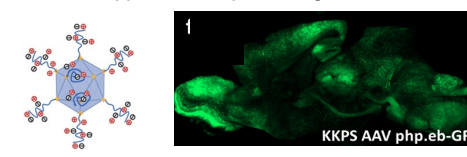
- Chris Shaffer & Nozomi Nishimura, BME

Cancer

- Richard Cerione, CVM

Adeno-Associated Virus (AAV) for DNA Delivery

Immunosuppressive Peptide Mitigate the Immunogenicity of AAV-mediated Gene Therapy



JACS, 144 (44), 20507, 2022

Collaborator and Project

Gene therapy

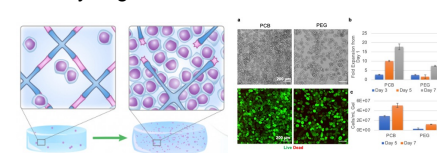
- Michael Kaplitt, WCM

Biomaterials & Cell Engineering

• Controlled Culture of Induced Pluripotent Stem Cells (iPSCs) and Cancer Organoids

Zwitterionic PCB Hydrogels for iPSC Culture

PCB Hydrogels are Better than PEG to Maintain Cell Viability and Promote Expansion



Collaborators and Projects

Controlled differentiation of iPSCs

- Shuibing Chen, WCM

Controlled culture of cancer organoids

- Olivier Elemento, WCM

Acknowledgements

