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Engineering Active Nano/Micro Platforms for Targeted and Image-Monitored Drug Delivery

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Development of nano- and micro-scale biomaterials as carriers for drugs and genes is an exciting area of research at the interface of pharmaceutical sciences and biomedical engineering. Drug carriers are sought to encapsulate a drug cargo, protect it from elimination and degradation, and ferry it to the site of pathology, while minimizing potentially harmful detours to healthy organs. However, success in these tasks is at odds with the normal human physiology, which has evolved to eliminate harmful pathogens and xenobiotics. Although many “passive” drug carriers have been devised in an attempt to achieve targeted delivery of drugs and genes to diseased tissues, the mission of these carriers is often compromised by elimination mechanisms and multiple transport barriers obstructing their access to target cells. Our research focuses on development of “active” nano/micro drug platforms that combine sensitivity to external physical stimuli with visibility to medical imaging modalities. Such platforms allow on-demand activation by physical triggers to prevail over transport barriers at the site of pathology and non-invasive monitoring to synchronize triggered activation of the carriers with their arrival at the target site. In my talk, I will illustrate our strides in this domain through examples of magnetically- and acoustically-responsive and image-visible platforms we are currently developing. I will describe the process of implementing a biomaterial-based gene carrier with desired in vivo performance from an idea to material fabrication to proof-of-concept demonstration of functionality in animal models.

Biography

Dr. Beata Chertok is an Assistant Professor of Pharmaceutical Sciences and Biomedical Engineering at the University of Michigan, where she directs the Laboratory for “Remote and Image-Guided Therapeutics”. Beata Chertok received her Ph.D. from the University of Michigan and trained as an NIH/NIBIB Postdoctoral Fellow at the Massachusetts Institute of Technology. Her research expertise is in engineering advanced biomaterials at the nanometer and micrometer scales for targeted, image-guided and personalized drug delivery. Dr. Chertok is a recipient of multiple research awards including the MIT Cancer Center for Nanotechnology Excellence Award (2010), the NIH/NIBIB National Research Service Award for Postdoctoral Fellows (2012) and St. Baldrick’s Scholar Award in pediatric oncology research (2015-2019).

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