

Nanoparticle Hematocompatibility

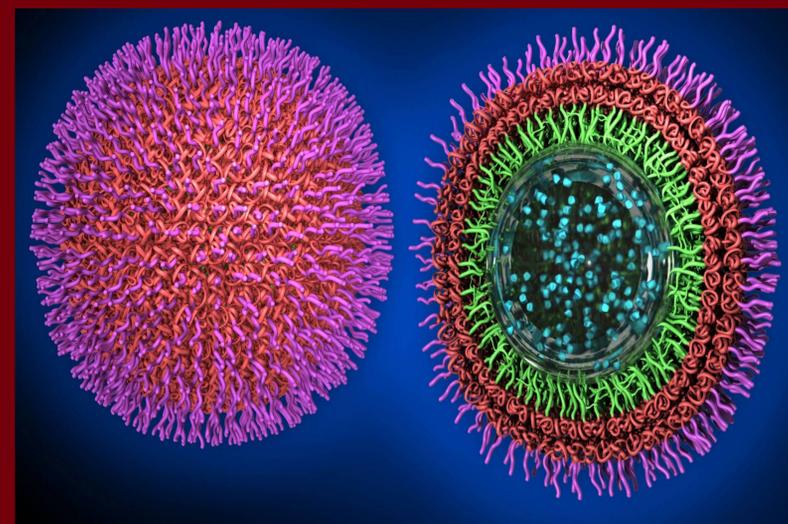
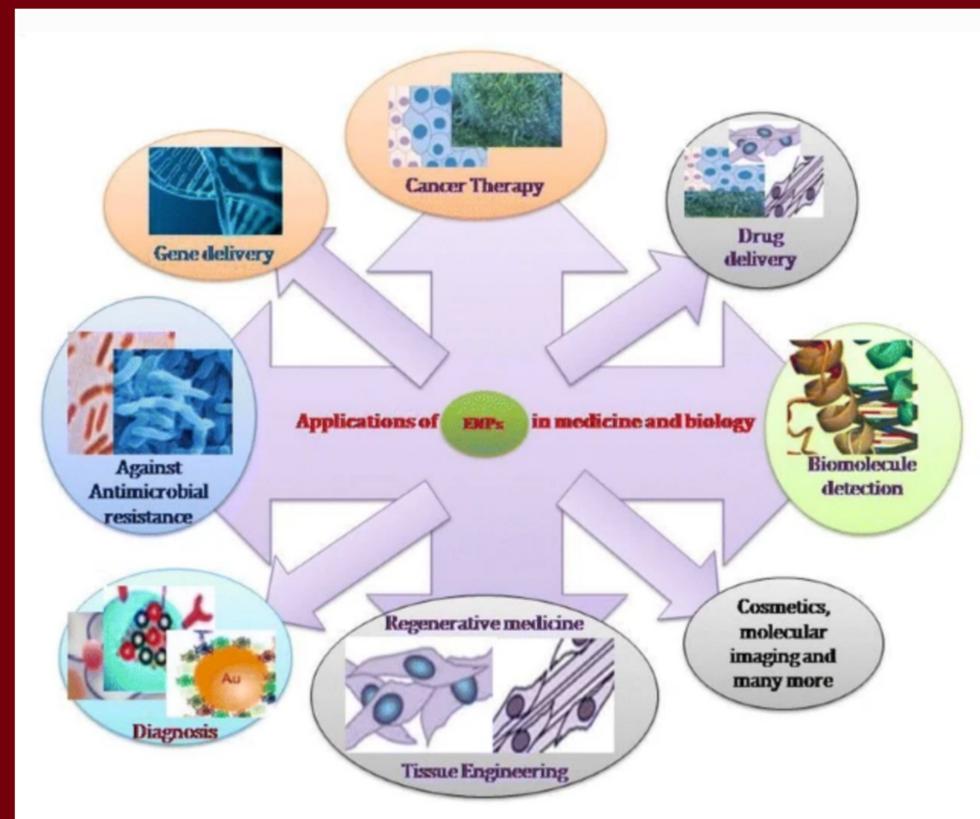


INTRODUCTION

The tremendous potential of nanomedicine is reflected by the 300 applications the FDA has received in the last 10 years for drugs utilizing nanoparticles.¹ Unfortunately, there remains an incomplete understanding of the effect of these nanomaterials on blood, and a lack of robust protocol standardization for their testing and approval.² Polyethylene glycol-b-poly(lactic acid) (PEG-PLA) and polyethylene glycol-poly(ϵ -caprolactone) (PEG-PCL) are polymersomes which are composed of polymers individually approved by the FDA.³ This study will examine their effects on whole blood and individual blood components. Hemolysis, coagulation, and complement activation will be studied in vitro adopting protocols from the Nanotechnology Characterization Lab of the National Cancer Institute.⁴ Additionally, this study aims to characterize the relationship between nanoparticle characteristics and hemocompatibility.

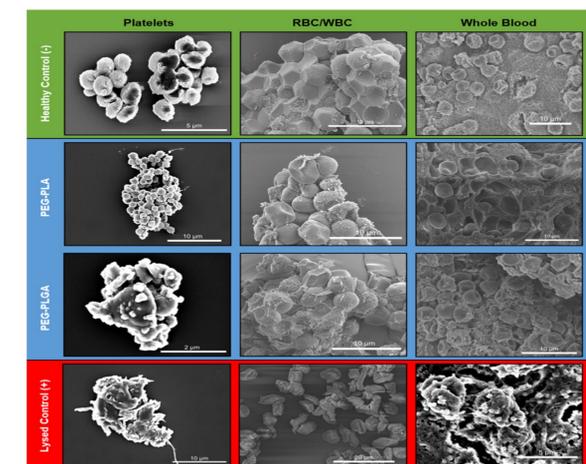
METHODS

- Blood specimens collected from healthy volunteers will be incubated with PEG-PLA and PEG-PCL and analyzed for hemocompatibility including the parameters of hemolytic activity, complement activation, and platelet activation.
- Hemolytic activity will be quantified using a spectrophotometric method, NCL-method ITA-1
- Complement activation will be qualitatively analyzed using western blotting, NCL-method ITA 5.1
- Platelet function will be assessed with a flow cytometry protocol outlined by Leonardo Pasalic et al. in Methods Mol. Biol.
- Additionally, variation in polymer characteristics such as molecular weight, hydrophilic fraction, and individual polymer amphiphiles vs formed polymersomes will be studied to determine if there is a predictable relationship between these features and hemocompatibility.
- TEM and SEM may be used for visualization of changes to blood components



ANTICIPATED RESULTS

Previous research that nanoparticles formed from certain FDA approved polymers had deleterious effects on blood components in vitro.³ We anticipate our experiments will further quantify these effects and provide insight on how to better design nanoparticles that avoid these complications.



DISCUSSION:

Nanomedicine is poised to impact medicine in numerous ways including targeted drug delivery (i.e., to cancer cells and across the blood brain barrier), diagnostics, and tissue engineering. Because these vehicles travel throughout the patients' blood stream it is tremendously important that their hemocompatibility is thoroughly studied and optimized in order to facilitate their successful implementation as a cornerstone of modern medicine.

