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# A Phosphorylcholine Polymer Platform for Cancer Drug Delivery


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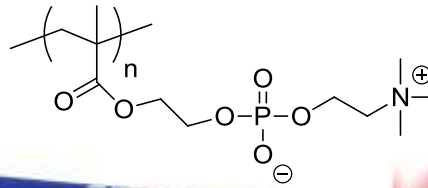
# A Phosphorylcholine Polymer Platform for Cancer Drug Delivery

**Todd Emrick & Sallie Schneider**  
**UMass Amherst Polymer Science and Engineering**  
**and the Pioneer Valley Life Sciences Institute**

# PolyMPC: current applications and future potential

## Current

**Contact lenses**  
Proclear (Copper Vision)

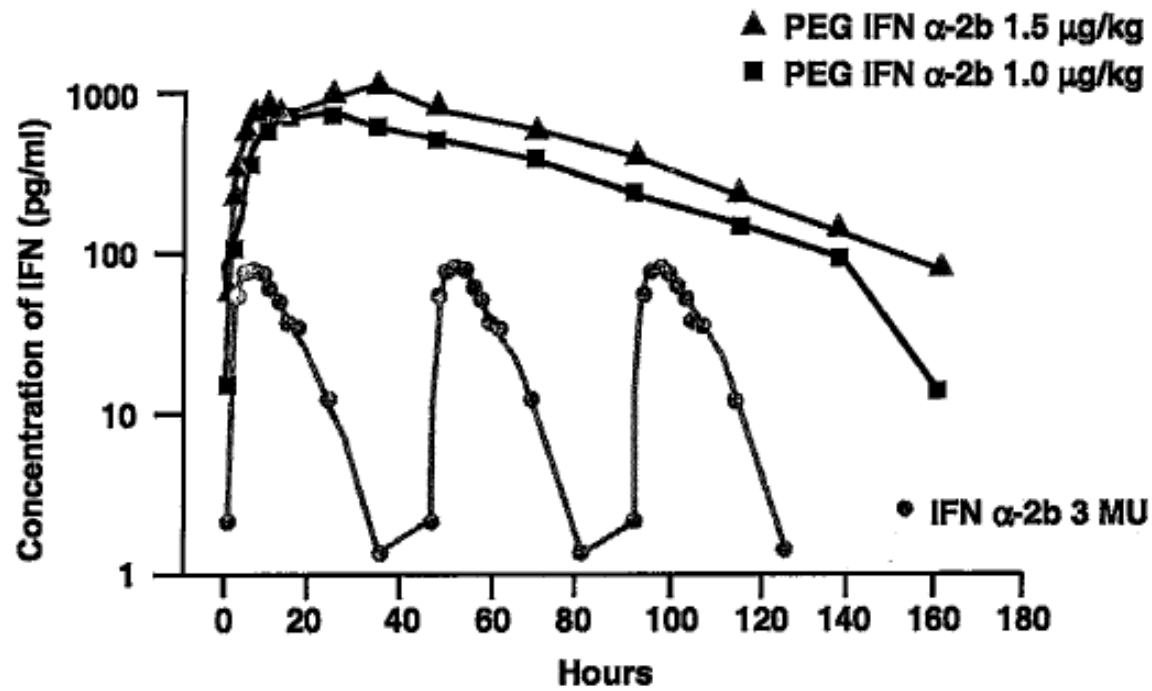


**Stent devices**  
Endeavor (Medtronic)  
Trimaxx and Dexamet (Abbott)  
BioDivYsio (Biocompatibles)

PolyMPC is extremely hydrophilic and biocompatible: Ishihara, Nakabayashi, Iwasaki, Armes, Lewis,...

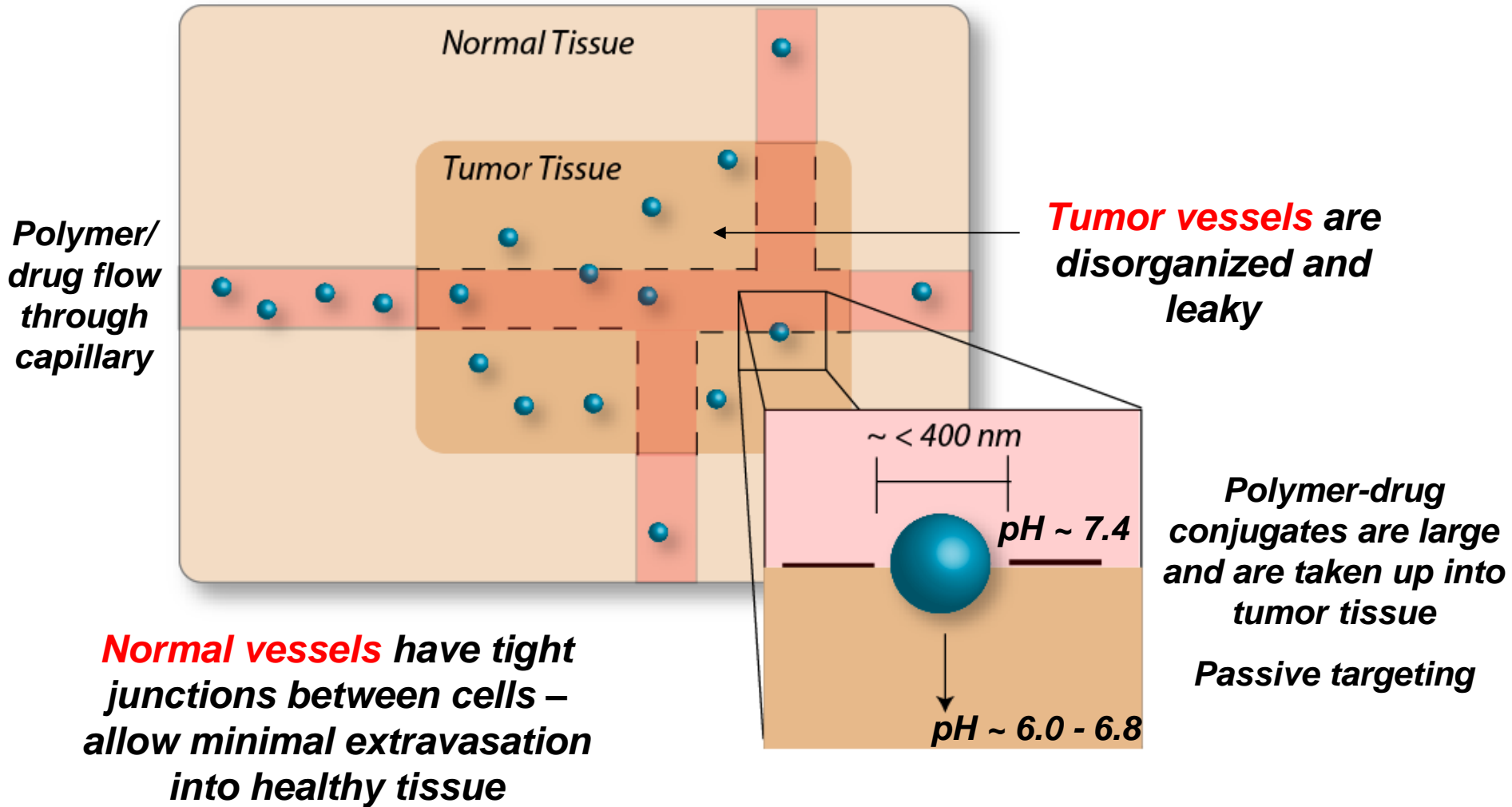
## Future

*Longer lasting  
protein therapeutics*

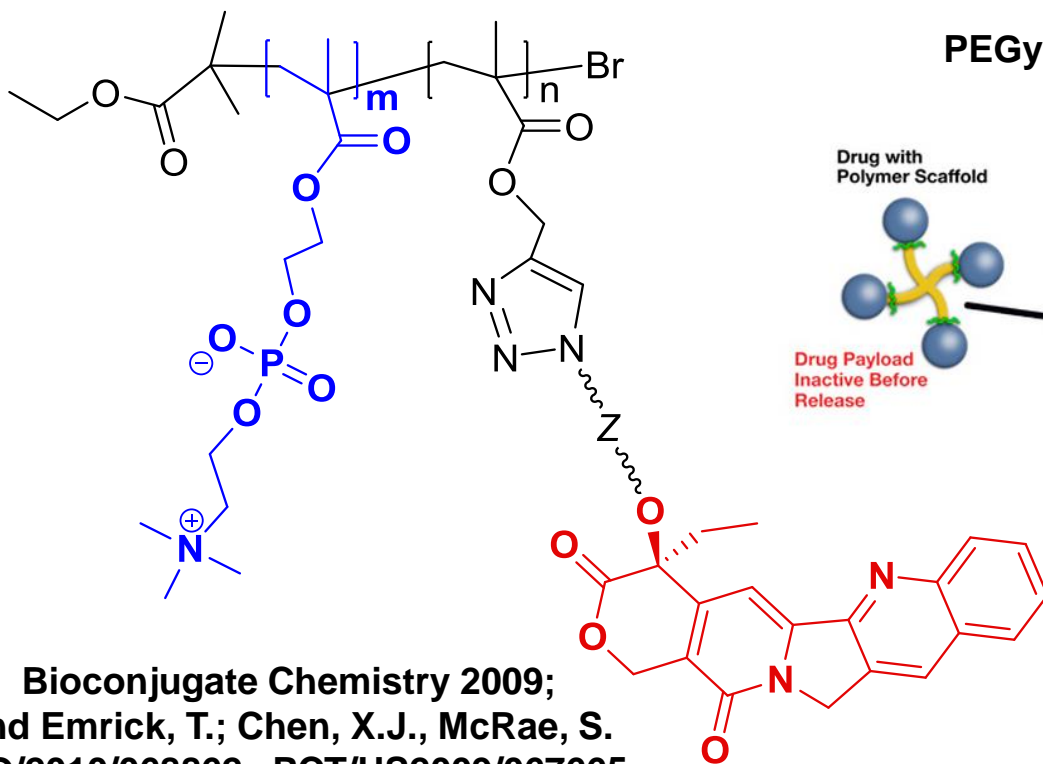


# Why Polymers? Polymers Enhance Drug Delivery

## Prolonged Circulation; Enhanced Permeation and Retention



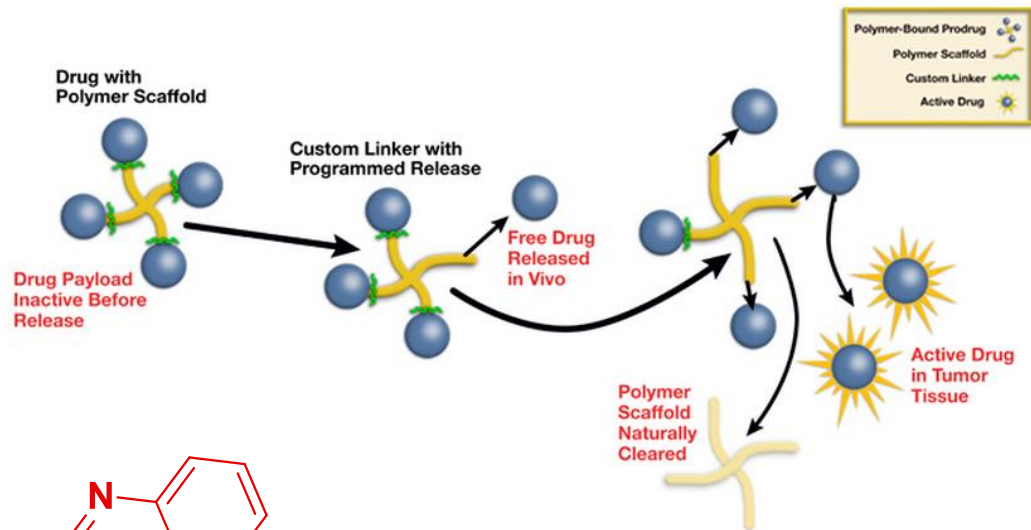
# PolyMPC-CPT: the first polyMPC pro-drug



Bioconjugate Chemistry 2009;  
and Emrick, T.; Chen, X.J., McRae, S.  
WO/2010/068862 PCT/US2009/067665

**Drug loading: 18 wt %,**  
**CPT equivalent solubility: 36.7 mg/mL**

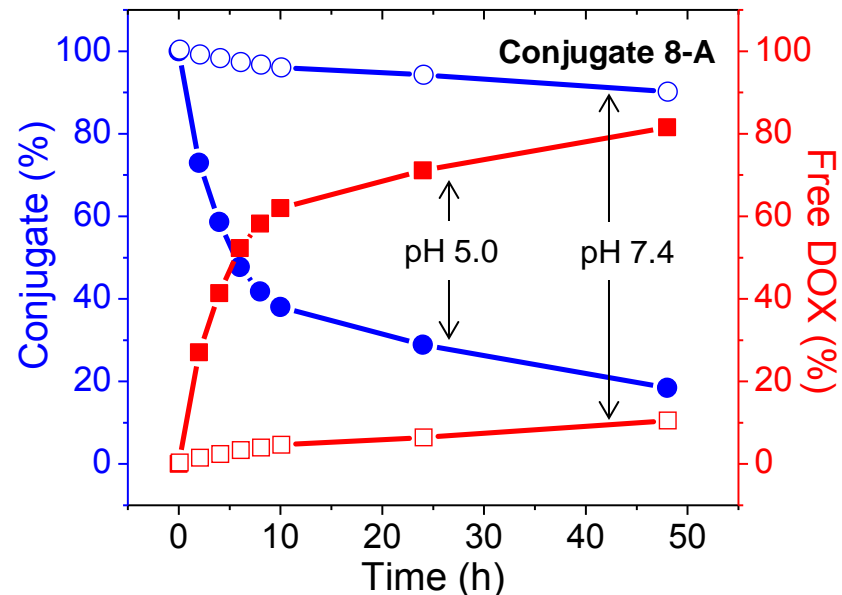
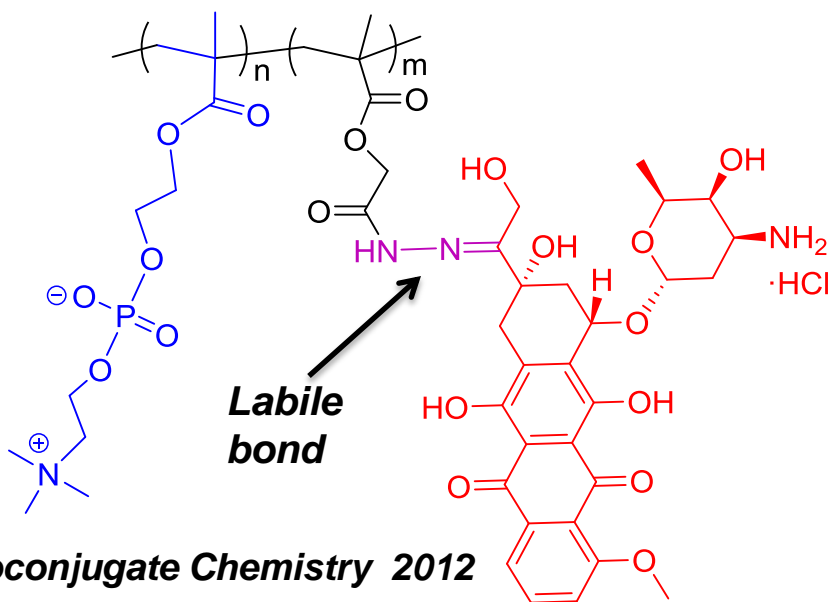
## NKTR-102 PEGylated Irinotecan (CPT11, Camptosar)



**4-arm star PEGylation**

**Drug loading: 3.7 wt %**  
**CPT equivalent solubility: 6.7 mg/mL**

# PolyMPC-Doxorubicin pro-drugs



**DOX release from polyMPC-DOX conjugates at pH 5.0 and 7.4**

Half-life of polyMPC-Dox samples range from 8-28 hours, depending on molecular weight and drug loading

polyMPC-DOX  
Increasing wt percent Dox loading →



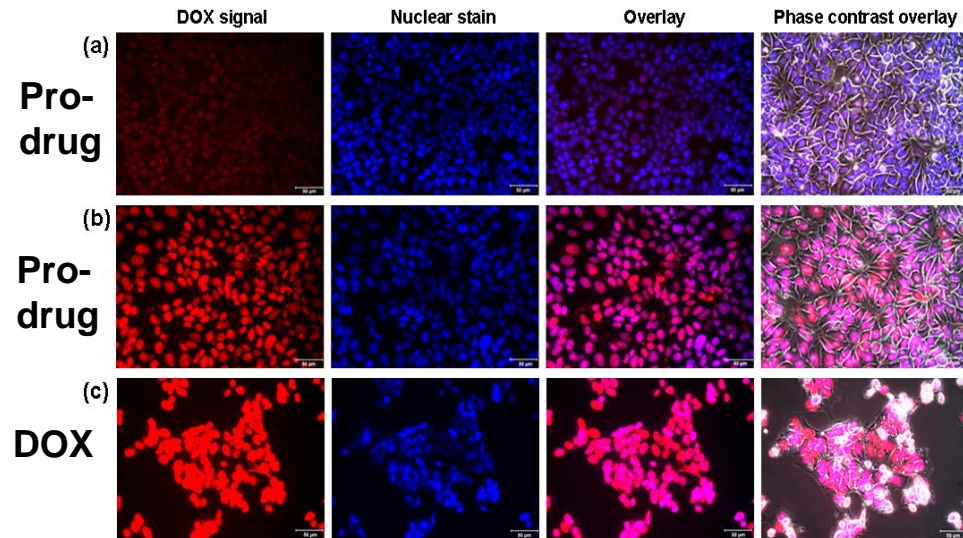
MeOH

H<sub>2</sub>O

**PolyMPC-Dox soluble in water and injectable saline at very high DOX loading**

# In vitro and in vivo evaluation

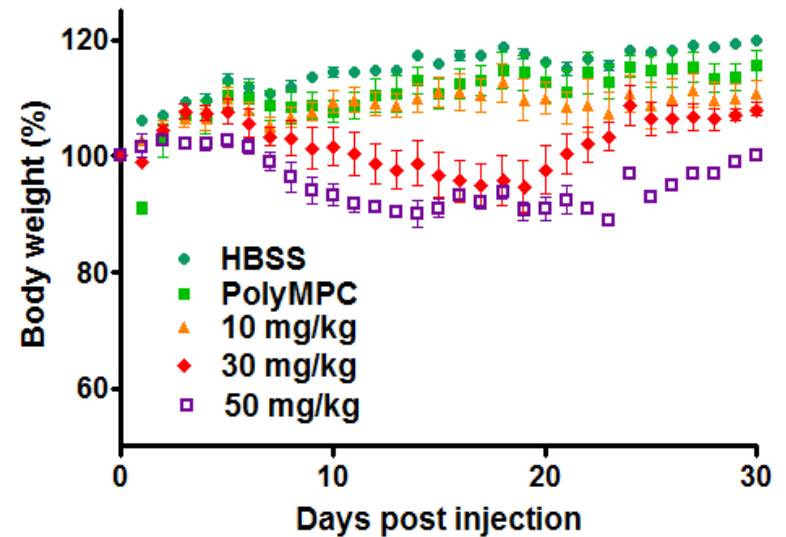
## Cell uptake MCF7 24 h



*Nuclear uptake seen for polyMPC-Dox*

*Bioconjugate Chemistry 2012*

## Maximum tolerated dose (MTD) of polyMPC-Dox



MTD values of 50 mg/kg or greater

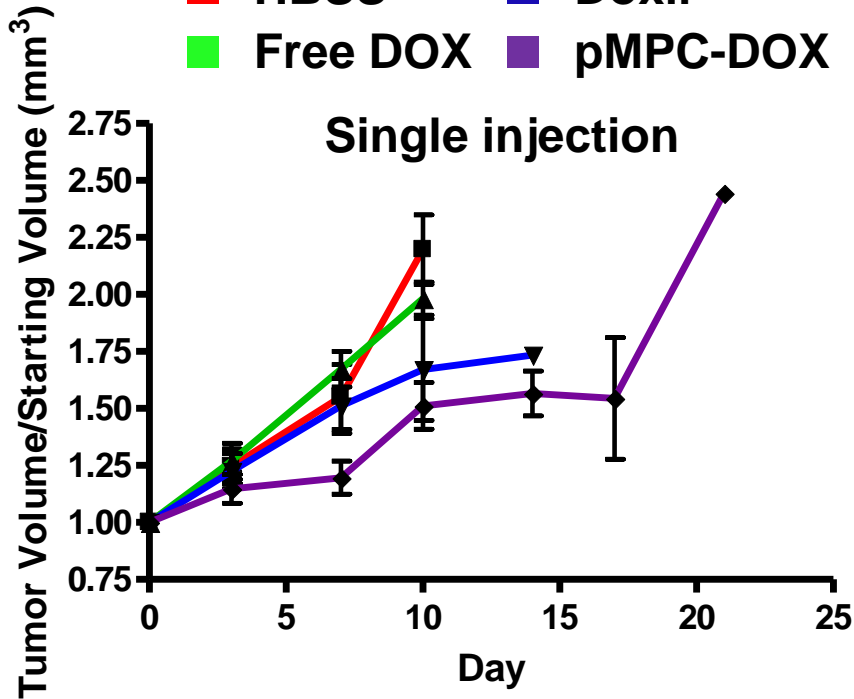
About 10 times that of Dox alone

About twice that of Doxil

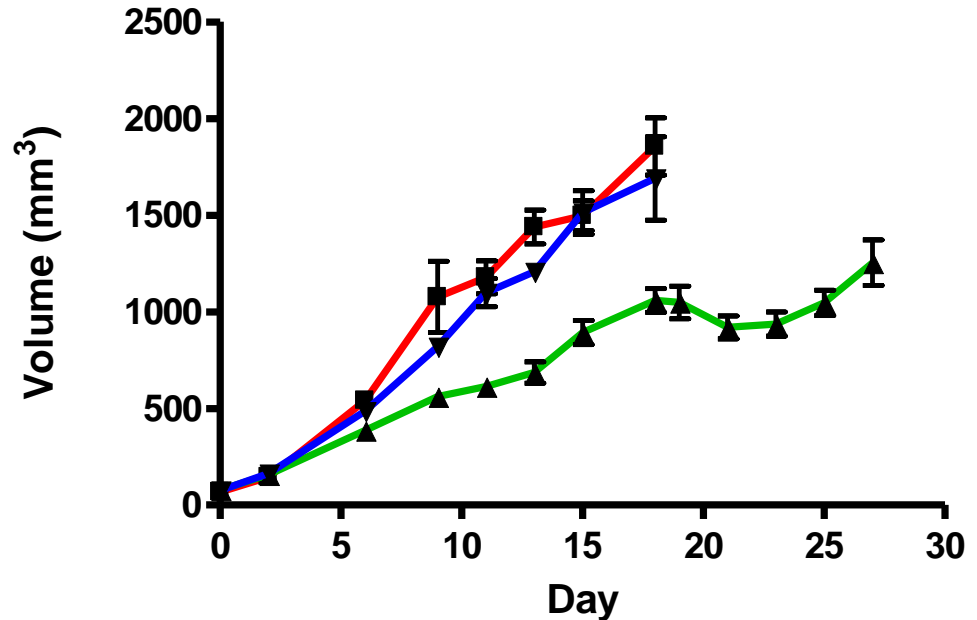
# *In vivo* experiments in mice: 4T1 breast cancer model

Highly invasive and spontaneously metastatic tumor line  
Large tumor starting volume; 1 injection

■ HBSS      ■ Doxil  
■ Free DOX    ■ pMPC-DOX



## Balb/c-4T1 efficacy: Tumor Volume



### Survival

Doxil: 40% at 7 days, 0% at 14 days  
polyMPC-Dox: 100% at 7 days  
50% at 14 days

### Survival

Day 15 with Dox: 10% survival  
Day 15 with polyMPC-Dox: 90% survival