2nd PANHELLENIC CONGRESS OF MEDICAL PHYSICS
4-6 OCTOBER 2024| EUGENIDES FOUNDATION

"Novel hybrid DSPC:P(OEGMA-co-LMA) nanoplatforms: Exploring the design parameters affecting their performance"

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1. Background-Aim

Hybrid Nanoparticles-Definition

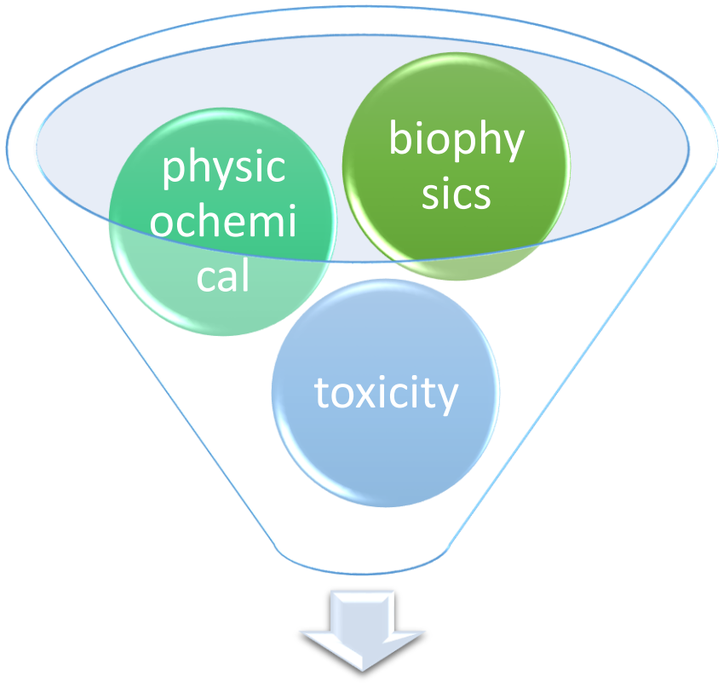
- Nanocarriers, composed of **two or more different biomaterials**, which maintain the biophysical properties of all components.

Main advantages

- Nanoscale
- **Modified** and **Targeted** Release
- Incorporation of multiple therapeutic drugs and/or **drugs with challenging properties**
- **Decrease of disadvantages of individual nanoparticles** (toxicity, in vivo stability, solubility)
- **New intrinsic properties**

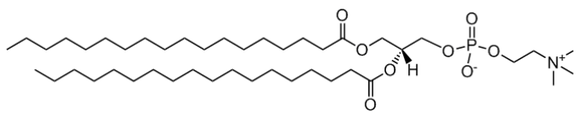
Main Scope

Elucidation of the **design parameters** affecting hybrid nanoparticles' behavior regarding:

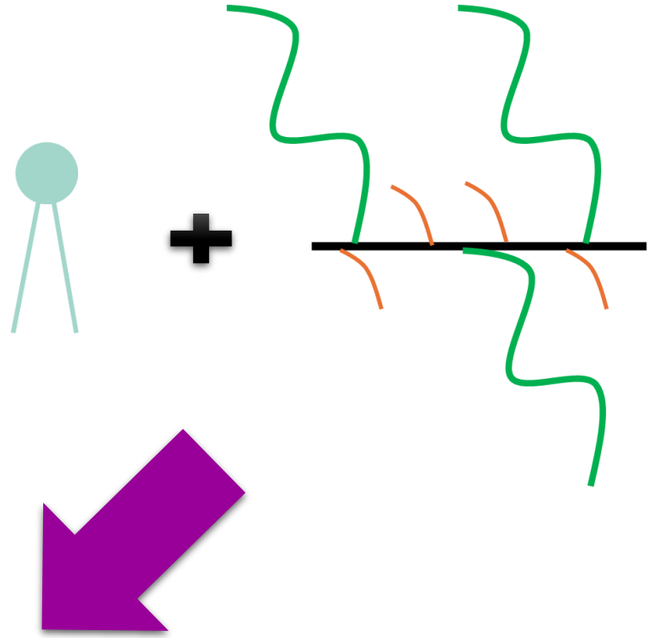


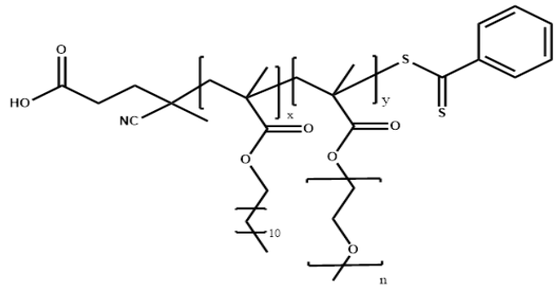
Development of **robust** and **well-defined** hybrid **lipid/random copolymer** structures as potential carriers

2. Materials & Methods



1,2-dioctadecanoyl-sn-glycero-3-phosphocholine **(DSPC)**

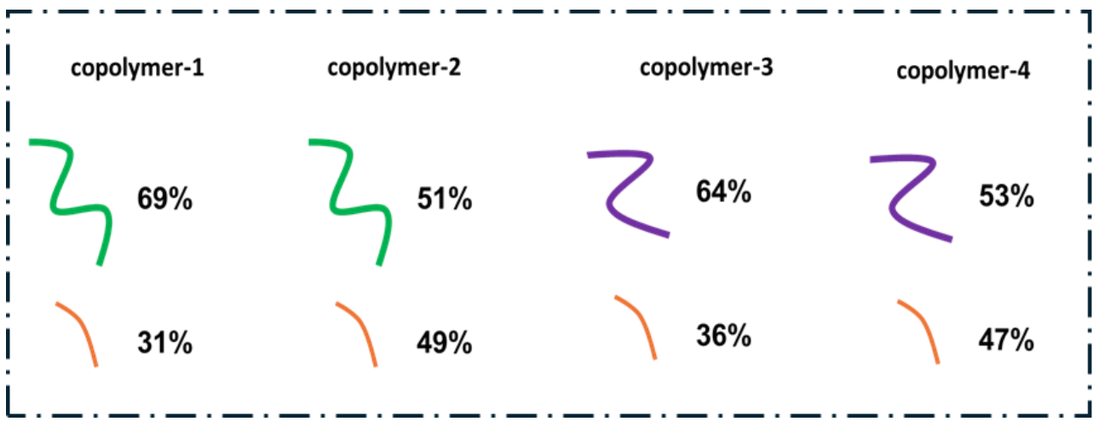




statistical (random) copolymers of oligo (ethylene glycol) methyl ether methacrylate **(OEGMA)** and lauryl methacrylate **(LMA)**

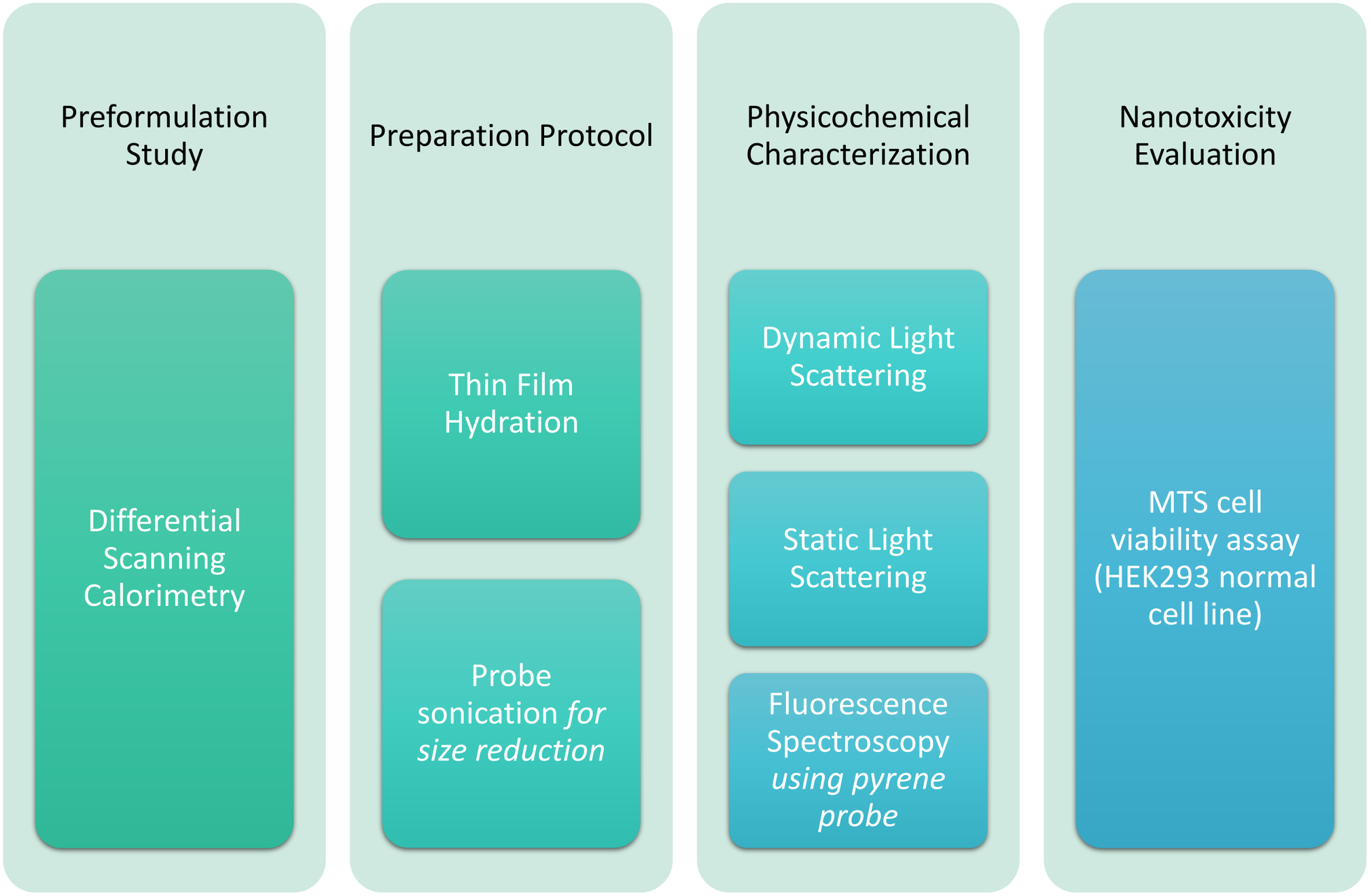
Hybrid systems of different

- length of OEGMA chain
- comonomer ratio
- lipid to polymer ratio

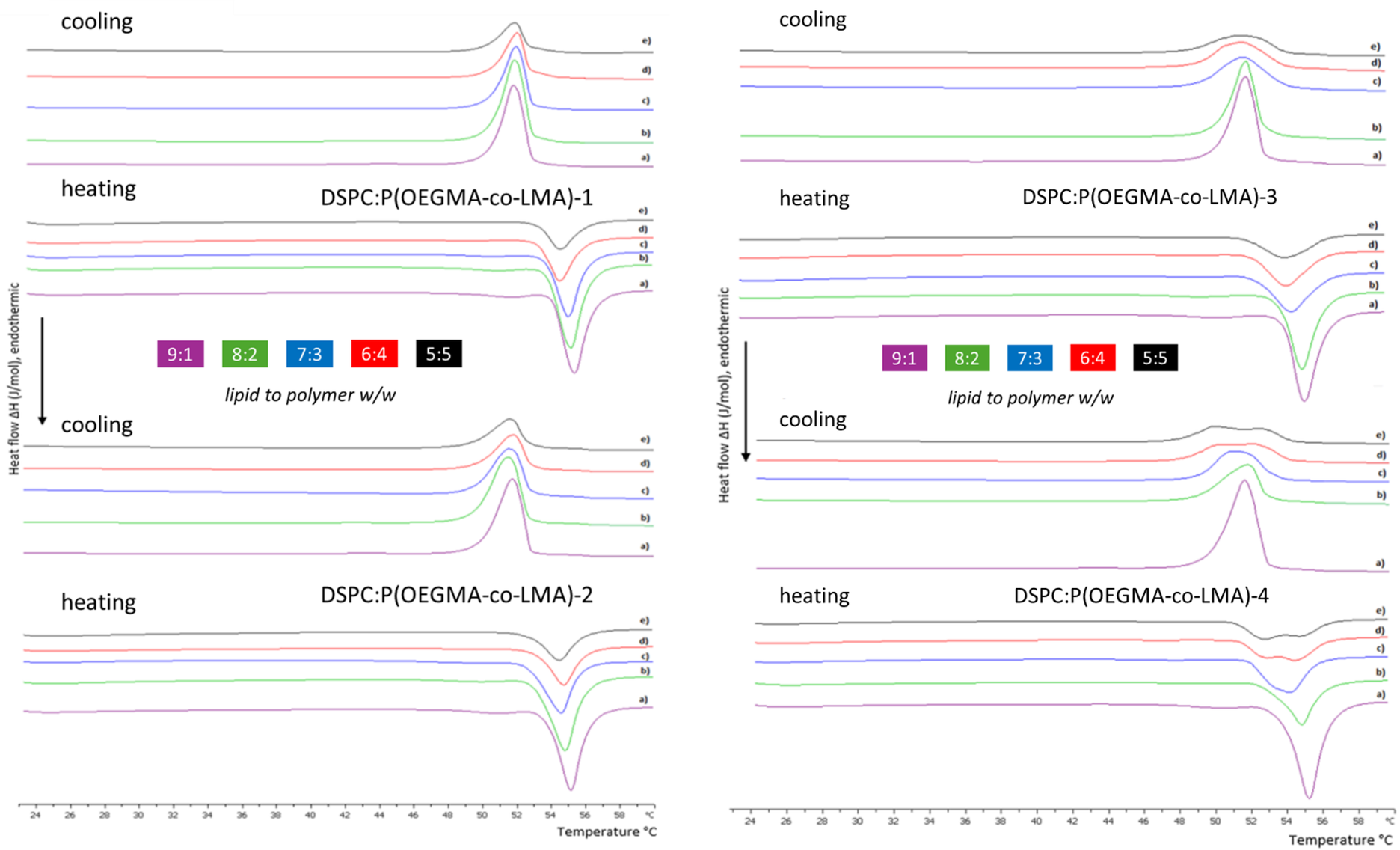


P(OEGMA)$_{950}$ segment **P(OEGMA)$_{500}$ segment** hydrophobic **LMA segment** **polymethacrylate backbone**

2. Materials & Methods



3. Results - DSC

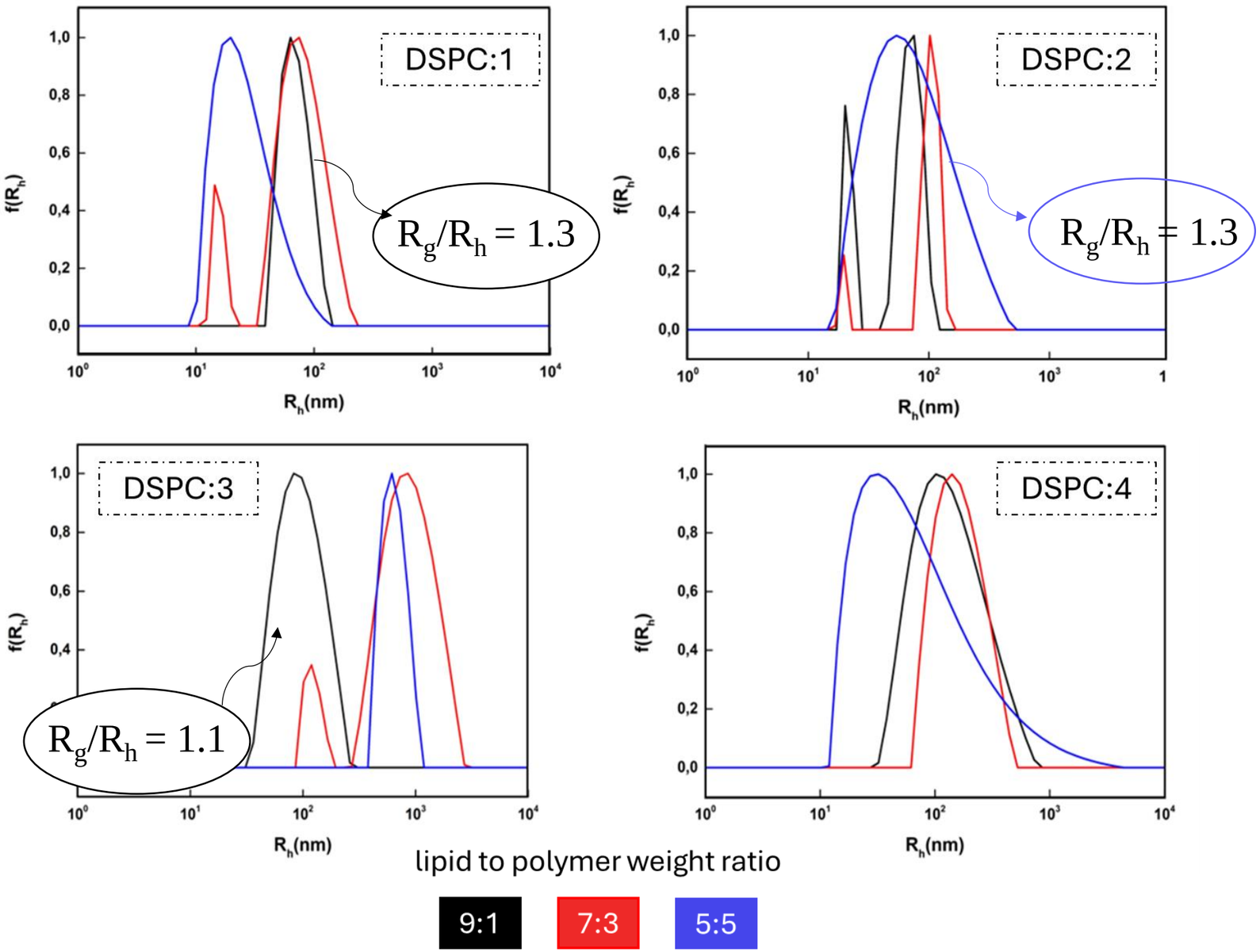


Trends

- Gradual loss of pretransition
- ↓ T_{onset}, T_m, and ΔH by ↑ copolymer

- **Successful incorporation** of the copolymers into DSPC bilayers
- **Cooperative hybrid bilayers** *except DSPC with copolymers 3 and 4 above 20% weight*

3. Results – DLS and fluorescence spectroscopy



- R_h= 50 - 320 nm

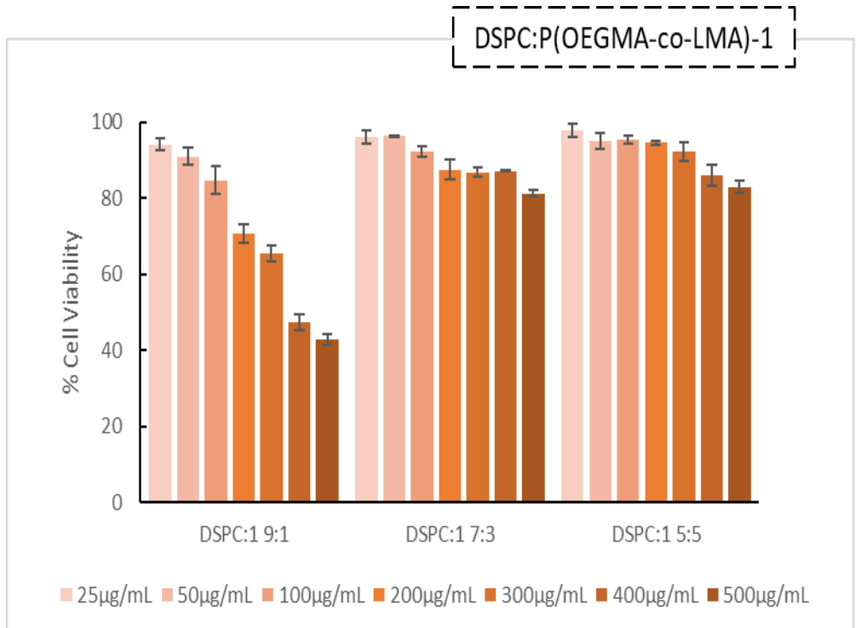
(for most of the structures)

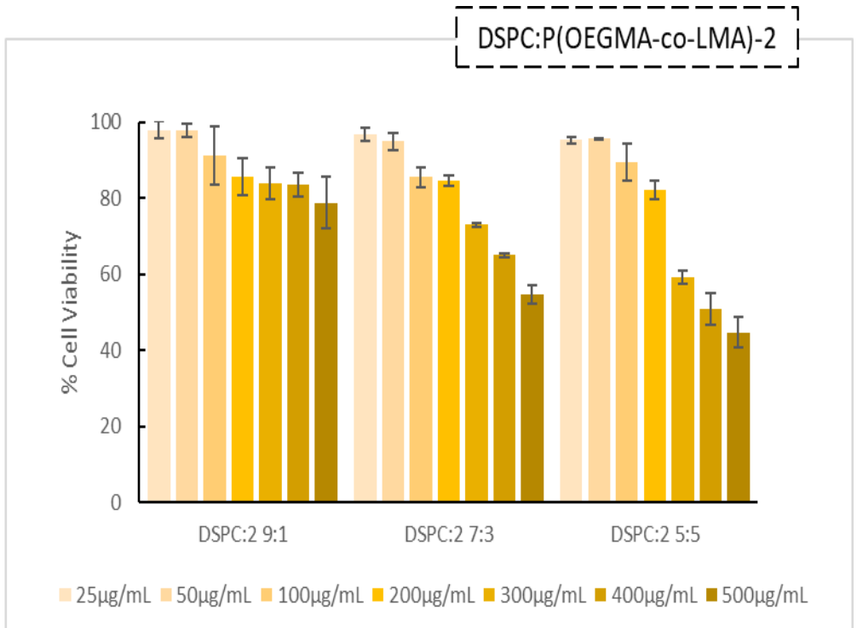
- Systems with longer OEGMA chains are **smaller**
- I_1/I_3 = 1.26-1.52

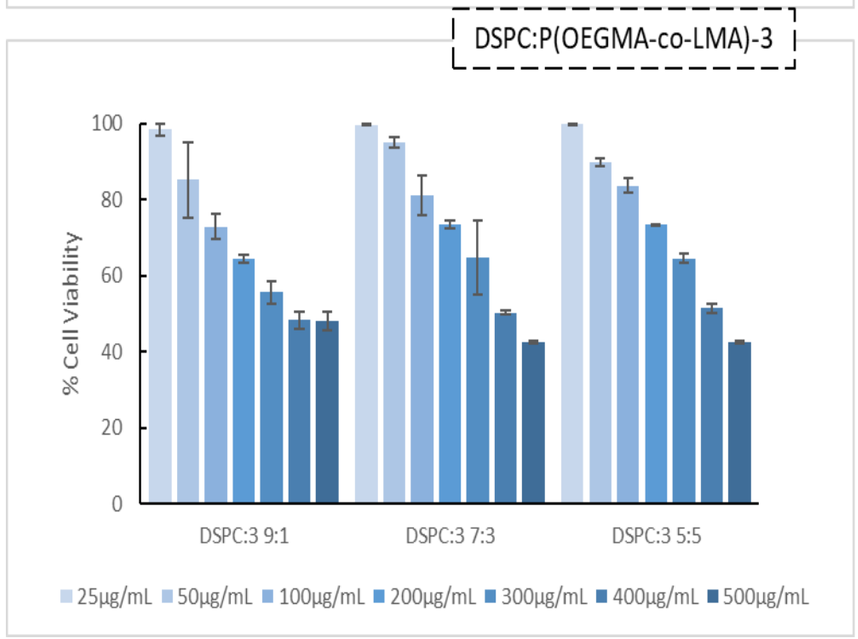
(rather polar microenvironment)

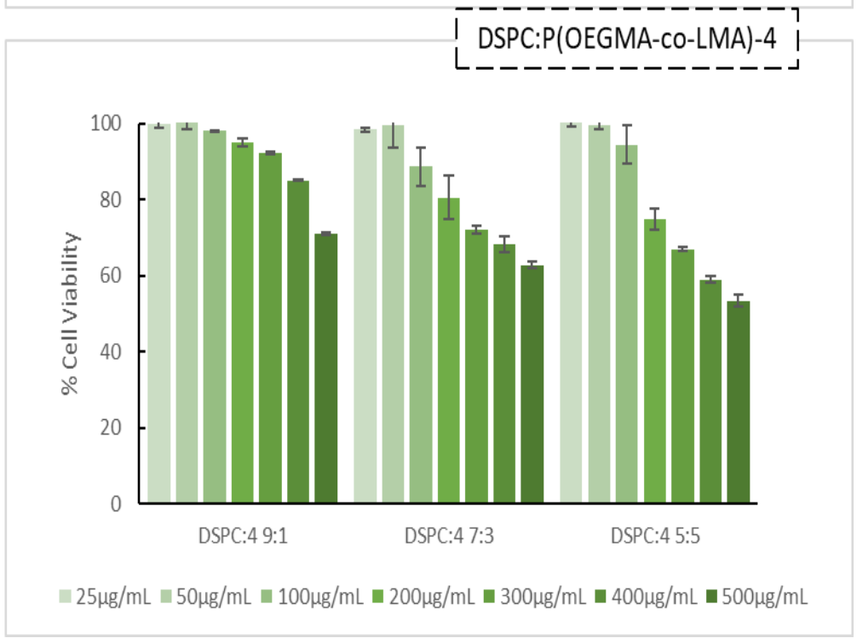
Exceptional behavior for each system due to random topology and different hydrophilic to hydrophobic balance

3. Results – Biological assessment







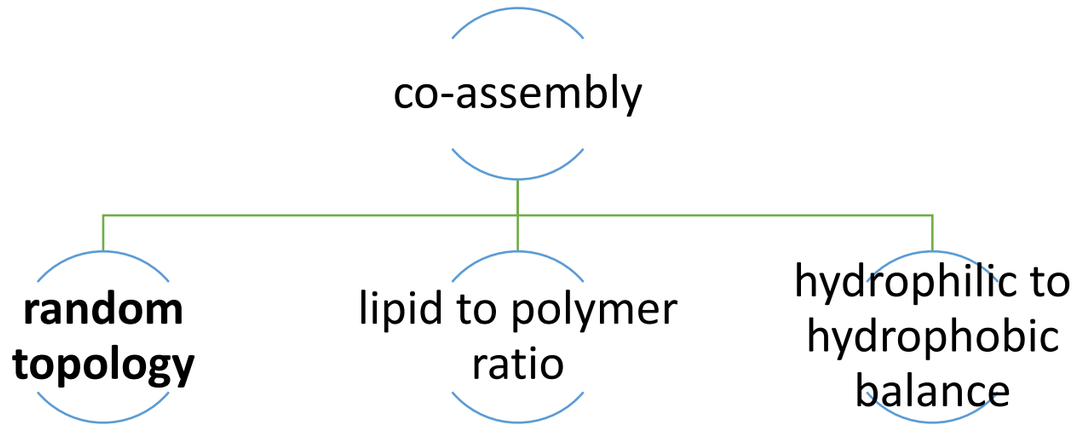


- **Dose dependent** - *biocompatibility at low concentration*
- Mainly **lipid to polymer dependent**
- **The most toxic:** DSPC:3 nanostructures
- **Biocompatible:** DSPC:1 (5:5) & DSPC:2 (9:1)
- Dependent on **%LMA and/or OEGMA chain length** ⟶ **different co-assembly**

4. Conclusions

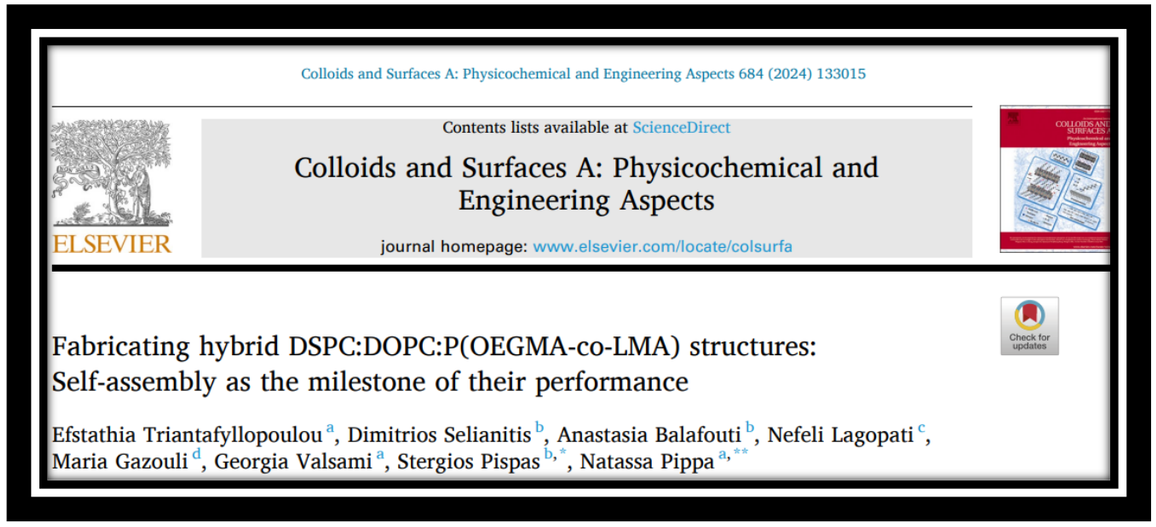
- **Successful** fabrication of **biocompatible DSPC:P(OEGMA-co-LMA)** hybrid systems

- The main **influential parameters**:



- **Future perspectives:**

Morphology
Microfluidity
Protein corona formation and in vivo stability
Drug loading
Drug release kinetics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Fabricating hybrid DSPC:DOPC:P(OEGMA-co-LMA) structures: Self-assembly as the milestone of their performance

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Thank you for your attention!