



INSTITUTE OF
MACROMOLECULAR
CHEMISTRY

Injectable Poly(α -Amino Acid) Hydrogels: A Modular Platform for Bioactive and Porous Biomaterials



Czech Academy
of Sciences

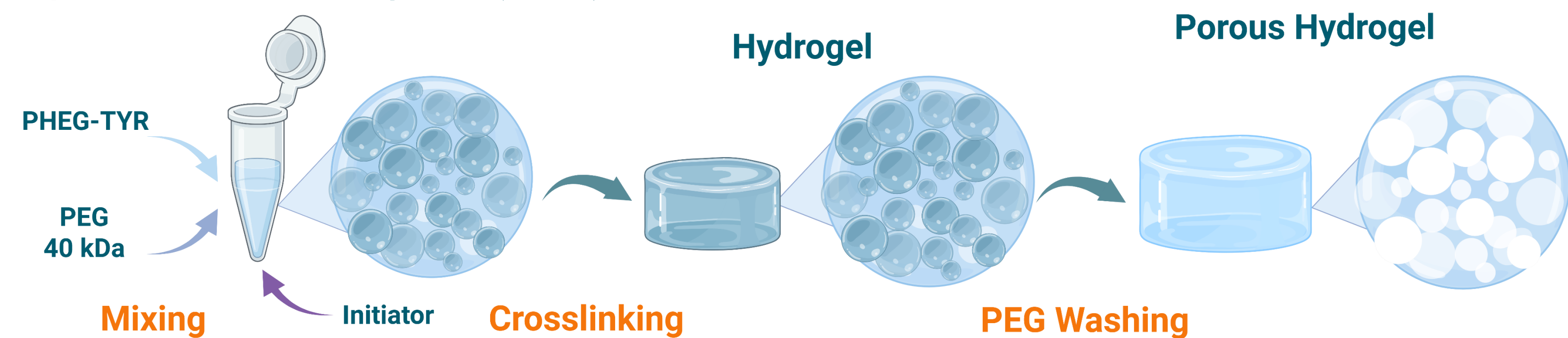
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INTRODUCTION

How we can prepare injectable porous hydrogels for *in vivo* biomedical application?

Aqueous Two-Phase System (ATPS)



GelMA (80% MA, porcine, type A, 180 Bloom)/PEO (300 kDa) ATPS – Photocrosslinked 405 nm/ LAP

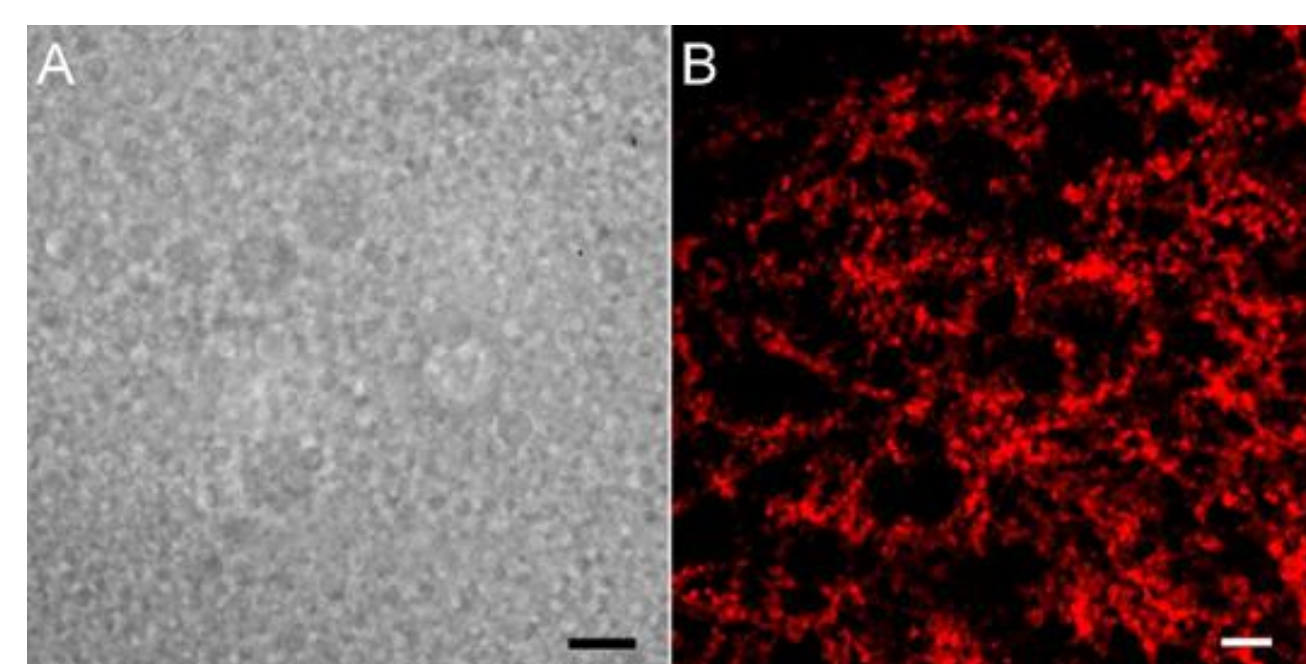


Figure 2. (A) Image of GelMA (180 Bloom) 5% (w/v)/LAP 0.1% (w/v)/PEO (300kDa) 0.8% (w/v) emulsion; (B) Fluorescence confocal image of rhodamine B-stained porous GelMA hydrogel after PEO leaching, scale bar: 100 μ m.

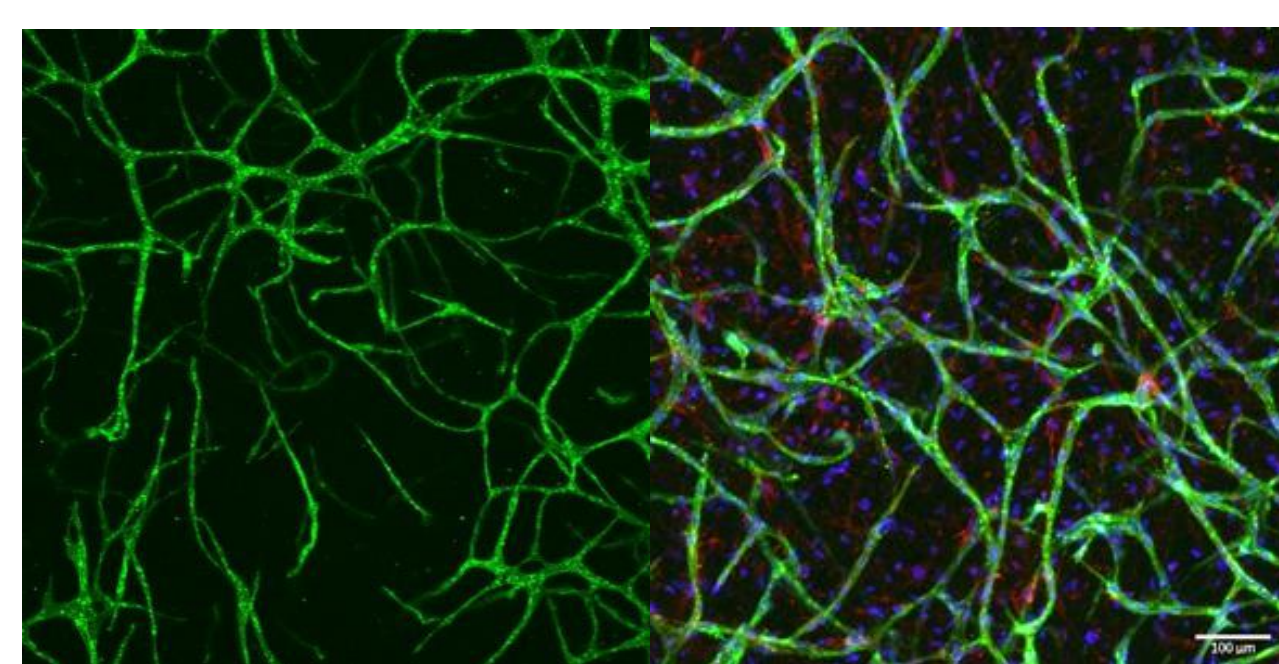
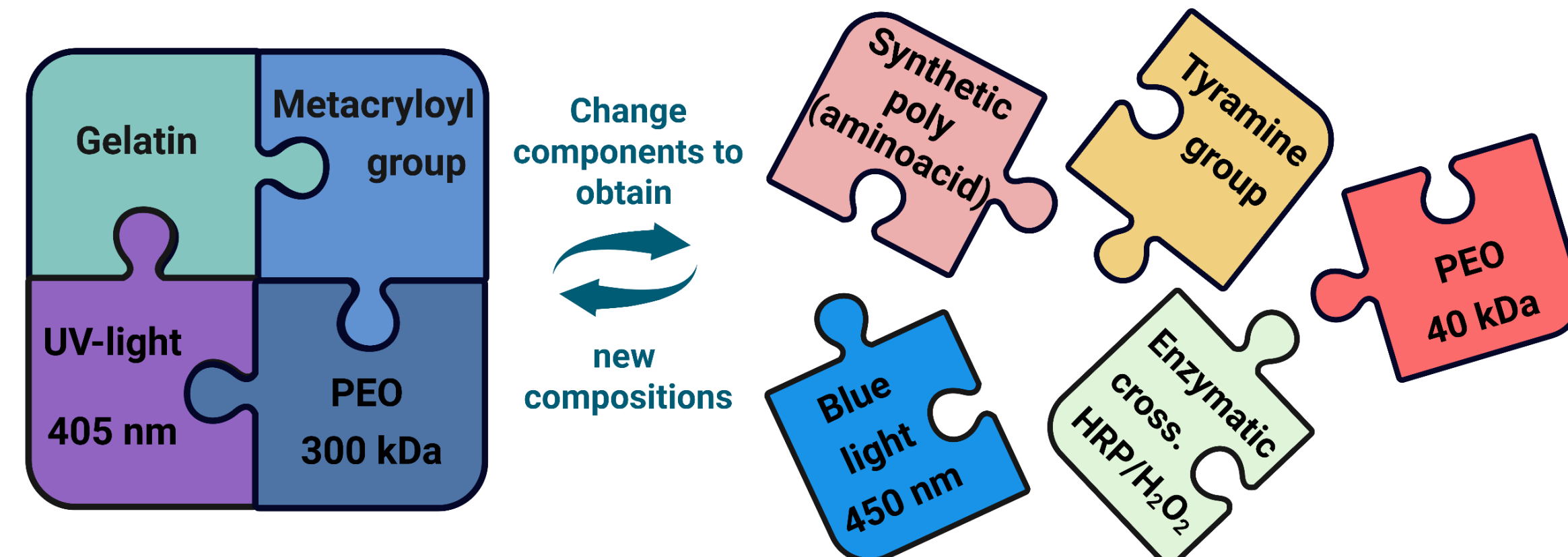


Figure 2. HUVEC culture in porous GelMA (180 Bloom) 5% (w/v)/LAP 0.1% (w/v)/PEO (300kDa) 0.8% (w/v) - UEA (endothelial cells), PhRh (actin fillaments), DAPI (nuclei) scale bar: 100 μ m.

What are our objectives in this work?



Natural polymer \rightarrow Synthetic polymer

In vivo = lower molecular weight PEO

300 kDa \rightarrow 40 kDa

From H₂O or PBS \rightarrow Culture medium (DMEM F12)

UV light (360, 405 nm) \rightarrow Blue light (460 nm)

METHODS & RESULTS

Polymer Synthesis

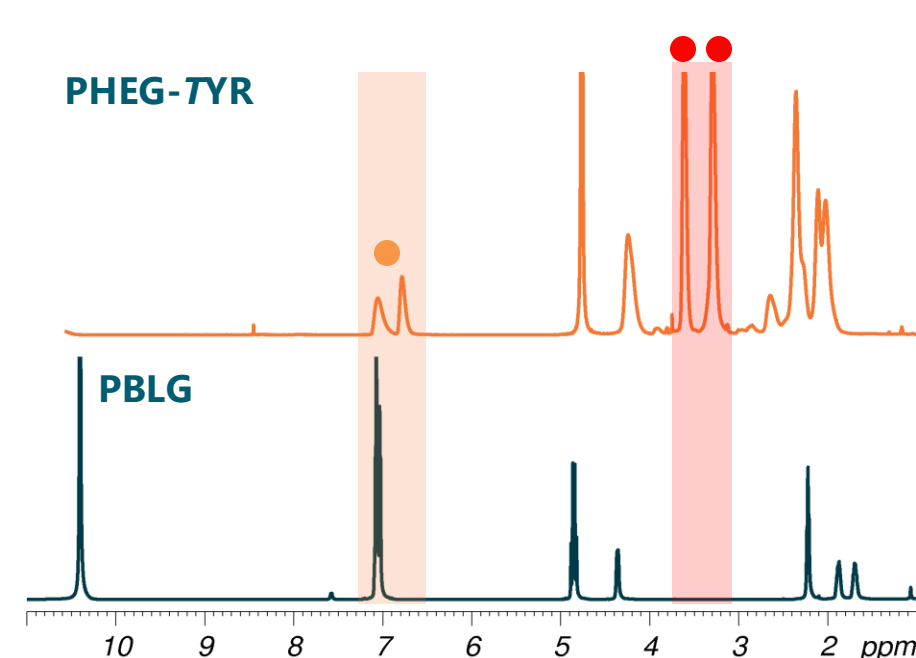
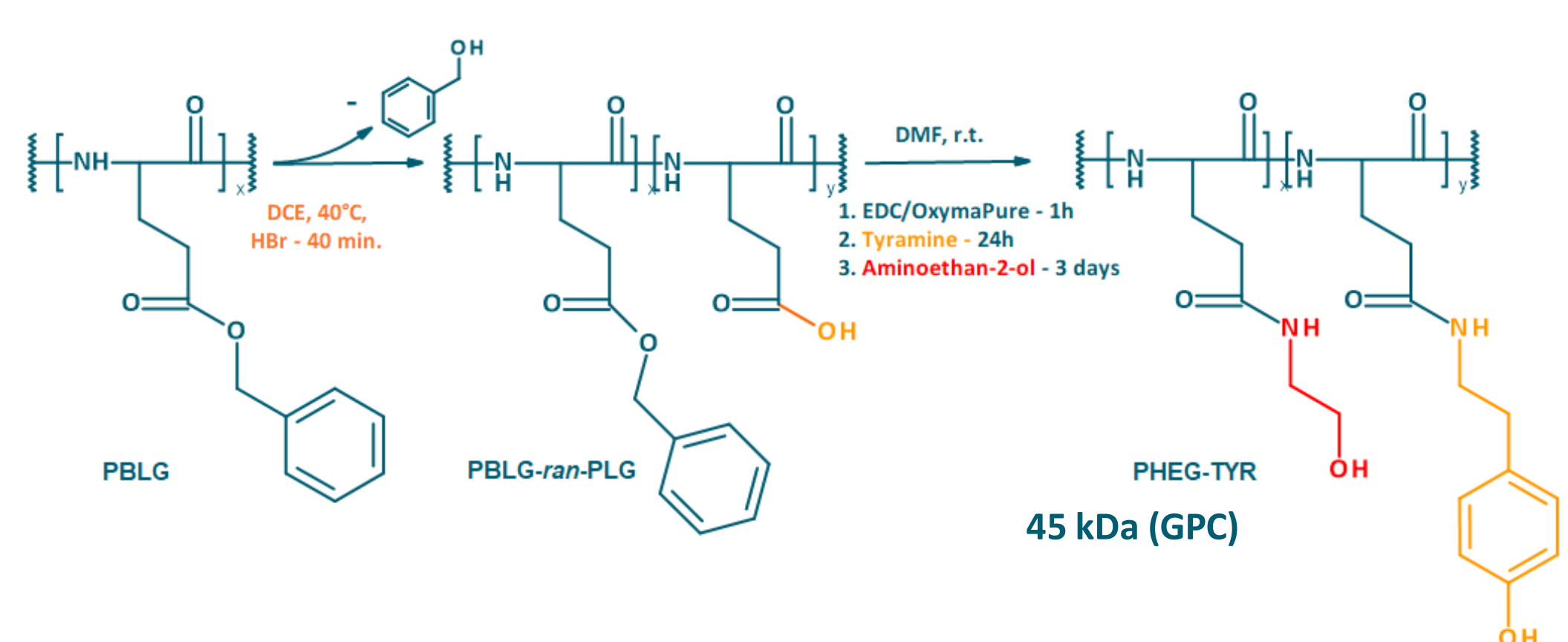
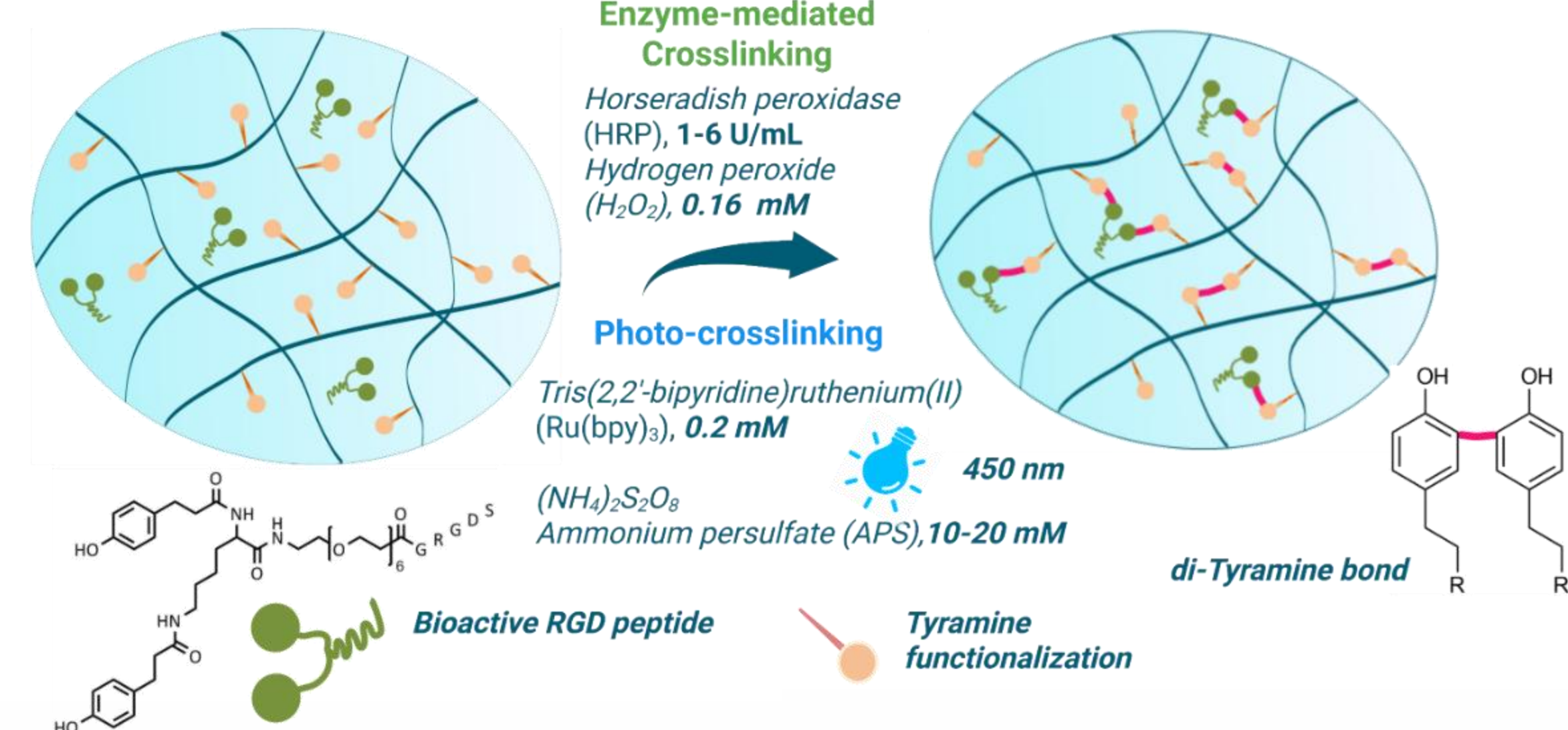


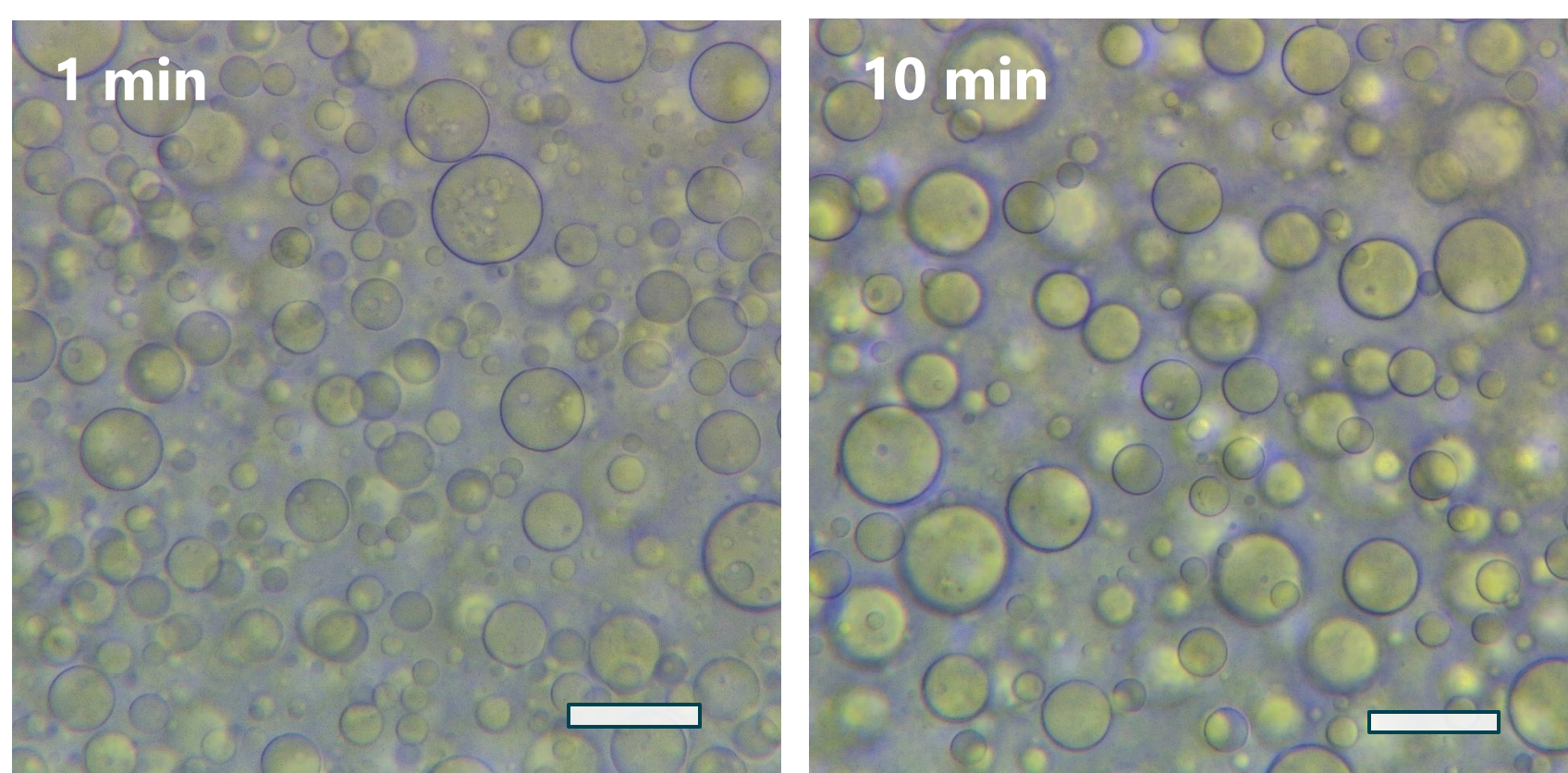
Fig 3: ¹H NMR spectrum of PHEG-TYR, Content of TYR group: 0.95 mmol/g

Crosslinking Strategy

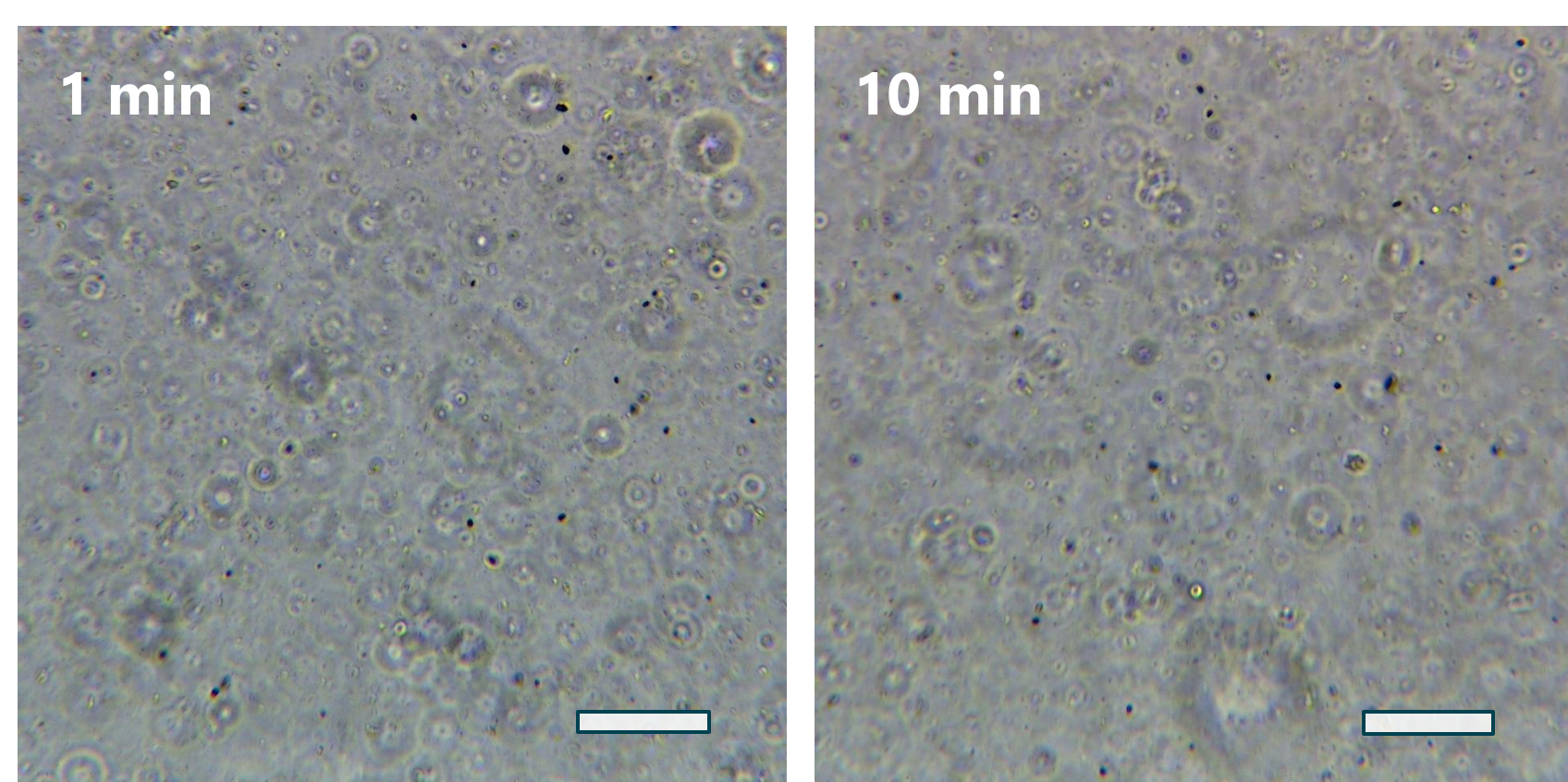


ATPS Formation

15 % w/v PHEG-TYR + 5 % w/v PEO 40 kDa in water



15 % w/v PHEG-TYR in F12 cell culture medium + 5 % w/v PEO 40 kDa in water



Hydrogels Characterization

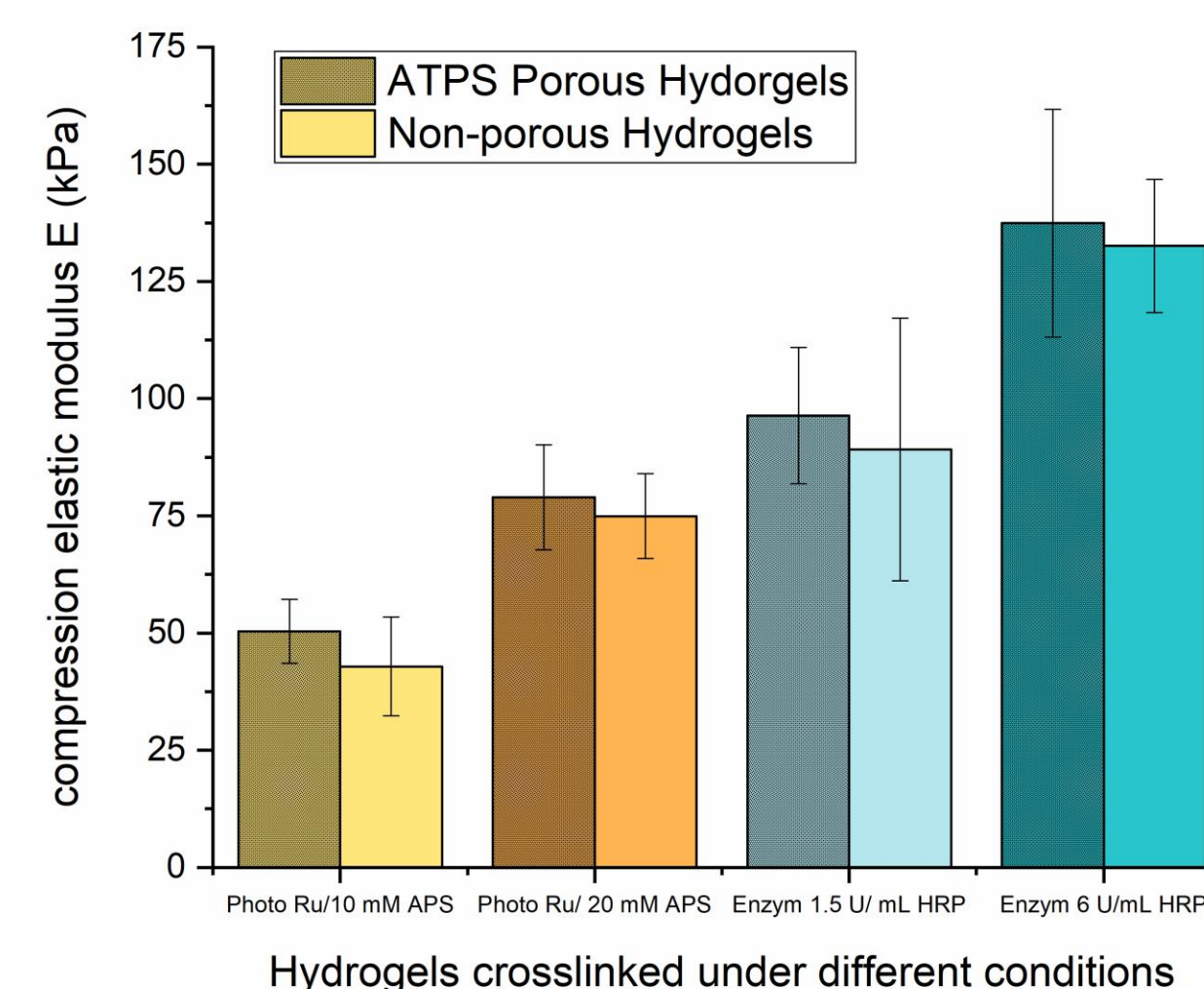
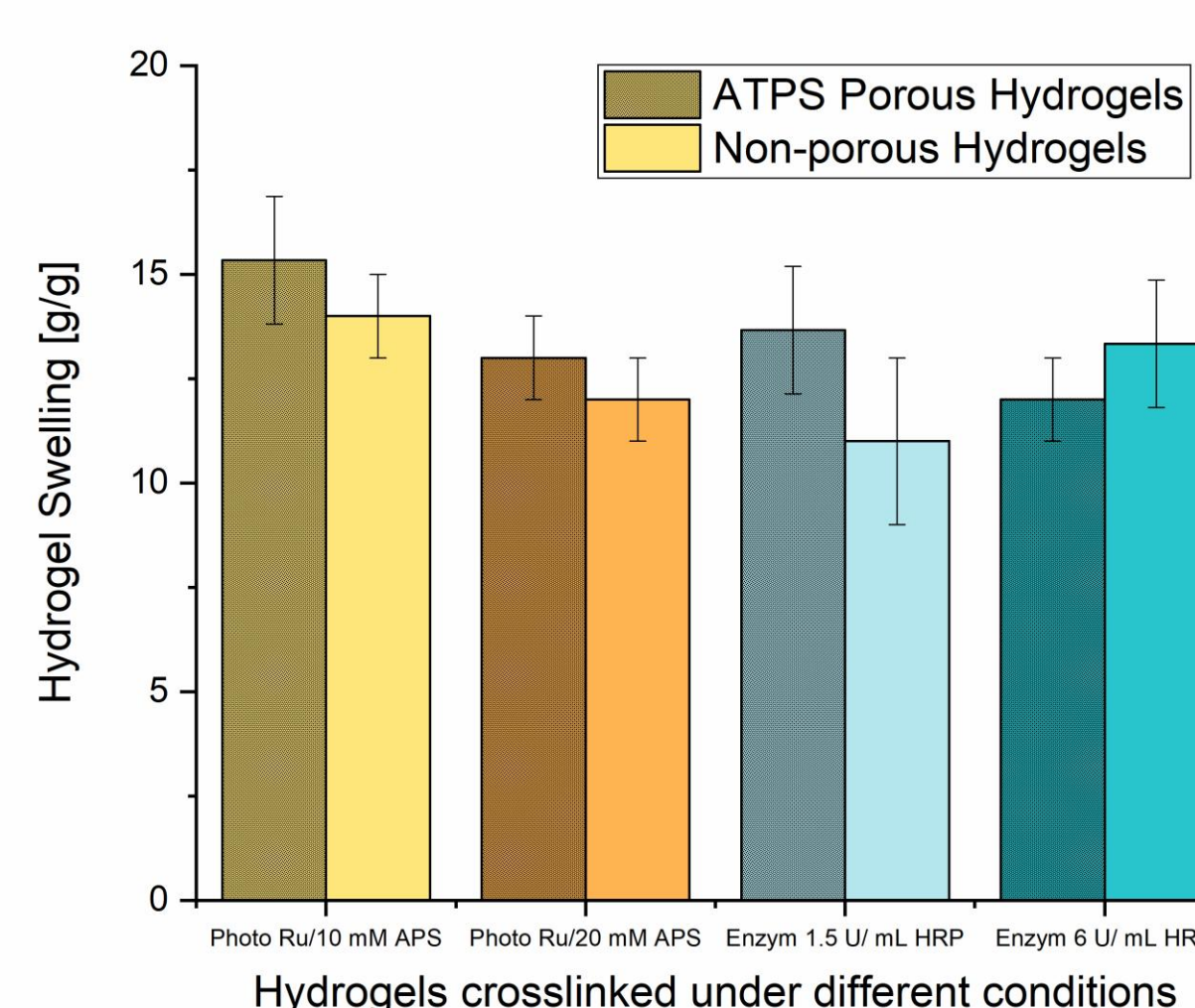
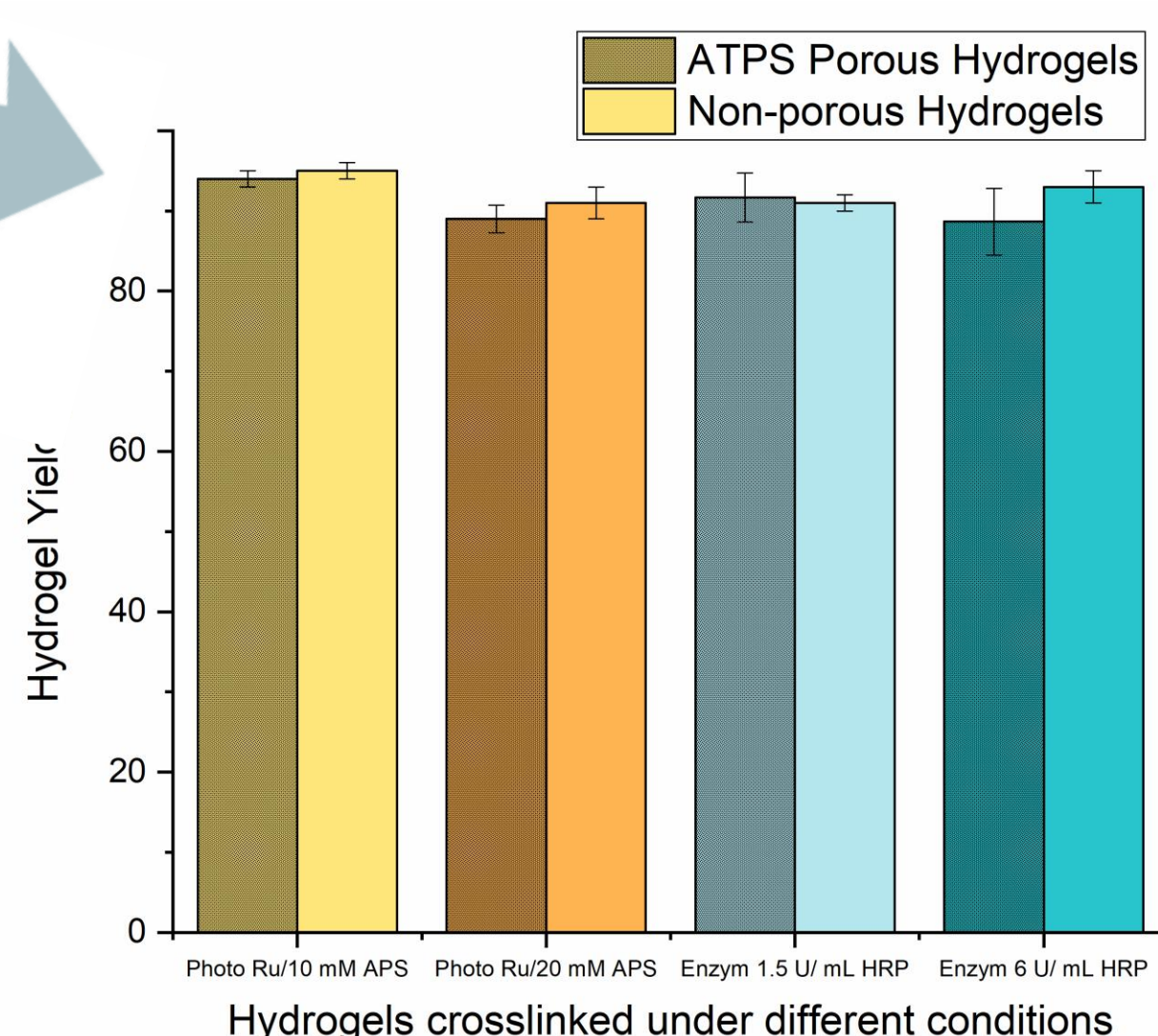
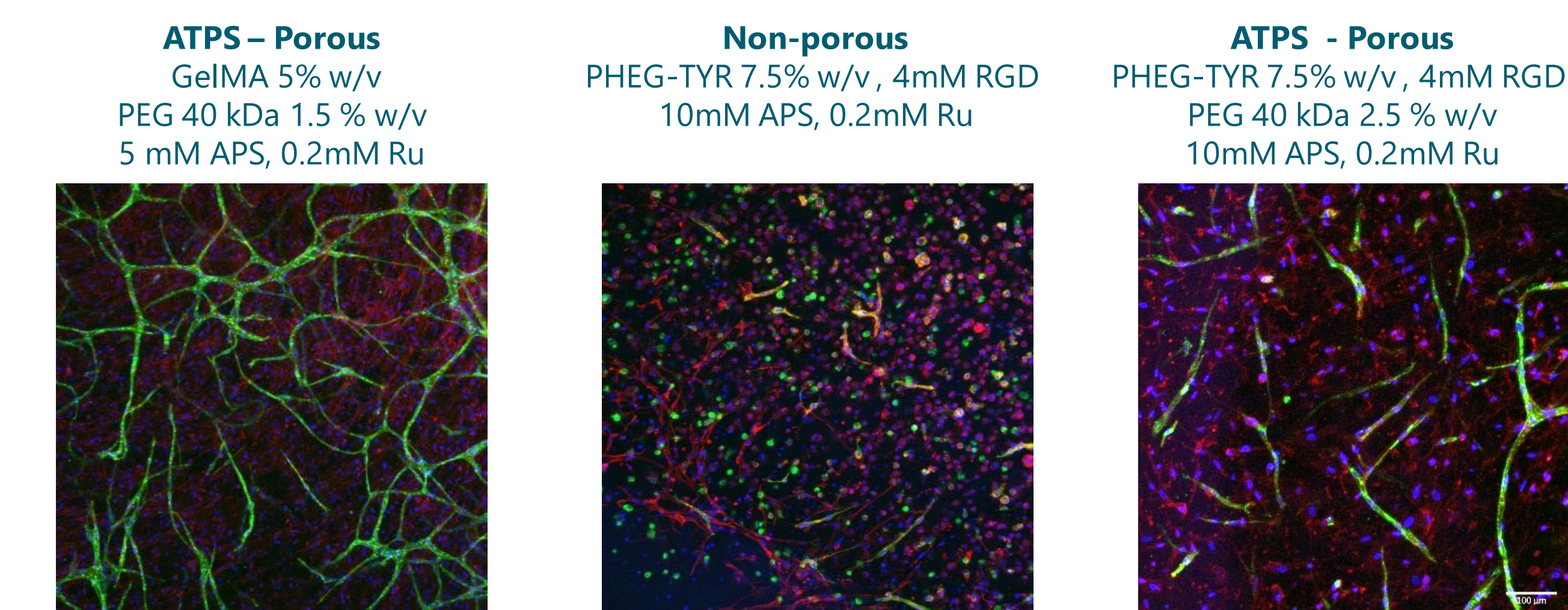


Photo and Enzymatically crosslinked stable Non-porous and ATPS Porous Hydrogels with tunable crosslinking density and mechanical properties

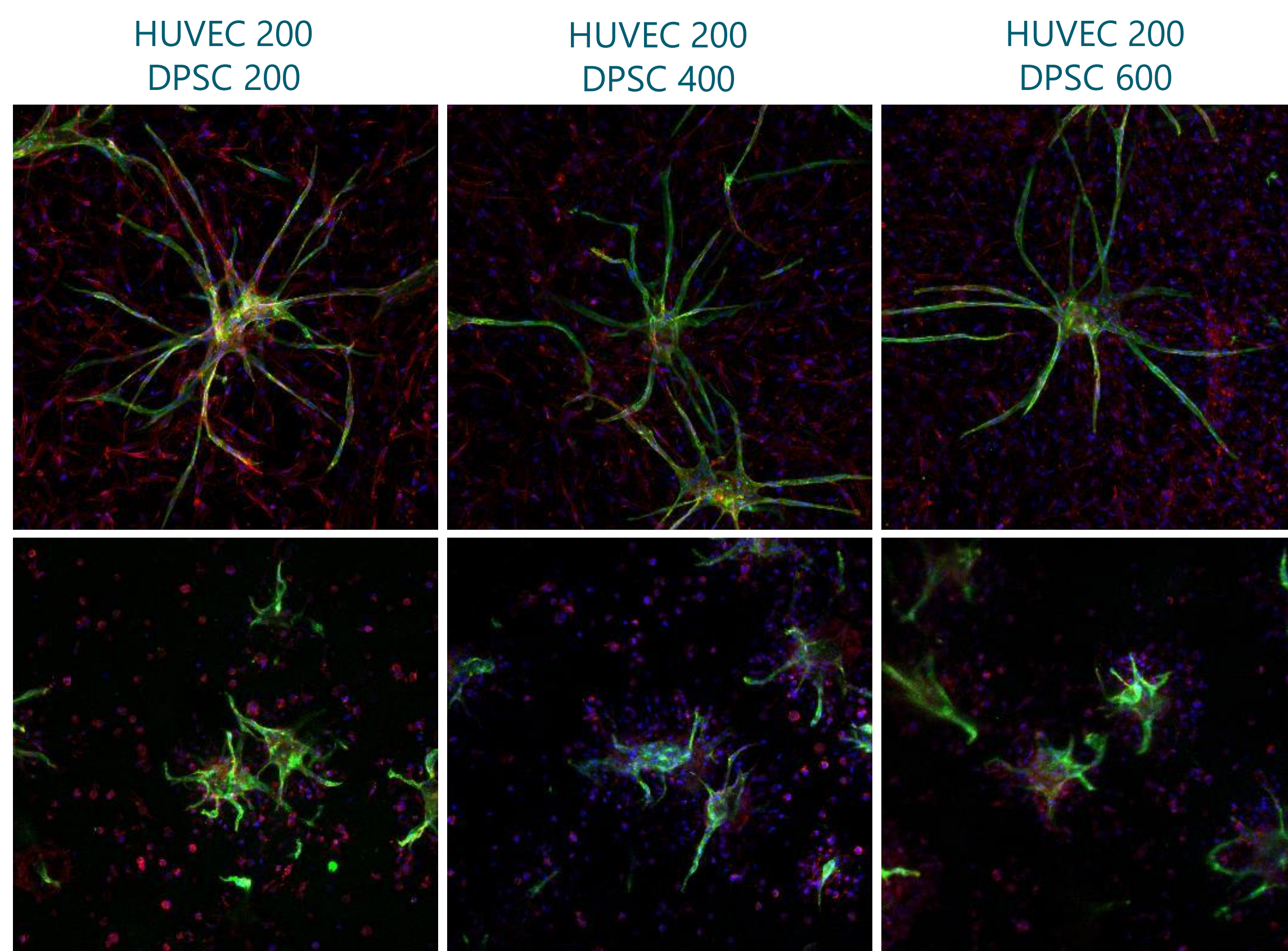
Cell experiments in Photo-crosslinked Hydrogels



HUVEC culture-UEA (endothelial cells), PhRh (actin fillaments), DAPI (nuclei) scale bar: 200 μ m.

ATPS – Porous
GelMA 5% w/v
PEG 40 kDa 1.5 % w/v
5 mM APS, 0.2mM Ru

ATPS – Porous
GelMA 5% w/v
PEG 40 kDa 1.5 % w/v
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ACKNOWLEDGEMENTS

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- [2] GOLUNOVA, Anna, et al. Fully synthetic, tunable poly (α -amino acids) as the base of bioinks curable by visible light. *Biomedical Materials*, 2024, 19.3: 035035.