



The Effect of Phase-separated Microstructures on Cell Migration in 3D Dextran Hydrogels

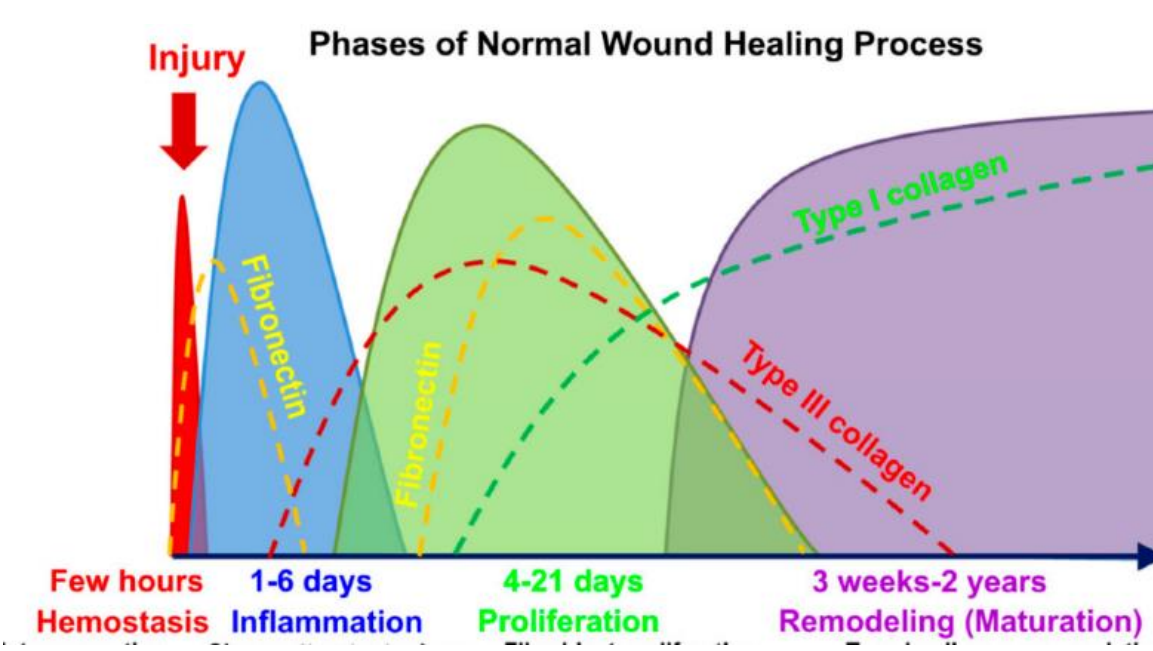
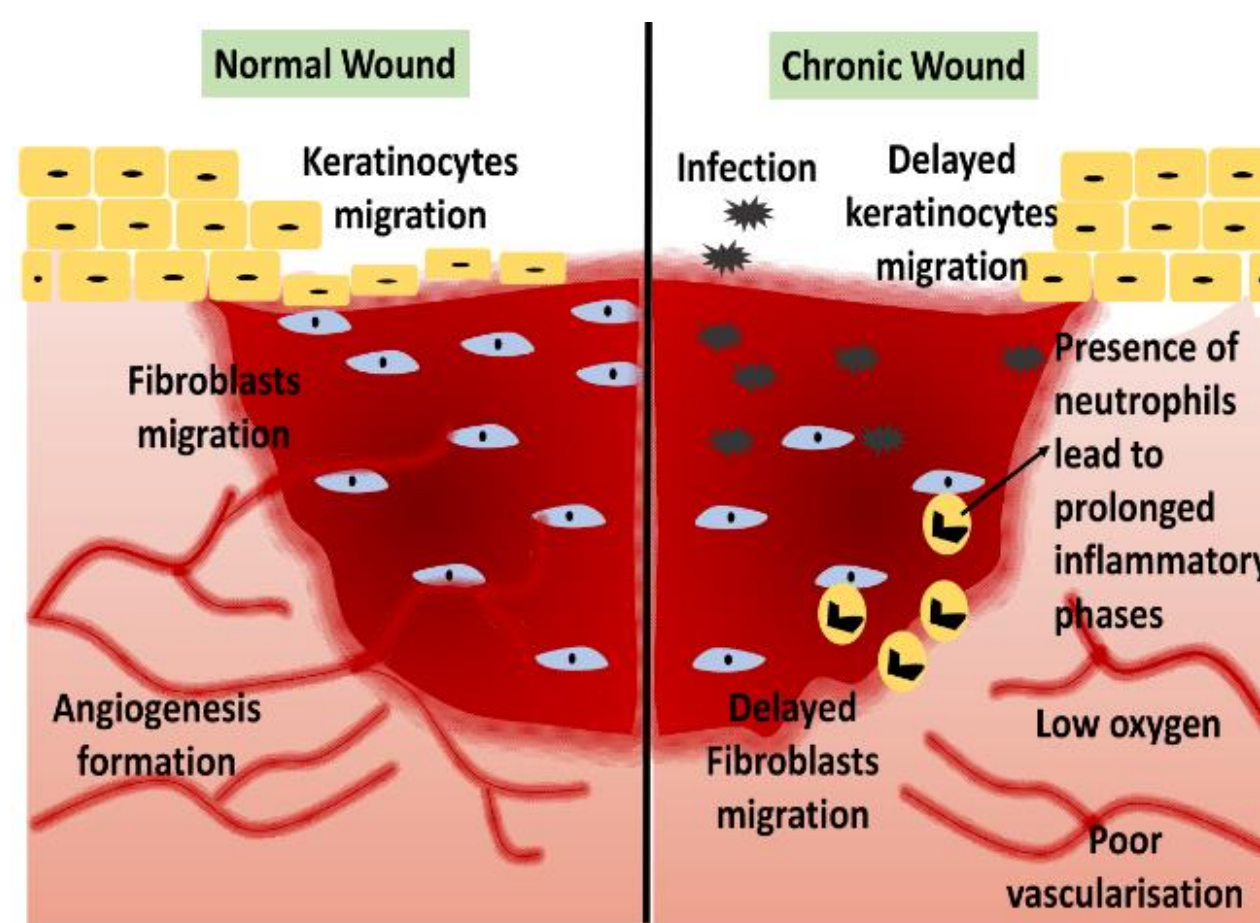
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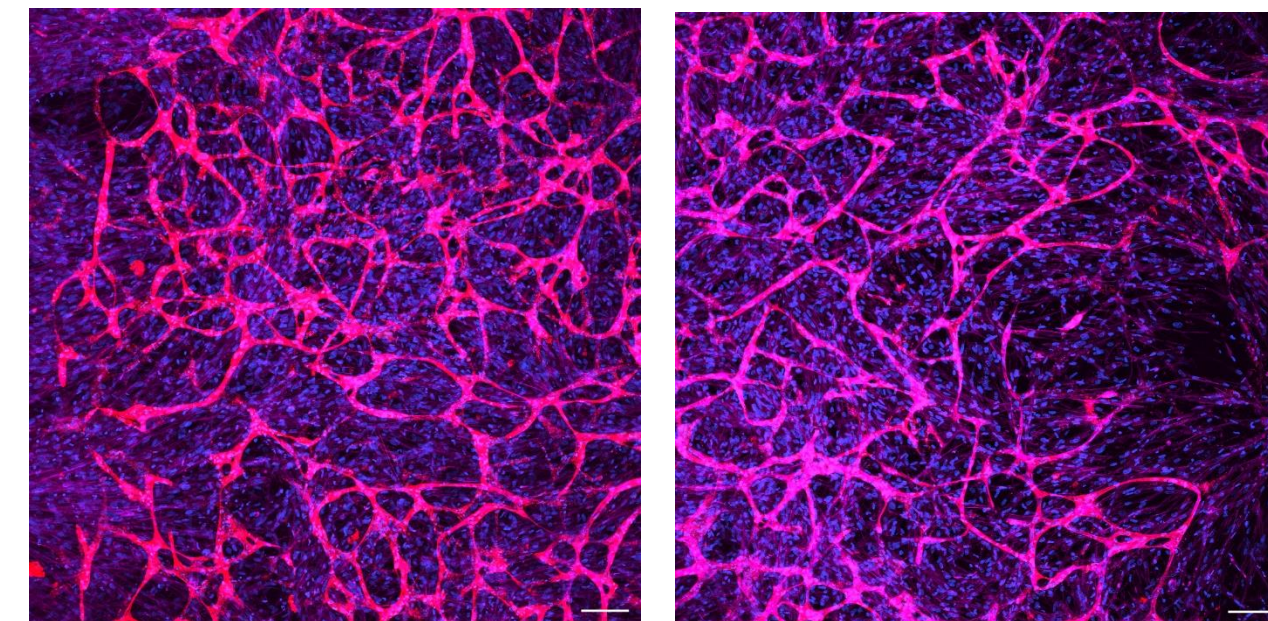
Introduction/ Background

- ❖ Chronic wounds impact approximately 6.5 million Americans, with all current treatments widely being therapeutic
- ❖ Wound that persist in the inflammation phase for more than 3 months are considered chronic
- ❖ With in-vivo models not accurately mimicking human physiology, in-vitro models, particularly cell encapsulated matrix-based hydrogels, help further understand cell interactions



Objective

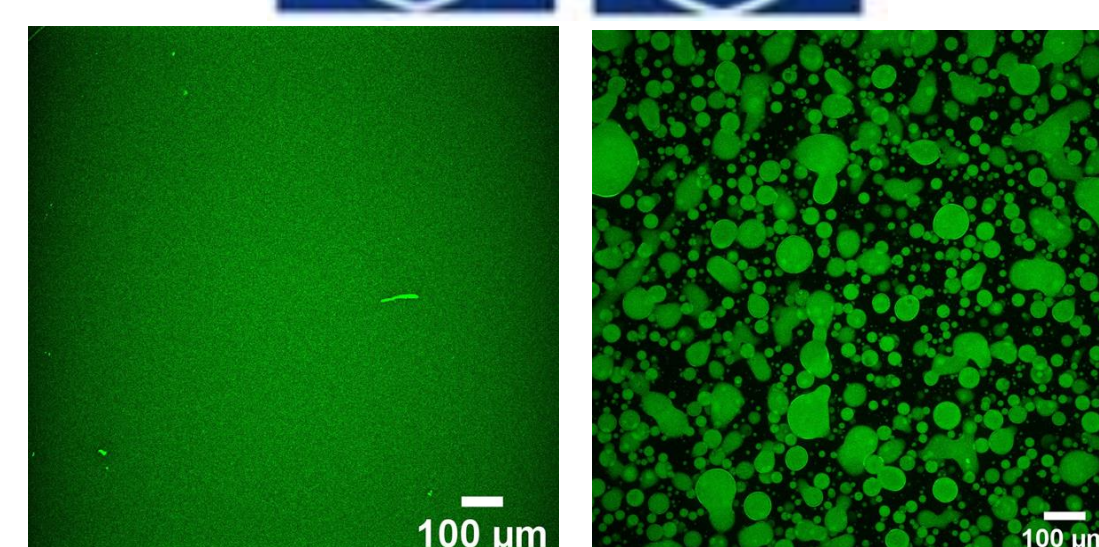
To create angiogenic structures by seeding fibroblasts and endothelial cell in phase separated dextran methacrylate (DexMA) hydrogels



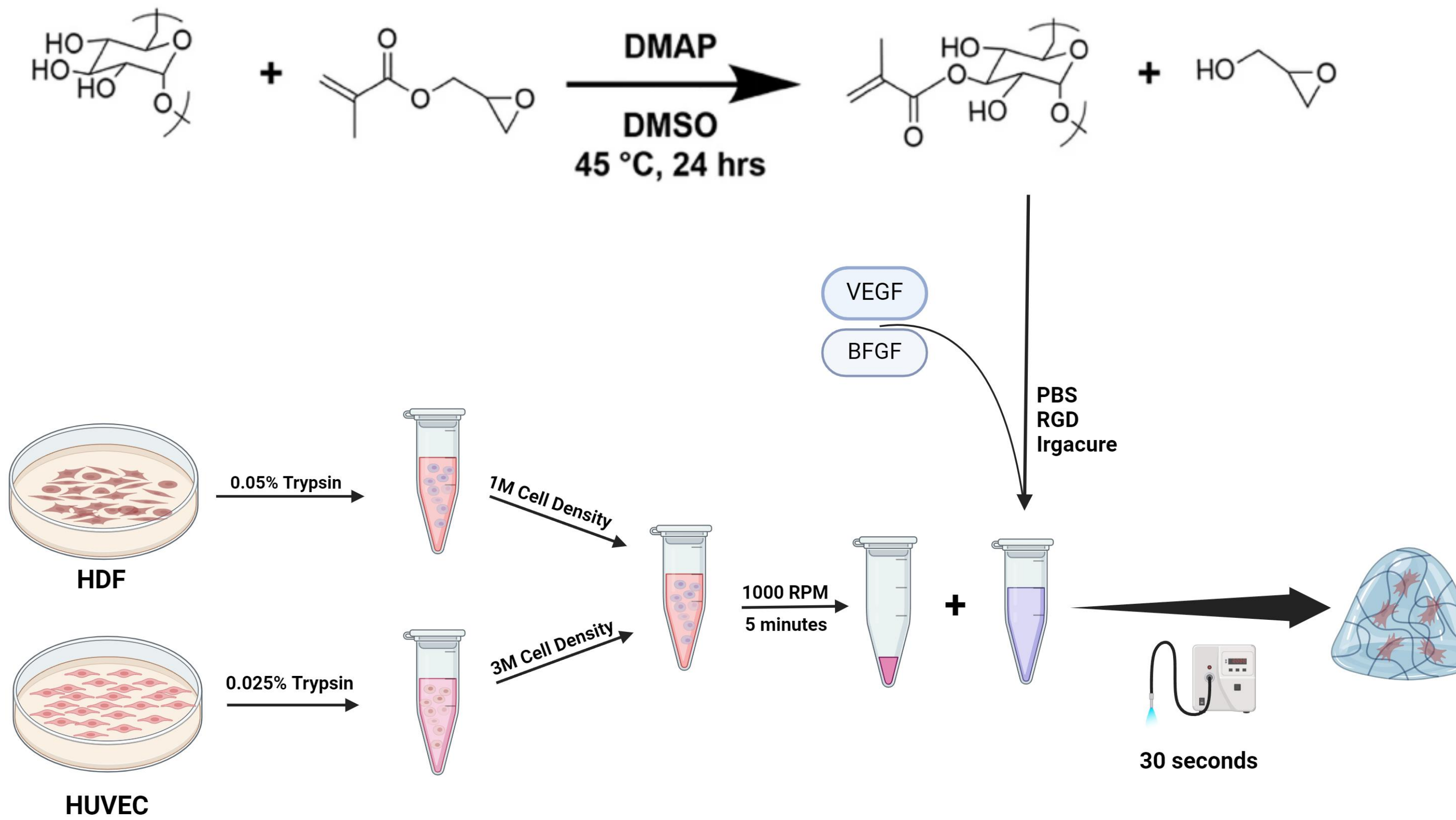
- ❖ Peptide crosslinked gel: 4% wt DexMA, peptide ratio 1:0.5, added VEGF and BFGF

Material Synthesis

- ❖ Dextran is an FDA approved biocompatible large macromolecule
- ❖ Methacrylate groups are added to replace the hydroxyls groups of dextran through *trans*-esterification, increasing its hydrophobicity
- ❖ Increased hydrophobic-hydrophobic interactions leads to thermo-responsive phase separations
- ❖ Entropy driven phase separation induces the formation of well defined microdomains

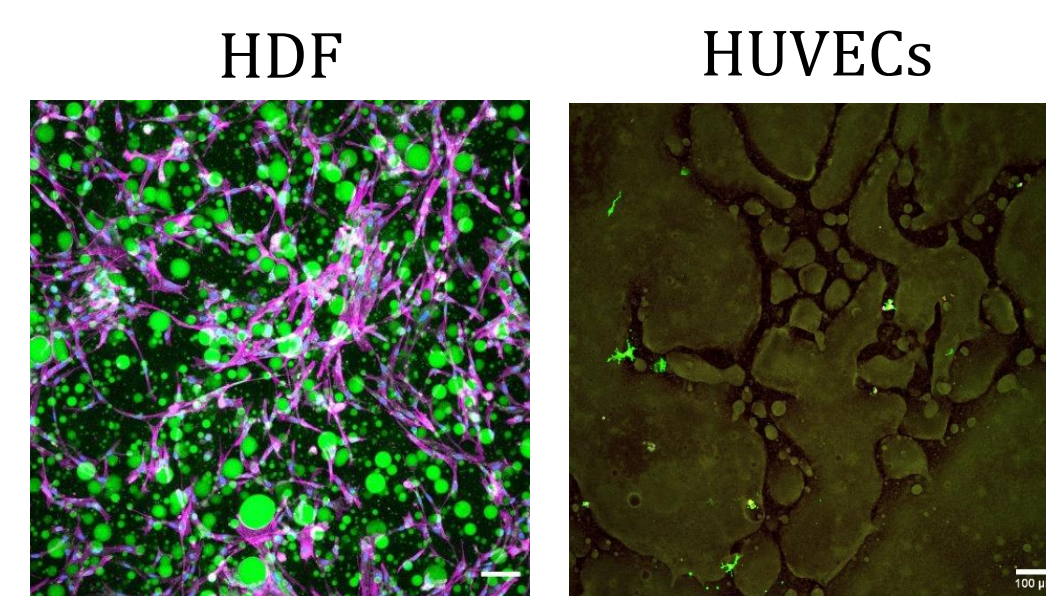


Overall Methodology



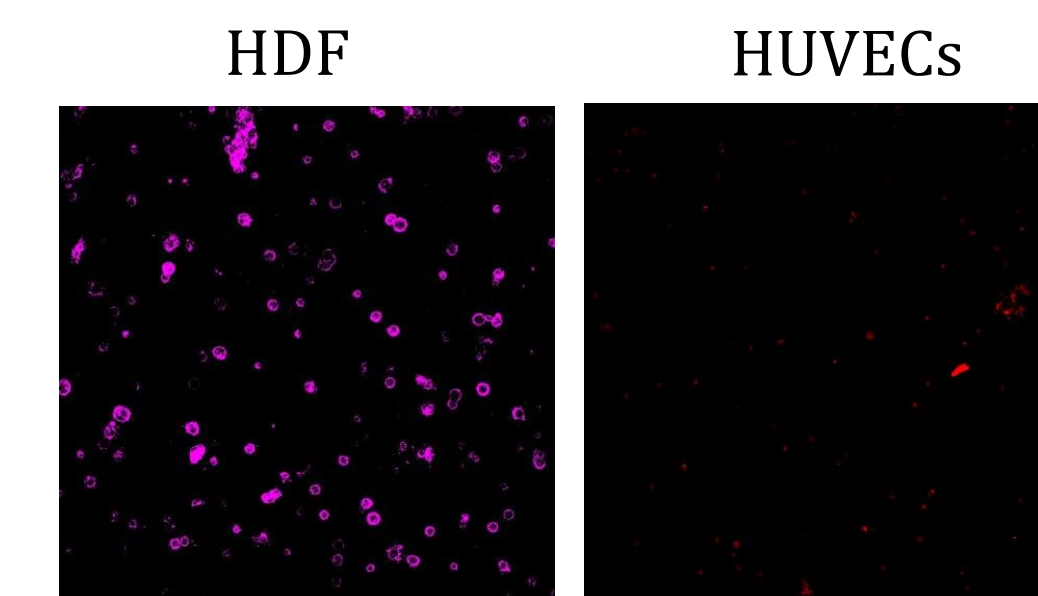
Understand Single Cell Response in Phase Separated and Non-phase Separated Gels

Phase-separated:



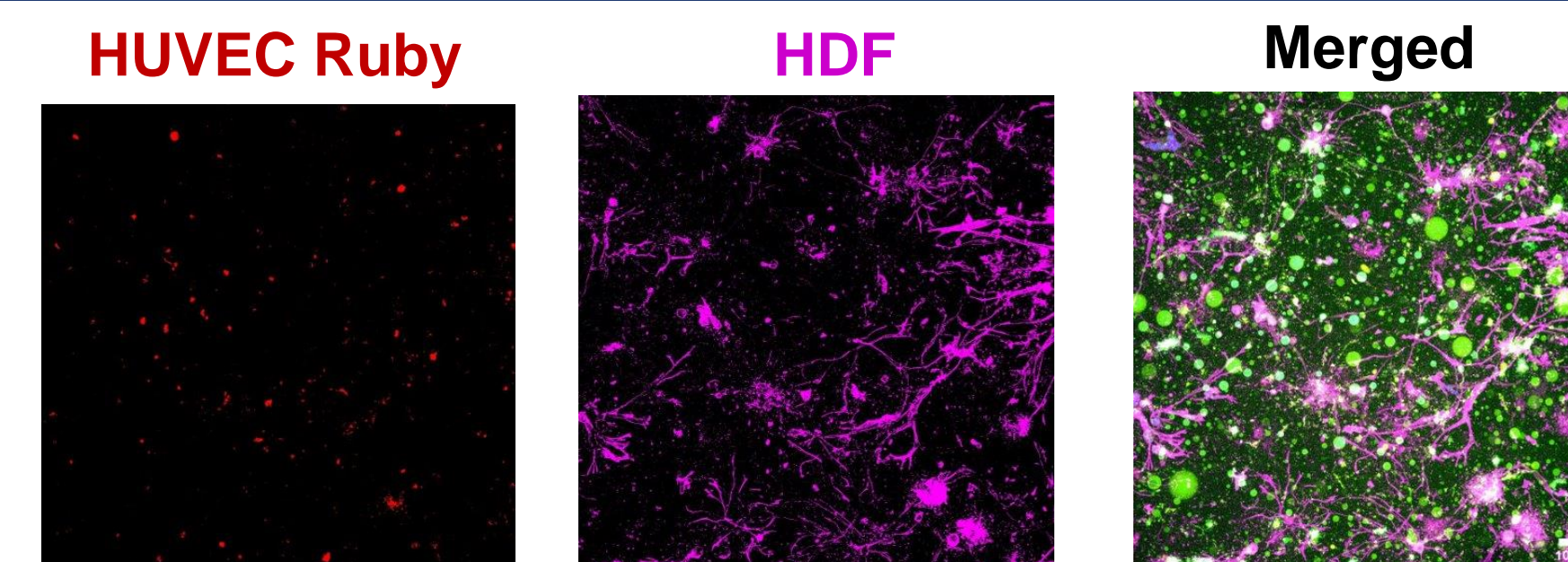
- ❖ Limited to no cell spreading in non-phase separated gels
- ❖ No HUVEC migration regardless of microstructures in single cell studies

Non-phase separated:

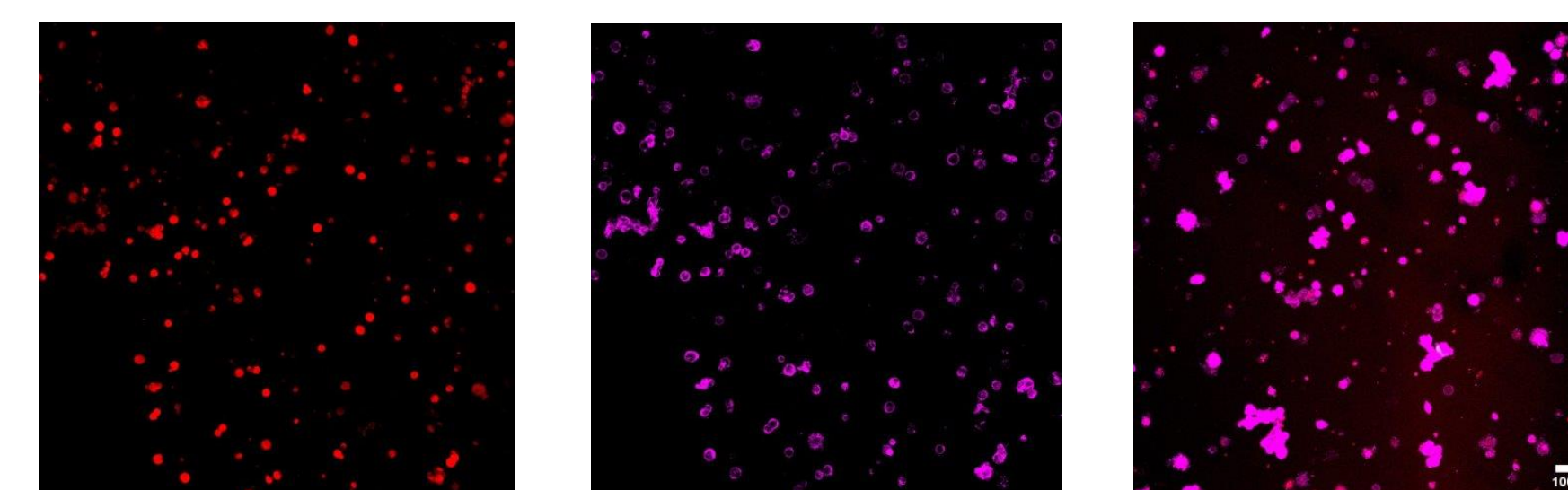


Addition of VEGF and BFGF Enhances Cellular Migration in Co-cultured Gels

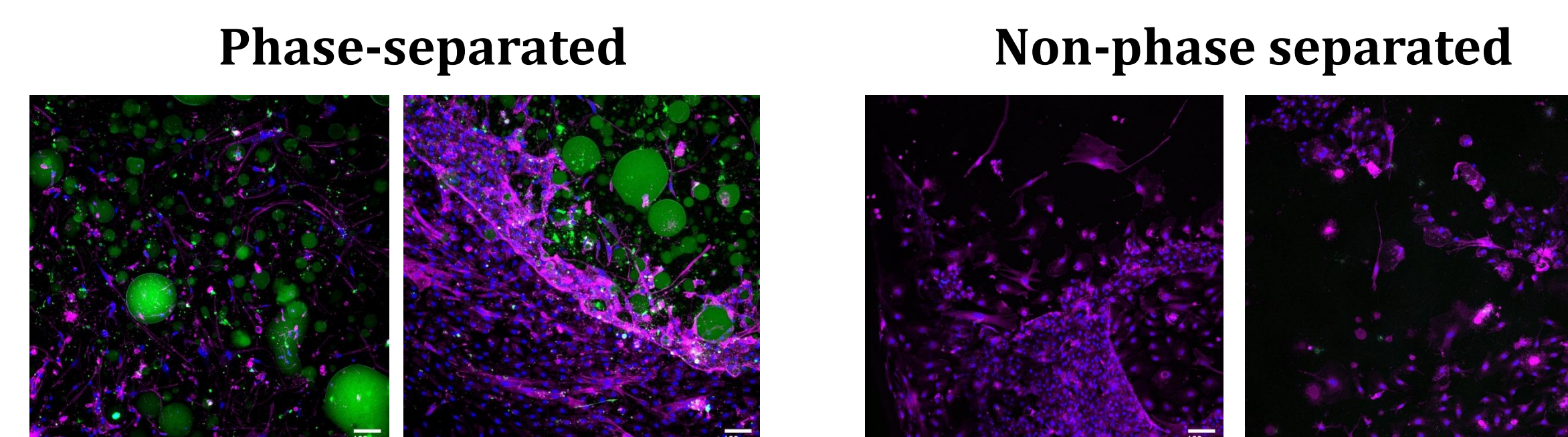
Day 14
No GF



Day 14 No GF
Non-phase separated

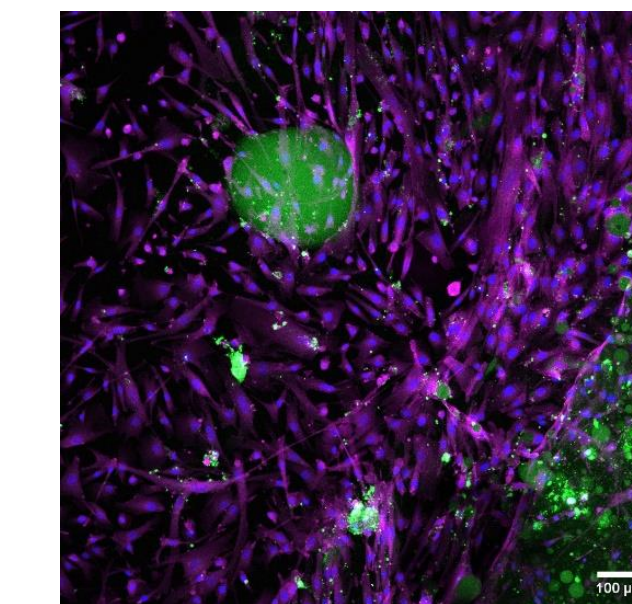
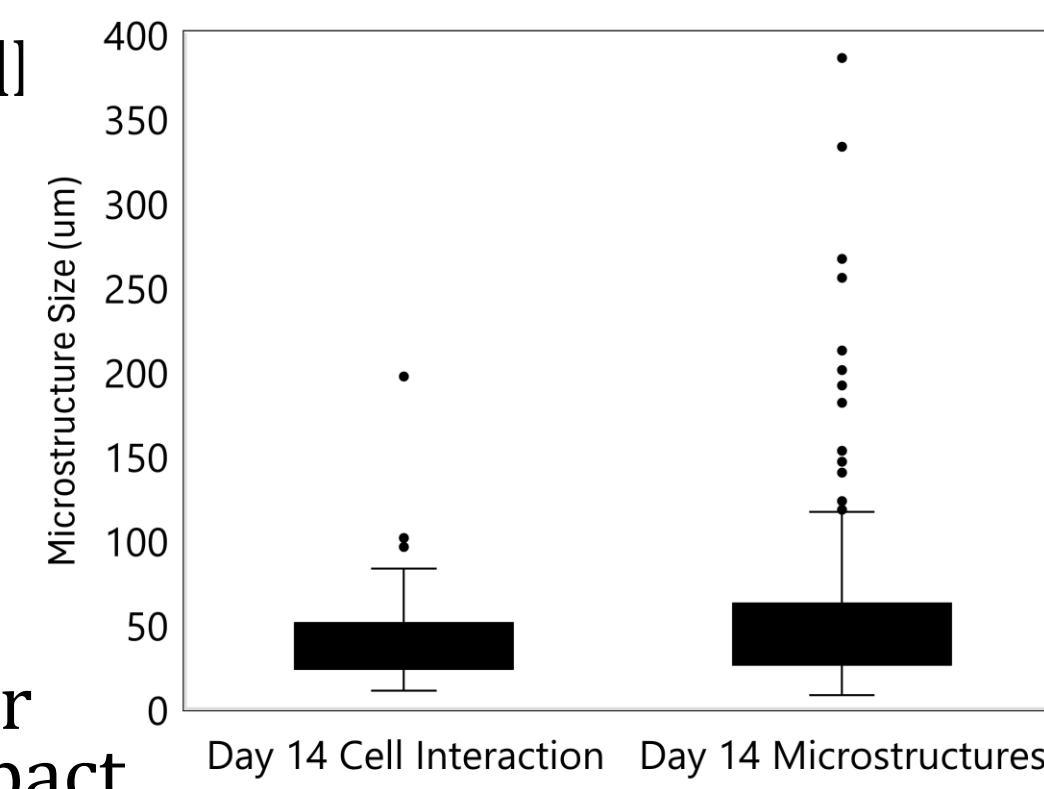


Day 14
With GF



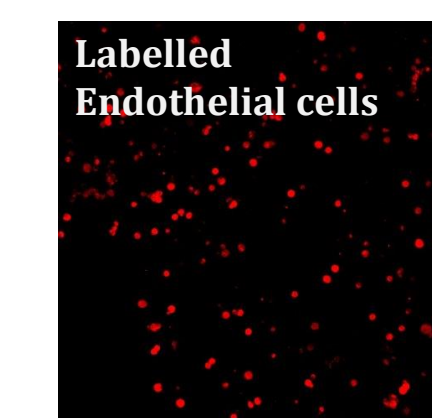
Results/Conclusions

- ❖ Interfacial driven cell migration of fibroblast
- ❖ Due to low cell density gels lacked vascular network
- ❖ Tuning growth factor loading time can impact cellular responses
- ❖ Average diameter cells attached to: 34.9um, average microstructure length in gel was 40.1um
- ❖ Microstructure range: 7.7um-385.2um

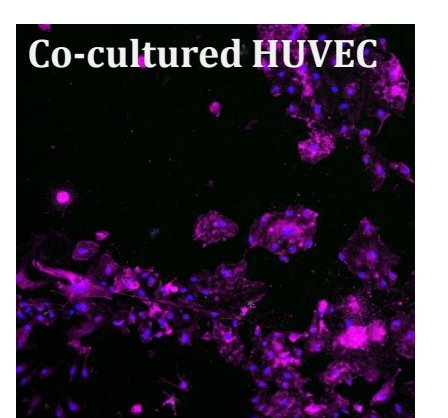


- ❖ Cellular migration of hydrogel matrix could possibly have drug deliver application in future chronic wound studies

Future Steps



VS.



- ❖ Labeled endothelial cells to differentiate cell lines
- ❖ Increased cell density
- ❖ Track cellular response in earlier days
- ❖ In-vitro scratch assay in pre-vascularized model

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- ❖ CIBBR NIH

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