

Chronic Wounds

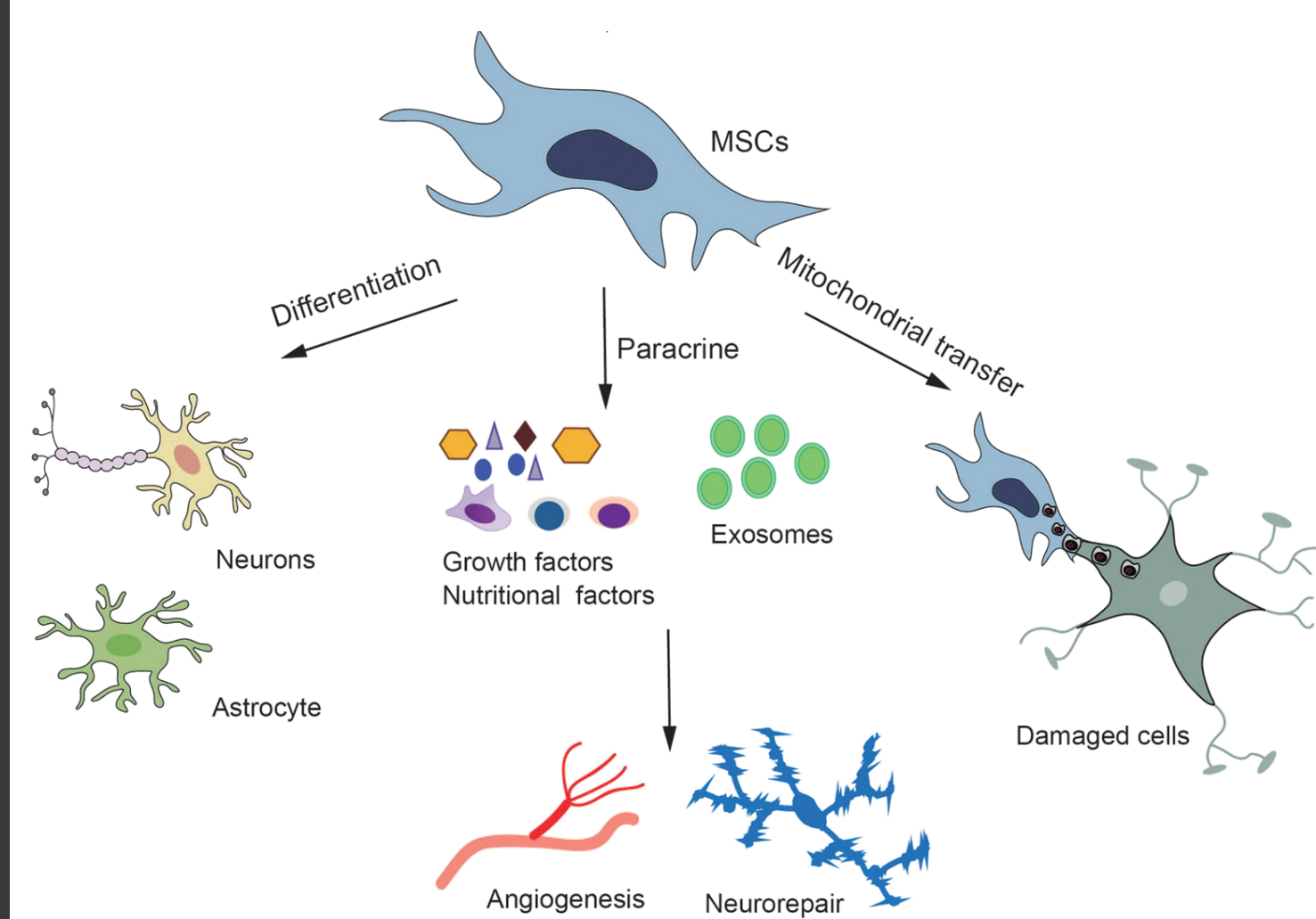
Clinical Need

- Chronic wounds affect **7 million** people in the US
- Wound healing process fails to restore function of skin
 - Diabetes
 - Severe burns
- Cost: **\$25 billion** annually

Treatments

- *Traditional dressings* + Inexpensive and simple - Limited efficacy
- *Tissue-engineered skin* + Improved healing - Inconsistent outcome - High cost/complexity
- *Mesenchymal stem cells* + Pro-healing factors - Require scaffold

Urgent need for more effective chronic wound treatments



Goal: Encapsulate mesenchymal stem cells into synthetic hydrogels for chronic wound therapy

Objective

Develop a tunable hydrogel platform with encapsulated mesenchymal stem cells to enable cell delivery with high viability to chronic wounds

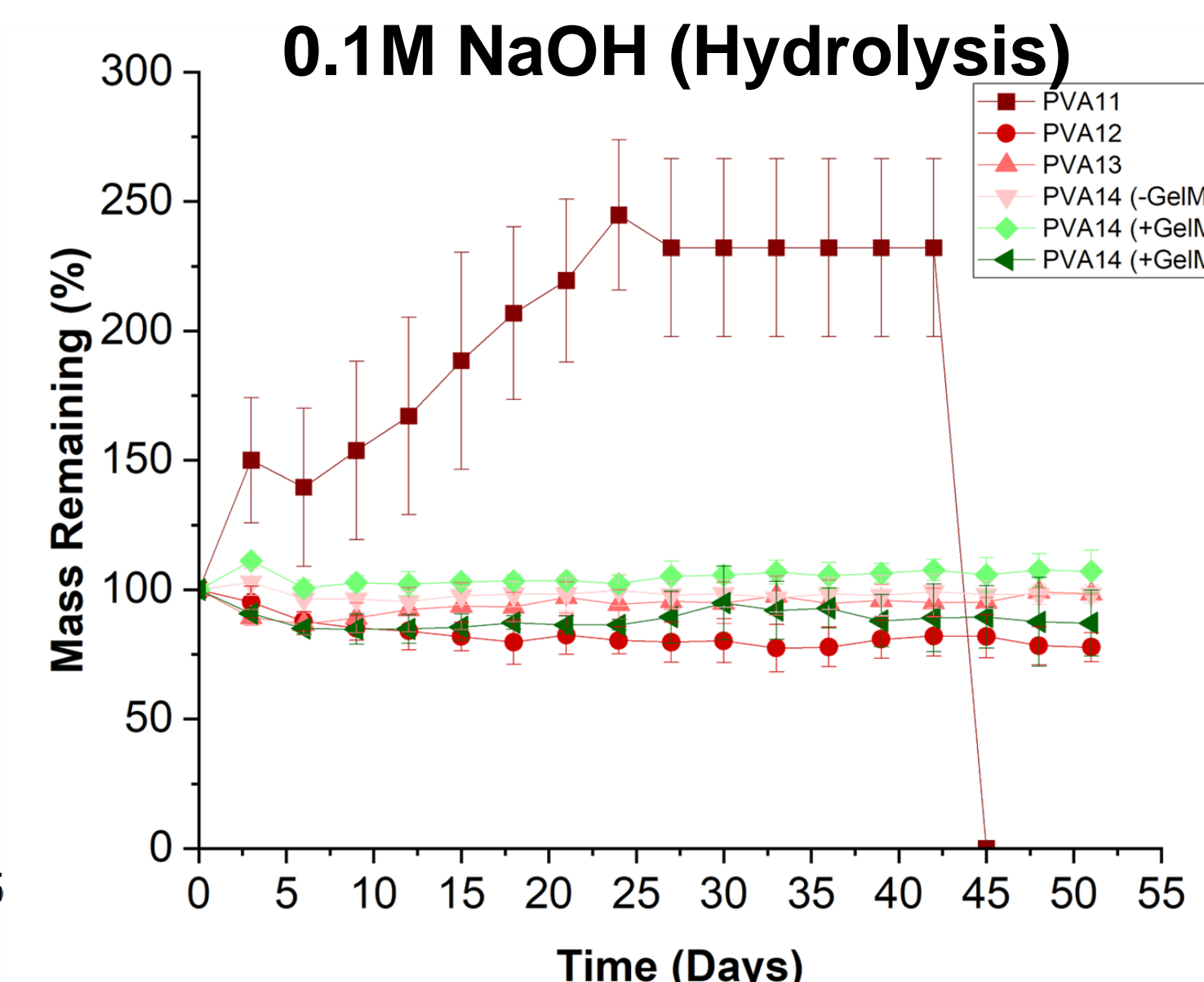
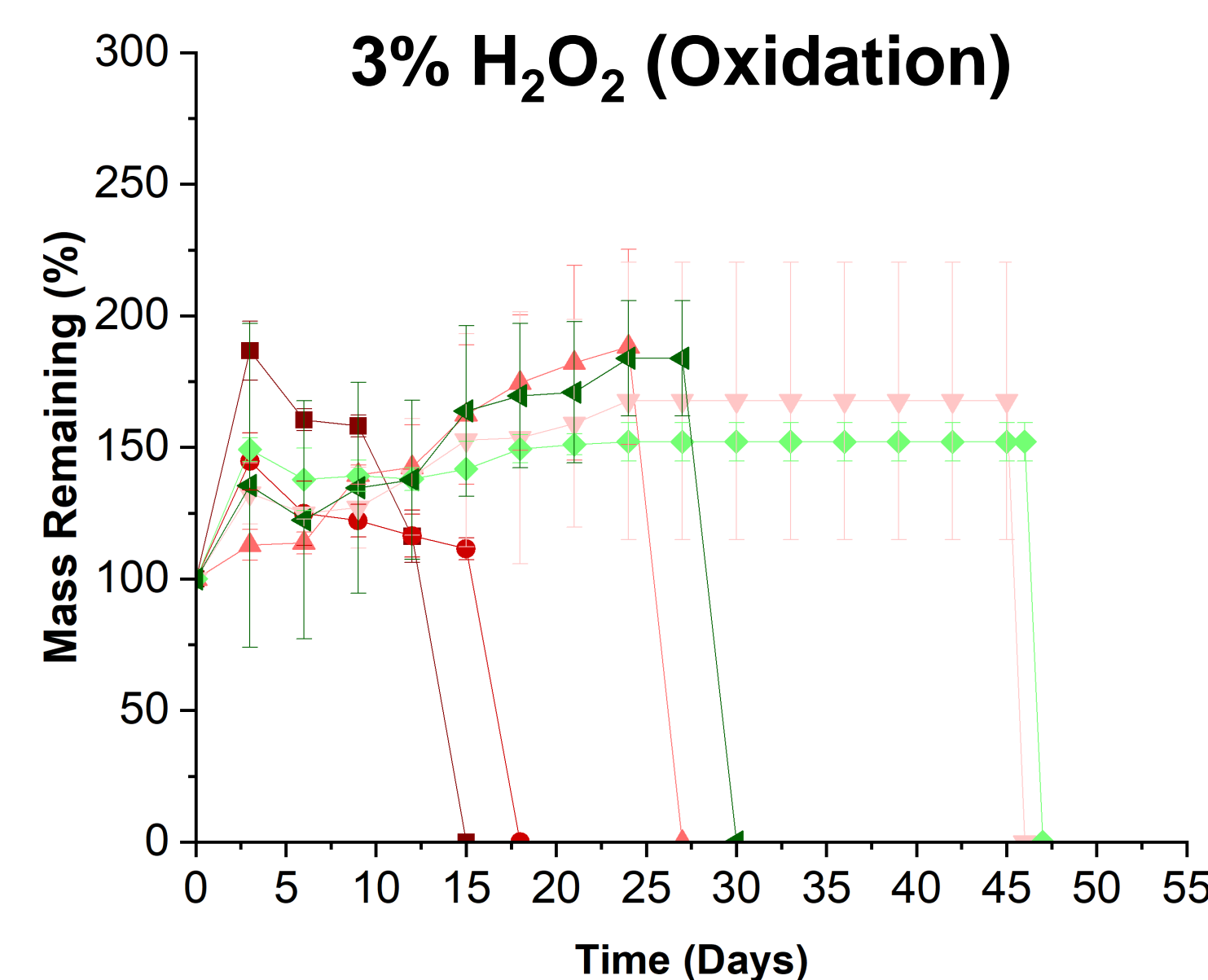
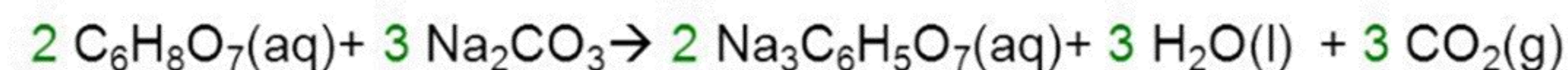
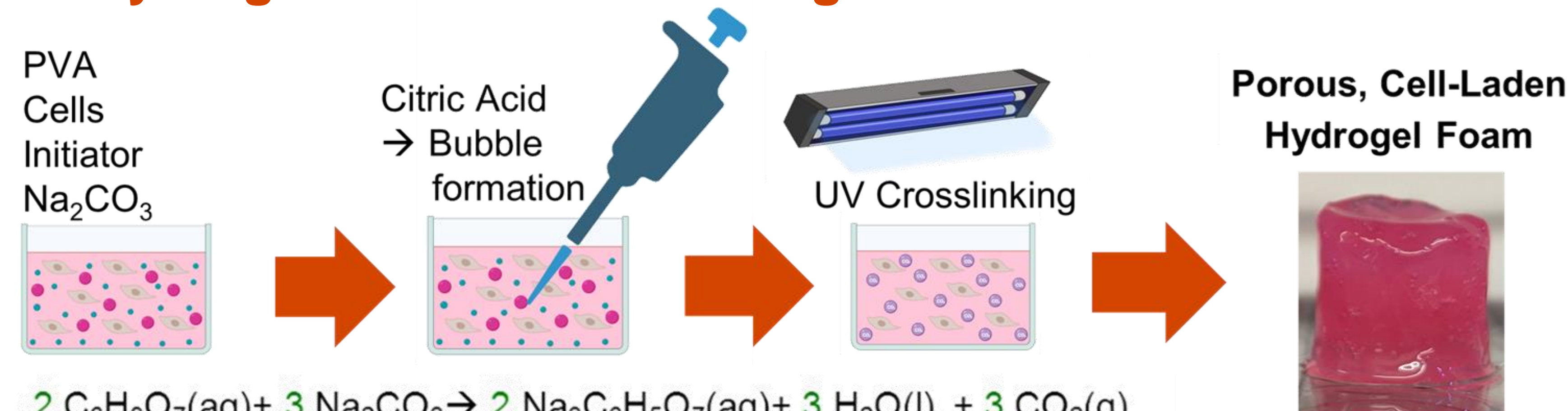
↑ **Sample Thickness**
Gas Blowing

↑ **Degradation**
Material Ratio

↑ **Cell Proliferation**
Gelatin/MA

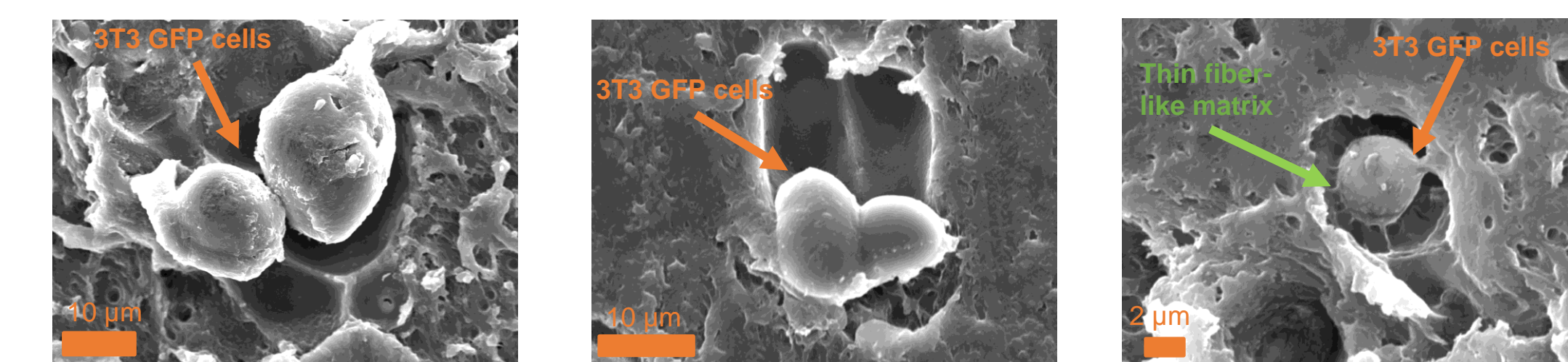
↑ **Cell Viability**
Pores

Hydrogel Fabrication and Degradation Characterization



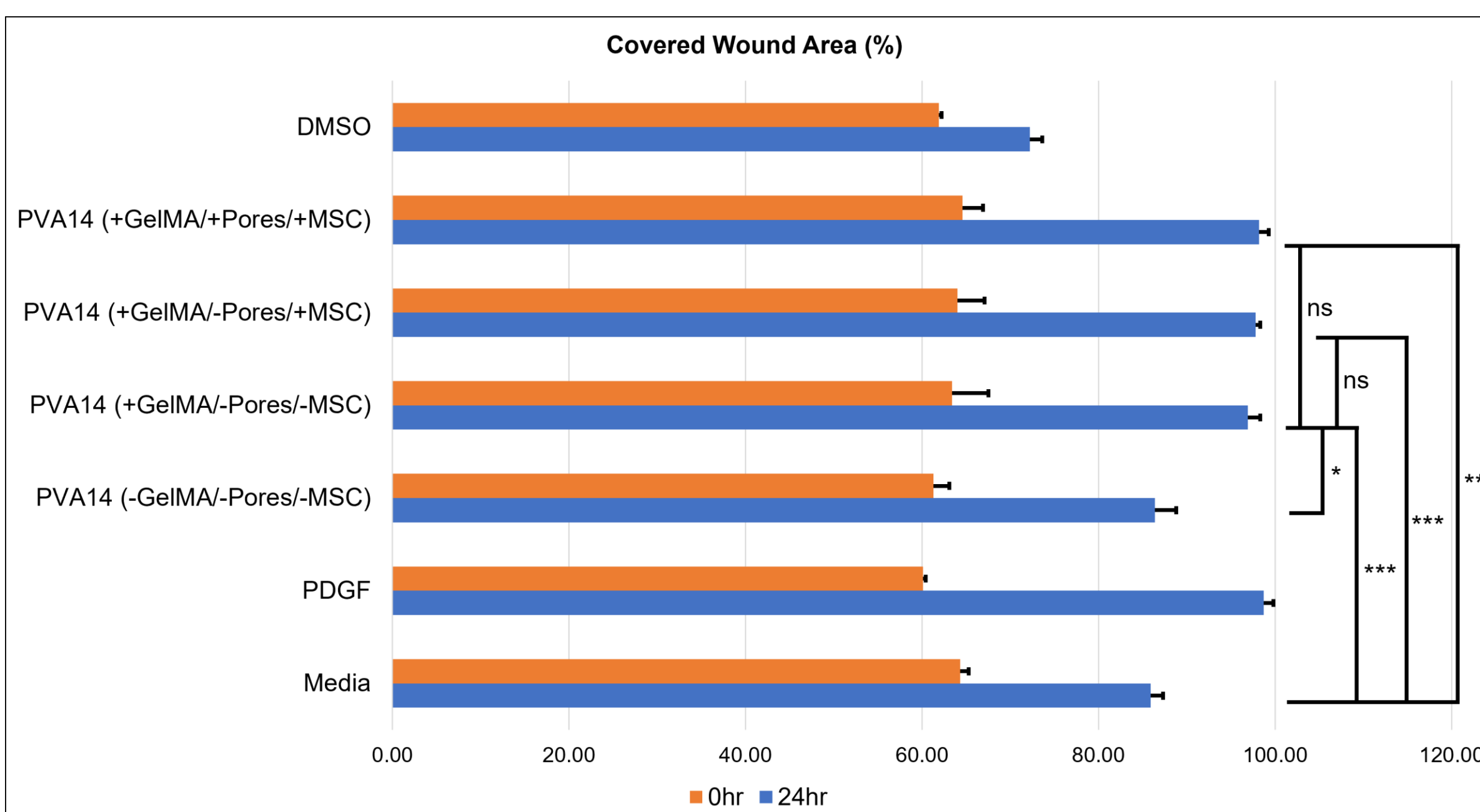
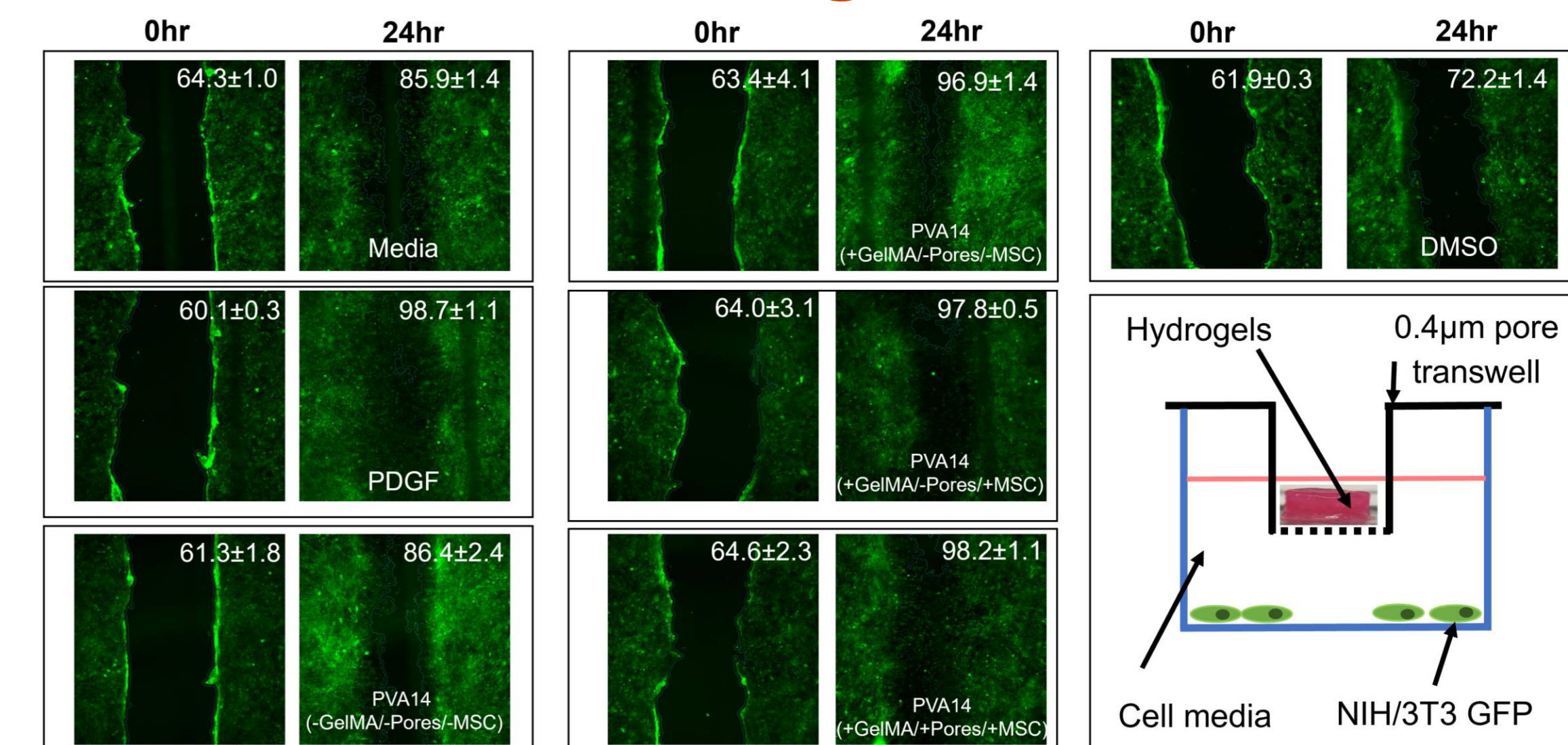
↑ thiolated PVA → ↑ degradation rates
Tunable degradation achieved

Cell Encapsulation: Microstructure



Porous PVA hydrogels support encapsulated cells

Cell Migration



Encapsulated MSCs + gelatin → ↑ cell migration

Synthetic Hydrogel Dressings

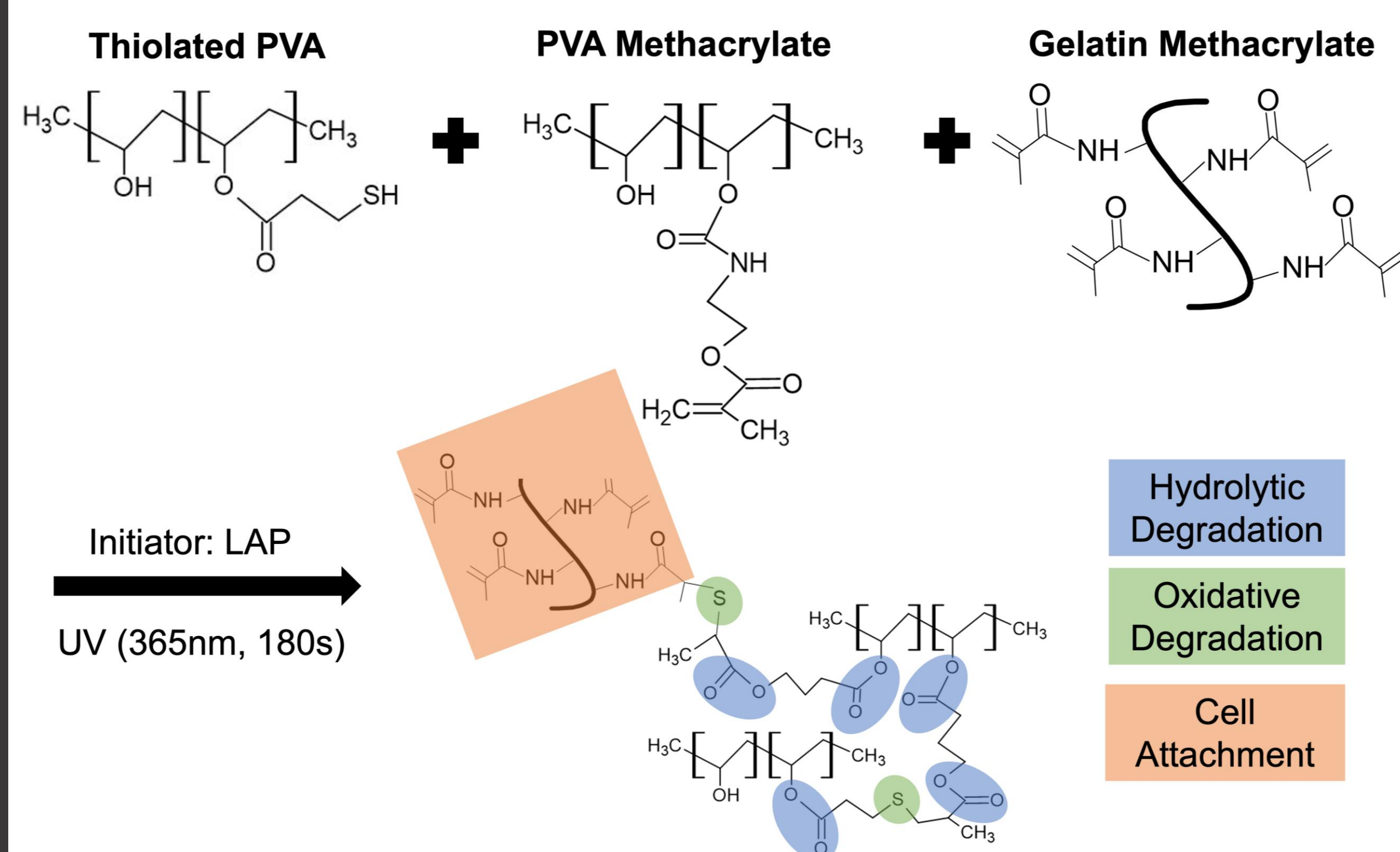
Polyvinyl Alcohol

- Water-soluble
- Biocompatible
- Tunable properties

Thiol-Methacrylate

- Form degradable groups
- Simple synthesis
- Affordable

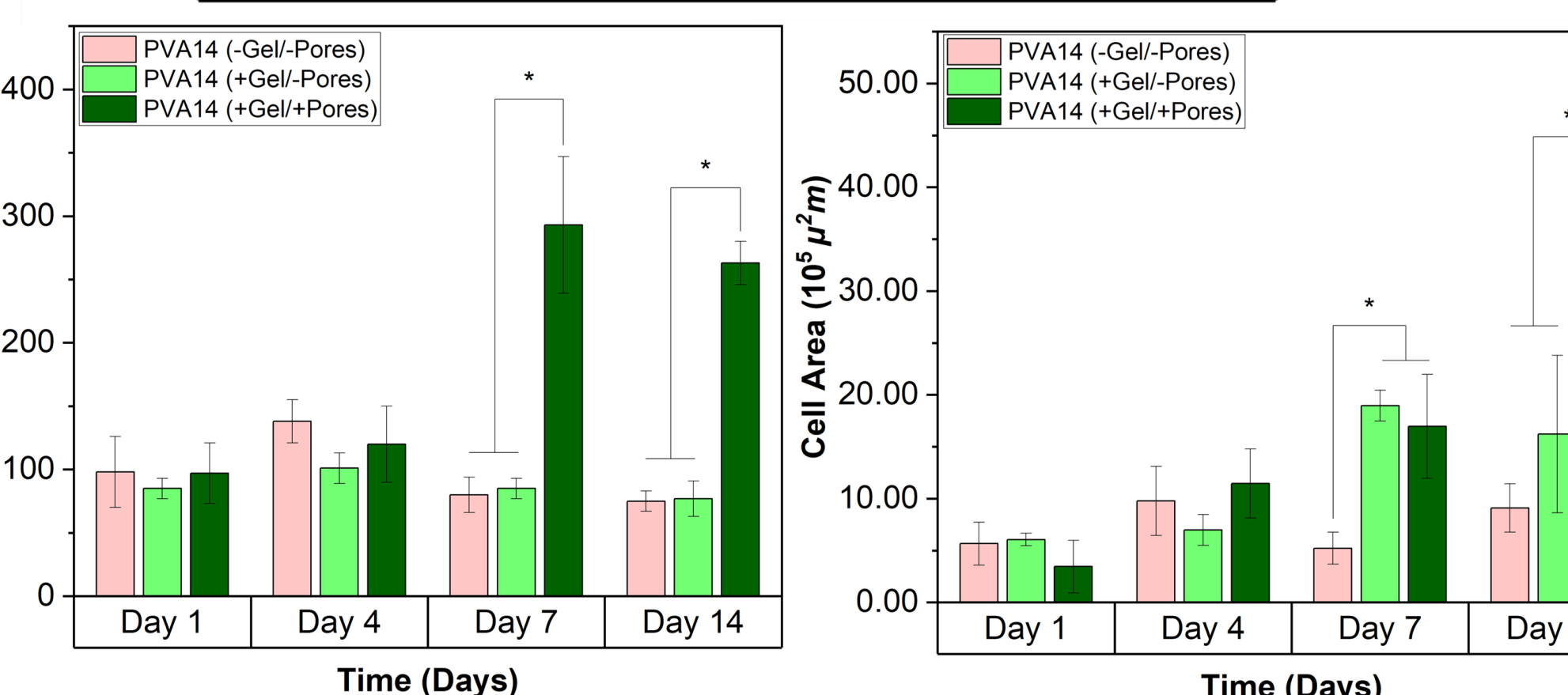
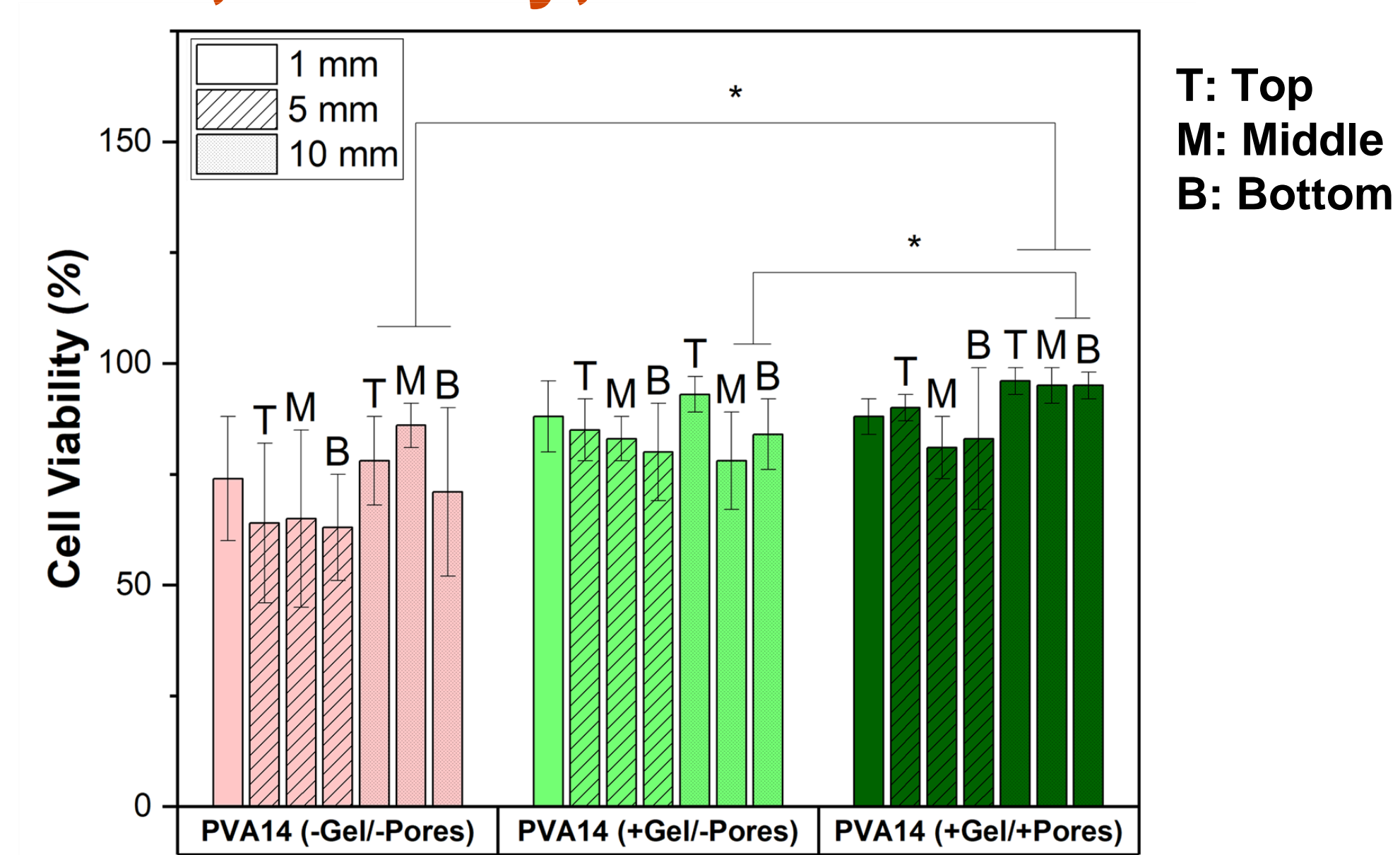
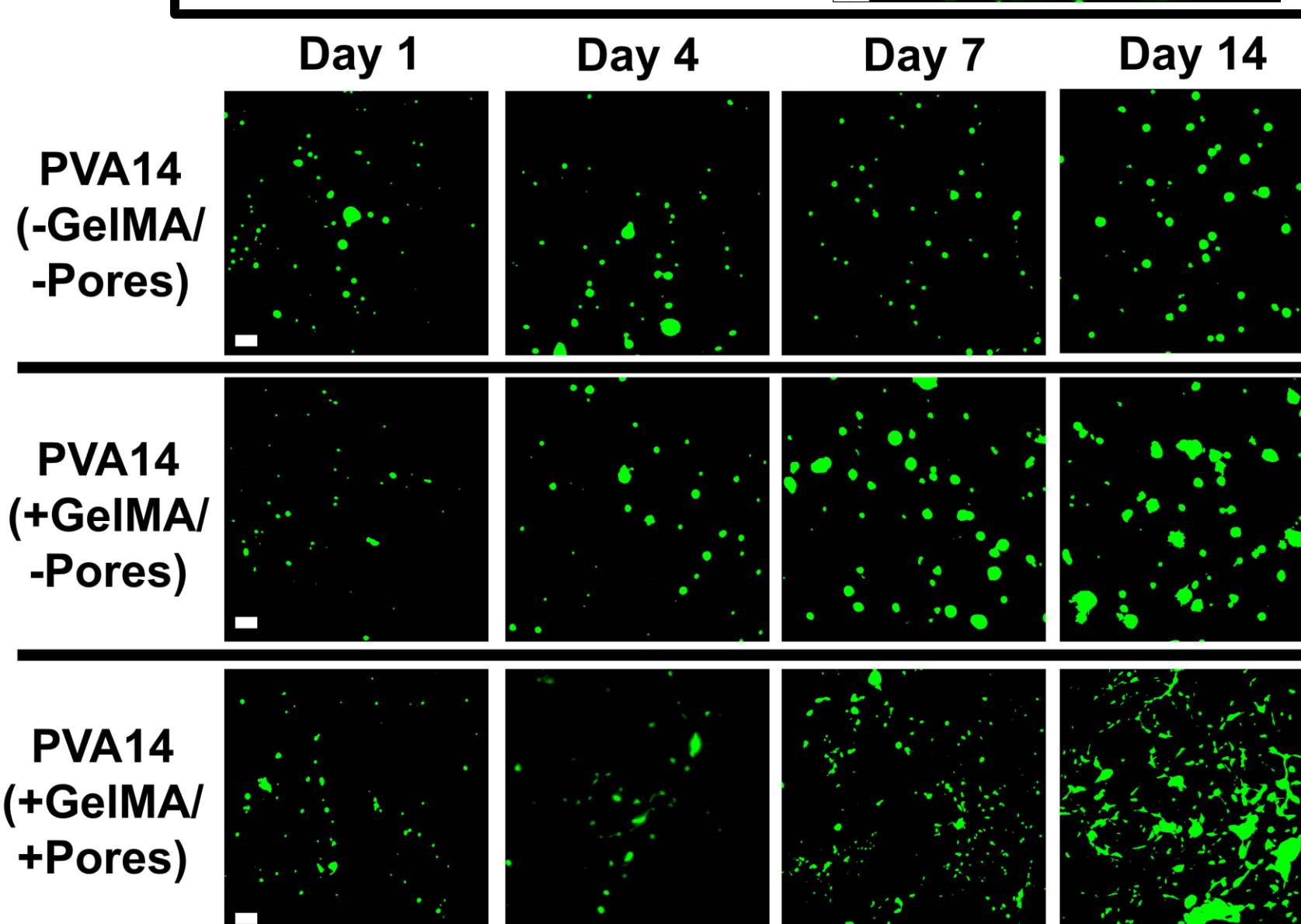
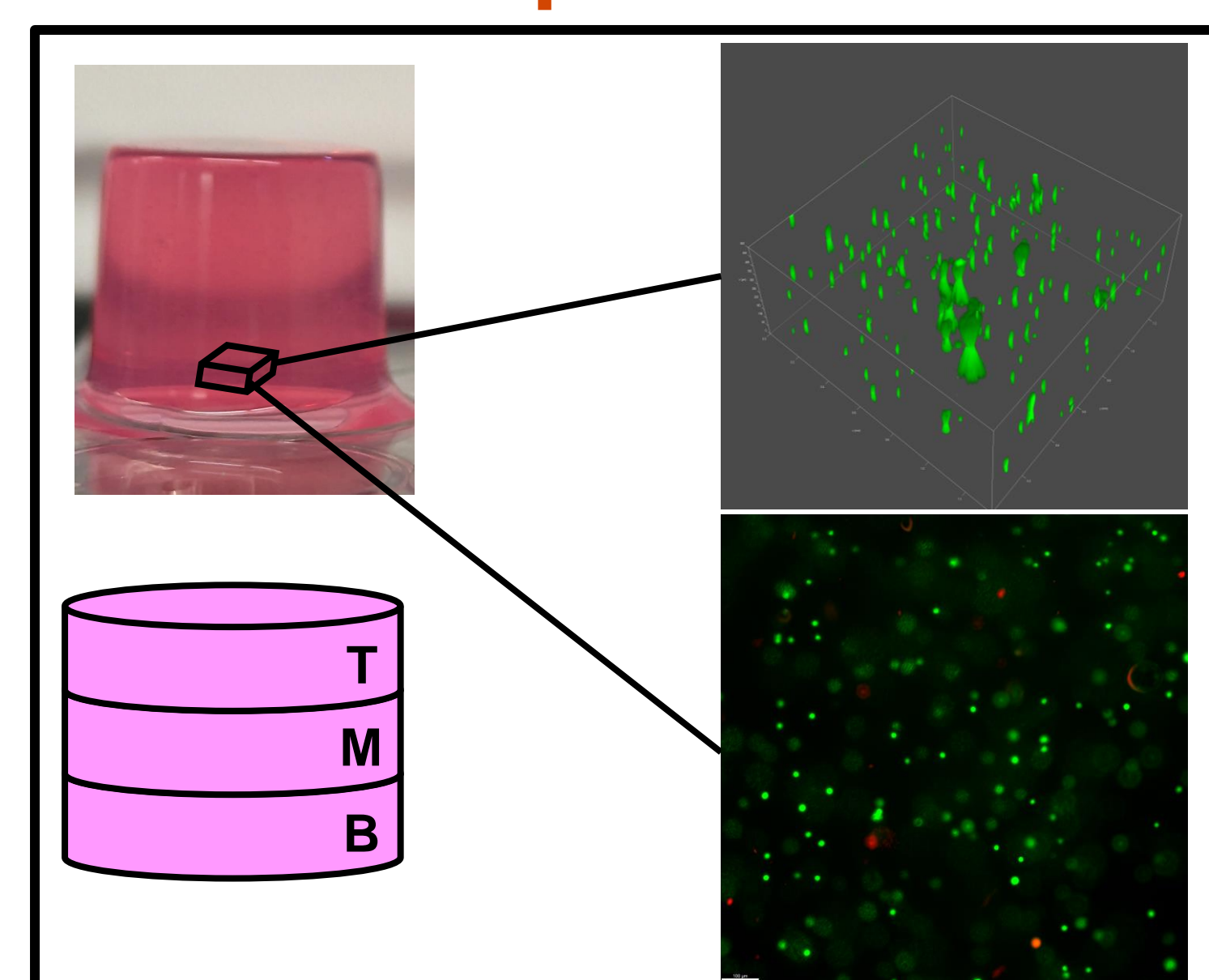
Photoinitiated Thiol-Ene Coupling



- Hydrolytic Degradation
- Oxidative Degradation
- Cell Attachment

Synthetic Hydrogel System Based On Photoinitiated Thiol-Ene Coupling Reactions

Cell Encapsulation: Distribution, Viability, and Proliferation

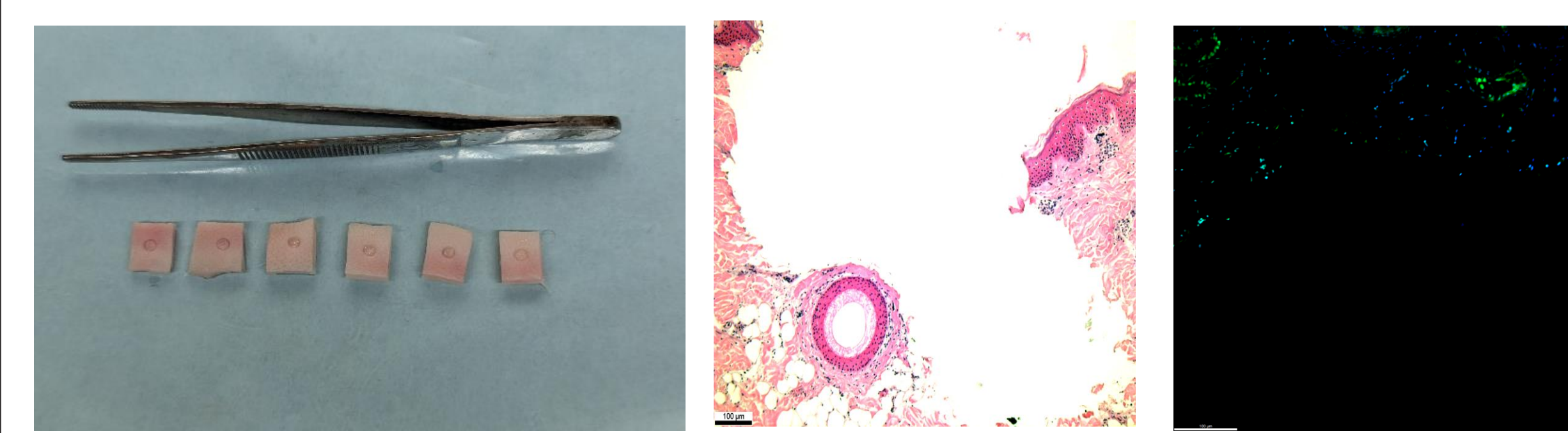


- Even cell distribution
- Porous hydrogels → ↑ viability
- Pores + gelatin → ↑ proliferation & spreading

Conclusions and Future Work

TPVAGelMA hydrogel foams are a potential platform for chronic wound therapy that are degradable, tunable, and suitable for cell encapsulation

- *Ex vivo* porcine skin model to assess wound healing capability
- *In vivo* wound healing assay



Acknowledgements

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