

MOTIVATION: Surveillance Of Infections In Chronic Wounds

- Wounds that do not reduce in size by >40-50% in a month^[1]
- Infection prevents healing**^[1]
 - Polymicrobial communities in **biofilms**: impenetrable to host immunity and antimicrobials
- Infection Surveillance**: Symptoms, blood work, biopsy, needle aspiration, swab cultures

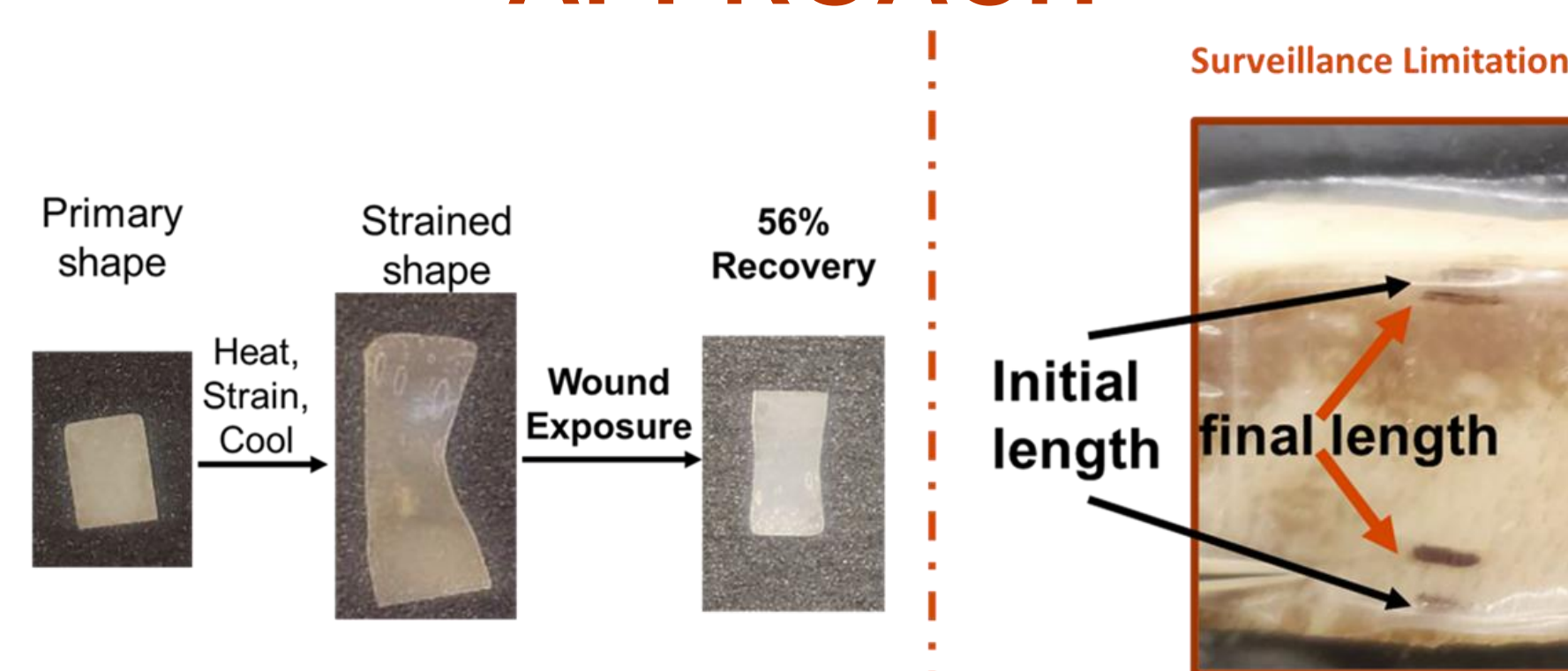


→ Current methods are non-specific for biofilms, painful, inefficient, and/or inhibit healing

Clinical need:

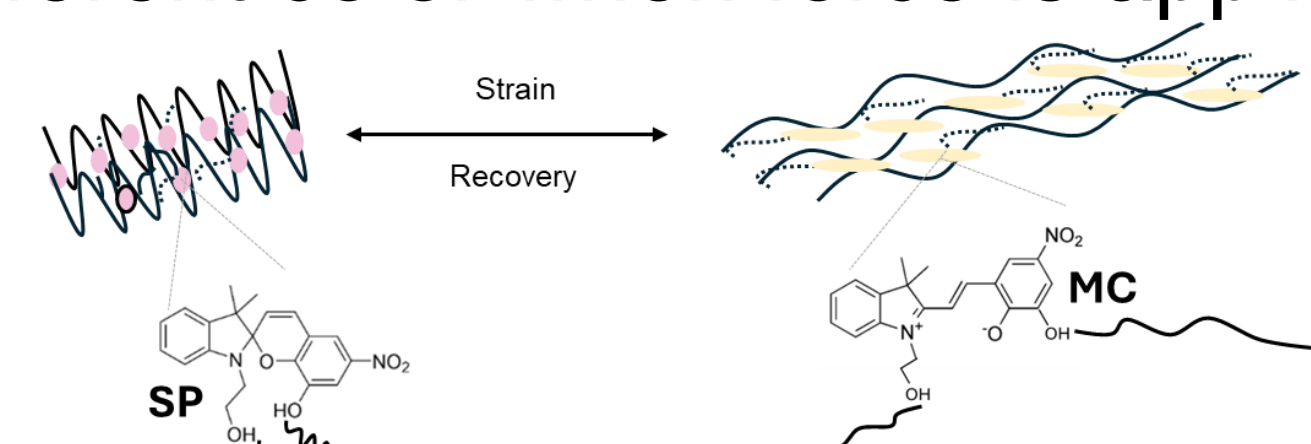
Critical need for biomaterials to improve chronic wound infection surveillance and treatment

APPROACH

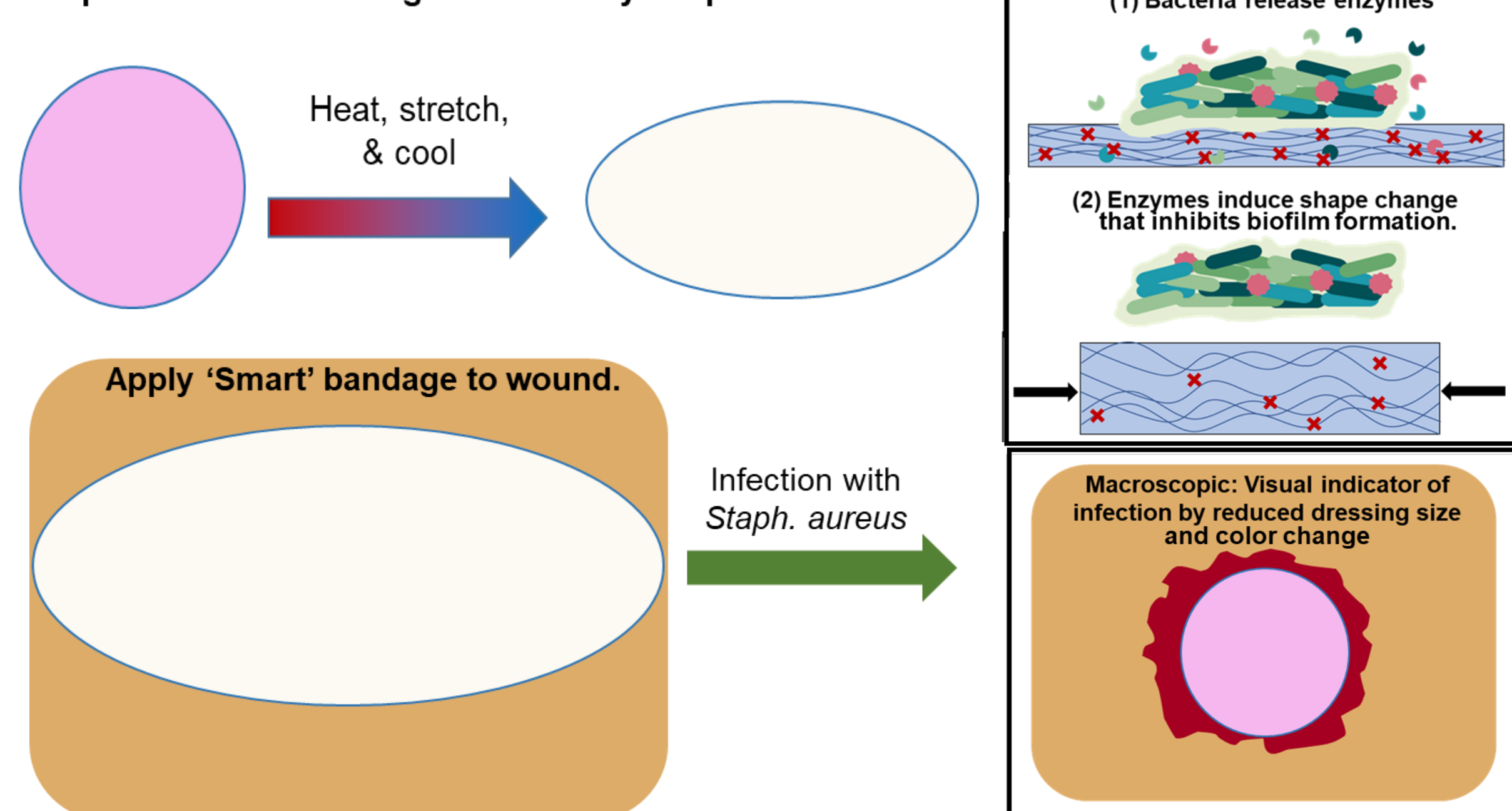


Goal: Provide bacterial protease-responsive PUR shape memory polymer (SMP) with simultaneous shape and color change^[2]

Color change mechanism: Spiropyran (SP) mechanophores change to merocyanine (MC) with different color when force is applied



Prepare 'Smart' dressing in secondary shape and color

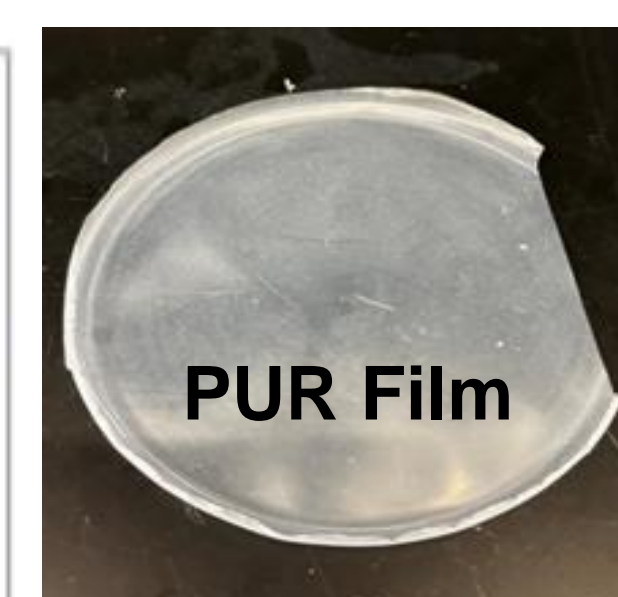
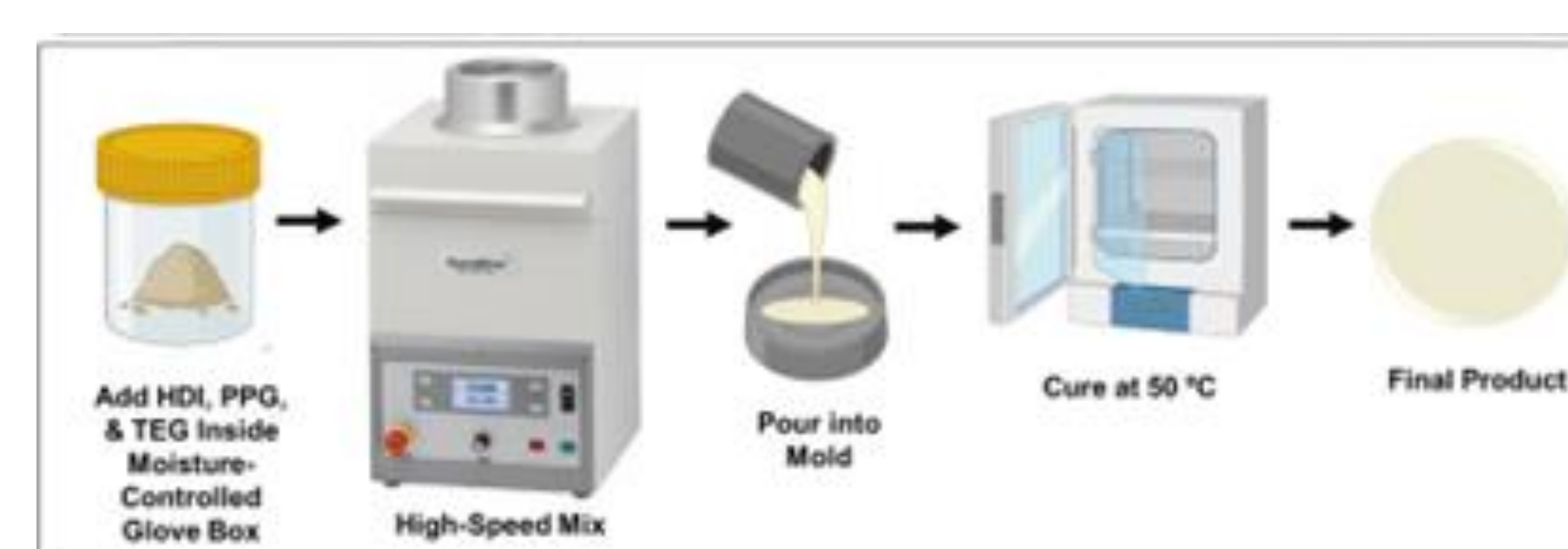
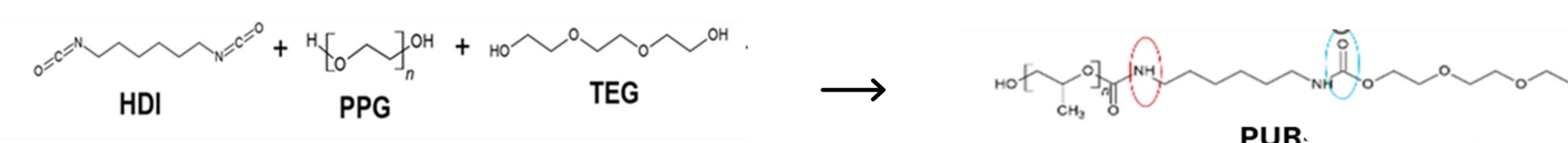


GOAL

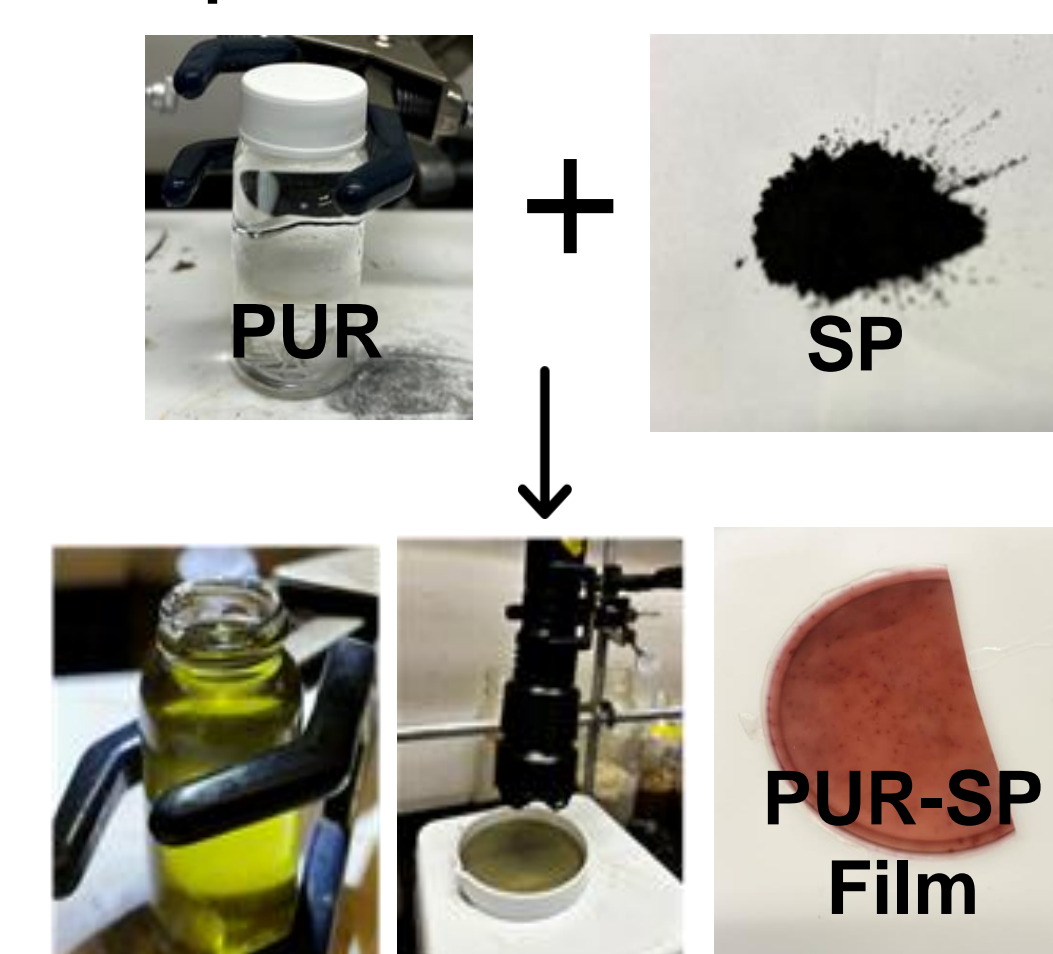
A shape- and color-changing smart material for infection surveillance in chronic wounds

EXPERIMENTAL METHODS

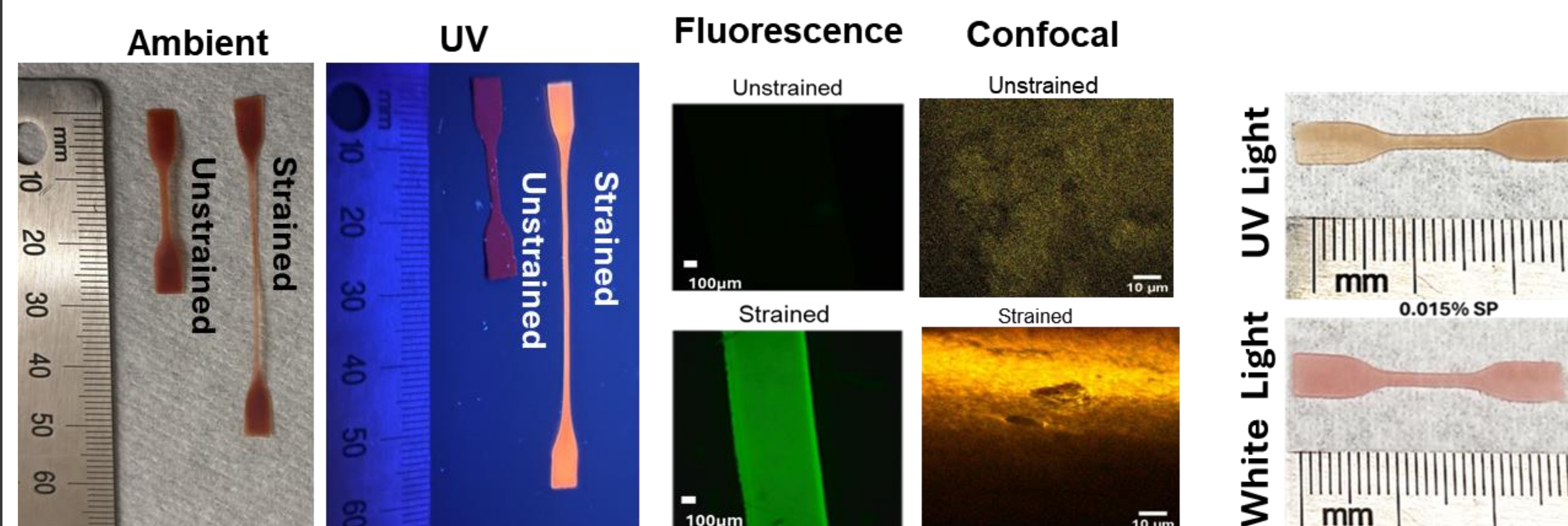
Step 1: Solvent-Free PUR Synthesis^[3&4]



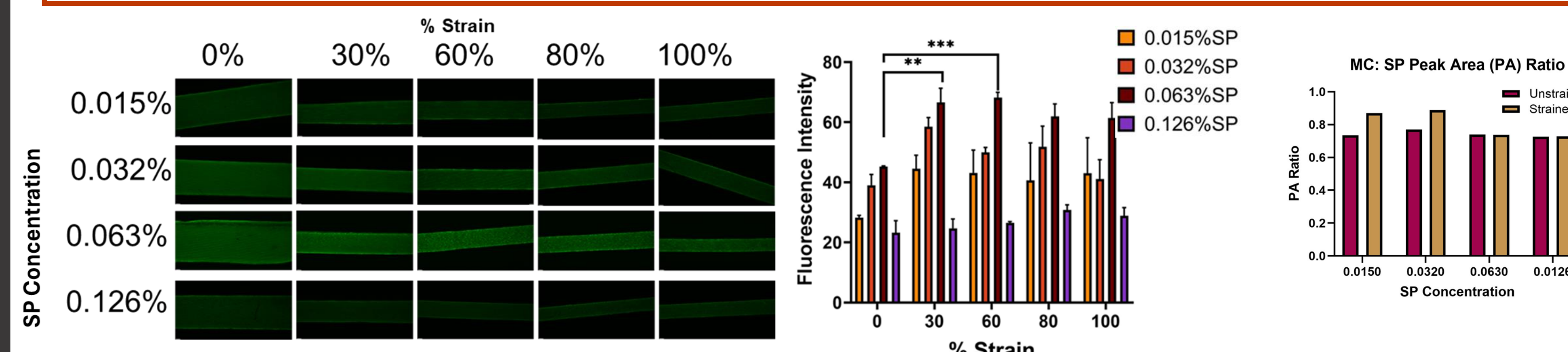
Step 2: Physical Incorporation of SP



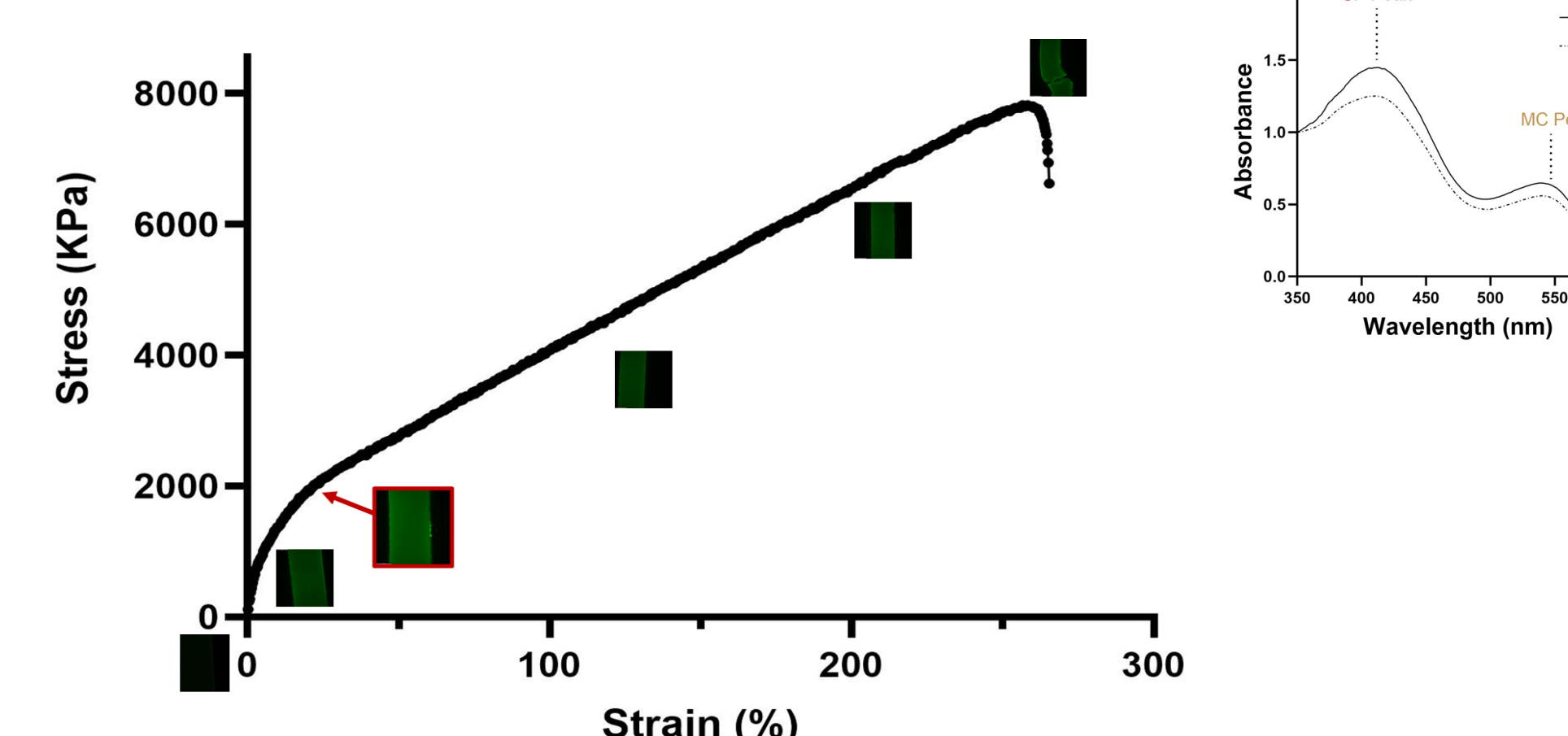
RESULTS: Mechanochromism in PUR-SP Films



Strain and light induce mechanochromism in PUR samples containing SP

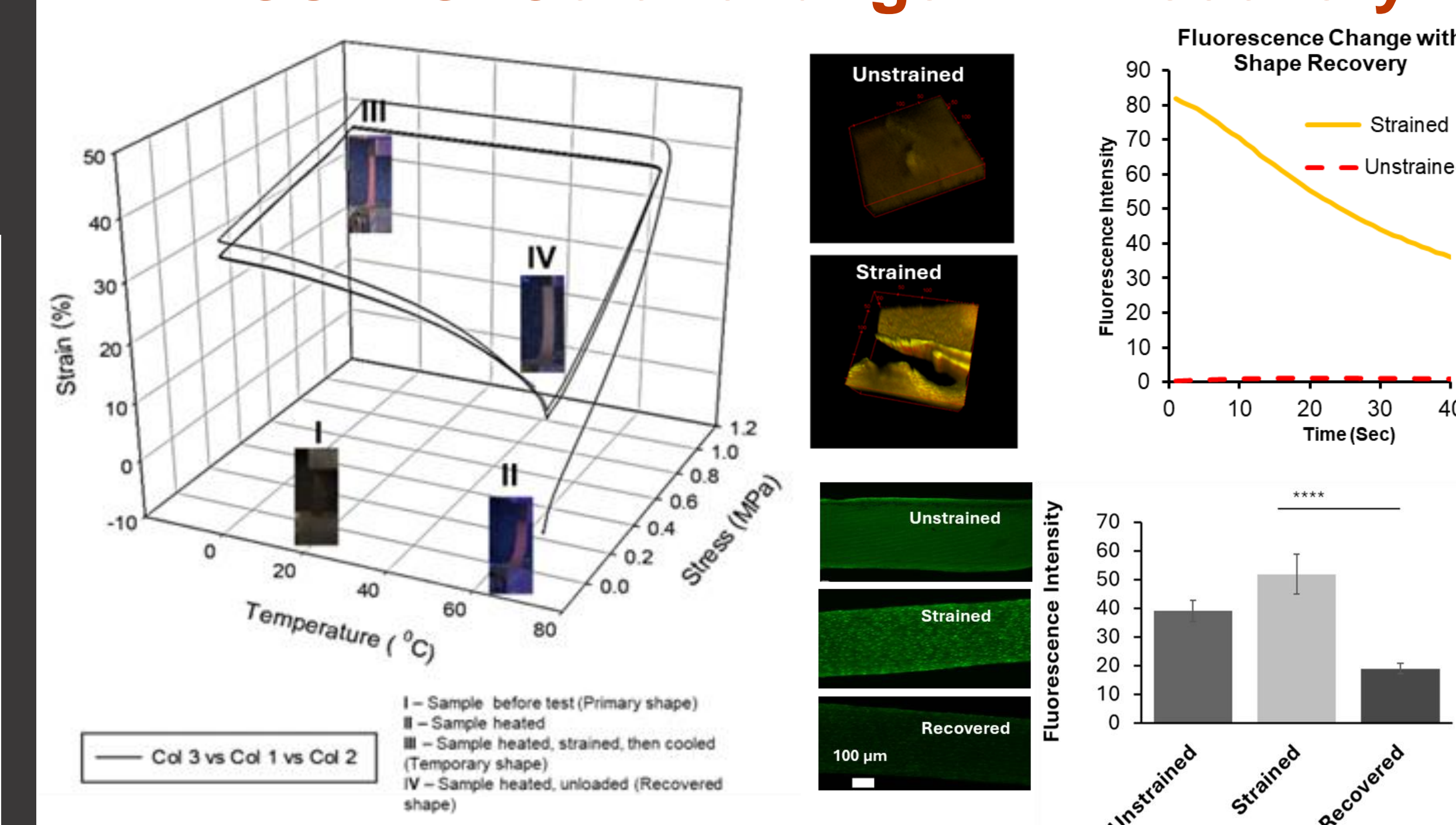


- ✓ Fluorescence ↑ with (1) increased SP content up to 0.063% and (2) strain application.
- ✓ SP conversion to MC ↑ in strained samples.
- ✓ SP conversion occurs at onset of plastic deformation.

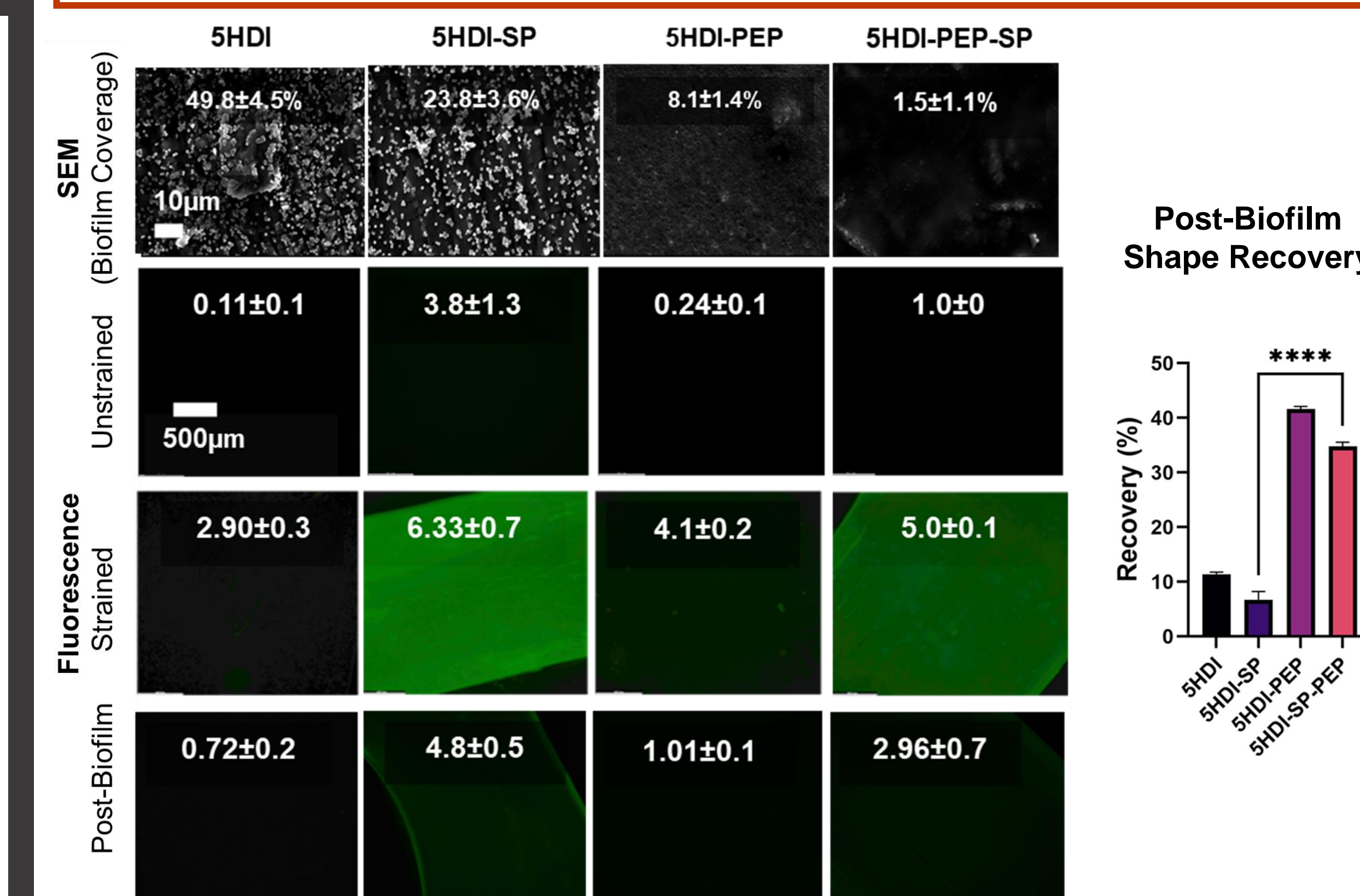


PUR samples with SP have tunable color changing capabilities with strain application

RESULTS: Color change with recovery



SP to MC conversion that occurs with straining is reversed by shape recovery via heating



Bacterial protease-responsive PUR-SP undergoes significant shape recovery after incubation with S. aureus, which (1) inhibits biofilm formation and (2) induces MC to SP conversion to provide color change with shape change.

CONCLUSIONS & FUTURE WORK

SP-containing protease-responsive PURs change shape and fluorescence in the presence of bacteria while preventing biofilm formation → **SP-containing PUR could enable shape- and color-based surveillance of infections in chronic wounds**
Current work: Altering chemistry to achieve eye detectable color changes.

ACKNOWLEDGEMENTS

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