Planting the future: Hydrogel microenvironments enabling mechanical control of protoplast regeneration

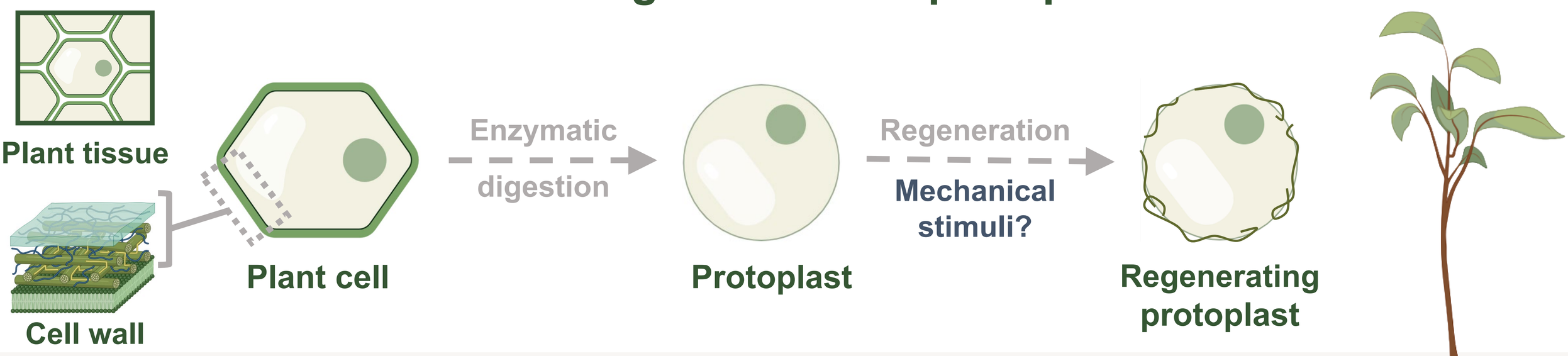
Adrivit Mukherjee[1*], Aaltje van der Molen[1], Pierre Preulier[1], Patricia Schöppl[2], Rik Froeling[2], Julien Es Sayed[1], Joris Sprakel[2], Marleen Kamperman[1]

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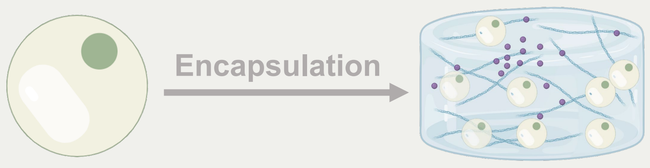


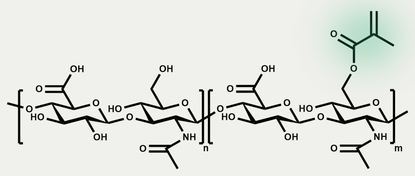
De novo regeneration of protoplasts

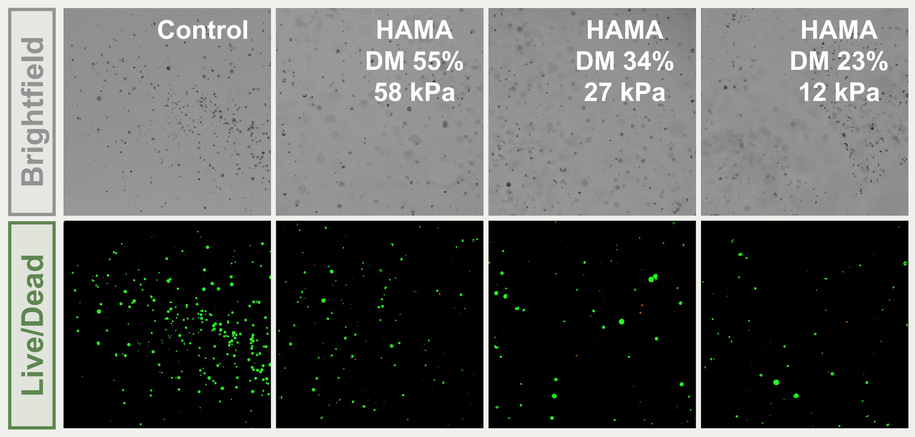


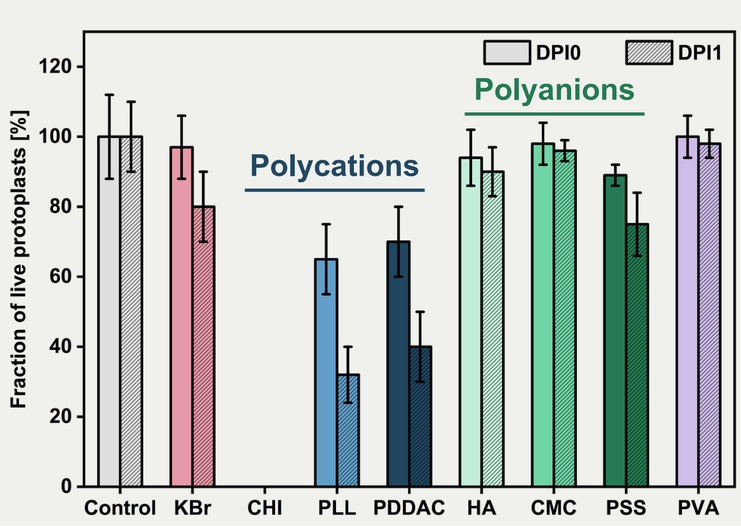
How do mechanical cues affect cell wall organization during protoplast regeneration?

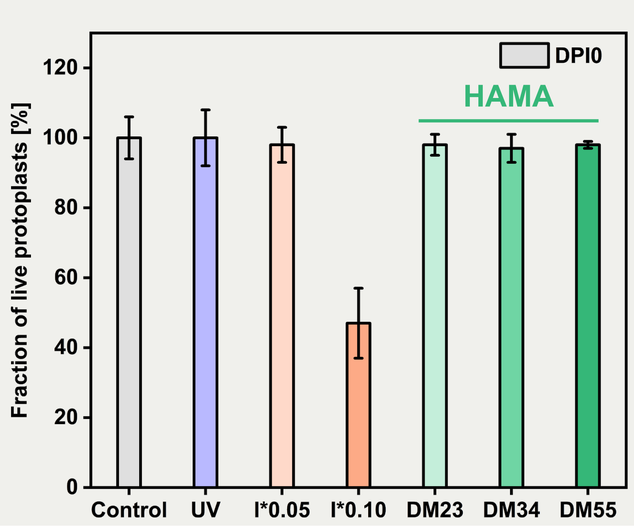
Protoplast encapsulation in photocrosslinked hydrogel networks





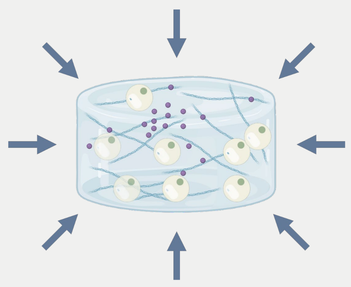




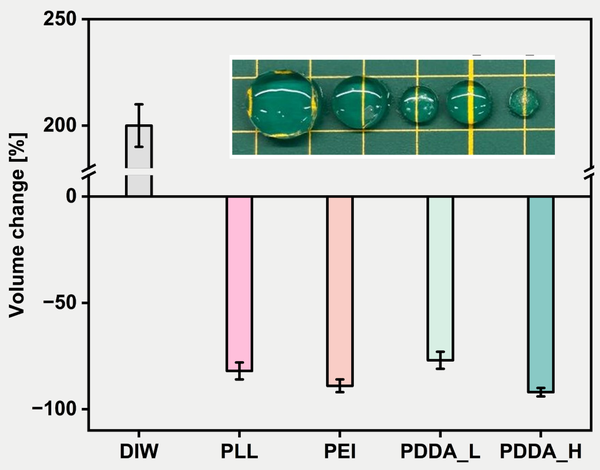


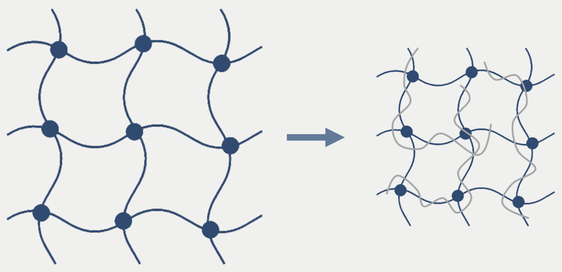
- Photoencapsulated protoplasts in polysaccharide based hydrogel networks show high viability
- Hydrogel stiffness modulated by degree of methacrylation, molecular weight, UV exposure
- Higher protoplast viability and regenerative potential in stiff hydrogel microenvironments

Compressive stress



Deswelling encapsulating hydrogel network



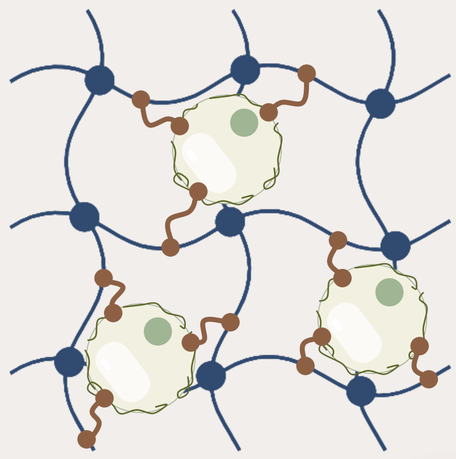


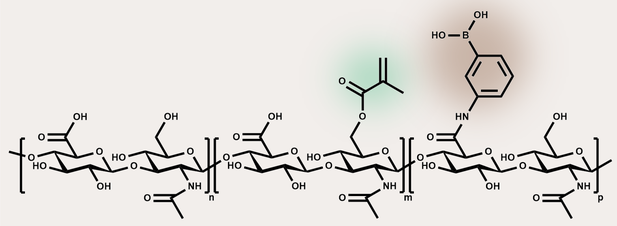
Photocrosslinked polyanionic network

Deswelling with polycations

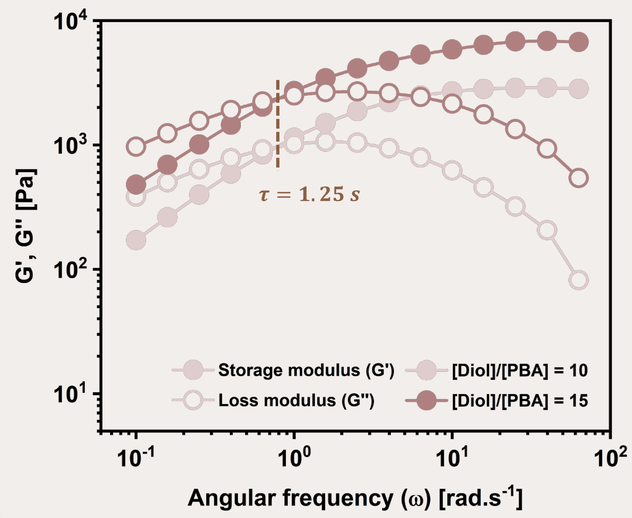
- Polyelectrolyte complexation mediated deswelling hydrogel networks via water expulsion
- Polycation charge density, and molecular weight govern network shrinkage

Tensile stress





Phenyl boronic acid modified HAMA



- Protoplast immobilization via dynamic covalent boronate-ester bonds
- Enables application of tensile stress during regeneration

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