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**Physical and Biological Properties of Engineered Protein Hydrogels**

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Injectable hydrogels show substantial promise for use in minimally invasive tissue engineering and drug delivery procedures. A new injectable hydrogel material, developed from recombinant telechelic proteins expressed in *E. coli*, demonstrates shear thinning by three orders of magnitude at large strains. Large amplitude oscillatory shear illustrates that shear thinning is due to yielding within the bulk of the gel, and the rheological response and flow profiles are consistent with a shear-banding mechanism for yielding. The sharp yielding transition and large magnitude of the apparent shear thinning allow gels to be injected through narrow gauge needles with only gentle hand pressure. After injection the gels reset to full elastic strength in seconds due to rapid reformation of the physical network junctions, allowing self-supporting structures to be formed. The shear thinning behavior is largely independent of the midblock length, enabling genetic engineering to be used to control the equilibrium modulus of the gel without loss of the characteristic yielding behavior. The shear-banding mechanism localizes shear stresses during flow into narrow regions of the gel, allowing more than 95% of seeded cells to survive the injection process.