Supporting Information

Catechol Functionalized Elastin-like Polypeptides as Tissue Adhesives

Malav S. Desai[a,b,c], Min Chen[d], Farn Hing Julio Hong[a], Ju Hun Lee[a,c], Yaojiong Wu[d] and Seung-Wuk Lee[a,b,c]*

[a] Department of Bioengineering, University of California, Berkeley, Berkeley, California 94720, United States

[b] Tsinghua Berkeley Shenzhen Institute, Berkeley, California 94720, United States

[c] Biological Systems and Engineering, Lawrence Berkeley National Laboratory, Berkeley, California 94720 United States

[d] Tsinghua Berkeley Shenzhen Institute, Tsinghua University, Shenzhen, China

Materials:

Protein modification -- dimethyl sulfoxide (DMSO) – Fisher Scientific, BP231-100; N,N-dimethilformamide (DMF) – Fisher Scientific, D119-500; dopamine hydrochloride – Sigma, H8502; N-(3-dimethylaminopropyl)-N‘-ethylcarbodiimide hydrochloride (EDC) – Sigma-Aldrich, E7750; N-hydroxysuccinimide (NHS) – Aldrich, 130672; hydrochloric acid – VWR, VW3110-3, triethylamine (TEA) – TCI America, T0424

Mechanical testing -- cyanoacrylate glue – Permabond 105; sodium periodate – Sigma-Aldrich, S1878

Cell substrate preparation -- (3-aminopropyl)triethoxysilane (APTES) – Aldrich, 440140; sulfuric acid – Fisher Scientific, A300C-212; hydrogen peroxide – Fisher Scientific, H325-100; glass coverslips – Hampton Research, HR3-277; Toluene – Fisher Scientific, T290-1

Cell culture -- DMEM with 4.5 g/L glucose, L-glutamine and sodium pyruvate – Corning, 10-013-CV; HyClone Calf Serum – GE Healthcare, SH30073.03; penicillin-streptomycin – Gibco, 15140-122; DPBS without calcium and magnesium – Corning, 21-031-CV; 0.25% trypsin with 0.1% EDTA – Corning, 25-053-CI; Bovine Albumin (BSA) – Affymetrix, J10857-18; Phalloidin-iFluor 488 – Abcam, ab176753; DAPI – Invitrogen, D21490; Triton X-100 – Fisher Scientific, BP151-500

Supplementary Figures:

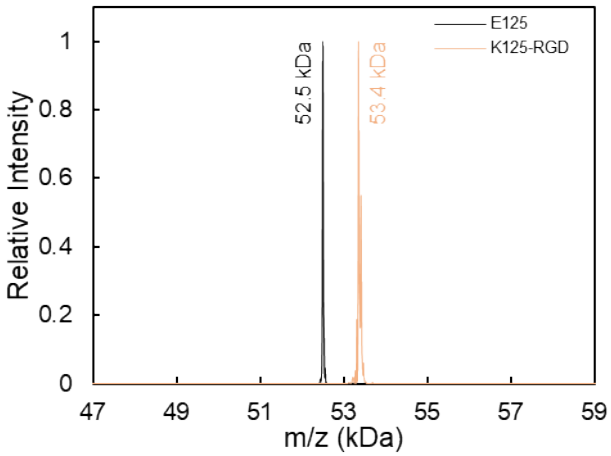

Figure S1 Mass spectrum of E125 (52.5 kDa) and K125-RGD (53.4 kDa)

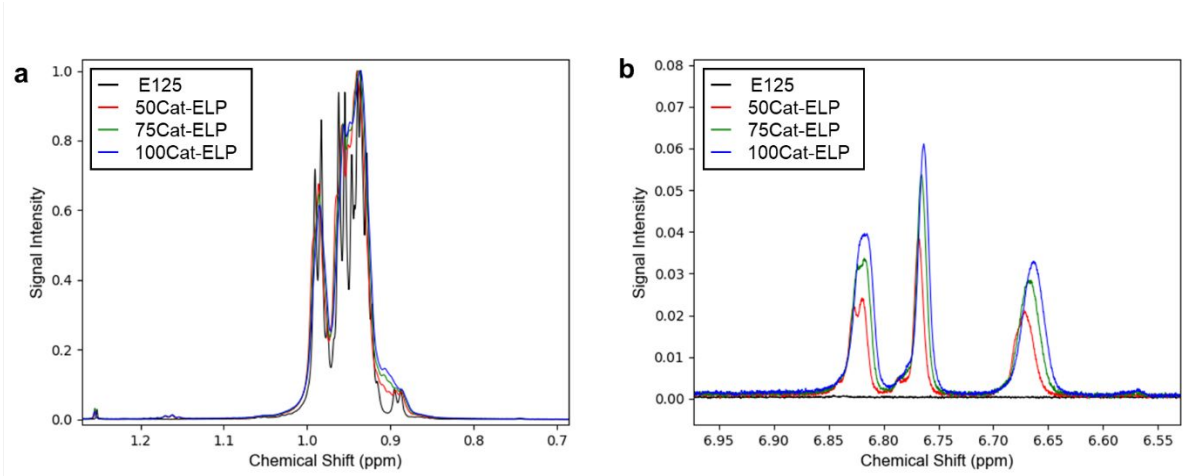

Figure S2 ^{1}H NMR signal from valine methyl groups is used to quantify dopamine: a) Signal from protons on valine methyl groups; b) Signal from catechol functional groups. 50Cat-ELP showed 90% reaction yield, while 75 Cat-ELP showed 86% and 100 Cat-ELP showed 79% reaction yield

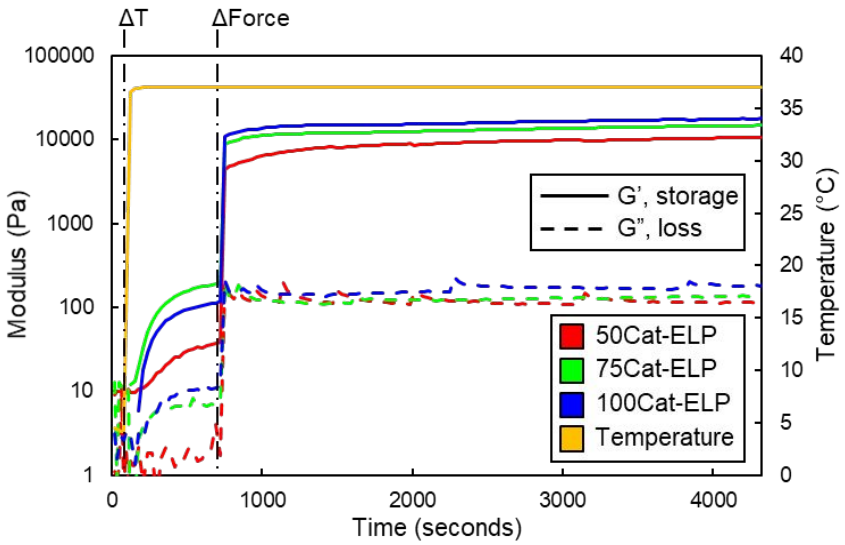

Figure S3 Representative rheology test data; Rheology tests for Cat-ELP hydrogels initially show negligible moduli at 4°C. The moduli increase slightly when the temperature is ramped (ΔT) to 37°C; however, because Cat-ELP deswells upon crosslinking, it has poor contact with the probe until the application of 0.2 N normal force (ΔForce). As shown, after the normal force is applied, the storage and loss moduli values reflect the hydrogel properties

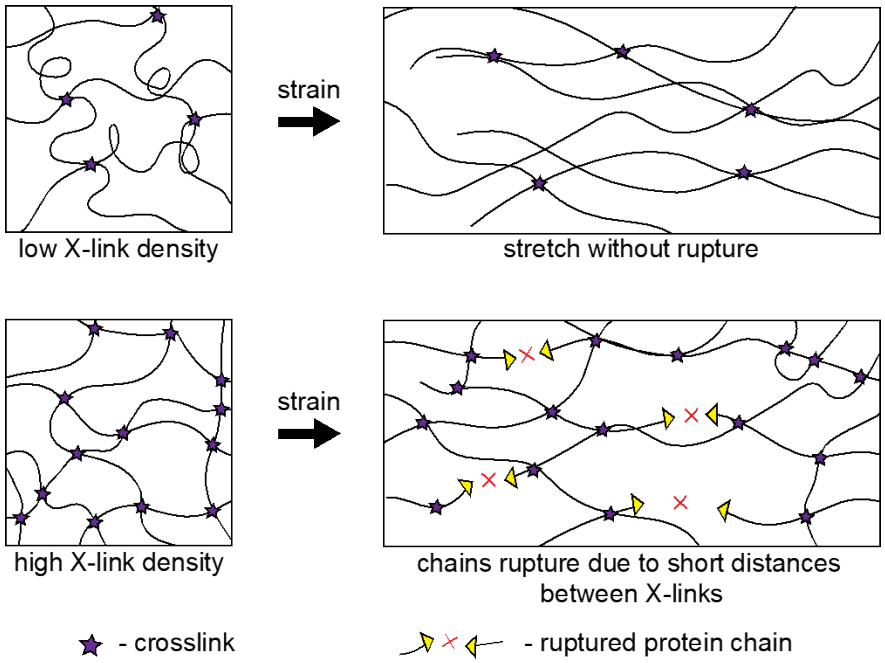

Figure S4 Schematic showing the effects of crosslink density and strain. 50Cat-ELP hydrogels show higher flexibility because a larger portion of the polymer chain is available for stretching compared to highly crosslinked 100Cat-ELP

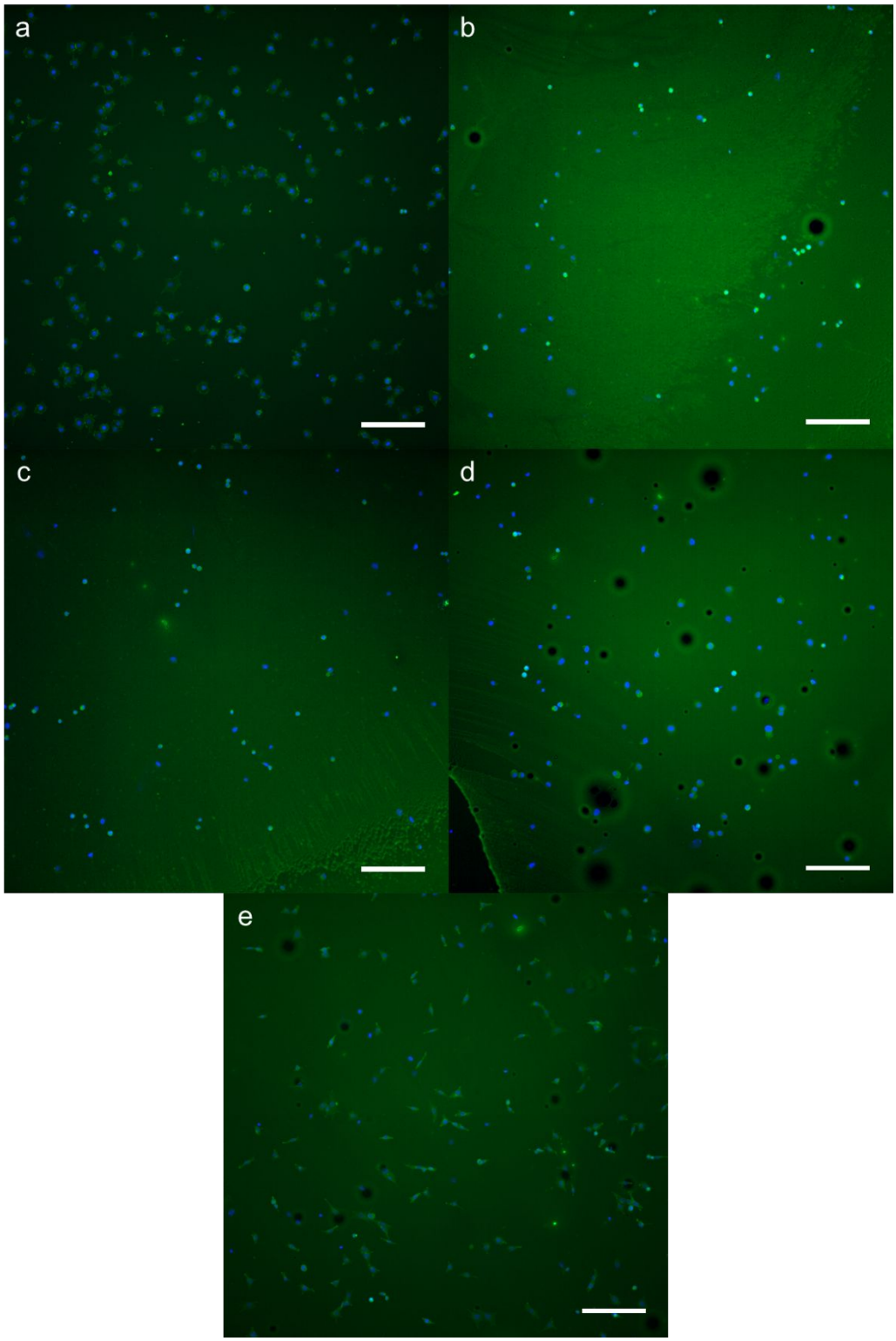

Figure S5 Representative images of fibroblasts on coated glass substrates: a) Control - APTES coated; b) 50Cat-ELP; c) 75Cat-ELP; d) 100Cat-ELP; e) 100Cat-RGD. Nuclei are stained blue with DAPI and cell cytoskeleton is stained with phalloidin-iFluor 488 (Scale bars: 100 μm)

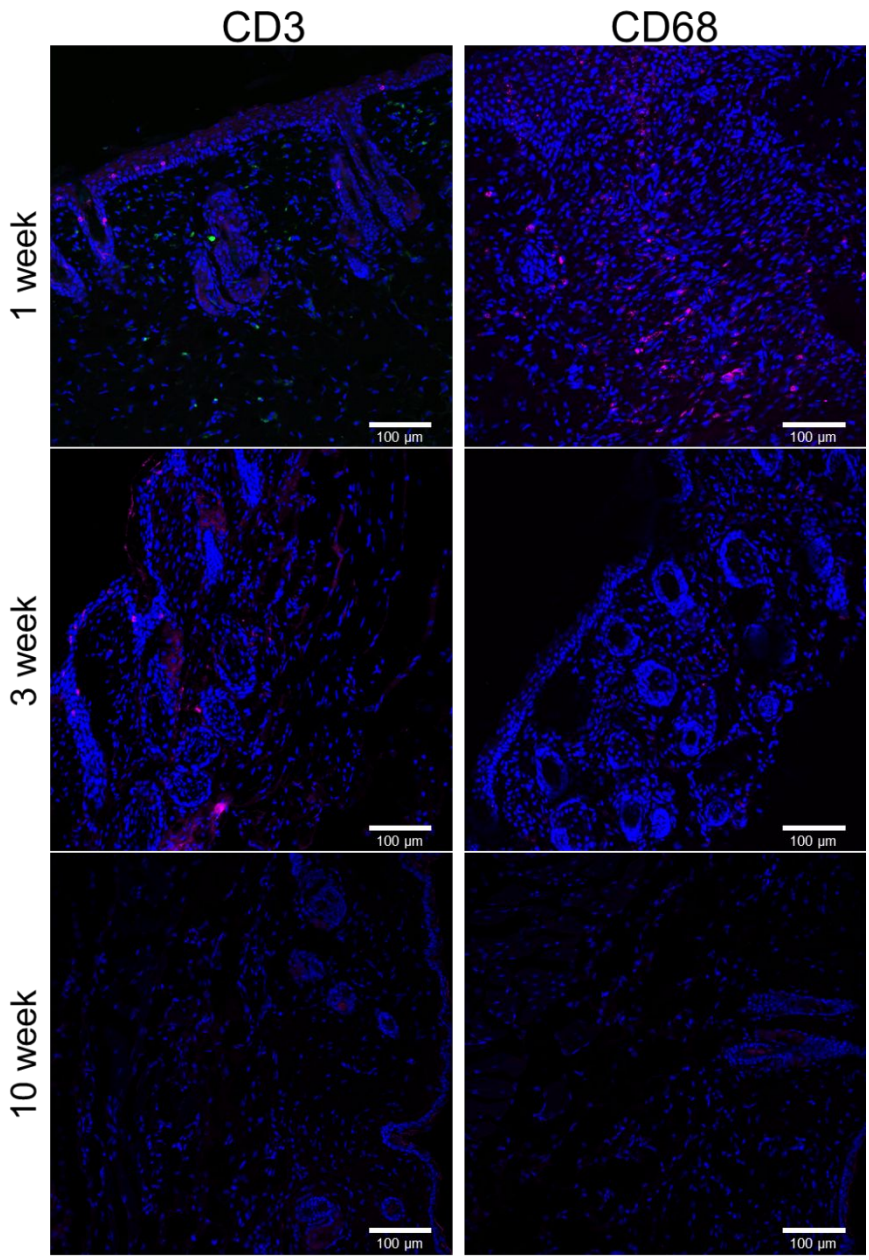

Figure S6 Representative images of tissue sections from sham controls at weeks 1, 3 and 10. Similar to the 100Cat-ELP and 100Cat-RGD samples, the control samples were stained for CD3 and CD68. CD68 signal is observed at the 1 week, which indicates the presence of macrophages.