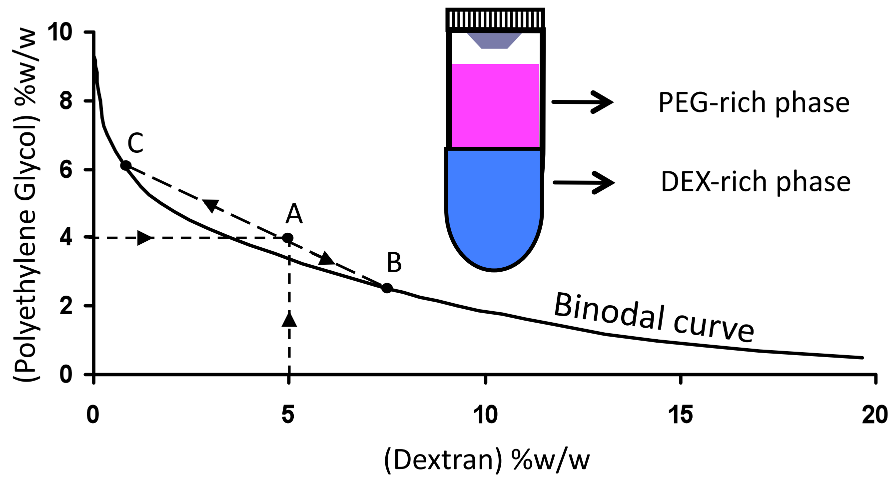

Figure S1. **Aqueous two-phase system (ATPS) comprising Polyethylene glycol (PEG) and Dextran (DEX) as phase forming polymers**

Phase diagram of an ATPS describes the composition of each phase and the range of concentrations that results in phase separation. Only those combinations of the two polymers PEG and DEX above the binodal curve give an ATPS. Point A represents the initial concentration of each polymer in the entire solution whereas points B and C describe the compositions of bottom and top phases in equilibrium, respectively. Line BC represents a tie line and is a unique property of the given ATPS.

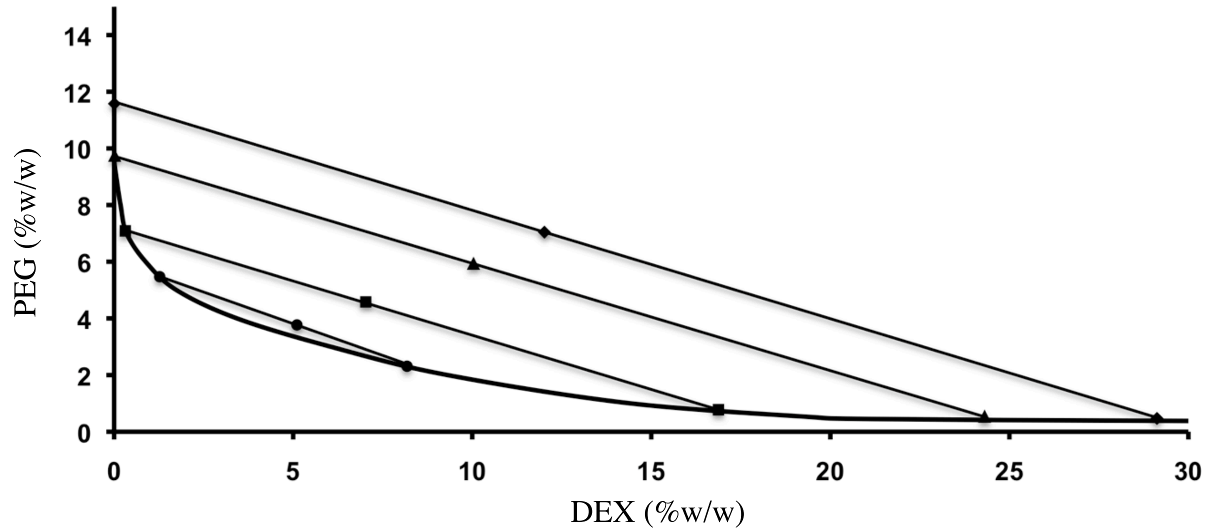

Figure S2. **Interfacial tension of aqueous two-phase systems**

The interfacial tension between two immiscible aqueous polymer phases (γ_{12}) directly correlates with the tie line length (TLL) through the following empirical relation: Log (γ_{12}) = A + B Log (TLL). Constants A and B depend on the two-phase system under consideration [*Bamberger et al., J. Colloid Interface Sci. (1984) 99, 194-200*]. Therefore on a phase diagram, longer tie lines correspond to larger γ_{12} values. Since each tie line represents a different pair of concentrations (%w/w) of the two-phase system, decrease in γ_{12} can be achieved by lowering the concentrations of the phase-forming polymers. The figure represents four different concentrations of phase-forming polymers PEG (Mw:8000) and DEX (Mw: 500000) in a range of PEG 4-7 (%w/w) and DEX 5-12 (%w/w). The resulting TLLs were 11.8-28.5 (%w/w), which correspond to γ_{12} of ~15 μJ/m^2 to ~146 μJ/m^2.

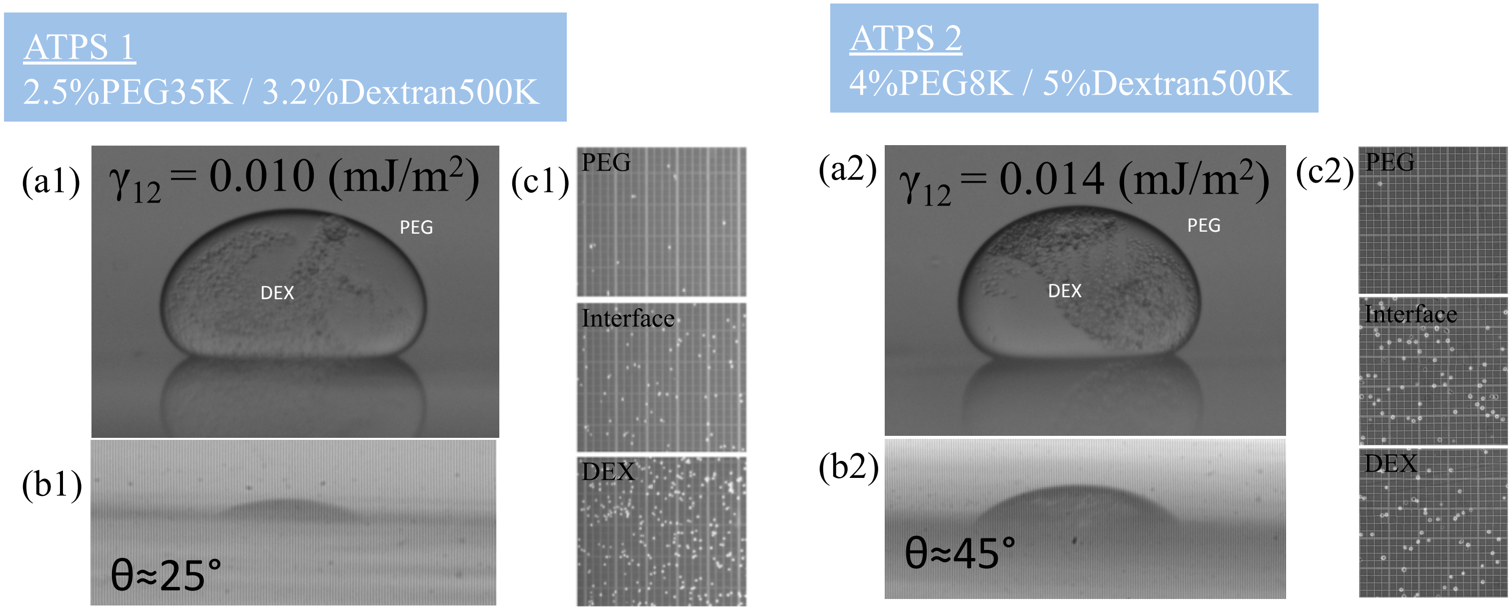

Figure S3. **Interfacial tension of PEG-DEX ATPS, contact angle on cell monolayer, and partition coefficient of cells**

Interfacial tension: The interfacial tension between PEG and DEX phases (γ_{12}) was measured using a drop shape technique called axisymmetric drop shape analysis-no apex (*Kalantarian et al. Langmuir, 2009: 25, 14146-14154*). ADSA determines γ_{12} from the shape of a drop in equilibrium, which is governed by the Laplace equation: $\Delta P=\gamma_{12}(1/R_1+1/R_2)$, where R_1 and R_2 are principal radii of curvature of the drop. Sessile drops of the DEX phase were formed on a glass slide immersed in the PEG phase (panels a1, a2). Images of the drops were taken and drop profiles were extracted using the Canny edge operator. ADSA searches for a Laplacian curve that best matches the extracted drop profile. γ_{12} is determined from this best match.

Contact angle: To determine contact angles, sessile drops of the DEX phase were formed on a monolayer of MDA-MB-231 cells immersed in the PEG phase (panels b1, b2). Images were taken and contact angles were measured by fitting a tangent to the drop profile at the point of contact with the cell layer.

Partition coefficient: To perform cell partition experiments, cells were trypsinized and 0.5×10^6 cells were suspended in the DEX phase, which was then mixed with the PEG phase. The mixture was let equilibrate for 30 min and form an ATPS. Then samples were taken from both phases and the interface, centrifuged down, resuspended in culture media, loaded onto a hemocytometer, and imaged (panels c1, c2). The partition coefficient was calculated as the number of cells in the DEX phase divided by the total number of cells, i.e. $K=n_{DEX}/n_{total}$. With the ATPS 1, cells mainly partitioned to the DEX phase and a K value of 78% was obtained, whereas with the ATPS 2, cells distributed between the DEX phase and the interfacial region and resulted in a K value of 42%.

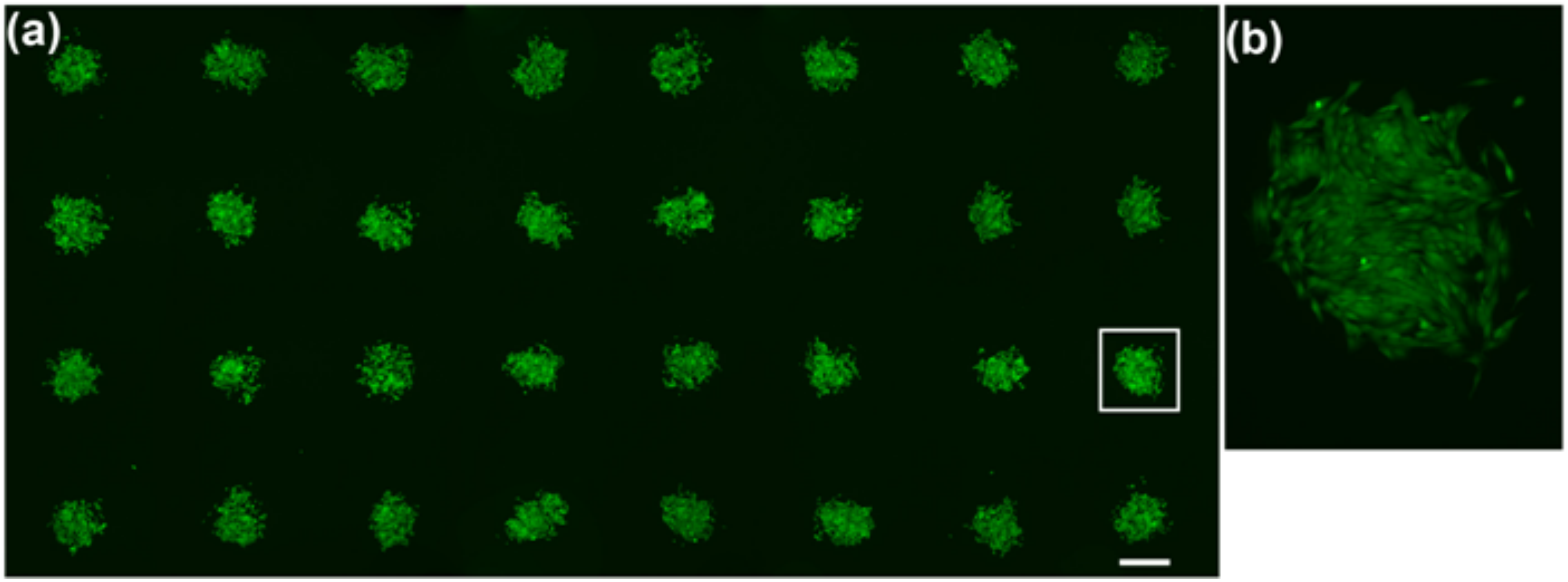

Figure S4. **Viability of ATPS-mediated printed cells**

(a) An 8×4 microarray of C2C12 myoblast cells was examined for viability post-printing using Calcein AM (green, live cells) and ethidium homodimer-1 (red, dead cells) stains. Almost 100% of printed cells were viable. (b) A magnified view of the boxed spot in (b). scale bar 800 μm in (a).