Hierarchically designed injectable hydrogel from oxidized dextran, amino gelatin and 4-arm poly(ethylene glycol)-acrylate for tissue engineering application

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**Fig.SI-1** £H NMR spectra of dextran and ODex treated with tert-butyl carbazate.

**Fig.SI-2** £H NMR spectra of 4A-PEG and 4A-PEG-Acr.

**Fig.SI-3** Phase diagram of gelatin and MGel. Conditions of flow (sol) or no flow (gel) were determined by the vial-inverting approach. MGel with different concentrations show obviously lower sol-gel transition temperature than gelatin.

**Fig.SI-4** The Scanning electron microscopy pictures of cross-section of hydrogels incubated in 37°C for degradation. The white particles represent the PBS salt sediments. Scale bar represents 50 μm.

**Fig.SI-5** Behaviour of different solutions during the two-step crosslinking method. For P, P-D-G-1, P-D-G-2, and D-G hydrogels, a, b, c, and d are the initial states of them; e, f, g, and h are the states after they were crosslinked for 15 min at 37°C; i, j, k, and l are the states after they were crosslinked by UV light for 5 min, and m, n, o, and p are the hydrogels in the vials.

**Fig.SI-6** Photographs for tensile testing of P and P-D-G-2 hydrogel. P hydrogel become fracture when it is stretched to double of its original length. P-D-G-2 hydrogels can still maintain elasticity at the double of elongation state.

**Table.SI-1** Composition of P’, P-D-G-2, and D-G’ hydrogels.

**Fig.SI-7** Representative stress-strain curves of P’, P-D-G-2, and D-G’ hydrogels at room temperature.

**Fig.SI-8** The cell density on the hydrogel surface after 2 days culture. *P<0.05, **P<0.001, and ***P<0.0001 (n=3).

**Fig.SI-9** Representative optical images of P, P-D-G-1, P-D-G-2, and D-G hydrogels (from left to right) after 4 days degradation in PBS (PH=7.4).
**Fig.SI-10** Bright-field microscopy pictures of cells cultured within IPN hydrogels for 4 days. Pictures at different layers of P-D-G-2 hydrogel was obtained by alter the height of the platform. a, b, c, and d are taken from top to bottom of the hydrogel. The cell labeled as I appeared at layer b, and disappeared at layer d. The cell labeled as II appeared at layer d and became obscure at layer a and b. The fact indicates that the two different cells belong to different layer of the hydrogel. Scale bar represents 100 μm.

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<table>
<thead>
<tr>
<th>Sample</th>
<th>Concentrations (mg ml⁻¹)</th>
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<tbody>
<tr>
<td></td>
<td>4A-PEG-Acr</td>
</tr>
<tr>
<td>P’</td>
<td>120</td>
</tr>
<tr>
<td>P-D-G-2</td>
<td>40</td>
</tr>
<tr>
<td>D-G’</td>
<td>0</td>
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</tbody>
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ODex/MGel/4A-PEG-Acr IPN Hydrogels were prepared through the Schiff-based reaction (step I) and UV crosslinking (step II) with the existence of photoinitiator.