BOTM: October - November 2011

Auxetic Materials that Do the Unexpected - They Expand Transversely When Stretched

Most materials have a positive Poisson's ratio and contract transversely when stretched. However, Pranav Soman and David Fozdar in Shaochen Chen's lab have developed a new class of scaffolds that do the unexpected - they expand transversely when stretched - demonstrating a negative Poisson's ratio. In the figure, a new scaffold design called "re-entrant honeycomb" was microfabricated using a digital micromirror device (Fozdar, et al., 2011). When the ends of this scaffold are pulled, the scaffold expands perpendicularly to the tension. Auxetic scaffolds may have application for engineering blood vessels which demonstrate natural auxetic properties. Vascular tissues are subjected to a circumferential strain during pulsatile blood flow which causes the sub-endothelial fibrous protein layer to thicken, indicating a negative Poisson's behavior (Timmins et al., 2010). Auxetic scaffolds could also be useful for engineering tissues that are subjected to cyclic stretching such as a skin graft or cardiac patch.

Figure

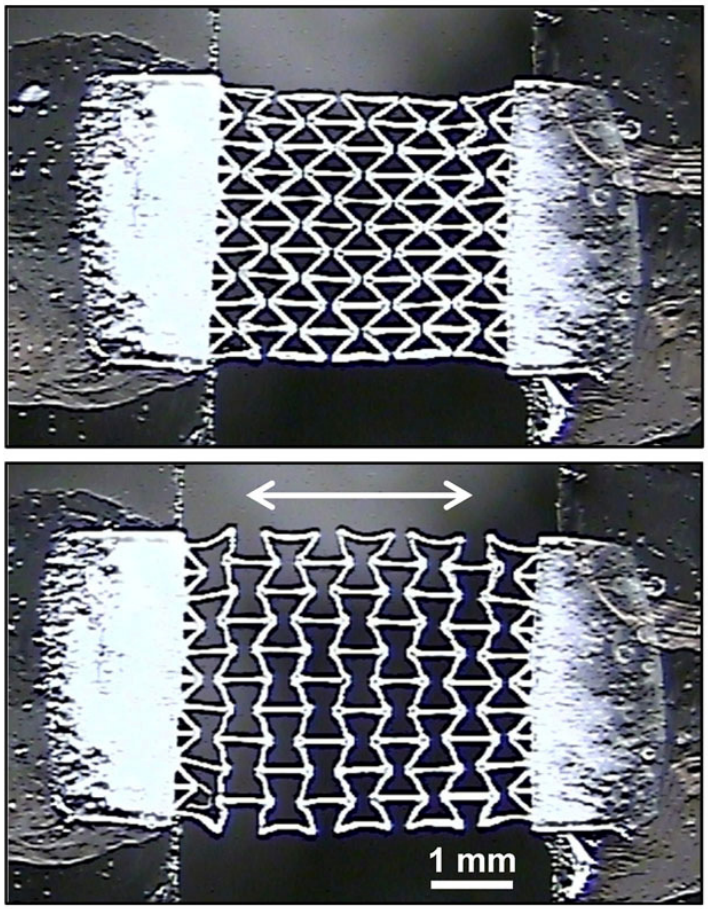

Figure Caption:

The top image shows the auxetic scaffold before stretching and the bottom image shows the scaffold after strain is applied. The scaffold shown was microfabricated from a poly(ethylene glycol) dimethacrylate hydrogel.

References

1. Fozdar DY, Soman P, Lee JW, Han L-H, Chen S **(2011)** Three-dimensional polymer constructs exhibiting a tunable negative Poissonss ratio.*Adv Funct Mater,*in press.
2. Timmins LH, Wu QF, Yeh AT, Moore JE, Greenwald SE **(2010)** Structural inhomogeneity and fiber orientation in the inner arterial media. *Am J Physiol Heart Circ Physiol 298,*H1537-H1545.