Glycerol is a very simple and important biomolecule. Its three hydroxyl groups render glycerol a highly versatile building block for polymeric biomaterials. I will attempt to highlight the promise of this small molecule in biomaterials science and regenerative medicine through the design philosophy and unique properties of two series of biodegradable polymers. The first uses the secondary –OH group of glycerol to crosslink a polymer into three-dimensional network of random coils. The resultant elastomer is very useful in soft tissue engineering, especially bioartificial blood vessels. The second uses glycerol derivatives with epoxy rings to polymerize primary amines into biodegradable polyesters. Many different primary amines can be polymerized in such a fashion including amino acids, peptides, and their derivatives. One example of this series of polymers utilizes dopamine to impart biological activities. This polymer can induce extensive neurite outgrowth in differentiate PC12 cells and rat dorsal root ganglia and is at least as effective as standard nerve culture substrate such as laminin and polylysine. These polymers may offer a fresh approach to nerve regeneration.