Matrigen Softwell®

Hydrogels

For a cell, elasticity matters. Softwell® replicates a broad range of physiological tissue softness, from fat to cardiac muscle, so you can routinely venture beyond the rigidity of tissue culture plastic.

Softwell® is available in a variety of stiffness values and available with different coatings as follows:

- Collagen pre-coated hydrogels are ready for cell culture.
- Easy Coat™ hydrogels are chemically activated to bind to your matrix protein of choice.
- Non-Activated hydrogels form an ultra-low attachment surface.

Scientists have long been growing cells in natural and synthetic matrix environments to elicit phenotypes that are not expressed on conventionally rigid substrates. Unfortunately, growing cells either on or within soft matrices can be an expensive, labor intensive, and impractical undertaking.

Softwell® overcomes these challenges. It enables you to study cell behaviors in soft environments with unprecedented efficiency. Not only that, it provides remarkable control over matrix stiffness, a concept that has led to discoveries in a wide range of areas.

Softwell® plates offer uniform flatness over the entire working surface of the plate. They are provided in individual foil packs which keep them in perfect condition for 3 to 6 months at RT or 4°C.

Soft substrates for stem cells tuning the stiffness of the extracellular environment is a relatively new, but powerful approach for stem cell culture that:

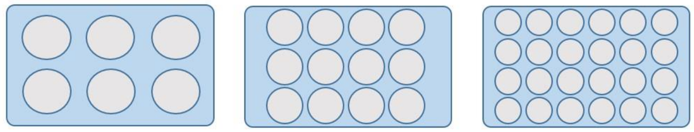
1. Promotes self-renewal. Muscle stem cells derived from mice self-renew and sustain their ability to regenerate damaged muscle tissue in-vivo when cultured on substrates replicating the elastic modulus of muscle (E=12 kPa).
2. Maintains pluripotency. On E=0.6 kPa substrates, mouse embryonic stem cells generate homogenous undifferentiated colonies in the absence of exogenous LIF.
3. Directs lineage specification. Human adult mesenchymal stem cells are directed towards neurogenic, myogenic, and osteogenic lineages on E=1, 11, and 34 kPa substrates, respectively.

Choosing the Matrigen plate that's right for your cells

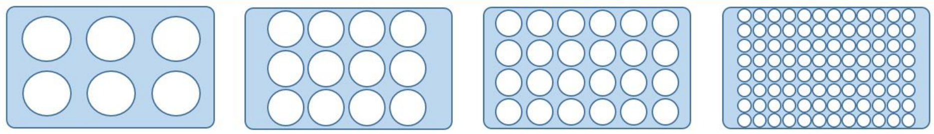
Hint: If you don't know what stiffness is optimal for your cells, you can purchase single plates to test each of 0.2, 0.5, 1, 2, 4, 8, 12, 25, and 50 kPa hydrogels. In addition, there is a 96 well HTS option in which every plate contains a column of 8 wells of each elasticity allowing all elasticities to be tested within a single plate.

FORMAT

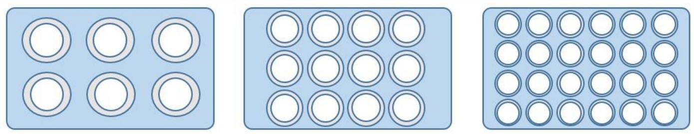
Softwell®
Hydrogels bound to 6, 12, 24, and 96 well polystyrene plates



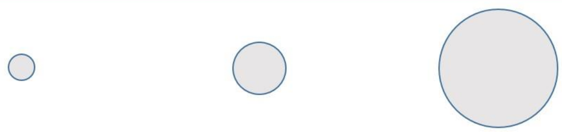
Softwell G™
Hydrogels bound to 6, 12, 24, and 96 well plates with a #1.5 glass bottom



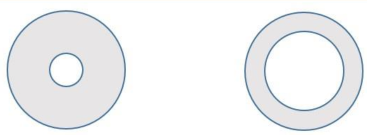
Softslip™
Hydrogels bound to removable glass coverslips in 6, 12, and 24 well plates



Petrisoft™
Hydrogels bound to 35, 100, and 150 mm polystyrene dishes



Softview™
Hydrogels bound to 35 mm dishes with a 10 or 20 mm #1.5 glass bottom



ELASTIC MODULUS (kPa)

0.2	0.5	1	2	4	8	12	25	50
	SOFT			INTERMEDIATE			STIFF	

COATING

Non-Activated
hydrogels form an ultra-low attachment surface. Allows the possibility to choose a chemistry method for proteins attachment.

Easy Coat™
hydrogels are chemically activated to bind to your matrix protein of choice, including ECM proteins.

Collagen
pre-coated hydrogels are ready for cell culture. All collagen-coated products use rat tail collagen type I.

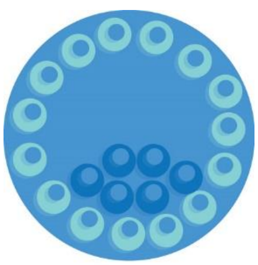
SPECIALTY OPTIONS

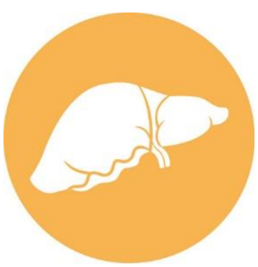
SoftTrac™
hydrogels with fluorescent microspheres immobilized at the surface, to be used for traction force microscopy.

Adhesion Free™
hydrogels that resist protein adsorption and are 100% non-adherent to cells.

Ultrasoft™
hydrogels as soft as mucus bound to glass substrates. Elastic modulus of 30, 70, and 100 Pa.

The importance of surface elasticity has been demonstrated in studies utilizing a range of cell types. Example papers are provided below. This list was last updated in March 2014.

Tissue	**References**
 Bone, Cartilage Skeletal muscle	1. Osteocyte differentiation is regulated by extracellular matrix stiffness and intercellular separation. 23994943 2. Effect of substrate stiffness on the osteogenic differentiation of bone marrow stem cells and bone-derived cells. 23447501 3. Response of sheep chondrocytes to changes in substrate stiffness from 2 to 20 Pa: effect of cell passaging. 23323769 4. Substrate stiffness and oxygen as regulators of stem cell differentiation during skeletal tissue regeneration: a mechanobiological model. 22911707 5. Substrate elasticity regulates skeletal muscle stem cell self-renewal in culture. 20647425 6. Cross talk between matrix elasticity and mechanical force regulates myoblast traction dynamics. 24164970 7. Substrate elasticity regulates skeletal muscle stem cell self-renewal in culture. 20647425
 Embryonic	1. Culturing of mouse and human cells on soft substrates promote the expression of stem cell markers. 24360205 2. Differential regulation of morphology and stemness of mouse embryonic stem cells by substrate stiffness and topography. 24529627 3. Soft substrates promote homogeneous self-renewal of embryonic stem cells via downregulating cell-matrix tractions. 21179449 4. Effect of substrate stiffness on early mouse embryo development. 22860009 5. Dual inhibition of Src and GSK3 maintains mouse embryonic stem cells, whose differentiation is mechanically regulated by Src signaling. 22553165 6. Soft substrates promote homogeneous self-renewal of embryonic stem cells via downregulating cell-matrix tractions. 21179449 7. Matrix elasticity directs stem cell lineage specification. 16923388 8. Interplay of matrix stiffness and protein tethering in stem cell differentiation. 25108614
 Endothelial and Blood	1. Effect of substrate stiffness and PDGF on the behavior of vascular smooth muscle cells: implications for atherosclerosis. 20648629 2. Endothelial barrier disruption and recovery is controlled by substrate stiffness. 23296034 3. Influence of membrane cholesterol and substrate elasticity on endothelial cell spreading behavior. 23239612 4. OxLDL and substrate stiffness promote neutrophil transmigration by enhanced endothelial cell contractility and ICAM-1. 22560286 5. Endothelial cell responses to micropillar substrates of varying dimensions and stiffness. 22389314 6. The effect of substrate modulus on the growth and function of matrix-embedded endothelial cells. 23102623

	7. The combined influence of substrate elasticity and ligand density on the viability and biophysical properties of hematopoietic stem and progenitor cells. 22444641 8. Neutrophil adhesion and chemotaxis depend on substrate mechanics. 20473350 9. The combined influence of substrate elasticity and surface-grafted molecules on the ex vivo expansion of hematopoietic stem and progenitor cells. 23876761 10. Substrate rigidity regulates human T cell activation and proliferation. 22732590 11. B cell activation is regulated by the stiffness properties of the substrate presenting the antigens. 23554309 12. Substrate rigidity regulates human T cell activation and proliferation. 22732590 13. B cell activation is regulated by the stiffness properties of the substrate presenting the antigens. 23554309
 Eye	1. Substrate elasticity as biomechanical modulator of tissue homeostatic parameters in corneal keratinocytes. 23664838
 Heart	1. Substrate stiffness modulates gene expression and phenotype in neonatal cardiomyocytes in vitro. 22519549 2. The constant beat: cardiomyocytes adapt their forces by equal contraction upon environmental stiffening. 23519595 3. Cardiomyocytes from late embryos and neonates do optimal work and striate best on substrates with tissue-level elasticity: metrics and mathematics. 22752667
 Hepatocytes	1. Relative rigidity of cell-substrate effects on hepatic and hepatocellular carcinoma cell migration. 23565595 2. Hepatic stellate cells require a stiff environment for myofibroblastic differentiation. 21527725 3. Increased stiffness of the rat liver precedes matrix deposition: implications for fibrosis. 17932231 4. Functional modulation of ES-derived hepatocyte lineage cells via substrate compliance alteration. 18266108 5. Engineering hepatocellular morphogenesis and function via ligand-presenting hydrogels with graded mechanical compliance. 15744840

 Mesenchymal	1. The effect of matrix stiffness on the differentiation of mesenchymal stem cells in response to TGF-β. 21397942 2. Differential regulation of stiffness, topography, and dimension of substrates in rat mesenchymal stem cells. 23863454 3. Physical and chemical microenvironmental cues orthogonally control the degree and duration of fibrosis-associated epithelial-to-mesenchymal transitions. 23018598 4. Mesenchymal stem cell durotaxis depends on substrate stiffness gradient strength. 23390141
 Neural	1. Migration of glial cells differentiated from neurosphere-forming neural stem/progenitor cells depends on the stiffness of the chemically cross-linked collagen gel substrate. 24041935 2. Photocured biodegradable polymer substrates of varying stiffness and microgroove dimensions for promoting nerve cell guidance and differentiation. 22857011 3. Effects of substrate stiffness and cell density on primary hippocampal cultures. 20547372 4. The effects of substrate elastic modulus on neural precursor cell behavior. 23429962 5. The influence of substrate stiffness on the behavior and functions of Schwann cells in culture. 22738780
 General and Mechanistic	1. Determination of local and global elastic moduli of valve interstitial cells cultured on soft substrates. 23746597 2. Computational model predicts cell orientation in response to a range of mechanical stimuli. 23708875 3. Investigating the role of substrate stiffness in the persistence of valvular interstitial cell activation. 22581728 4. Mechanochemical model of cell migration on substrates of varying stiffness. 22304116 5. Influence of substrate stiffness on circulating progenitor cell fate. 22169135 6. Integrin activation and internalization on soft ECM as a mechanism of induction of stem cell differentiation by ECM elasticity. 21593411 7. Cell shape and substrate rigidity both regulate cell stiffness. 21354386 8. Cellular contractility and substrate elasticity: a numerical investigation of the actin cytoskeleton and cell adhesion. 23775256 9. Effects of adhesion dynamics and substrate compliance on the shape and motility of crawling cells. 23741334 10. Differential effects of substrate modulus on human vascular endothelial, smooth muscle, and fibroblastic cells. 22374788 11. Evidence of a large-scale mechanosensing mechanism for cellular adaptation to substrate stiffness. 22509005 12. Feedback amplification of fibrosis through matrix stiffening and COX-2 suppression. 20733059 13. Mechanically Activated Integrin Switch Controls α5β1 Function. 9179533 14. Traction dynamics of filopodia on compliant substrates. 19074349 15. Role of YAP/TAZ in mechanotransduction. 21654799