# Development of a modified PDMS hydrogel for use in cell culture

## INTRODUCTION


### Abstract

Cells sense their physical environment through mechanotransduction - that means they convert mechanical forces and deformations into biochemical signals, such as activating different signaling pathways. The surface of polystyrene, which is used in everyday life in the cell culture laboratory, is quite stiff and influences the cellular functions, such as: proliferation, differentiation, migration, and apoptosis. For this reason, the development of a hydrogel that resembles the mechanical structure of human tissue is very important.


### Aim

In this project, different polydimethylsiloxane (PDMS) gels with different elasticities were polymerized. The surface of PDMS was coated with a three-dimensional Gelatin-Glutaraldehyde cross linking. The influence of the composition of PDMS on the attachment, growth, morphology and spreading of NIH 3T3 cell line (fibroblasts) was within this work examined. In addition, the long-term stability of the coating should be considered as well.

## METHODS

Preparation of PDMS-Gels → MicroSquisher, Contact angle measurement and tensile test → Plasma coating → Gelatin-glutaraldehyde coating → Fluorescence staining → Cultivation of fibroblasts

## RESULTS

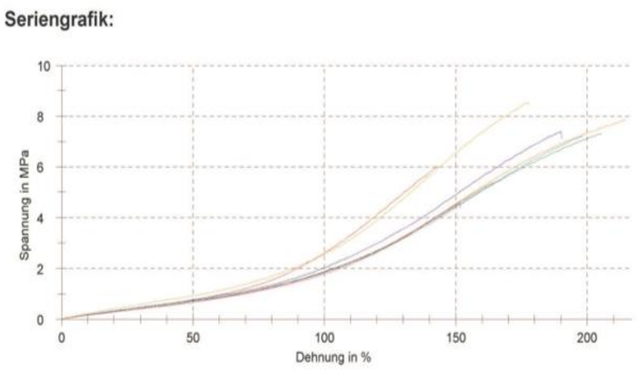


***Fig.1*** Graphic of the tensile test

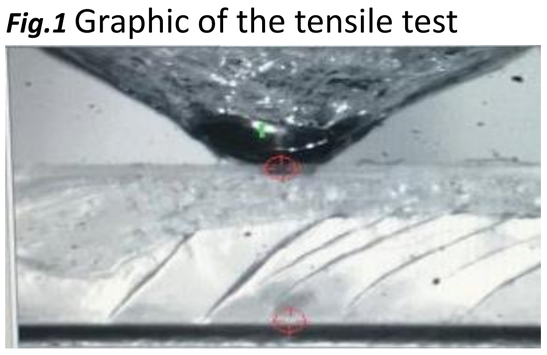

***Fig.3*** Cantilever of the MicroShquisher

***Fig.2*** A total of 8 tensile tests were carried out. This gave an average modulus of elasticity of 1.56 MPa for the stiffest gel.

| | Wasser | | Wasser |
|---|---|---|---|
| Sylgard 184 (1:10) | 128,9 ° | Sylgard 184 (1:10) | 46,6 ° |
| Sylgard 527 : 184 (5:1) | 146,8 ° | Sylgard 527 : 184 (5:1) | 125 ° |
| Sylgard 527 : 184 (10:1) | 143,3 ° | Sylgard 527 : 184 (10:1) | 82,2 ° |

***Fig.4*** Contact angle measurements for gels: left without plasma coating and right with plasma and GA-coating

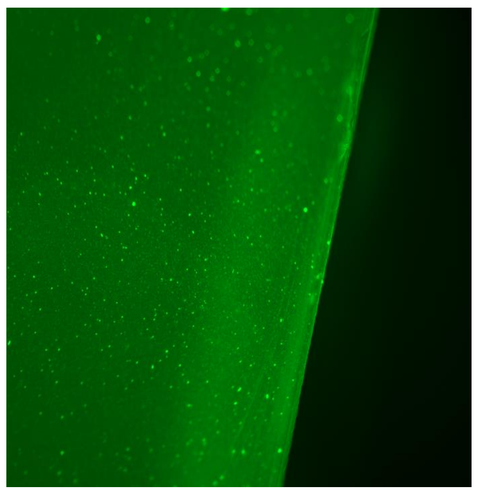

***Fig.5*** Fluorescence staining of PDMS 10:1 (S.527: S.184) coated with gelatin-GA by using 4-chloro-7 nitrobenzofurazan.

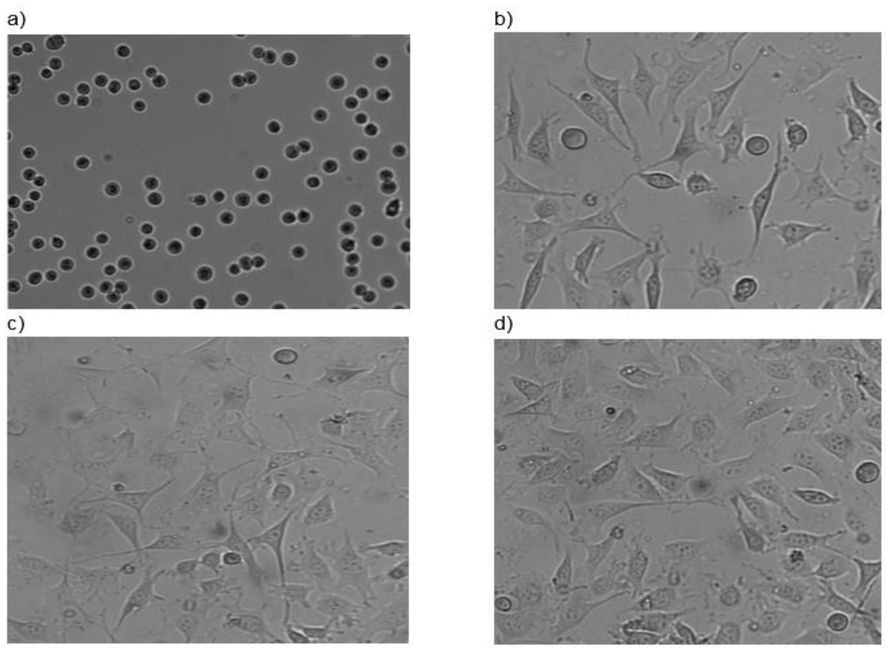


***Fig.6*** Images of cell culture on PDMS gel 10:1 (S.527: S.184) taken with the inverted microscope Lens 10x, with:

a) Immediately after suturing the 3T3 cells.
b) After 2 hours of incubation of the 3T3 cells.
c) After 5 hours of incubation of the 3T3 cells.
d) After 24 hours of incubation of the 3T3 cells.

## DISCUSSION

Overall, all project goals were implemented. As an alternative to the common polystyrene flasks *in vitro* cell experiments, PDMS gel blends from Sylgard 527 and Sylgard 184 were also used in this project. The stiffness or elasticity of some tissues of the human body is compared with the elasticity of the PDMS blends.

The adhesion and proliferation of cells on three different PDMS gel surfaces with 4 kPa, 26 kPa and 1,6 MPa, that are modified with gelatin glutaraldehyde is very possible and investigatable. In order to yield more stability of the gel surfaces, a subsequent modification with plasma treatment is useful. Further study and investigating of the long-term stability attempts are necessary to improve the work.


Referenzen: https://www.researchgate.net/profile/Yeh_Chuin_Poh/publication/30859351/figure/fig1/AS:309935381467137@1450905761202/Figure-1-LBL-dipping-method-for-adsorption-of-positive-and-negative-solutions-5.png
Guo S, Zhu X, Loh X-J: Controlling cell adhesion using layer-by-layer approaches for biomedical applica-tions Material Science and Engineering C2017; 1163-1175
https://images-na.ssl-images-amazon.com/images/I/91w0ZSOxX2L._AC_UL130_.jpg



Mayar Abdo, Derya Eliacik, Madlen Schellhammer, Akram Al-Rawhani, Maryam Drechsel
Reutlingen University, Biomedical Sciences WS 18/19; Biomaterials Laboratory