

# Cytocompatibility of biodegradable polyurethanes to cells and bacteria

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**INTRODUCTION:** Biodegradable polyurethanes have potential for use as implantable devices (orthopedic, maxillofacial, cardiovascular, wound dressing and plastic surgery) due to their elasticity, and the possibility of changing their chemistry and structure<sup>1</sup>. Studying bacterial and cell adhesion help determine surface cytocompatibility and suitability for *in vivo* trials. To determine the cytocompatibility of experimental polyurethanes (PUs) with different hydrophobic:hydrophilic (pho:phi) content ratios, the adhesion of hTERT (infinity telomerase-immortalised) human fibroblast cells, *Staphylococcus aureus* and *Staphylococcus epidermidis* to these surfaces were studied.

**METHODS:** Materials used in the study (Table 1) were characterised using laser profilometry for roughness, contact angle for wettability, and scanning electron microscopy (SEM) for morphology. The surfaces were either coated with 5µg/ml human plasma fibronectin (Fn) or left uncoated. To quantify the amount of cell spreading on each surface, approx. 20,000 hTERT fibroblasts were cultured in DMEM with 10% FCS at 37°C onto each surface for 2 and 4 days, before fixation and imaging with an SEM using a backscattered electron detector (BSE)<sup>2</sup>. The area of spread cells were analysed using an image analysis package. *S. aureus* (SA) and *S. epidermidis* (SE) were cultured on the test surfaces (no Fn) in Brain Heart Infusion broth for 2 and 4 hours. Adherent bacteria were fixed and imaged with an SEM using BSE imaging<sup>2</sup>, and the amount adhering quantified using a Partec PAS flow cytometer.

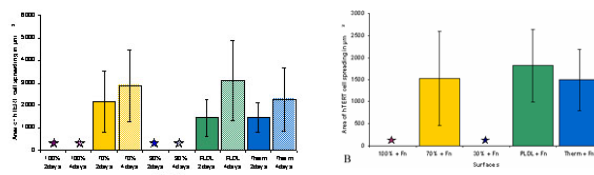
Materials used	Code	Ra (µm)	Contact angle
100% hydrophobic PU	100%	0.28	80 +/- 1
70/30 pho:phi PU	70%	0.16	73+/- 2.5
30/70 pho:phi PU	30%	1.93	77 +/- 2
70/30 poly(L-DL-lactide)	PLDL	0.05	80 +/- 2
Thermanox <sup>®</sup> (polyethylene tetraphthalate; cell culture plastic)	Therm	0.04	64 +/- 2

Table 1. Surfaces characterisation, including profilometry results and contact angle measurements

**RESULTS:** The characterisation of the studied surfaces show that they have different roughness (Ra) and wettability (Table 1). 100% hydrophobic is the smoothest and 30% hydrophobic the roughest. hTERT cells showed the greatest degree of cell spreading on the 70% and Thermanox surfaces after 2 days with and without fibronectin

(Fig 1). Only round cells were found on 100% and 30 % with and without fibronectin, therefore they were not analysed.

Fig 1. Average cell area on each surface. A) without Fn after 2 and 4 days of culturing; B) with Fn after 2 days of culturing. Stars refer to samples not analysed because few spread cells were found on the surfaces.



*S. aureus* and *S. epidermidis* were found on all surfaces to varying degrees when visualised with the SEM and counted with the flow cytometer (Fig. 2).

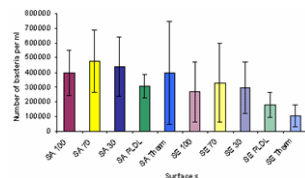


Fig. 2. Differences in the amount of SA and SE adhering to each surface after 4h of culturing.

## DISCUSSION & CONCLUSIONS:

Surface characterisation have shown that the surfaces have different properties. On the 100% and 30% hydrophobic surfaces, hTERT cells spread less in comparison to the 70%, PLDL and Thermanox surfaces. The adsorption of fibronectin to the surfaces had no effect on the adhesion and spreading of hTERT cells when compared to the uncoated surfaces. A similar trend was observed in the adhesion of *S. aureus* and *S. epidermidis* to the surfaces. Slightly less *S. epidermidis* were seen in comparison to *S. aureus*.

**REFERENCES:** <sup>1</sup>Gorna K, Gogolewski S (2002) J Biomed Mater Res 60:592-606; <sup>2</sup>Richards RG, ap Gwynn I (1995) J Microsc 177:43-52.

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