Proceedings of the ASME 2008 Summer Bioengineering Conference (SBC2008)
June 25-29, Marriott Resort, Marco Island, Florida, USA

SBC2008- 192538

USE OF POLYELECTROLYTE FILMS IN VASCULAR TISSUE ENGINEERING

H. Kerdjoudj, V. Moby, N. Berthelemy, J. C. Voegel, P. Menu, J. F. Stoltz

1. Groupe Ingénierie Cellulaire et Tissulaire, LEMTA-UMR Centre National de la Recherche Scientifique 7563, Nancy université, UHP, Faculté de Médecine, 54505 Vandoeuvre-lès-Nancy, France

2:Institut National de la Santé et de la Recherche Médicale, unité 595, Université Louis Pasteur-Strasbourg, Faculté de chirurgie dentaire, France

Vascular diseases with their high morbidity and mortality are a major challenge for medical science, engaging the best minds in modern medicine. The development of antithrombogenic surfaces still remains a huge challenge in the vascular tissue engineering field. Various researchers have expanded surface coating procedures allowing endothelial cells (EC) adhesion and retention on vascular substitutes or by incorporating some of the mechanisms employed by vascular endothelial cells i.e.heparin. The short *in vivo* patency of these grafts is related. Our group study evaluates a new surface modification based on polyelectrolyte building. The layer by layer self assembly and the result in polyelectrolyte multilayer films (PEM) became also in a recent past a challenging, simple and versatile way to engineer surfaces with highly specific properties. Previous studies indicated that the poly(sodium-4 styrene sulfonate)/poly (allylamine hydrochloride) PSS/PAH multilayered films when ended by PAH induce strong adhesion and retention of mature EC which spread and keep their phenotype as well on glass [1,2], on expanded polytetrafluoroethylene ePTFE [3] and on cryopreserved arteries [4,5]. The mechanical properties (compliance), leading to early intimal hyperplasia and graft failure, were lost after artery cryopreservation. We have demonstrated the compliance restoration of PEM treated cryopreserved close to native arteries [5]. The use of an autologous EC source avoids the immunological rejections of the grafts. With an autologous origin, high proliferation capacity and potentialities to proliferate and differentiate into matures EC, the endothelial progenitor cells (EPC) have raised huge interest and offer new opportunities in vascular engineering. Currents protocols for isolation and differentiation of EPC from peripheral blood requires at least 1 month to observe an endothelium-like morphology and about 2 months for confluent EC monolayer. The EPC cultivated on PEM treated glasses showed a monolayer development after only 14 days of culture. The morphological appearance and mature phenotype markers expression and repartition of the monolayer cells are close to mature EC [6]. These main results have led to French patent deposit in June 2007[7].

[1]C. Boura, P. Menu, E. Payan, et al., Endothelial cells growth onthinpolyelectrtolyte multilayered films:an evaluationofa new versatile surface modification, Biomaterials 24 (2003), 3521-3530.
[2]C. Boura, S. Muller, D. Dumas, et al., Endothelial cell-interactions with polyelectrolyte multilayer films, Biomaterials 26 (2005), 4568-4575.
[3]V. Moby, C. Boura, H. Kerdjoudj, et al., (Poly (styrene Sulfonate)/Poly (allylamine)) Multilayers: a route to favour Endothelial Cell Growth one PTFE Vascular grafts, Biomacromolecules 8 (2007), 2156-2160.
[4]H. Kerdjoudj, C. Boura, L. Marchal, et al., Decellularized umbilical artery treated with thinpolyelectrolyte multilayer films: potential use in vascular engineering, Biomed.Mater.Eng.16 (2006), S123-129.
[5]H. Kerdjoudj, C. Boura, V. Moby, et al., Re-endothelialization of human umbilical arteries treated with polyelectrolyte multilayers: a tool for damaged vessel replacement, Adv. Funct. Mater. 17 (2007), 2667-2673.
[6]N. Berthelemy, H. Kerdjoudj, C. Gaucher, et al., Polyelectrolyte films boost progenitor cells differentiation into endothelial like monolayers, Adv. Mater. (In press).
[7]Frenh patent: Procédé de prolifération de cellules sur des multicouches de polyélectrolytes et son application notamment à la préparation de biomatériaux cellularisés. Inventors :P. Menu, J. F. Stoltz, J. C. Voegel, H. Kerdjoudj, V. Moby, N. Berthelemy, P. Schaaf, C. Boura,. Go back to deposit: 18th June 2007, patent number: 07/04313.