EMCMRE-1
Marrakech-Morocco
November 21-25 2011

First Euro-Mediterranean Conference on Materials and Renewable Energies (EMCMRE-1) 21-25 November 2011

Long- And Short-Range Interactions Initiates The Axonal Growth On Rigid Substrates.

G. Lamour,[1,2] S. Souès,[3] and A. Hamraoui[1,4]

E-mail : ahmed.hamraoui@cea.fr

[1] Université Paris Descartes, UFR Biomédicale, 45 rue des Saints-Pères, 75006 Paris, France.
[2] Present address: University of British Colombia, Centre for High-Throughput Biology, 183F-2125 East Mall, Vancouver, British Colombia V6T 1Z4, Canada.
[3] Université Paris Descartes, Régulation de la Transcription et Maladies Génétiques, FRE3235, 45 rue des Saints-Pères, 75006 Paris, France.
[4] CEA Saclay, Service de Physique et Chimie des Surfaces et Interfaces, 91191 Gif-sur-Yvette, France.

Abstract:
Substrate factors such as surface energy distribution can affect cell functions, such as neuronal differentiation of PC12 cells [1]. However, the surface effects that trigger such cell responses need to be clarified and analyzed. Here we show that the total surface tension is not a critical parameter [2]. Self-assembled monolayers of alkylsiloxanes on glass were used as culture substrates [2-3]. By changing the nanoscale structure and ordering of the monolayer, we designed surfaces with a range of dispersive (γ^{d}) and non-dispersive (γ^{nd}) potentials, but with a similar value for total free-energy ($50 \leq \gamma^{d} + \gamma^{nd} \leq 55$ mN/m) [4]. When seeded on surfaces displaying $\gamma^{d}/\gamma^{nd} \leq 3.7$, PC12 cells underwent low level of neuritogenesis [5]. On surfaces exhibiting $\gamma^{d}/\gamma^{nd} \geq 5.4$, neurite outgrowth was greatly enhanced and apparent by only 24 h of culture in absence of nerve growth-factor treatment [5]. These data indicate how the spatial distribution of surface potentials may control neuritogenesis [1; 5], thus providing a new criterion to address nerve regeneration issues on rigid biocompatible substrates.

REFERENCES:

[1] Influence of surface energy distribution on neuritogenesis *Colloids and Surfaces B: Biointerfaces 72, pp 208-218, 2009*
[2] Neuritogenesis on antagonist surfaces, *Global Journal of Physical Chemistry, Vol. 2, pp 140-144, 2011*
[3] Neuronal adhesion and differentiation driven by nanoscale surface free-energy gradients *Biomaterials Vol. 31, pp 3762-3771, 2010*
[4]Contact angle measurements using a simplified experimental set-up, *J. Chem. Educ., 87, pp 1403–1407, 2010*
[5] Interplay between long- and short-range interactions drives neuritogenesis on stiff surfaces, *Journal of Biomedical Materials Research Part A, 2011, in press*