Contribution ID: **82** Type: **Oral Presentation**

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Friday, 29 June 2018 12:40 (20 minutes)

Laser-induced differentiation of Adipose Stem Cells to neuron-like cells

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The effect of lasers (light) on living cells and organs, referred as photobiomodulation (PBM) is capable of bringing morphological and functional changes to stem cells. However, our understanding of transforming stem cells to any specific-lineages under the influence of photons (light) is very limited. In many occasions light along with biological and chemical agents can induce, lineage-specific differentiation of Adipose Stem Cells (ASCs) often harvested from the body fats of adult humans. These stem cells possess better survivability and are capable of differentiation, which makes them an ideal choice for replacement therapies in clinics. Particularly, transforming ASCs into neuron-like cells allow us finding solutions to maladies of Central Nervous System (CNS) for cell therapies based on patient's own genetic background. This study was performed using ASCs isolated from healthy human subjects undertaking abdominoplasty in clinics. Harvested cells were maintained in culture medium supplemented with 10% fetal calf serum and passaged repeatedly, while been characterized based on their surface protein markers CD44/90/133/166. Cultured ASCs were proliferated and induced to differentiate into neuron-like cells using Fibroblast Growth Factor, basic (bFGF) and Forskolin in the presence of Near Infra-Red (NIR) lasers. Proportion of ASCs growing in the culture and capable of differentiation by induction was estimated as 6.3% based on the expression of CD90, a key stem cell marker. Exposure to 15 J/cm2 of NIR and growth factors for 14 days resulted in the initiation of differentiation of 7.8% these ASCs expressing CD90 into neuron-like cells (as revealed by the expression of Nestin, an early neuronal marker). Subsequent analysis identified the presence of 6.25% of β-tubulin, a late neuronal marker on the 21st day of induction. Current analysis identifies that Forskolin retained pluripotency of ASCs for up to 10 J/cm2 of NIR. This study gives us an indication that light energy can alter the fate of stem cells in favour of differentiation. More such initiatives are essential for our understanding and standardization of light in altering cellular phenotype and functionalities.

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Session Classification: Photonics

Track Classification: Track C - Photonics