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## Laser-induced differentiation of immortalized adipose stem cells to neuronal cells

Adult stem cells of mesodermal origin differentiate into other tissues such as cartilage and bone, when treated with specialised induction media *in vitro*. However, transdifferentiating adipose stem cells (ASCs) to other dermal layers is a challenge to researchers and therapists in regenerative medicine. Current activities in phototherapy are focused in optimizing the biological activities of lasers or light on stem cells including human immortalized ASCs (iASCs). A growing body of literature suggests that low intensity laser irradiation (LILI) increase stem cell migration, stimulates proliferation and possibly differentiates them to other cell types. This study used a combination of biological and physical inducers for increasing the differentiation of neurons in culture models. It has used a combination of growth inducers to differentiate iASCs to free-floating neural stem cells called neurospheres. Further, it has applied near infrared (NIR) lasers of wavelength 825nm with fluences ranging from 5 to 15 J/cm$^2$ on these neurospheres. Changes in the metabolic and redox status of these newly differentiated neurons were gauged from transcriptome. Moreover, neuronal differentiation was determined by immunostaining using early and late markers. This study was able to generate neurospheres from iASCs and differentiate them to neuronal cells *in vitro*. There was a sharp distinction between the metabolic processes of these iASCs with the primary ASCs. Strikingly, there was an increase in an early neuronal marker at 5 J/cm$^2$ and 15 J/cm$^2$ signifying the biphasic dose response of NIR laser on living systems. Thus, LILI increased the yield of neurons and effected stem cell differentiation through modulation of cellular redox status. However, these differentiated cells failed to express late neuronal markers. This study found that iASCs, which has the capacity to proliferate indefinitely in culture medium is an excellent model for differentiation. It gives an insight into the cellular and molecular events during neuronal differentiation of iASCs by growth factors and LILI. Further, it has identified the mode of action of NIR laser in differentiating iASCs to other cell types. The outcome of this study has to be taken forward for validation by functionality testing and analysis.

### Speaker Biography

Heidi Abrahamse is currently the director of the laser research centre, University of Johannesburg and Department of Science and Technology/National Research Foundation SARChI chair for laser applications in health. Her research interests include photobiology and photochemistry with specific reference to photodynamic cancer therapy, stem cell differentiation and wound healing. She has supervised 40 masters; 15 doctorates and 12 post-doctorate fellows and has published over 150 peer reviewed accredited journal publications, 42 accredited full paper proceedings and 11 chapters. She serves on the editorial boards of 8 peer-reviewed internationally accredited journals while acting as reviewer for over 30 journals. She is also the co-editor in chief of the international accredited journal photomedicine and laser surgery.

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