University of Victoria | Graduate Studies

Notice of the Final Oral Examination
for the Degree of Master of Applied Science

of

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BASc (Sharif University of Technology, 2016)

"Engineered Infected Epidermis Model for In Vitro Study of the Skin Proinflammatory Response"

Department of Mechanical Engineering

Thursday, January 16, 2020
2:00 P.M.
Engineering Computer Science Building
Room 468

Supervisory Committee:
Dr. Mohsen Akbar, Department of Mechanical Engineering, University of Victoria (Supervisor)
Dr. Rodney Herring, Department of Mechanical Engineering, UVic (Member)

External Examiner:
Dr. Patrick Walter, Department of Biology, UVic

Chair of Oral Examination:
Dr. Annalee Lepp, Department of Gender Studies, UVic

Dr. David Capson, Dean, Faculty of Graduate Studies

Abstract

Recent advances in tissue engineering has enabled the development of in vitro human skin models for wound infection modeling and drug testing. The existing skin models are mostly representative of the healthy human skin and its normal functions. However, to study the wound healing process and the response of skin to the infection, there is still a need to develop a skin model mimicking the wound infection. This paper presents a simplified functional infected epidermis model, fabricated with enzymatically crosslinked gelatin hydrogel. The human keratinocyte cell line, HaCaT, was successfully cultured and differentiated to a multilayer epidermis structure at the air-liquid interface, and expressed terminal differentiation marker, filaggrin, in the outer layer. The barrier function of the epidermis model was proved by measuring the electrical resistance and permeability across the layer. To show the capability of the developed epidermis model in wound modeling and drug testing, the model was infected with Escherichia coli and the inflammatory response of keratinocytes was studied by measuring the expression level of proinflammatory cytokines, including IL-1β and TNF-α. The robust fabrication procedure and functionality of this model suggest that the model has a great potential for wound modeling and high throughput drug testing.