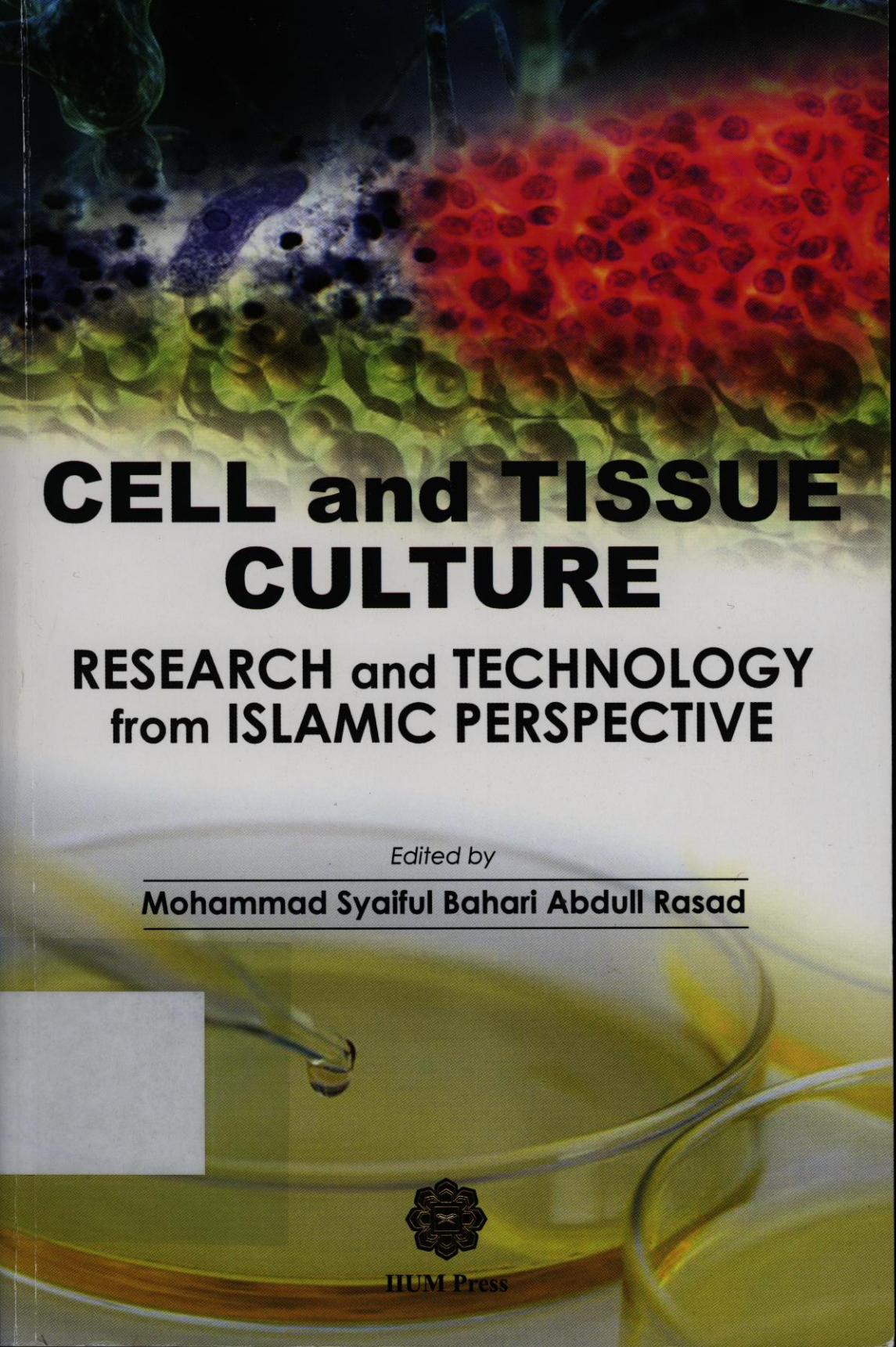

CELL and TISSUE CULTURE

RESEARCH and TECHNOLOGY from ISLAMIC PERSPECTIVE

Edited by

Mohammad Syaiful Bahari Abdull Rasad

IIUM Press

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CHAPTER 9

STEM CELLS RESEARCH: VALUE, ETHICAL AND RELIGIOUS VIEWS

Muhammad Lokman Md. Isa

Introduction

Stem cells are biological cells found in all multicellular organisms that are able to divide (through mitosis) and differentiate into various specialized cell types and can undergo self-renew process to generate more stem cells. These cells can be placed in four main classes according to their source of origin which are; germ stem cells (GSCs), adult stem cells (mesenchymal stem cells, somatic stem cells), embryonic stem cells and induced pluripotent stem cells (iPSCs). Adult stem cells can be isolated from tissues at any stage from the fetus to the adult and are regarded as multipotent cells which are involved in normal tissue development and maintenance. Embryonic stem cells (ESCs) are fundamentally different in a number of ways. These cells are created outside the body from the cells that are naturally in a transitional state of development in the very early embryo but are then transformed by specific *in vitro* culture conditions to retain an undifferentiated state. Thus, ESCs can be defined as a derivation of pluripotent stem-cell lines from early embryos that occurred before tissue germ layers formation (Smith, 2006). ESCs are usually isolated from the inner cell mass (ICM) of pre-implantation embryos at the blastocyst stage. Their distinguishing feature is that as well as an apparent infinite capacity for self-renewal, they seem unrestricted in which cell type they can generate. In this regard, they are at least pluripotent and potentially totipotent (for human ESCs-hES). IPSCs have similar characteristics to ESCs but are created by reprogramming somatic cells with pluripotent factors (Takahashi and Yamanaka, 2006).

Two other types of pluripotent stem cells are also related ESCs. Embryonic germ (EG) cells are derived from primordial germ cells (PGCs) of the foetal genital ridge of the mouse [day 12-13 gestation (Matsui, Zsebo and Hogan, 1992)] or human [5-12 weeks of gestation (Turnpenny *et al.*, 2003; Shamblott *et al.*, 1998)]. A counterpart of ESCs is also embryonic carcinoma (EC) cells, which are derived from malignant stem cells of a germ cell tumour or teratocarcinoma (Andrews *et al.*, 2005). The exact relationship between these "embryonic" stem cell types remains unclear but all express common surface markers suggesting a similarity in molecular physiological composition. Different totipotent stem cells can therefore be created at different stages of the life cycle of a mammal (Figure 9.1).

Indication of hESCs Research

There have been realized benefits of stem cell research, the best known of which is the successful treatment of leukaemia and many other haematologic disorders by bone marrow transplants and, more recently, by using umbilical cord blood stem cells. However, the real promise of stem cell research is the potential development of a new field of "regenerative medicine," (Weissman, 2005) which aims at growing tailor-made human tissues or organs to be used to colonize or to replace damaged tissues/organs to recover their lost function. Progenitor cells have been developed and they can be made to differentiate into myocardial cells, neurons, and pancreatic as well as other types of cells.