INTRODUCTION

Stem cell biology has attracted tremendous interest recently. It is hoped that it will play a major role in the treatment of a number of incurable diseases via transplantation therapy. Several varieties of stem cells have been isolated and identified *in vivo* and *in vitro*. Very broadly they comprise of two major classes: embryonic/fetal stem cells and adult stem cells ***(Alison et al., 2002)***.

The word "stem cell" has also been loosely used without the demonstration of stem cell markers or confirmation of stemness via transcriptome profiling. It is their ability to self-renew and differentiate that certain cells are termed stem cells both *in vivo* and *in vitro*. Stem cell therapy has already reached the bedside in some hospitals through the transplantation of donor bone marrow stem cells into the circulatory system of leukemic patients and the transfer of umbilical cord stem cells into the circulatory system of leukemic children or their siblings produced from the same mother who had previously stored her umbilical cord cells ***(Weissman, 2000)***.

Liver diseases affect approximately 17.5% of the population with the most severe cases being treated by orthotopic transplantation. The continuing shortage of donor organs has been a major roadblock in orthotopic liver transplantation. This has led to the consideration of several potentially viable alternatives, including bioartificial and nonbiological liver assist devices, transplantation of mature hepatocytes or of stem/progenitor cells, and potential of transplanting xenogeneic organs and cells ***(Bellentani et al., 2001)*** and ***(Neuberger, 2000).***

There has been much interest in recent years in using stem cells to repair or regenerate damaged tissues and organs. Stem cells can be utilised as a source for cell transplantation due to their ability to differentiate into a variety of cell types ***(Vassilopoulos et al., 2003).***

Stem cells either embryonic or liver stem cells, are a potential source of hepatocytes for transplantation. A number of criteria must be fulfilled in order for stem cells to be therapeutically beneficial. Ideally, cells for liver therapies should expand extensively *in vitro*, differentiate into mature liver cells, have minimal immunogenicity and be able to reconstitute liver tissue when transplanted *in vivo*. Alternative approaches to using liver stem cells include the production of cells from differentiated cells or from embryonic or extra-hepatic stem cells. While there is some evidence for the ability to induce the differentiation of embryonic stem cells and non-hepatic cells to cells with some hepatocyte properties, there is no clearly identifiable adult liver stem cell. There is however, evidence to suggest that candidate liver stem cells do exist and may be exploitable ***(Shafritz and Dabeva, 2002)*** and ***(Fausto, 2004).***

There are three broad groups of liver disease we can identify for the purpose of cell therapeutic options. Fulminant hepatic failure which is characterised by rapid failure of the liver and death of the patient if whole liver replacement does not occur urgently. Cell therapeutic trials for fulminant hepatic failure in the form of liver cell transplants are underway and have shown moderate success ***(Neuberger, 2000).***

Metabolic liver diseases which are characterised by an inherited defect of one hepatic enzyme, and include urea cycle defects, bilirubin metabolising defects and organic acidaemias. Metabolic liver diseases are

ideal targets for development of cell therapeutic programs since only a small number of functional donor cells would affect disease correction through single enzyme replacement ***(Bellentani et al., 2001)***

Chronic liver disease which is characterised by simultaneous liver regeneration and development of fibrosis that results in end stage cirrhosis. Although fibrosis or cirrhosis could be an inhibitor of cell engraftment either through mechanical barriers or altered cytokine milieu in any form of cell therapy, whether using liver cells for transplantation or other stem cells ***(Selden and Hodgson , 2004).***