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)***.

Stem cells are one of the most fascinating areas in regenerative medicine today. They play a crucial role in the development and regeneration of human life and are defined as cells that continuously reproduce themselves while maintaining the ability to differentiate into various cell types. Stem cells are found at all developmental stages, from embryonic stem cells that differentiate into all cell types found in the human body to adult stem cells that are responsible for tissue regeneration. There are three important characteristics that distinguish stem cells from other cell types. Stem cells are unspecialized but pluripotent (can differentiate into all three major tissue types) cells, which have the ability to indefinitely renew themselves. Scientists put great effort in the understanding, identification, and characterization of the various differentiation processes stem cells may undergo ***(Ehnert et al., 2009).***

The adult human kidney contains at least 26 different cells types, such as tubular epithelial cells, glomerular cells, interstitial cells, and those of the vasculature. Recent reports suggest a role for stem cells, both from local and distant pools in normal turnover, e.g., to prevent chronic kidney diseases or in acute injury, e.g., following a toxic or ischemic

event **(Lin, 2006).** In this context, bone marrow derived stem cells as well as embryonic and adult renal stem cells have been reported ***(Brodie &, Humes, 2005)***.

In the kidney, tubules and glomeruli show a totally different plasticity. It is widely known from the clinical practice that, in most cases, tubules are able to regenerate even after major damage ***(Brenner& Rector's, 2008),*** although postnatal glomerulogenesis has not been described in human. Probably for this reason, major acute or chronic glomerular damage invariably leads to ESRD. The recent identification of renal progenitor cells both inside the kidney **(Bussolati et al, 2005)** and in the bone marrow may pave the way toward the future regeneration of the damaged kidney ***(Morigi et al, 2004)*** .

Most recently, adult stem cells originally from the kidney have been reported for the first time in the mouse renal papilla that commence proliferating in response to ischemia/reperfusion injury and may migrate to the medulla ***(oliver et al., 2004)***. Nevertheless, further characterization of this potential stem cell population is essential, and the existence of such an adult renal stem cell undoubtedly will have tremendous impact on the development of new therapies for acute and chronic kidney disease ***(Bates & Lin, 2005).***