Regenerative Medicine
The Future of Treatments

Regenerative medicine is an emerging interdisciplinary field of research and clinical applications focused on the repair, replacement or regeneration of cells, tissues, or organs. By using a combination of several technologies, it aims at restoring impaired function resulting from any cause, including congenital defects, disease, and trauma. These approaches may include, but are not limited to, the use of stem cells, soluble molecules, genetic engineering, tissue engineering, and advanced cell therapy.

This new field of regenerative medicine encompasses many novel approaches to treatment of disease and restoration of biological function through the following methods:

a) Using therapies that prompt the body to autonomously regenerate damaged tissues
b) Using tissue-engineered implants to prompt regeneration and
c) Direct transplantation of healthy tissues into damaged environments.

The main advantage of regenerative medicine over current therapies is that it is a one-time cure to a particular disease. It saves the patient from recurring treatments and its associated costs. For example, in Diabetes, the popular treatment is insulin therapy. Insulin therapy, even if providing appropriate glucose homeostasis, does not cure the disease. The patient needs a regular dose of insulin and further becomes prone to long-term complications such as kidney failure. Through regenerative medicine the patient’s insulin producing cells can be regenerated.

Other major contributions of regenerative medicine have been seen in the field of improving myocardial functions and curing of damaged blood vessels. Thus regenerative medicine aims at increasing the quality of life by decreasing the healthcare cost of chronic disorders.

Regenerative medicine can also combat end-organ failure. Today, the number of patients requiring whole organ transplant always exceeds the number of organs available. Regenerative medicine aims at bridging this gap by artificially developing the tissue. Organ transplant remains a major healthcare issue worldwide. Regenerative medicine also holds promise in transplanting and growing replacement organs. With regenerative medicine, waiting for a tissue or organ transplant will become a worry of the past.

Stem Cells: The Base
Since the derivation of Human Embryonic Stem Cells by Thompson and his team in 1998 at the University of Wisconsin, stem cells have attracted a lot of attention worldwide. Researchers have been busy deriving them from various sources and getting to know their properties which maintain their “stemness” (property of self division and self renewal). Stem cells are of two types:

1. Embryonic Stem cells: Embryonic stem cells are stem cells derived from the inner cell mass of an early stage embryo known as a blastocyst. Human embryos reach the blastocyst stage 4-5 days post...
2. Adult Stem Cells: Adult stem cells are undifferentiated cells, found throughout the body after embryonic development, that multiply by cell division to replenish dying cells and regenerate damaged tissues. Scientific interest in adult stem cells has centered on their ability to divide (non-dividing) for long periods of time until they are activated by a normal need “niche”. Stem cells may remain quiescent in a specific area of each tissue, called a “stem cell niche”. Stem cells may remain quiescent (non-dividing) for long periods of time until they are activated by a normal need for more cells to maintain tissues, or by disease or tissue injury.

**Future of Regenerative Medicine**

In March 2006, Anthony Atala, Director of the Institute for Regenerative School of Medicine at Wake Forest University School of Medicine was the physician who for the first time reported the derivation of engineered bladders, grown from the patient’s own cells. In *The Lancet*, Atala describes long term success in children and teenagers who received bladders grown from their own cells. In this particular case, the engineered bladders were grown from the patient’s own cells, so there was no risk of rejection.

Scientists hope that laboratory-grown organs will one day help solve the shortage of donated organs available for transplantation. Atala reported that the bladders showed improved function over time with some patients being followed for more than seven years. The main goal of the surgery was to reduce pressures inside the bladder to preserve the kidneys. In addition, urinary incontinence, which was a problem before the surgery, improved in all patients.

So, regenerative medicine has a bright future. Scientists worldwide are involved in discovering various regenerative therapies especially using adult stem cells such as the Retinal, Cardiac, Pancreatic and neural stem cells. This field also attracts pharmacologists for discovering drugs that show a therapeutic role on interaction with various stem cells. The latest is the discovery of the drug Salinomycin by Piyush B. Gupta et al. as reported in Cell. In this case, scientists found that the drug reduced the number of cancer stem cells in mouse by at least hundred folds.