Cardiovascular Drug Delivery - Technologies, Markets and Companies

Description: Drug delivery to the cardiovascular system is different from delivery to other systems because of the anatomy and physiology of the vascular system; it supplies blood and nutrients to all organs of the body. Drugs can be introduced into the vascular system for systemic effects or targeted to an organ via the regional blood supply. In addition to the usual formulations of drugs such as controlled release, devices are used as well. This report starts with an introduction to molecular cardiology and discusses its relationship to biotechnology and drug delivery systems.

Drug delivery to the cardiovascular system is approached at three levels: (1) routes of drug delivery; (2) formulations; and finally (3) applications to various diseases. Formulations for drug delivery to the cardiovascular system range from controlled release preparations to delivery of proteins and peptides. Cell and gene therapies, including antisense and RNA interference, are described in full chapters as they are the most innovative methods of delivery of therapeutics. Various methods of improving systemic administration of drugs for cardiovascular disorders are described including use of nanotechnology.

Cell-selective targeted drug delivery has emerged as one of the most significant areas of biomedical engineering research, to optimize the therapeutic efficacy of a drug by strictly localizing its pharmacological activity to a pathophysiologically relevant tissue system. These concepts have been applied to targeted drug delivery to the cardiovascular system. Devices for drug delivery to the cardiovascular system are also described.

Role of drug delivery in various cardiovascular disorders such as myocardial ischemia, hypertension and hypercholesterolemia is discussed. Cardioprotection is also discussed. Some of the preparations and technologies are also applicable to peripheral arterial diseases. Controlled release systems are based on chronopharmacology, which deals with the effects of circadian biological rhythms on drug actions. A full chapter is devoted to drug-eluting stents as treatment for restenosis following stenting of coronary arteries. Fifteen companies are involved in drug-eluting stents.

New cell-based therapeutic strategies are being developed in response to the shortcomings of available treatments for heart disease. Potential repair by cell grafting or mobilizing endogenous cells holds particular attraction in heart disease, where the meager capacity for cardiomyocyte proliferation likely contributes to the irreversibility of heart failure. Cell therapy approaches include attempts to reinitiate cardiomyocyte proliferation in the adult, conversion of fibroblasts to contractile myocytes, conversion of bone marrow stem cells into cardiomyocytes, and transplantation of myocytes or other cells into injured myocardium.

Advances in molecular pathophysiology of cardiovascular diseases have brought gene therapy within the realm of possibility as a novel approach to treatment of these diseases. It is hoped that gene therapy will be less expensive and affordable because the techniques involved are simpler than those involved in cardiac bypass surgery, heart transplantation and stent implantation. Gene therapy would be a more physiologic approach to deliver vasoprotective molecules to the site of vascular lesion. Gene therapy is not only a sophisticated method of drug delivery; it may at time need drug delivery devices such as catheters for transfer of genes to various parts of the cardiovascular system.

The cardiovascular drug delivery markets are estimated for the years 2016 to 2026 on the basis of epidemiology and total markets for cardiovascular therapeutics. The estimates take into consideration the anticipated advances and availability of various technologies, particularly drug delivery devices in the future. Markets for drug-eluting stents are calculated separately. Role of drug delivery in developing cardiovascular markets is defined and unmet needs in cardiovascular drug delivery technologies are identified.

Selected 82 companies that either develop technologies for drug delivery to the cardiovascular system or products using these technologies are profiled and 80 collaborations between companies are tabulated. The bibliography includes 200 selected references from recent literature on this topic. The report is supplemented with 30 tables and 8 figures.
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