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Drug delivery: 11 technologies of the future

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Drug delivery technologies of the future



The drug delivery technology landscape is rapidly evolving with new classes of pharmaceuticals and biologics fuelling this revolution. The last few decades have witnessed the emergence of several drug delivery technologies including hydrogels, liposomes, microparticles, nanoparticles, and polymers. The growth of drug delivery solutions is of increasing importance to pharmaceutical companies, and has resulted in significant changes in the drug delivery landscape.

The future growth projections for these devices are increasing, causing a number of innovative drug delivery systems to be introduced each year.

With significant paradigm shifts in drug discovery and development, the industry is also gearing up to adopt alternative drug delivery strategies in order to further facilitate drug development. Opportunities have significantly increased in the last few years. Pharmaceutical companies are collaborating with drug delivery firms to effectively target patient concerns.

Newer methods, such as transdermal technologies, intelligent delivery systems capable of modulated delivery, nasal delivery and skin-based delivery technologies, have come up. And the change in the outlook of the drug delivery industry is further facilitating a better understanding of market dynamics, encouraging innovation for alternative technologies and giving rise to competition.

The story focuses on the emerging drug delivery landscape in Asia Pacific along with briefly highlights the drug delivery achievements in Asia. The 11 innovative techniques emerging in the Asia Pacific marketplace are:

Auto-injectors:Ã?Â It is a new approach to design painless modes of injectables.Ã?Â Taiwan-based Scandinavian Health (SHL Group) believes that besides having advanced alternative drug delivery technologies, the number of injectable drugs would be substantially large in the future. The company is focusing onÃ?Â auto-injector manufacturing.

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Ultrasound-enhanced technology: Researchers at Nanyang Technological University, Singapore, have designed a novel approach to enhance the penetration of small molecules into ex vivo tissue. The hypothesis of researchers is that the mechanical effect of ultrasound energy, radiation force of ultrasound pulse and microstreaming resulting from bubble cavitation are the major mechanisms of pulse high-intensity focused ultrasound (pHIFU)-enhanced drug penetration.

Nasal vaccine drug delivery: Intramuscular and oral administrations have been the most widely used methods of delivery of vaccines so far. However, to overcome the challenges of needle injuries and to avoid any threat of disease transmission, drug delivery companies are looking for alternative approaches to deliver vaccine through the nasal drug delivery system instead of traditional methods.

Multiple approaches are being taken in laboratories. In 2009, Pune-based Serum Institute of India launched Nasovac, a vaccine for swine flu which is administered through intranasal spray. US-based OptiNose has been doing research in vaccine administration through the nasal system and the company suggests that nasal vaccination has the advantage that elicits both local and systemic immune responses.

Hydrogels-based delivery: The Institute of Bioengineering and Nanotechnology, Singapore, has developed an injectable biodegradable hydrogel system using enzyme-mediated reaction for drug delivery and tissue engineering applications.

This system does not involve toxic chemicals or reactions in the hydrogel formation process, thus allowing therapeutic proteins, growth factors and cells to be incorporated without damaging the biological molecules.

This system also allows controlling the mechanical strength of the hydrogel, while achieving a rapid gelation rate.

The researchers of the institute claim that this technology has advantages in controlling degradation, drug release and cell proliferation or differentiation, while preventing uncontrolled leakage of the bioactive agents during the gelation process in-vivo.

Polymer-based drug delivery: Drugs conjugated to a polymer backbone at one end and to another molecule, which targets a tumor specific ligand, are being developed for a number of drugs.Ã?Â Targeting ligands on the surface of the carrier, molecules can bind to targets on endothelial cells and can be useful for anti-angiogenesis therapy. MediVas, a San Diego-based biomedical company, has developed a technology for the delivery of biologics and drugs based on next generation set of polymers.

Image-guided drug delivery: In image guided drug delivery, the goal is to optimize and ensure delivery of the therapeutic agent to the target cell or site and provide imaging feedback of the therapeutic protocol.Ã?Â The delivery method is at a relatively nascent stage and many research organizations and universities are working on this platform.

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Orodispersible technology: The orodispersible tablet (ODT) technology offers advantages over the traditional dosage formulations as they allow easy swallowing without the use of water in paediatrics and geriatrics patient populations.

This technology is advantageous to patients suffering from diseases, such as mouth cancer, where swallowing the drug is a challenge. Global drug giant Merck has launched ODT technologies for delivery of water-insoluble compounds with robust in-vivo performance.

Nanoparticle drug delivery:Ã?Â Nanoparticles as a drug delivery system enables unique approaches for cancer treatment. Over the last two decades, a large number of nanoparticle delivery systems have been developed for cancer therapy, including organic and inorganic materials.

Transdermal technology: This platform technology can be used to deliver an extensive range of different products.Ã?Â The delivery platform called targeted pentration matrix (TPM) has been developed by Australia-based Phosphagenics.

HyACT technology: HyACT technology uses hyaluronic acid's (HA) unique properties to enhance delivery and retention of chemotherapeutic drugs and biologics at the site of a tumor. At Alchemia, a company leveraging on drug delivery products, three phase I clinical trials of the technology have been completed and are ready for the next stage of clinical development.

Shockwaves-based delivery: Shock waves are one of the most efficient mechanisms of energy dissipation observed in nature. A novel non-intrusive needleless vaccine delivery system has been developed utilizing the instantaneous mechanical impulse generated behind the micro-shock wave during controlled explosion.