



ADVANCED & TARGETED DRUG DELIVERY GLOBAL MARKET

 **KELLY
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Advanced and Targeted Drug Delivery Market Segmentation, Analysis & Forecast to 2021 - Nanoparticles, Polymers, Liposomes, Micelles, Nanoemulsions, Dendrimers, Monoclonal Antibodies by Geography, Therapeutic Area and Stakeholder Environment

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1.0 Introduction

Targeted drug delivery refers to targeting drugs to specific tissues of interest while reducing relative concentration of the drug in other regions of the body. It is also referred to as “smart drug delivery”. Targeted drug delivery is best suited for cancer drugs, because of their inherent toxicity and need targeted drug delivery inside the human body. This method of delivery uses vehicles, which are non-toxic, biocompatible, and biodegradable and avoid recognition by the host's defense mechanism. This delivery method has the largest market share of about 54% of all drug delivery systems.

The market for targeted drug delivery systems is anticipated to grow exponentially with aggressive developments in nanotechnology, biomarker discovery and genetic engineering/cell engineering technologies. The development of new disease biomarkers and target ligands (surface receptors) is about to accelerate the development of highly targeted drug delivery carriers that can improve safety and efficacy of drugs. Safety, efficacy and cost effectiveness are some of the important factors that leverage a pharmaceutical/biotech company's decision for the adoption of a targeted delivery platform.

Currently, oncology has been the major focus area for most companies, but central nervous system (CNS) delivery and other targeted delivery applications are also gaining prominence. Besides the development of a large number of functionalized nanoparticle technologies, many firms are venturing into advancing liposomal and polymeric delivery methods to meet some of the important end user needs. There are plenty of opportunities for future commercial developments of new targeted delivery technologies for the pharmaceutical industry, and these can offer patenting opportunities for existing drugs as well as new chemical entities (NCEs). Although, many people consider extended-release drugs as a type of targeted drugs, technically, this report omits them as they are not exactly targeted in their action. They are simply meant to stay in the bloodstream for a prolonged time.

1.1 Executive Summary

Drug delivery technologies are growing remarkably from the reformulation of conventional plain drugs and release technologies to novel platforms that hold huge potential for the effective delivery of both small molecule and biologic drugs. The limited success of conventional drugs in the treatment of severe diseases has resulted in the adoption of a multidisciplinary approach for the targeted delivery of drugs. The new drug delivery systems are built on the foundation of polymer science, pharmaceuticals, bioconjugate chemistry and molecular biology. The carriers used to encapsulate drugs include nanoparticles such as liposomes, micelles, dendrimers, inorganic nanoparticles, magnetic particles, nucleic acids/peptides and living cells. These carriers are engineered in such a way as to remain intact until the delivery of the drugs to the intended site. Among them, cell-based delivery systems are yet to bring out marketable products whereas the other carrier particles have generated

revenues of about \$x billion in 2015 and with a CAGR of x%, the market is likely to bring revenues of \$x billion dollars to the pharmaceutical industry by 2021.

Inorganic nanoparticles are found to have enormous potential as drug delivery carriers due to their distinctive physicochemical characteristics such as high surface area per unit volume, their optical and magnetic uniqueness and the ability to become attached with a large number of ligands to increase their affinity towards target molecules. These characteristics, along with the therapeutic activity of some drugs, provide the combination of these two entities (nanoparticle-drug) as an attractive alternative in the area of drug delivery. One of the key advantages of these conjugates is the direct delivery of the drug to the target. Among the inorganic nano-based particles, only the gold nanoparticles have significant market share with several products in the market for targeted drug delivery, diagnosis and medical imaging as contrast agents. For drug delivery, diagnostic and imaging uses, they earned revenues of nearly \$x billion in 2015 and with a CAGR of x%, they are predicted to earn about \$x billion in 2021.

Monoclonal antibodies have become one of the fastest growing classes of biopharmaceutical drugs within the pharmaceutical industry. In the U.S. and Europe, 47 mAbs have been approved (at the time of writing) over the past several years and mAbs such as Rituxan, Remicade, Avastin, Humira, and Herceptin reached blockbuster status. Moreover, more than 300 mAbs are currently in clinical trials. With both multinational biotechnology companies and small start-ups engaging themselves in the development of this important class of molecules, mAb products will become increasingly prevalent over the next decade.

Two types of mAbs are used mostly in the treatment of cancer. Most of the mAbs are naked and carry no drugs. Upon administration, they move towards antigens overexpressed on cancer cells, bind to them and prevent the cancer cells from developing further. Other mAbs are conjugated with a toxic drug and upon reaching the target, these mAbs unload the drug directly into the cancer cell and consequently, the cancer cells alone are killed. Both therapeutic mAbs and antibody drug conjugates (ADC) represent the largest group of targeted drug delivery systems generating revenues of about \$x billion in global sales in 2015. With a CAGR of c%, they are anticipated to grow and have a global value of \$x billion in 2021.

One of the largest segments of targeted drug delivery is represented by pulmonary drug delivery systems. The high prevalence and incidence of respiratory diseases such as asthma and COPD (chronic obstructive pulmonary disease) is one of the key driving forces of this market. Drugs meant for pulmonary delivery adopt the route of oral inhalative administration or by intranasal administration. The active ingredients of the drug are targeted to the lungs for local or systemic therapeutic activity. The pulmonary route is a common route of administration because of the large surface area for absorption, high blood circulation and high permeability rate in the lungs. Drugs targeted by this route can bypass the hepatic first-pass metabolism, providing quick onset of action. These drugs are mostly in the form of powder or liquid and are delivered through specialized inhalation devices. The segment of pulmonary drug delivery had a value of \$x billion in 2015 and growing at a CAGR of x%, it has the potential to reach \$x billion in 2021.

The purpose of topical ocular administration of drugs is for treating superficial eye diseases, such as conjunctivitis, blepharitis and keratitis sicca, and to provide intraocular treatment through the cornea for diseases such as glaucoma or uveitis. Nearly 90% of ocular drugs are in the form of eye drops. But more than 90% of these drug formulations are washed from the eye by various mechanisms (lacrimation, tear dilution, and tear turnover). The impermeable corneal barrier restricts the entry of drugs and only less than 5% of the drug can actually penetrate the cornea and reaches intraocular tissues. To overcome this barrier, companies have started formulating drugs with nanocarriers. Liposomes, dendrimers and hydrogels are now being used for the encapsulation of drugs. These nanobased drugs remain for a longer time, cross the corneal barrier and reach the targeted site. Ocular implants are made from biodegradable or non-biodegradable polymers and they too target the drug

crossing the retinal barrier. Together, the ocular drop and implant market was worth about \$x billion in 2015 and with a CAGR of x%, it is predicted to reach \$x billion in 2021.

Another targeted drug delivery system is represented by drug eluting stents (DES). The coronary stent can carry the drug through drug eluting. DES can deliver local high concentration of the drug by local drug delivery system and reduce the systemic side effects. Thus, the development of thrombus is avoided, and the risk of restenosis is minimized. DES has become a revolutionary technology for the clinical treatment of stenosis disease. Nearly 90% of angioplasty now involves a stent and most patients receive a drug-eluting stent. At present, drug-eluting stents cost about \$2,000 more than bare-metal stents. Despite the added cost, drug-eluting stents are a small part of the overall angioplasty cost. Current estimates put the global market for drug eluting stents at \$x billion in 2015 and with a CAGR of x%, it is projected that the market will reach \$x billion in 2021.

In total, the targeted drug delivery market analysed in this report is currently worth \$168 billion globally and is forecast to grow at a CAGR of 10.4% between 2016 and 2021, when it will hit \$312.9 billion annually. The largest segment is currently monoclonal antibodies, and this area will continue to command the largest market share in 2021 (\$x billion). However, nanosystem delivery that includes liposomes, micelles, dendrimers and inorganic nanoparticles will grow the strongest between 2016 and 2021, with a CAGR of x%, generating \$x billion in 2021. KellySciPub analysis indicated that the drug eluting stent market will grow at the weakest market rate at x% CAGR over this time period, and will hit sales of \$x billion by 2021. The ocular drug targeted delivery market will grow strongly however, and its CAGR of x% will contribute to strong sales globally by 2021. The following table and figure give a comprehensive financial analysis of all markets analysed in this report, through 2021.

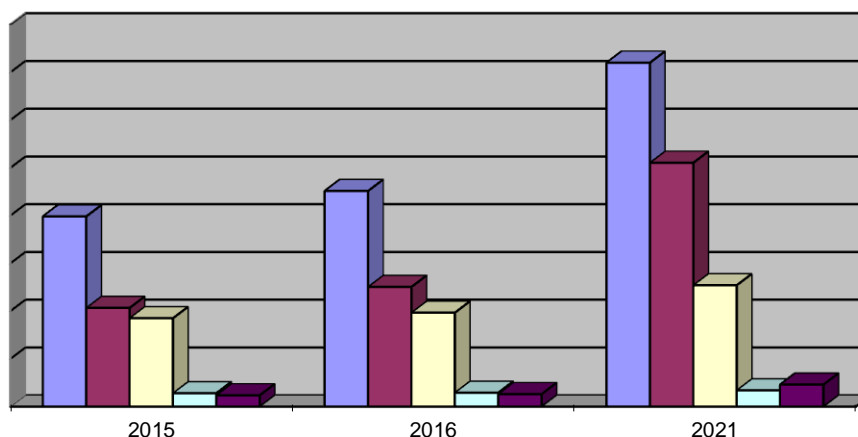
Table 1.1: Summary of Targeted Drug Delivery Market, Through 2021

Market Segment	2015 (\$ Billions)	2016 (\$ Billions)	2017 (\$ Billions)	2021 (\$ Billions)	% CAGR 2016-2021
Nanosystems (liposomes, micelles, Dendrimers, inorganic nanoparticles)					
Ocular drugs including ocular implants					
Drug eluting stents					
Pulmonary drug delivery					
Monoclonal antibodies (mAbs)					
Total	168.2	190.7	213.8	312.9	10.4

Source: www.kellyscipub.com

Figure 1.1: Summary of Targeted Drug Delivery Market, Through 2021

\$ Billions



Source: www.kellyscipub.com

1.2 About this Report

This report provides the reader with:

- An overview of the technologies focusing on targeted drug delivery carriers such as lipid-based, polymer-based, nanoparticle-based, magnetic particle-based, cell-based etc.
- Focuses on some of the important innovations in targeted delivery technological platforms and the level of improvement made in different types of drug carriers.
- Major technical and business restraints faced by targeted drug delivery research and development.
- Major technical and business growth drivers that are fuelling success in this industry.
- Protocol of technologies and drug delivery systems that will address technology/end user needs and prospective application areas of targeted drug delivery systems.
- Profiles, product offerings and pipeline products of 170 companies mainly engaged in developing targeted drug delivery systems.
- However, the report does not provide data on slow-release, controlled-release or extended-release drug delivery systems as they are technically not delivering the drugs to a specific target.
- Among the inorganic nanoparticles, the report covers only gold-based systems in market analysis, and others are mainly used for imaging purposes.
- Also, the report does not provide market data for the cell-based targeted systems such as dendritic cells, engineered RBCs, genetically engineered stem cells and microbial hosts, as they are yet to reach the market.

1.3 Key Questions Answered in this Report

- What is the need for targeted drug delivery?
- What are the maximum drug release times reported for various nano-based drug carriers?
- What are the two types of targeted drug delivery systems?
- What are the examples of actively targeted drug delivery systems?
- What are the examples of passively targeted drug delivery systems?
- What ideal characteristics should the targeted drug delivery carriers possess?

- What are the sizes of dendrimers, micelles, liposomes and quantum dots used for encapsulating drugs for targeted delivery?
- What are the examples of nanomedicines approved by different regulatory agencies?
- What are the various targets in our body that are being targeted by nanomedicines?
- What is the mechanism by which the nanomedicines are internalized in the targeted cells and tissues?
- How do you visualize the future of multifunctional nanomedicines?
- What are the examples for orally administered nanomedicines?
- What are the examples of parenterally administered nanomedicines?
- What are the examples of intravenously administered nanomedicines?
- What are the examples of nanomedicines delivered through pulmonary route of administration?
- What are the uses of nanomedicines in different fields of Medicines?
- What are the types of lipid-based targeted drug delivery systems?
- How are liposomes classified?
- What are the sizes of various types of liposomes?
- How many liposome-based drugs are available in the market?
- How many stealth liposomes have been granted market approval?
- How many PEGylated liposomes are used for targeted drug delivery?
- Who are the leading players in liposome-based drug formulation?
- What are stimuli-responsive polymers?
- Who are the market leaders in polymer-based drugs?
- What are the sizes and drug release time for various types of polymeric micelle?
- How do you visualize the function of multifunctional polymeric micelles?
- What are the examples of multifunctional polymeric micelle?
- Can you list the commercially available dendrimer-based drugs for targeted delivery?
- What are the applications of inorganic nanoparticles in targeted drug deliver?
- Which companies are focusing on inorganic nanoparticles for targeted drug delivery?
- What are the applications of magnetic nanoparticles in drug delivery, diagnostic and imaging?
- What is the global market value of nanomedicines?
- What is the global market for nanomedicines by therapeutic areas?
- What is the global market for monoclonal antibodies by geography?
- What are the best-selling mAbs?
- What is the global market for major targeted delivery systems?

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