



D. M. Banerjee is a Marketing manager at Cygnus Business Consulting & Research, Hyderabad. He tracks the Pharmaceutical Sector and is involved in the marketing of the products and services offered by Cygnus in various verticals.(www.cygnusindia.com)

Technology providers to the pharmaceutical industry

A preview of the hi-tech tools which are helping pharma companies to cut costs and find new ways of meeting healthcare challenges

The pharmaceutical industry is one of the most research-intensive industries and is backed by regular technological developments. The technologies cover various functions, including both upstream (drug discovery, drug delivery) and downstream (manufacturing and marketing). One example of a promising technology, expected to gain wide acceptance in the future is the recent polymorph screening technology. This technology protects the innovator of a drug from patent infringement, by using polymorphs of the drug. This technology provides easy, fast production and

analysis of various polymorphs of the drug when it is under development phase. The Table lists technology providers across the world.

TECHNOLOGY IN DRUG DISCOVERY

As the pharmaceutical industry is a research-driven industry, there is a continuous evolution of new technologies, most of them pertaining to drug research. Many new technologies have come up in the recent past. The ones expected to have a promising future are discussed below.

Special Feature

TABLE : TECHNOLOGY PROVIDERS

IBM	Health Market Science
Siebel	Saffron Technology
QlikTech	Business Edge Solutions
Dendrite	Everypath
Teradata	Target SFA
Prevision	Cegedim Rx
StayinFront	Temel Inc
SAS	

Source: Cygnus Research

Super computers in drug discovery

Georgia Institute of Technology is bringing into use one of the world's most powerful supercomputing clusters, the 1000-node Cluster 1350 system based on IBM BladeCenter systems and powered by dual-core AMD Opteron processors. It can perform more than 8.5 trillion calculations per second. It helps in the development of more targeted drugs by determining the biological and chemical processes of human cancer genes and proteins through fast and accurate analysis of complex DNA and proteins. The speed and flexibility associated with this technology will benefit the pharmaceutical companies by providing a considerable decrease in time involved in exploring new commercial opportunities in drug research and thereby, significantly shortening the time to market new drugs.

Polymorph screening

The task of developing and determining the diversity of polymorphs (crystal forms) of new drugs under development was a tedious and time-consuming process until now. ReactArray Solo, a new technology from Anachem Ltd, the UK-based instrumentation company, launched in February 2006, provides fast and efficient polymorph screening by enabling simultaneous runs of up to 48 different reaction conditions. This technology will benefit the research-based pharmaceutical companies to a greater extent by protecting the patents of their novel drugs. This is possible because it provides easy and speedy production and analysis of polymorph forms of a new drug thereby stopping the

competitors from copying and producing the polymorph forms of that drug without patent infringement.

Microdosing in clinical trials

Microdosing of new experimental drugs to human volunteers helps to determine the key pharmacokinetic data before phase-I clinical trial and save considerable amount of money. In the microdosing technique, volunteers are given radio-labeled doses of new experimental drugs and accelerator mass spectroscopy (AMS) is used to count radioactive carbon atoms in blood, urine and fecal samples taken from the volunteers.

Determination of pharmacokinetic data of a new compound by microdosing takes 4-6 months and costs \$35 million. It is an improvement over the conventional phase-I studies which take 12-18 months, costing \$3-5 million for the determination of the same data. Since the amount of drug consumption is in micrograms, it does not need expensive production facilities. Microdosing is cost-effective as it helps in identifying the failures at an early stage in research.

TECHNOLOGY IN DRUG DEVELOPMENT

Research plays an important role in drug development and there are various technologies to support this research function. The technologies reduce the complexity involved in the process, thereby decreasing the time taken for a drug to reach the market. This will ultimately benefit the pharmaceutical company by reducing the cost of drug development. The widely-used technologies that can significantly reduce the cost of drug development are combinatorial chemistry and high throughput screening, chemo informatics, medical imaging and Pharmacogenomics.

TECHNOLOGY IN DRUG DELIVERY

Nanotechnology in drug delivery

Drugs when carried by nanoparticles (microscopic particles whose size is measured in nanometres)

can offer the following advantages: gaining the ability to cross blood brain barrier and other such critical systems; providing localized delivery thereby enhancing dosing efficiency of the drug; sustained drug delivery; genomic targeting and gene delivery. It benefits the patient by enhancing the bioavailability of the drug, decreasing the toxicity and reducing the treatment costs. This delivery system can be used by the pharmaceutical companies to extend the patent period of their existing drugs and helps in repositioning of these drugs. This technology is used in injectable drugs, implantable delivery systems, and topical delivery and in the area of toxin removal.

Transdermal drug delivery

The drug is delivered through the skin into the bloodstream by a medicated adhesive patch called transdermal patch that is placed on the skin. Stratum corneum layer of the skin acts as a barrier because of its lipophilic nature, allowing only lipophilic drugs to pass through it. To overcome this barrier, in the past, chemical penetration enhancers were used along with the drug to increase drug penetration through the skin.

In recent developments, drug penetration through skin is enhanced through physical means with technologies including microporation, needle less injectors, medicated tattoos, iontophoresis (using small electric current to deliver drug into the skin) and phonophoresis (using ultrasound energy to deliver drug into the skin).

Benefits of transdermal drug delivery

- Improved bioavailability
- Uniform plasma levels
- Longer duration of action
- Reduction in dosing frequency
- Reduced side effects
- Maintenance of drug plasma levels up to the end of the dosing interval

Sources: US Pharmacist website, pharmanicensing ltd

Using transdermal drug delivery technology, pharmaceutical companies can go for reformulation of their existing products and thereby gain patent extensions for the reformulated products.

Chronopharmaceutical delivery

In chronopharmaceutical delivery, the drug releases at specific times of the day when the clinical manifestation of a disease is really high. One of the prominent technologies in this category is the OROS technology that uses osmosis for drug release. It is used for controlled onset & extended release of Verapamil, which is marketed by Alza. Verapamil, normally taken at night, is released after 4-5 hours of its ingestion to address the risk of cardiac events in morning by providing the required blood pressure control during the early hours of the day. Another method to have this chronopharmaceutical approach is chronotherapeutic oral drug absorption system that uses a combination of water soluble and water insoluble polymers coated on drug-loaded beads to drug release by 4-5 hours after its ingestion. Pharma companies can use this technology for the patent extensions (Bryan, 2005a) of their products which are nearing patent expiry.

TECHNOLOGY IN MANUFACTURING

Process Analytical Technology

According to the FDA, Process Analytical Technology (PAT) is a system for designing, analyzing, controlling and manufacturing through timely measurements during the processing of critical quality and performance attributes of raw and in-process materials and processes that ensure final product quality. The benefits offered by PAT include: reducing the duration of production cycle, lesser rejection, scrap, and re-processing; possibility of real-time release; improved operator safety and reduced human error through automation and improved efficiency through continuous processing.

The underlying concept in PAT is that quality cannot be tested in products and should be either built-in

Applications of PAT

- Inbound and outbound logistics
- Manufacture of active pharmaceutical ingredients
- Bulk formulation
- Filling and packaging of drugs

or designed. The tools required for this technology include: multivariate data acquisition and analysis tools; process analytical chemistry tools; process and endpoint monitoring; control tools and continuous improvement and knowledge management tools. Software companies that make packages for PAT include Automsoft, Pertinence, Umetric and Opulus. Some of the companies involved in the manufacturing of equipments needed for PAT implementation are Optimal, Malvern, Niroinc, Thermo Electron Corporation and Taratec. The consulting companies are TNO, Llyods Registry Serentec, NNE and Tunnell Consulting.

TECHNOLOGY IN MARKETING

Customer relationship management

Customer relationship management (CRM) enables better management of customers through introduction of systems, processes and procedures for interacting with customers. It integrates and automates the various customer serving processes within an organization.

Operational CRM involves the automation of business processes of marketing, sales and service that have customer contact. Analytical CRM involves analysis of data gathered with operational CRM and other sources to profile customers to improve client relationship.

In pharmaceutical industry, CRM provides insight into drug utilization, and prescribing pattern of physicians, which helps in improvising physician detailing and maximizes returns on investment from marketing campaigns.

Benefits of CRM

- Enhance customer profitability
- Optimize multi-channel interaction
- Measure and improve campaign effectiveness

Pharmaceutical companies spend billions to develop a bond with consumers and physicians and this is the place where CRM can significantly reduce cost and improve revenue.

CONCLUSION

Most of the emerging technologies in the pharmaceutical industry are mainly focusing on drug discovery to reduce the time taken to bring a novel drug to the market. Another reason for technology development in research is that the R&D pipeline of major pharmaceutical companies is drying up as a result of conventional research practices that take considerable time compared to the new technologies.

With regard to manufacturing technology, the FDA's positive attitude towards PAT is expected to drive its implementation by pharmaceutical companies. Growing health consciousness among the people and rising competition in the pharmaceutical industry will require the companies to focus more on CRM and have a better bonding with customers and physicians.

ABOUT CYGNUS

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