

Chapter 4

GLOBAL MARKET FOR NANOPARTICLES IN LIFE SCIENCE

NANOPARTICLES IN BIOTECHNOLOGY, DRUG DEVELOPMENT AND
DRUG DELIVERY

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CHAPTER 4
GLOBAL MARKET FOR NANOPARTICLES IN LIFE SCIENCE

The global market for nanoparticles applied to the life sciences was over \$24.9 billion in 2013. That was a 15.9% CAGR from 2012, for which revenues were nearly \$21.6 billion. The projected revenues for 2014 are \$29.6 billion, at a CAGR of 18.5% over the 2013 level. It is projected that revenue will increase in the five-year period from 2014 to 2019 to \$79.8 billion at a CAGR of 22.0%. While the percentage increase shows a decreasing trend over time, the overall value of this industry is strong, exhibiting double-digit increases in each period.

TABLE 10
GLOBAL MARKET FOR NANOPARTICLES IN BIOTECHNOLOGY AND PHARMACEUTICALS, THROUGH 2019 (\$ MILLIONS)

Application	2012	2013	2014	2019	CAGR% 2014-2019
Drug delivery systems	11,346	13,388	15,798	44,503	23.0
Drug development and formulation	9,345	10,563	12,571	32,266	20.7
Diagnostic imaging, diagnostic testing*	466	550	649	1,621	20.1
Biotechnology applications	412	486	587	1,448	19.8
Total	21,569	24,987	29,605	79,838	22.0

*Revenues in this category do not include the cost of imaging instruments or fees paid to physicians or hospitals for imaging and analysis.

Source: BCC Research.

The total market for biomedical-related nanoparticles will grow by 22.0% CAGR from 2014 to 2019. This will increase 2012 revenues from nearly \$21.6 billion to \$79.8 billion in 2019, a CAGR of 20.6%.

The largest part of this will come from the drug system delivery segment. New nanoparticles will be developed, nanocrystal production methods will be improved and newly discovered drugs will be incorporated into these systems. In addition, many older drugs (especially anticancer drugs) that were too difficult to use because of toxicity or solubility problems will not be brought into the market as nanoparticle systems improve or eliminate these problems.

GLOBAL MARKET FOR NANOPARTICLES IN BIOTECHNOLOGY

Biotechnology applications of nanoparticles are primarily in diagnostic assay development, identification and testing of new tags to add to nanoparticles, refining the method for producing nanoparticles to develop more selective systems, and basic investigation of metabolic and other processes going on within the normal and the diseased cells. Revenues for 2012 for this area were \$412 million, with much of that coming from NIH

grants and other types of research funding. Many grants have been given to universities and medical facilities for the development of specific probes. There is also a large amount of internal R&D spending that has occurred internally within major pharmaceutical companies. The value of this spending is mainly confidential. For that reason, this type of revenue is not included in the biotechnology applications figures used in this report.

TABLE 11

GLOBAL REVENUES BIOTECHNOLOGY APPLICATIONS OF NANOPARTICLES, THROUGH 2019 (\$ MILLIONS)

Field	2012	2013	2014	2019	CAGR% 2014-2019
Biotechnology applications	412	486	587	1,448	19.8
Total	412	486	587	1,448	19.8

Source: BCC Research.

Revenues for this segment of the nanoparticles industry are forecast to increase to \$1.4 billion by 2019 for a CAGR of 19.8% over 2014 value. Basic biochemistry and biotechnology research and development will: (1) improve our knowledge of the multiplicities of biological processes that are at work in the normal cell and in diseased cell systems, (2) provide identification and testing of new biomarkers, cell receptors and regulators (activators/inhibitors), (3) improve functionality of RNA species, and (4) fuel the investigation into new drugs, biomedical testing and devices.

GLOBAL MARKET FOR NANOPARTICLES IN DRUG DEVELOPMENT

Nanoparticles are finding increased use in screening candidate drugs under development. This screening provides data on the efficacy and selectivity of a drug for the target disease for which it is intended. It allows determination of the minimum effective dose to achieve the required medical outcome and indicates minimum levels of toxicity for the drug candidate. These studies are done in animal model systems and in selected human trials. The successful candidate drugs then move on to full clinical trials in humans. Nanoparticle probes that also enable the drug developer to visualize the results of treatment can eliminate drugs that might fail when put into full-blown clinical trials. Failure of a candidate drug at that level represents a large loss of time and money to the developing company.

Drug formulation is also a critical step along the pathway from drug discovery to commercialization. Nanoparticle drug delivery systems allow smaller doses of a drug to be required for clinical trials and eventual production. For many drugs, the task of finding the right formulation to allow the drug to be delivered to the cell target in the proper amount requires many tries at getting the right mix of drug, fillers, additives and other components required for a stable preparation. This is particularly true for encapsulated drug preparations that are to designate long-acting (LA) or sustained-release (SR) drugs.

TABLE 12

GLOBAL MARKET FOR NANOPARTICLES IN DRUG DEVELOPMENT AND FORMULATION, THROUGH 2019 (\$ MILLIONS)

Field	2012	2013	2014	2019	CAGR% 2014-2019
Drug development and formulation	9,345	10,563	12,571	32,266	20.7
Total	9,345	10,563	12,571	32,266	20.7

Source: BCC Research.

The 2014 market for drug development and formulation nanoparticles was nearly \$12.6 billion. This was a CAGR of 19.0% from 2013 when revenues were almost \$10.6 billion. Revenues are forecast to increase to almost \$32.3 billion by the end of 2019, a 20.7% rate of growth over 2014.

Revenues in this area are high in 2013 and 2014 because many of the older, less effective drugs that were abandoned years ago have been the subject of reformulation efforts. These drugs have the potential to get FDA approval as a new chemical entity (NCE) based on an innovative way to deliver an existing approved drug. While projections are strong for the five year period (2014 to 2019), they may be diminish in the period as legacy drugs complete reformulation and additional drugs are not developed. The percent increase in revenue for the forecast period is also projected to decrease due to the application of knowledge gained in nanoparticle drug formulation during the preceding 10 years. This knowledge should enable more rapid formulation of new drugs, thus reducing the overall cost for this step in the drug development timeline.

GLOBAL MARKET FOR NANOPARTICLES IN DRUG DELIVERY SYSTEMS

The most promising area for nanoparticle application in the life sciences is in the area of drug delivery systems. The ability to deliver a potentially smaller dose of a drug specifically to the target organ or, in the case of cancer, to specific cells will revolutionize the practice of medicine. Furthermore, if the nanoparticles can be tagged with components from individual patients' cells and then put back into the patient's body, this will eliminate the problems of immunological rejection of the nanoparticles and go a long way toward advancing the concept of individualized treatment. In general, there is a great deal of interest in the medical community toward these types of approaches.

TABLE 13

**GLOBAL REVENUES FROM NANOPARTICLES IN DRUG DELIVERY SYSTEMS,
THROUGH 2019
(\$ MILLIONS)**

Field	2012	2013	2014	2019	CAGR% 2014-2019
Drug delivery systems	11,346	13,388	15,798	44,503	23.0
Total	11,346	13,388	15,798	44,503	23.0

Source: BCC Research.

The revenue from nanoparticle-derived drug delivery systems is forecast to show double-digit growth through the projected five-year period of 2014 to 2019. During this period, drugs currently in pharmaceutical company pipelines will gain FDA approval and enter the market, adding to the potential revenue for this area. Drugs that go off patent during this period may have generic equivalent drugs that use nanoparticle delivery systems enter the market. Additional growth will occur from sales of these drugs and delivery systems in other countries around the world. Growth from 2012 to 2013 was 18.0%, and from 2013 to 2014 (projected) will also be 18%. Projected growth from almost \$15.8 billion in 2014 to \$44.5 billion in 2019 will be at a CAGR of 23.0%.

It should be noted that nanoparticles for drug development (almost \$32.3 billion) and drug delivery systems (\$44.5 billion) account for 96% of the life sciences nanoparticle applications revenue (\$79.8 billion).

GLOBAL MARKET FOR NANOPARTICLES IN DIAGNOSTIC IMAGING

The diagnostic imaging area will continue to expand in its revenue base for nanoparticle-based imaging probes. Revenues will continue to increase in the double-digits for the period 2012 to 2019. This is in part due to the advancement being made in tags for nanoprobe and nanosensors. It is also due to the increased utilization of this technology as more physicians begin to see the merits of using nanoparticle probes in their imaging work.

The CAGR for the increase in revenue from 2012 to 2019 is 19.5%. This was slightly higher than the increase realized in the one year period 2013 to 2014 (18.0%). For the five-year forecast period from 2014 to 2019, the revenues will increase by about 20.1%. From there on, this area will remain relatively flat unless some unexpected new development occurs to advance this technology further.

TABLE 14

GLOBAL REVENUES FROM NANOPARTICLES IN DIAGNOSTIC IMAGING SYSTEMS, THROUGH 2019 (\$ MILLIONS)

Field	2012	2013	2014	2019	CAGR% 2014-2019
Diagnostic imaging, diagnostic testing*	466	550	649	1,621	20.1
Total	466	550	649	1,621	20.1

*Revenues in this category do not include the cost of imaging instruments or fees paid to physicians or hospitals for imaging and analysis.

Source: BCC Research.

A part of the increase in imaging revenues will come from countries like India, China, Russia, Japan and the Pacific Rim, where improving healthcare and awareness is leading to better treatment facilities. These countries will develop their own diagnostic imaging departments and utilize the nanoparticle-probe imaging agents in their practices.

GLOBAL DISTRIBUTION OF NANOBIO TECHNOLOGY AND NANOMEDICINE COMPANIES

Nanobiotechnology and nanomedicine companies are starting up in many countries around the world. In the United Kingdom, there are 20 companies; Canada has 19, and the U.S. has at least 34. The U.S. figure does not include much of the nanoparticle drug working going on in major pharmaceutical companies unless they have a specific subsidiary (usually through acquisition) in this area.

The table below shows the countries with the highest number of companies. There are no listed companies in Mexico or South America. Russia has no (reported) companies in this area.

TABLE 15

GLOBAL DISTRIBUTION OF NANOBIO TECHNOLOGY AND NANOMEDICINE COMPANIES

Country	Number of Companies	Company Names
Australia	9	Alchemia
		Anteo Diagnostics
		Biometric
		CeramiSphere
		EnGene
		Living Cell Technologies
		pSivida
		Starpharma

Belgium	1	Alynx
		Axela
		Biophage Pharma
		DiagnoCure
		Epocal
		Innovative Bioceramax
		Labopharm
		Nicoya Lifesciences
		NanoMed
		QLT
		Sopratak Pharma
		Tekmira Pharmaceuticals
Canada	10	Zymeworks
China	2	NanoTech Med, NOD Pharmaceutical
		AC Serendip
		Across Barriers
		Aquonova
		Biomers
		Biontex
		Capsulation
		Endotherme
		Life Sciences Molecules
		Febit Aynbio
		Genocxx
		Graffinity Pharma
Germany	15	Xantes Bioanalytics
Singapore	1	Curiox Biosystems
India	2	Dabur Pharma
		Meda Biotech
		Biosensia
		Cellix
		Deerac Fluidics
Ireland	4	Elan
		Micronit
Netherlands	2	Nanosens
		Arrayon
		Atheris Laboratories
		Debiopharm Group
		Debiotech
		Molecular Machines & Industries
		Nano Bridging Molecules
Switzerland	7	Tecan

South Korea	8	Dongbu HiTek
		Ecopro
		Finetex EnE
		InkTec
		LG Chem
		Park Systems
		Seron Technologies
		TTM
Sweden	7	Attana
		Camurus
		Cline Scientific
		Genovis
		Nanoxis
		Oasmia
		Spago Imaging
Spain	6	Advancell
		Bionostra
		Endor Nanotechnologies
		Ingeniatrics Technologies
		Izasa
		Nanoimmunotech

Source: BCC Research, NanoWerk database