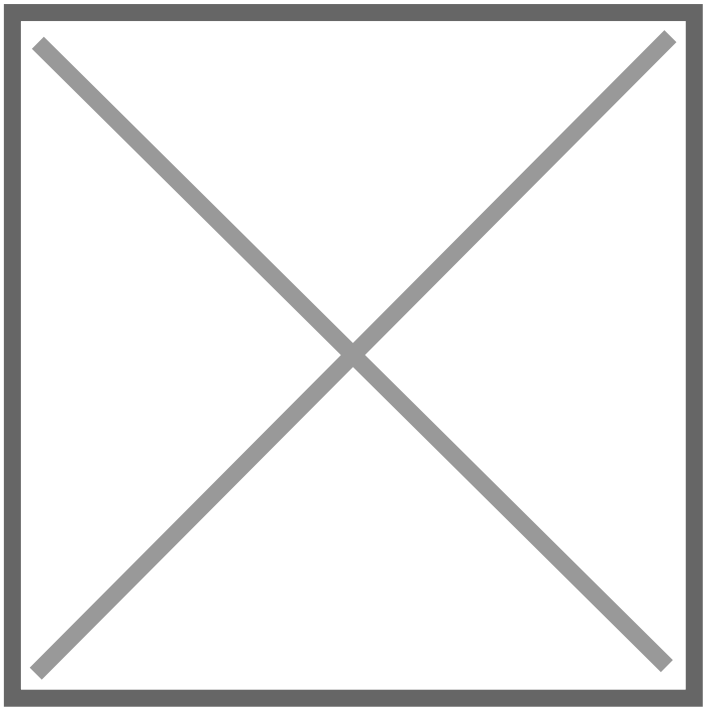
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Nanobiotech initiatives intensify

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Nanobiotech initiatives intensify

Though the Indian government has announced some major initiatives to spur new developments and deals in nanotech, technologies from the laboratories are yet to be commercialized.

Nanotechnology in India has emerged as an area of significant interest, both in the academia as well as in the industry. In 2007, India launched a program to promote nanoscience and nanotechnology with a budget of $255 million. Several public and private research institutes are working on carbon nanotubes and nanoparticles. Considering the strategic importance of research and development in this novel area, the Department of Science and Technology (DST) has been encouraging tremendous thrust on nanomaterials. The Indo-US joint forum on science and technology has identified this area of research for intense cooperation. Government of India's Nanomaterials Science and Technology Initiative (NSTI) potentially offers a venue for greater cooperation. As part of this scheme, Government of India has plans to spend Rs 1,000 crore on nanotechnology research and development over the next five years.

Dr Anita Goel, chairman and CEO of the US based nanotech company Nanobiosym said, "Nanotechnology's ability to touch a number of industrial sectors has led to a huge growth in the level of discovery, investment and application over the last 10 years. Globally, over $13.5 billion is being invested to explore the potential for nanotechnology to impact fields such as biotechnology, materials, construction, energy, and textiles."

Current status

India, China, Japan, Singapore, South Korea, and Taiwan are a few countries in Asia which have significant ongoing research projects in nanotechnology. It is one of the main science and technology priority areas for several government in the Asia-Pacific region. Budgets for nanotechnology R&D have been increased substantially and are more strategically allocated. Joseph Asantraj, CEO of the Bangalore based nanobiotech company, Velbionanotech said, " The total spending for Asia-Pacific countries has exceeded $2 billion during the last two years and this would continue to increase. Japan has been investing in nanoscience since the 1980s and after the US is the heaviest nanotechnology R&D spender worldwide. China, South Korea and Taiwan have increased their budgets substantially since 2001 too." Australia is currently formulating a national strategy, but it already has a considerable infrastructure and funding in place. Thailand, India and Vietnam have also identified nanotechnology as a priority area and are taking steps to implement the proper framework.

As far as market prognosis is concerned, industry experts claim that it is difficult to arrive at any concrete estimates. "Nanomaterials, particularly nanoparticles and nanocomposites, currently dominate the nanotechnology market. The largest end-user markets for nanotechnology are environmental remediation, electronics, energy and biomedical applications," said KV Subramaniam, President and CEO, Reliance Life Sciences (RLS). The market at present is at a nascent stage and has not yet kickstarted completely in India though there are some products which have already been commercialized. Dr Murali Sastry, CSO, Tata Chemicals Ltd (TCL) and a stalwart in the field, added, "To the best of my knowledge, there are some products marketed by one company based on nano-encapsulation developed by Delhi University that made it to the market and it is difficult to estimate the market for these products."

Experts are skeptical about the pace at which research work in nanobiotech is moving. Dr Samuel JK Abraham, Department of Surgery,Yamanashi University-Faculty of Medicine and Director of Chennai-based Nichi-In Centre for Regenerative

Medicine (NCRM), said, “I am not sure on how much of the research work really is in the basic research of nanomaterials and whether we have standardized them in taking them to biotech applications.”
Globally the scenario is just the opposite. While Subramaniam estimates the global market at $12 billion, Dr Sastry gives a fairly lower figure. “The global market of nanotech products in medical applications (this would be a subset of all nanobiotech applications) is known to be close to $1.7 billion and is projected to reach $3.8 billion in the next five years growing at an annual rate of 24 percent. Applications of nanomaterials/technology in medical applications are mainly in the areas of imaging, devices, diagnostics and drugs.”
In the US and Japan, the nanotech applications are undergoing tremendous evolutions in various fields and biotechnology is one among them. “Japanese firms have been working for the past three decades in the areas of proteomics, cell culture and tissue engineering. The drug ‘Doxil’ which is now available for cancer treatment is a real revolution,” added Dr Abraham.

Trends
Nanobiotechnology is being considered for direct delivery of drugs into the human body. This apart, the research trends can be numerous. Currently, nanomaterials of different chemical compositions in biomedical applications are pushing the growth of this market. “There is a greater understanding of toxicity issues on the use of nanomaterials in medical and food applications which is expected to drive greater acceptance of nano-based products in such applications. It is also expected that more drug-delivery nanosystems will be approved and in the medium term, diagnostic tools (lab-on-a-chip) will be available for commercial use,” added Dr Sastry.
Bhuvaneashwar S, senior research analyst, Frost & Sullivan, said, “The factors fueling growth of nanobiotechnology in India are pretty much the same as that elsewhere in the world. Some key trends that have been consistent across the world have been development of novel means of drug delivery on account of properties of nanomaterials, in vivo imaging systems which offer high potential to study cellular metabolism and prosthetic innovations that offer better tensile strength and resistance to the skeletal structure and development of a customized healthcare setting in response to the genome information overload that has brought out significant interest in designing medication according to a person’s genetic makeup”
Speaking specifically on regenerative medicine, Dr Abraham mentioned, “The nanomaterials based implants using ceramics for dentistry and orthopedics, tissue engineered cartilages and cornea are hot topics.”
“In vitro cell culture and tissue engineering have been in existence for the past several decades without much breakthroughs because we haven’t changed the protocols of cell culture and the same old biological reagents, culture media, were used without much developments. The biological reagents, culture media, etc. are not only expensive but being biological materials, the possibility of contamination and lot-to-lot variation in bioavailability of the active ingredients, which make reproducibility, are two big problems. But the concept of synthetically produced, reproducible, biological component and contamination free nano materials, nanosheets, films, and scaffolds have made significant impacts. In fact PGLA (used in synthetic surgical sutures) and hydroxy appetite (used in dentistry, orthopedics) heralded the birth of such concept of scaffolds and now with nano-level manipulation of synthetically produced materials which could be good scaffolds we are able to gain significant mileage in bringing expected results in cell culture and tissue engineering,” Dr Abraham added.
“There are myriad factors pushing the growth of this market. Drug delivery vehicles for targeted and sustained delivery of drugs to minimize size effects; better and more reliable tools for early and rapid detection of diseases; development of tools for probing cellular processes in real time (more academic at the moment); nanotech based materials for medical implants and perhaps much less appreciated; and nanomaterials/processes in agriculture and food products. The range of applications also underlines the fact that nanotechnology is an enabling technology rather than a stand-alone one,” pointed out Dr Sastry.

VC funding
Giving the fact that nanobiotech is a high risk venture, venture capitalists are hesitant to invest in this field. The problem is compounded further as their understanding and views on the subject are a bit blurred. “They are vary of nanotech as a whole and until greater clarity on potential side effects of nanomaterials in medical and food applications become clearer, they may be vary of large investments in nanobiotechnology as well,” revealed Dr Sastry.
However Indian companies and research institutes have been fortunate to receive monetary investments to augment their respective projects. Dr Abraham of NCRM mentioned, “Our organization is an Indo-Japanese firm funded mainly by our Japanese collaborators.”
Mumbai-based Virtus Technoinnovation Pvt Ltd, is a player in gene repair therapy. According to its CEO, Dr Tripathi Virtus has signed a MoU with an NRI investor for the use of gene repair therapy as a tailored SPA for rejuvenation of skin, heart, kidney, lever, nails, hair and eyes. Dr Tripathi has received Rs 2 crore as technology fees and a 55 percent share in the SPA company which is likely to be launched by March 2009 in Mumbai. “Venture capitalists are already approaching us with high valuation for replacing 70,000 SPAs globally with yearly revenue of $250 billion. India’s share currently is $35 million revenue. One can see the ocean of opportunity when the entire $252 billion of business is likely to turn to India for cost effectiveness and now for the differentiated SPA technology,” informed Dr Tripathi.

The recession effect
Global recession in general is affecting capital inflows to all sectors of economy and nanotechnology is no exception. “ The recession is adversely affecting all the ongoing projects and certainly the new projects. Venture capitalists are averse to

investing in riskier areas like nanobiotechnology. The only projects that would still continue are those funded by government organizations," opined Subramaniam.
Speaking on the same issue Dr Abraham said, "We don't feel the recession because our research has been going on for the past 20 years and we have developed several applications which themselves are taking care of our research funds. We recently transferred our technology to start a center in Malaysia."
Dr Sastry confirmed, "Yes, there is a delay in the inflow of funds but this has not stopped research work. "There is a temptation to cut funding in research in whatever field during economic downturn times but the companies and investors with a vision step up investment in asset-light and knowledge-heavy possibilities such as nanobiotech."

Government stimulation

Government of India has given considerable thrust to nanoscience and nanotechnology in the recent years. The allocation for the research and development on this technology has increased significantly in the last few years. The national mission on nano-science and nano-technology has been formulated. India has established several nanotechnology programs under its five-year nanotechnology initiative. The government recently announced a $255 million program that includes three national institutes for nanoscience. Two centers of excellence in nanotechnology are being set up in Bangalore and in Mumbai. India has also launched a national program focusing on micro and smart systems and a network program on nanoscience overseen by government-owned R&D agencies.
India has also formed the Vision Group consisting of about a dozen researchers from academia, industry and research spheres to develop a national nanotechnology policy. The Department of Science and Technology is backing the Nanotech Mission by providing Rs 50 lakh special grant for nanotech start-ups. It has set aside nearly Rs 1, 000 crore as funds for R&D labs and the academia as part of its nanoscience and technology initiative. Last year, a 14-acre nanotechnology research center was opened at JNCASR near Jakkur in Bangalore.
The Government of India through the DST and DBT is funding a number of projects in the nanobiotech area. Incubators to promote entrepreneurship in nanotech have also been created at select academic institutes and national laboratories. In addition to this, soft loans to entrepreneurs are also being provided. "The Government of India is taking multiple steps to make India a leader in this emerging area of science and technology. Towards this, the government launched a 'Nano science & Nanotechnology initiative (NSTI)' program for encouraging research in nanotechnology. Under NSTI, many R&D projects have been supported in the areas of nanofabrication, nanolithography, DNA chips, nanocomposites, molecular electronics, nanosensors, drug delivery, carbon nanotubes and wires etc. They have also established multiple centers of excellence and core groups in nanoscience. Recently, the Indian government announced setting up India's first premier 'Nano-institute', the Institute of Nano Science and Technology, in Bangalore, under the guidance of Jawaharlal Nehru Centre for Advanced Scientific Research," said Subramaniam.
Dr Abraham however gives a different perspective. He shared, "We haven't received any direct funding from the government. But our collaborating institute, Institute of Pathology, ICMR has received funds for a joint research and a few other proposals are under scrutiny for funding."

Looking ahead

Though the Indian government is making some major investments in nano, apparently in response to its potential to revolutionize diverse industries like biotech, pharmaceuticals, IT, catalysts, and surface coatings. Yet, the absence of a well defined national nanotech policy, inflexible institutional system and a lack of capital funding may prove to be a stumbling block for long-term progress of nanoscience in the country. The day government introduces attractive feed-in tariffs, incentives to industries coupled with a national policy, nanotechnology can become the next booming industry in India after IT and biotech.

Jahanara Parveen with Nayantara Som and Shalini Gupta