

# Biotech SMART Report

*Summarized Multipurpose Articles on Research and Technology (SMART)*



## Biotechnology Industry Research Assistance Program

A Programme of  
Department of Biotechnology, Ministry of Science and Technology, Govt. of India  
in partnership with ABLE and BCIL

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## Biotech SMART Report

(Summarized Multipurpose Articles on Research and Technology)

Biotech SMART Report is a Quarterly publication from BIRAP, a programme of DBT, Govt. of India which is dedicated to nurture, incubate and discover innovative research in the Biotechnology Industry.

The Report is an assemblage of updated news reports from company websites, e-newspapers, e-magazines and market report updates in the area of Biotechnology.



### BIOTECHNOLOGY INDUSTRY RESEARCH ASSISTANCE PROGRAM

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## Section A: Agriculture

### **Headline 1: Second plant pathway could improve nutrition, biofuel production**

**Published by:** Science Daily

**Date of Publication:** March 31, 2010

**Source:** <http://www.sciencedaily.com/>

WEST LAFAYETTE, Ind. - Purdue University scientists have defined a hidden second option plants have for making an essential amino acid that could be the first step in boosting plants' nutritional value and improving biofuel production potential.

The amino acid phenylalanine is required to build proteins and is a precursor for more than 8,000 other compounds essential to plants, including lignin, which allows plants to stand upright but acts as a barrier in the production of cellulosic ethanol.

It had been believed that plants could use two pathways to create phenylalanine. Natalia Dudareva, a professor of horticulture, and Hiroshi Maeda, a postdoctoral researcher in Dudareva's laboratory, have confirmed that while plants predominantly use one pathway, they have another at their disposal. The existence of this second pathway might one day allow scientists to increase a plant's production of the essential amino acid. Their research was published in the early online version of the journal *Plant Cell*.

Phenylalanine is one of the few essential amino acids that humans and animals cannot synthesize, so it must come from plants. It is produced when sugars enter a plant's shikimate pathway, which creates a link between the processing of sugars and the generation of aromatic compounds. The next steps had not been known until now, and were thought to involve one of two proposed routes - the phenylpyruvate or aroenate pathways.

Dudareva and Maeda found a gene responsible for phenylalanine production, and suppression of the gene expression knocked out 80 percent of the phenylalanine content in petunias. The hypothesis was that the gene suppression would act like a clogged pipe, creating an abundance of compounds that would have later become phenylalanine in a normal plant.

Maeda said the plant created some sort of feedback mechanism that slowed down the entry point of the shikimate pathway.

Dudareva and Maeda wanted to see what would happen if they forced the shikimate pathway to function, so they gave the petunias shikimic acid. The plants were flooded with the upstream

compounds as expected, but since they could not use the usual arogenate pathway to convert them to phenylalanine, they used another path that scientists had only theorized existed.

Understanding how the pathways work is a first step in finding ways to increase phenylalanine for boosting nutritional values of foods, or decreasing it, which may help in biofuel production.

Dudareva and Maeda will next try to determine how the plant creates feedback to the shikimate pathway. Disrupting that feedback could lead to an abundant production of phenylalanine in plants. The National Science Foundation funded the research.

## **Headline 2: Plant Hormone Increases Cotton Yields in Drought Conditions**

**Published by:** Science Daily

**Date of Publication:** March 27, 2010

**Source:** <http://www.sciencedaily.com/>

A naturally occurring class of plant hormones called cytokinins has been found to help increase cotton yields during drought conditions, according to Agricultural Research Service (ARS) scientists.

Cytokinins promote cell division and growth in plants. In cotton, cytokinins stimulate the growth of the main plant stem and branches. Commercially produced cytokinins are routinely applied in apple and pistachio orchards to promote fruit growth.

John Burke, director of the ARS Cropping Systems Research Laboratory in Lubbock, Texas, found that applying cytokinins to cotton crops can increase yields in water-limited environments with reduced irrigation or no irrigation. Burke was granted a patent for his discovery.

Half of the U.S.-produced cotton is grown in the arid high plains of Texas. In addition to a short growing season, 60 to 65 percent of the acreage in the area is dry land and relies on rainfall for soil moisture. Young cotton seedlings have small root systems, making it difficult for them to reach available soil water. Cytokinins trick the young plant's water stress defenses, prompting the plant to quickly build a bigger root system to access deep soil moisture. They also stimulate the growth of a protective wax on the surface of the plant that helps reduce water loss.

Tests conducted by Burke found one application of cytokinins produced a 5 to 10 percent increase in yields under water-reduced conditions. Additionally, tests determined that cytokinins didn't help or hinder yields under fully irrigated or rainy conditions, making it safe for use in all weather environments. There is also no extra work involved for the grower because cytokinins can be applied when conducting normal weed-management practices early in the season.

To be effective, the cytokinins should be applied at a relatively low concentration to cotton seeds or to cotton plants at an early stage of development. ARS is working closely with commercial companies to make this material available to cotton growers in the future.

### **Headline 3: Tropical maize gets vitamin A boost**

**Published by:** Scidev

**Date of Publication:** March 23, 2010

**Source:** <http://www.scidev.net>

Scientists have produced new strains of maize that could cut vitamin A deficiency among people in developing countries. Developed using traditional breeding methods, the vitamin-fortified maize could be introduced instead of maize modified by genetic engineering, a process that continues to face objections.

A research team reports this week in *Nature Genetics* (22 March) that they have identified rare variations of a gene known as crtRB1, which occur only in maize plants from temperate regions; these result in much higher production — up to 18 fold — of beta-carotene, the precursor and main source of dietary vitamin A. Using natural plant breeding, the researchers have now introduced these variations into tropical maize strains that are commonly grown in developing countries.

Poor people in many developing countries depend on cheap foods such as maize that do not provide enough vitamin A. In Zambia, more than half (53 per cent) of children do not get sufficient vitamin A, and the WHO estimates that up to 500,000 children worldwide are blinded each year by the deficiency, and half of them die of related causes within a year.

HarvestPlus (HP), an international research programme that aims to reduce micronutrient malnutrition, has set a target level of 15 micrograms of beta-carotene per gram of grain, sufficient to prevent vitamin A deficiency in areas where maize is a staple crop, such as many parts of Sub-Saharan Africa, Latin America and India.

### **Headline 4: BIO Welcomes EU Decision on Biotech Crops**

**Published by:** Medical News

**Date of Publication:** March 4, 2010

**Source:** <http://www.medicalnewstoday.com>

The Biotechnology Industry Organization (BIO) applauded today's announcement by the European Commission to authorize the cultivation of a biotech potato, as well as the commercialization of three varieties of biotech maize for food and feed uses and import and processing.

In a statement, Health and Consumer Policy Commissioner John Dalli said, "After an extensive and thorough review of the five pending GM files, it became clear to me that there were no new scientific

issues that merited further assessment. All scientific issues, particularly those concerning safety, had been fully addressed. Any delay would have simply been unjustified."

Sharon Bomer Lauritsen, BIO Executive Vice President for Food and Agriculture issued the following statement in response to the EU's decision:

"We welcome the decisions made by EU officials to move forward with these pending biotechnology applications. Authorization of the genetically engineered Amflora potato for cultivation and for use in animal feed and industrial practices is the first biotech crop approved for domestic growing in the EU in more than a decade.

"This represents an encouraging first step towards remedying an impasse that has put EU farmers at a disadvantage in the competitive marketplace. Currently 14 million farmers around the world choose to grow biotech varieties because these crops are more environmentally friendly, yield more per acre, resist diseases and insect pests and reduce farmers' costs.

"But a lot more needs to be done. Another 17 products are awaiting EU approval for cultivation, and 44 biotech products are awaiting authorization for food and feed as well as for import and processing in the EU.

"If the EU and the world are to reap the benefits of agricultural biotechnology, timely and science-based approval is needed now more than ever."

### **Headline 5: Genetically Engineered Tobacco Plant Cleans Up Environmental Toxin**

**Published by:** Science Daily

**Date of Publication:** March 1, 2010

**Source:** <http://www.sciencedaily.com/news/>

Tobacco might become as well known for keeping us healthy as it is for causing illness thanks to researchers from the U.K. In a new research report appearing in the March 2010 print issue of the FASEB Journal, scientists explain how they developed a genetically modified strain of tobacco that helps temper the damaging effects of toxic pond scum, scientifically known as microcystin-LR (MC-LR), which makes water unsafe for drinking, swimming, or fishing. This plant could serve as a major tool for helping keep water sources safe to use, especially in developing nations.

To develop this type of tobacco, Pascal M.W. Drake (form Centre for Infection at St. George's University of London) and colleagues genetically altered a tobacco plant to produce an antibody to MC-LR, by inserting genes which code for the production of this antibody. With the genes in place, the new strain of tobacco produced the antibody in its leaves and secreted the antibody from its roots into the surrounding hypotonic growth medium. When the toxin from MC-LR was added to the plant's

surrounding hypotonic growth medium, the antibody bound to the toxin, rendering it harmless. This is the first example of a transgenic plant expressing an antibody that remediates an environmental toxin, but according to Drake, more plants like these will be developed in the future to address different environmental problems.

"Tobacco is perhaps one of the most cultivated non-food crop in human history," said Gerald Weissmann, M.D., Editor-in-Chief of the FASEB Journal, "and for centuries it has hurt human health. Now, with smart genetic tweaking, tobacco may prove more valuable in the field than in the pipe."

### **Headline 6: Tomatoes 'silenced' to remain fresh**

**Published by:** SciDev Net

**Date of Publication:** February 15, 2010

**Source:** <http://www.scidev.net>

[NEW DELHI] Indian scientists have genetically engineered tomatoes to help them stay fresh for a month longer than they normally would. Asis Datta and his colleagues at the National Institute of Plant Genome Research (NIPGR) in Delhi identified and suppressed two enzymes that promote ripening to achieve results which have been published in the 9 February issue of Proceedings of the National Academy of Sciences (PNAS).

The two enzymes, 'alpha-man' (alpha-mannosidase) and 'beta hex' (beta delta N-acetylhexosaminidase), are specifically linked to fruit softening that happens during ripening. Excessive softening accounts for 40 per cent of fruit losses in India. The scientists 'silenced' or suppressed expression of the genes that code for the two enzymes. Their genetically engineered (GE) tomatoes were "2.5 times firmer" than conventional tomatoes.

GE tomatoes retain their texture and firmness for upto 45 days, compared to conventional ones that start shrinking after 15 days. They grow and mature in the same way as normal tomato plants, according to Datta and his colleagues. Similar manipulation of enzymes involved in ripening could be applied to other fruits such as mango and papaya to extend their shelf life, they say.

Datta, professor emeritus at NIPGR, who led the research team, told SciDev.Net that his team will next conduct larger-scale open field trials, followed by multi-location trials before seeking clearance for commercial cultivation from India's regulatory authorities. The entire process is expected to take two years. But Datta is confident about the enormous potential application of his technology not just for India but also other developing countries that suffer huge crop losses due to lack of adequate facilities for storage as well as transport from remote farming areas to urban centres.

He also points out that there are fewer safety issues involved since the genetic engineering does not involve adding foreign genetic material as in the case of India's genetically engineered 'Bt brinjal' that contains genes from the soil bacterium *Bacillus thuringiensis* to confer resistance to pests.

Datta adds that India's decision last week (9 February) to halt cultivation of genetically modified brinjal (aubergine) until scientists and public are convinced about its safety (see India says no – for now – to first GM vegetable) "will not cast a shadow" on the fate on GM tomato.

### **Headline 7: Biotech Crops Are Top Choice for World's Farmers**

**Published by:** Science Daily

**Date of Publication:** February 25, 2010

**Source:** <http://www.medicalnewstoday.com>

Because of its contribution to agricultural productivity and sustainable farming, growers around the world continue to choose genetically engineered (GE) crops according to a report released today by the International Service for the Acquisition of Agri-Biotech Applications (ISAAA). The ISAAA report, *The Global Status of Commercialized Biotech/GM Crops: 2009*, says a record 14 million farmers in 25 countries are using agricultural biotechnology today. Ninety percent (13 million) of these are resource-poor farmers in developing countries. Sharon Bomer Lauritsen, Executive Vice President, Food and Agriculture for the Biotechnology Industry Organization (BIO), issued the following statement in response to the report's findings:

- The annual ISAAA report is proof positive that the global adoption of biotech crops - especially corn, soybeans, cotton and canola - increases each year as more and more farmers gain access to this technology. Agricultural biotechnology provides solutions for today's farmers in the form of plants that are more environmentally friendly while yielding more per acre, resisting diseases and insect pests and reducing farmers' production costs.
- When you look at the rising number of acres of biotech crops planted each year (330 million in 2009 compared with 309 million in 2008), and the increasing number of farmers who have chosen this technology (14 million in 2009 compared with 13.3 million in 2008), it's obvious that biotech crops are delivering value to more and more growers around the world.
- In the United States more than 158 million acres of biotech crops were planted in 2009, and the United States remains the top country in terms of biotech acreage. The primary biotech crops grown in the United States are corn, cotton, canola and soybeans, but also squash, papaya, alfalfa, and sugarbeet.
- As the world confronts agricultural challenges such as climate change and a higher-than-ever demand for food supplies, advances in biotechnology can provide heartier crops that produce more food, often in areas with less-than-perfect growing conditions. For example, biotech crop varieties with drought tolerance traits and nutrient-enhanced foods offer the greatest potential for future adoption.

- The United Nations Food and Agriculture Organization have predicted that feeding a world population of 9.1 billion people in 2050 will require raising overall food production by some 70 percent (nearly 100 percent in the developing countries). The findings of this report prove that biotechnology is a key solution in meeting the growing demand to feed, fuel and heal the world."

### **Headline 8: African countries fight banana disease**

**Published by:** SciDev Net

**Date of Publication:** February 24, 2010

**Source:** <http://www.scidev.net>

[NAIROBI] A new front in the war against deadly banana diseases opens next month, with seven African countries uniting to launch a spatial surveillance programme.

The International Institute for Tropical Agriculture (IITA), based in Nigeria, is to lead the programme, which will focus on limiting the spread of banana bunchy top disease (BBTD) and banana Xanthomonas wilt (BXW). These diseases threaten the livelihoods and food security of over 70 million people in Sub-Saharan Africa. No banana varieties are known to resist BBTD or BXW, and there is a danger that all familiar banana types will be wiped out if urgent action is not taken, according to the IITA.

Under the programme, researchers will use Geographic Positioning Systems (GPS) and Geographic Information Systems (GIS) to develop a visual record of disease distribution. A second workshop in June will hone surveillance skills. IITA began a two-year study last October to examine, among other things, why BBTD has spread so rapidly in the past two decades. Lava Kumar, an IITA virologist, said the study's researchers are taking a variety of approaches to tackling the virus and its carrier.

BBTD is caused by the banana bunchy top virus (BBTV) spread by an aphid. It causes narrow bunched leaves and stunted fruitless plants, which eventually die. It is difficult to identify in newly infected plants and is often missed by farmers and government agencies in the region, resulting in its unabated spread. BXW is a bacterial disease that causes yellowing and wilting of the leaves, uneven and premature ripening of the fruits and, eventually, the plants to rot and die.

### **Headline 9: Discovery of Nutrient 'Mining Machine' in Plants**

**Published by:** Science Daily

**Date of Publication:** February 21, 2010

**Source:** <http://www.sciencedaily.com/news/>

Scientists from the John Innes Centre and the University of Oxford have discovered which genes control the specialized nutrient mining machine that develops on the surface of plant roots. Root hairs develop on roots and burrow into the soil releasing acids and other scouring chemicals that crack open rocky minerals releasing valuable nutrients such as iron and phosphate that are necessary for plant growth. It has long been known that when crops such as barley and wheat are grown on soils containing small amounts of phosphate, those plants with long hairs give higher yields than those with short hairs. Similarly long-haired beans grown on nutrient poor tropical soils of Central America do much better than short haired varieties.

The mechanism that controls the growth of these nutrient excavating cells has eluded scientists until now. A group of UK-based scientists shed light on the mystery in a paper just published in *Nature Genetics*. They discovered that a master regulatory gene called RSL4 acts like a switch; hair cells grow when the gene is turned on and growth stops when it is off.

When plants grow in conditions where there is insufficient phosphate they develop very long root hairs. This increases the amount of soil from which they can scavenge phosphate.

Given the ability of RSL4 increase root hair growth this discovery has the potential to help breeders develop crops that can grow on poor soils.

Most soils in Australia, extensive regions of sub-Saharan Africa and 30 per cent of China are not productive because plants cannot extract sufficient phosphate and iron from these soils.

## Section B: Healthcare & Clinical Research

### Headline 1: Study shows that mutations in 1 gene cause many cancers

**Published by:** Eurekalert

**Date of Publication:** March 31, 2010

**Source:** <http://www.eurekalert.org>

An important gene that normally protects the body against cancer can itself cause a variety of cancers depending on the specific mutation that damages it, according to a new study by investigators at the Ohio State University Comprehensive Cancer Center-Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC-James).

The study examined mutations in a gene called PTEN. People who inherit a mutated copy of this gene have Cowden syndrome, a condition that carries a high risk of cancer in a number of organs, including the breast, thyroid and ovary. In addition, PTEN is frequently mutated in normal body cells leading to prostate, lung and pancreatic cancers. Why people with Cowden syndrome develop different cancers, or cancers that are more severe in some than in others, is unknown, though the cause is often attributed to the natural genetic differences that exist between individuals. This animal study, however, linked specific mutations in the gene to distinct kinds of cancer in organs targeted by the syndrome.

"We showed that the mutations themselves play a critical role in driving the cancers that occur in certain organs in people with Cowden syndrome," says principal investigator Gustavo Leone, associate professor of molecular virology, immunology and medical genetics at the OSUCCC-James. "Together, our findings demonstrate that specific inherited PTEN mutations have a strong influence in the variable predisposition to cancer of patients with Cowden syndrome."

The findings, published in Proceedings of the National Academy of Sciences of the United States of America, suggest that testing for specific PTEN mutations might predict the kind and severity of cancer that will develop in people with the syndrome. Furthermore, because PTEN is the second most commonly mutated gene in human cancer overall, the same mutations might predict severity in sporadic tumors, as well.

"Mutations in this gene also play a role in developmental disabilities and perhaps in autism, so this mouse model might be useful for studies in those conditions, as well," says co-principal investigator Michael Ostrowski, professor and chair of molecular and cellular biochemistry at Ohio State.

For this study, Leone, Ostrowski and their colleagues developed three strains of genetically identical mice, each of which had one of three specific PTEN mutations found in people with Cowden syndrome. This left each strain with a different version of the PTEN protein. The study showed that

each version functioned in a different way, and each influenced cancer development to a different degree.

Mutation 1 disabled the protein altogether and often caused cancer in the animals, while mutation 2 produced a protein that was more active than the normal PTEN protein, and sometimes caused cancer. Mutation 3 altered the protein in ways that should have made it more cancer-causing but also made it more fragile, so less of the protein was present to cause problems. This mutation sometimes didn't cause cancer at all.

Using a database of more than 400 patients with Cowden syndrome, the researchers found that patients with these same mutations have cancer in the corresponding organs as the mice. The mice also showed equivalent gender differences in tumor development, with females developing more thyroid tumors, and males developing more adrenal gland and stomach tumors. The researchers are now investigating why patients may experience differences in cancer severity even when they have the same mutation.

## **Headline 2: Seeking 'Next Generation' Treatment for Breast Cancer**

**Published by:** Medical News

**Date of Publication:** March 13, 2010

**Source:** <http://www.medicalnewstoday.com>

Many women live with breast cancer that does not respond to standard medical treatment, a condition that researchers at the Virginia G. Piper Cancer Center at Scottsdale Healthcare want to change by aggressively targeting specific genes. Improving quality of life and potentially keeping the cancer under control for a longer period of time are goals of a new clinical trial at the cancer center's TGen Clinical Research Services, a partnership of Scottsdale Healthcare and the Translational Genomics Research Institute (TGen).

The pilot study is supported by the Side-Out Foundation, a group founded by volleyball enthusiasts to help wage war on breast cancer. Women or men with advanced breast cancer that has progressed through three prior treatments are eligible for the trial, available in the western U.S. only at Scottsdale Healthcare's Virginia G. Piper Cancer Center.

"Many are living with refractory, or advanced, breast cancer that has not responded or continues to grow despite standard treatments," explains Nurse Practitioner Gayle Jameson, principal investigator. "What we are offering here is a whole new approach for treating patients with refractory breast cancer."

Biopsied tissue will be analyzed for unique characteristics and abnormal genes in cancer cells, which are then targeted for treatment with FDA-approved anticancer medications. "We may discover that a

tumor has a gene mutation that responds to a drug not typically used in a 'one-size-fits-all' approach," explains Jameson.

"What we are doing here is precisely matching a treatment to a specific type of cancer cell mutation and abnormal protein signaling pathways that may activate cancer cell growth. The patient would then be treated with one or more medications based on the information provided by the analyses."

Researchers call the Side-Out study the "next generation of breast cancer treatment," expanding on what was learned about molecular profiling in an earlier clinical trial at the Virginia G. Piper Cancer Center. The new study, managed by TGen Drug Development (TD2), is open to a total of 25 patients at only two sites, the Virginia G. Piper Cancer Center at Scottsdale Healthcare and Fairfax Northern Virginia Hematology Oncology.

Results of the earlier trial, known as the Bisgrove Study, showed that molecular profiling can identify specific treatments that help keep cancer in check for significantly longer periods, and in some cases even shrinking tumors. Clinical trials at the cancer center are administered by the Scottsdale Healthcare Research Institute. Research at the Virginia G. Piper Cancer Center at Scottsdale Healthcare allows molecular and genomic discoveries to reach the patient bedside as quickly as possible through clinical trials of therapies directed at specific targets in patients' tumors. Established in 2004, the Side-Out Foundation's mission is to raise money for the war against breast cancer through the sport of volleyball. Major contributing laboratories in the Side-Out study are Caris Life Sciences and George Mason University's Center for Applied Proteomics and Molecular Medicine.

Patients seeking additional information about eligibility to participate in clinical trials at the Virginia G. Piper Cancer Center at Scottsdale Healthcare may contact research patient care coordinator Joyce Schaffer, RN.

### **Headline 3: Growing arteries could lead to 'biological bypass'**

**Published by:** The Times of India

**Date of Publication:** March 09, 2010

**Source:** [http:// www.timesofindia.indiatimes.com](http://www.timesofindia.indiatimes.com)

WASHINGTON: A new method of growing arteries could lead to a "biological bypass" or a non-invasive way to treat coronary artery disease, says a new report. Coronary arteries can become blocked with plaque, leading to a decrease in the supply of blood and oxygen to the heart. Over time this blockage can lead to debilitating chest pain or heart attack. Severe blockages in multiple major vessels may require coronary artery bypass graft surgery, a major invasive surgery.

"Successfully growing new arteries could provide a biological option for patients facing bypass surgery," said Michael Simons, chief of cardiology at Yale School of Medicine, who led the study. In the past, researchers used growth factors - proteins that stimulate the growth of cells - to grow new arteries, but this method was unsuccessful. Simons and his team studied mice and zebrafish to see if

they could simulate arterial formation by switching on and off two signalling pathways - ERK1/2 and P13K.

"We found that there is a cross-talk between the two signalling pathways. One-half of the signalling pathways inhibit the other. When we inhibit this mechanism, we are able to grow arteries," said Simons.

"Instead of using growth factors, we stopped the inhibitor mechanism by using a drug that targets a particular enzyme called P13-kinase inhibitor."

"Because we've located this inhibitory pathway, it opens the possibility of developing a new class of medication to grow new arteries," Simons added, according to a Yale release.

"The next step is to test this finding in a human clinical trial."

#### **Headline 4: Enzyme That 'Cleans Off' Cancer Cells Discovered**

**Published by:** Science Daily

**Date of Publication:** February 2, 2010

**Source:** <http://www.sciencedaily.com/news/>

Scientists have discovered that an enzyme can rid cells of a gene believed to be responsible for a wide range of cancers. Dr Jorg Hartkamp and Dr Stefan Roberts have found that the protease HtrA2 can "clean" cells of the oncogene WT1, which is found at high levels in many leukaemias and solid cancers such as breast and lung cancer. Their work has given drug designers a new target which will allow them to develop treatments for all these cancers in which WT1 expression is elevated.

WT1 is a well-known factor in cancer, having been discovered 20 years ago. It suppresses the development of Wilms' tumour of the kidney, a rare cancer that affects one in 10,000 children. However it has a cancer causing role in other forms of the disease, particularly leukemias such as acute myeloid leukaemia (AML) and chronic myeloid leukaemia (CML). In addition high expression of WT1 is associated with a bad prognosis in AML patients, while trials using peptide vaccines against WT1 in patients with lung cancer, breast cancer and leukaemia were promising.

This latest study -- published in the journal Molecular Cell and funded by the Wellcome Trust, Cancer Research UK and the Association of International Cancer Research (AICR) -- is the first to identify the enzyme that can rid cells of WT1.

Dr Hartkamp, at the University of Manchester's Faculty of Life Sciences, said: "The cancer causing role of WT1 has been known for many years, but how it worked was not understood so we studied a regulatory domain of WT1 to see what modified its activity. We carried out a fishing experiment and discovered the role of the protease HtrA2 instead, by accident. This discovery has a much bigger

impact. "We have filled in the black box of WT1. It is this protease that is doing the trick -- it can clean cells of WT1."

Dr Roberts, who initiated the work at Manchester and is now at the University at Buffalo, added: "There are great prognostic implications in leukaemias but this protease may have even more targets. It is unlikely that a protease cleaves only one transcription factor such as WT1."

Dr Lesley Walker, director of cancer information at Cancer Research UK, said: "This research sheds new light about how levels of WT1 are controlled and will help us understand more about its role in cancer. Although still at an early stage, this research is an exciting advance and could help to improve the treatment of types of cancer where WT1 is known to have an influence."

AICR's Scientific Adviser Dr Mark Matfield said: "This exciting new finding shows why it is so important to carry out basic research into cancer. More and more these days, we see basic research discovering something unexpected about cancer that could be a major new step forward. The more we find out about cancer the closer we get to beating it."

The team plans to study HtrA2 further, to find out how it is inactivated in cancer cells (allowing WT1 to proliferate) and what other targets HtrA2 has. This will help pharmaceutical companies design a drug to reactivate HtrA2 and apply the protease to different diseases. It is hoped that patients will be screened for a high level of WT1 and, if this is the case, clinicians can reactivate HtrA2. And as WT1 expression is low in healthy adults, oncogenic expression of WT1 has been found to be tumour specific so targeting WT1 will be less damaging to the patient's general health.

## **Headline 5: Clinical Trial Proves New Vaccine Effective In Preventing TB In African Patients With HIV Infection**

**Published by:** Medical News Today

**Date of Publication:** February 1, 2010

**Source:** <http://www.medicalnewstoday.com/articles/>

Investigators from Dartmouth Medical School (DMS) have reported results of a clinical trial showing that a new vaccine against tuberculosis, *Mycobacterium vaccae* (MV), is effective in preventing tuberculosis in people with HIV infection. The DarDar Health Study, named for Dartmouth and Dar es Salaam, Tanzania, found that MV immunization reduced the rate of definite tuberculosis by 39 percent among 2,000 HIV-infected patients in Tanzania. The study appears in the January 29, 2010 online issue of the journal *AIDS*, and it will be published in the March print issue of *AIDS*.

"Since development of a new vaccine against tuberculosis is a major international health priority, especially for patients with HIV infection, we and our Tanzanian collaborators are very encouraged by the results of the DarDar Study," said Principal Investigator Ford von Reyn, M.D., director of the DarDar International Programs for the Section on Infectious Disease and International Health at DMS.

The 7-year, randomized, placebo-controlled trial was conducted in Tanzania with collaborators at the Muhimbili University of Health and Allied Sciences (MUHAS) in Dar es Salaam, and was supported by a grant from the National Institutes of Health (NIH) in the United States. According to Kisali Pallangyo, M.D., the senior collaborator at MUHAS, "The study confirms that University institutions from the northern and southern hemispheres can establish partnerships to perform quality clinical research work with global importance. The results of the study are not only good news for people living in regions with high infection rates of HIV and tuberculosis but has also contributed to capacity building in performing TB vaccine trials among HIV infected persons in Tanzania."

TB is the most common cause of death from HIV in developing countries. Since newly-infected HIV patients risk contracting TB almost immediately, Dartmouth investigators are targeting a strategy for immunization with MV before patients need to start taking antiretroviral drugs.

The Dartmouth group began Phase-I human studies with MV in the United States in 1994, in collaboration with Robert Arbeit, M.D., now affiliated with Tufts University School of Medicine, and demonstrated that a multiple-dose series of MV was safe in both healthy subjects and patients with HIV infection. The group then conducted Phase-II studies in larger groups of adults in Zambia and in Finland. In the Zambian trial, Richard Waddell, D.Sc., a research assistant professor at DMS, found that MV boosted immune responses against tuberculosis that had first been primed in childhood with the current TB vaccine, BCG. Subsequently the DarDar group received NIH funding to conduct the large Phase-III efficacy trial among HIV-infected patients with prior BCG immunization in Tanzania.

Von Reyn, a Professor in the Department of Medicine at DMS, described the DarDar trial as "a significant milestone" - the first to demonstrate that any type of vaccine can prevent an infectious complication of HIV in adults. He added that the next steps are to improve the manufacturing methods to support the production of the larger quantities of the TB vaccine needed for further studies and subsequent clinical use. Development work on manufacturing will be conducted by the Aeras Global TB Vaccine Foundation in Rockville, Maryland, in conjunction with the London-based manufacturer, Immodulon Therapeutics.

"Aeras' goal is to speed the development and distribution of new TB vaccines for those who need them most," said Jerald C. Sadoff, MD President and Chief Executive Officer of Aeras Global TB Vaccine Foundation. "We are pleased that our internal manufacturing capacity can assist in the further development of this TB vaccine."

The vaccine is a type known as an inactivated, whole-cell mycobacterial vaccine and is expected to be economical to produce and distribute, von Reyn said.

## **Headline 6: Stem Cell Breakthrough: Bone Marrow Cells Are The Answer**

**Published by:** Science daily

**Date of Publication:** January 29, 2010

**Source:** [www.sciencedaily.com/](http://www.sciencedaily.com/)

Using cells from mice, scientists from Iowa and Iran have discovered a new strategy for making embryonic stem cell transplants less likely to be rejected by a recipient's immune system. This strategy, described in a new research report appearing in the February 2010 print issue of *The FASEB Journal*, involves fusing bone marrow cells to embryonic stem cells. Once fused, the hybrid cells have DNA from both the donor and recipient, raising hopes that immune rejection of embryonic stem cell therapies can be avoided without drugs.

"Our study shows that transplanted bone marrow cells fuse not only with bone marrow cells of the recipient, but with non-hematopoietic cells, suggesting that if we can understand the process of cell fusion better, we may be able to target certain organ injuries with the patient's own bone marrow cells and repair the tissues," said Nicholas Zavazava, M.D., Ph.D., a University of Iowa researcher involved in the work.

Although the study holds great promise for future embryonic stem cell therapies, the results may be even more far reaching. Zavazava and colleagues used two different mouse strains, one as the donor and the other as the recipient. When bone marrow cells were engrafted into the recipient, they tested for the presence of both donor and recipient cells and found three different types of cells: donor cells, recipient cells, and fused cells that had DNA from the donor and recipient. They then discovered that these cells could fuse with many different types of cells in addition to embryonic stem cells, including those from the liver, kidney, heart, and gut. Although more work is necessary to determine the exact clinical outcomes, the discovery raises the possibility that bone marrow cells could be fused to transplant organs to reduce the likelihood of rejection. They could also be fused to failing organs to support regeneration.

"Unlike machines where the same part can be used for several different makes and models, each of us is custom built, and our immune system does the quality control," said Gerald Weissmann, M.D., Editor-in-Chief of *the FASEB Journal*. "As a result, human replacement parts, or organs, need to closely match the tissue of the recipient. This research uses bone marrow cells to fuse with patient tissues so that nothing transplanted is rejected by our immune systems, and brings universal graft survival closer to reality."

## **Headline 7: Scientists claim to convert skin cells into brain cells**

**Published by:** The Hindu

**Date of Publication:** January 28, 2010

**Source:** <http://beta.thehindu.com/>

In a stem cell breakthrough that could speed-up treatment of dementia, American scientists have claimed to have developed a method to directly convert skin cells into nerve cells.

"We actively and directly induced one cell type to become a completely different cell type," claimed study author Dr. Marius Wernig from Stanford University in California.

"These are fully functional neurons. They can do all the principal things that neurons in the brain do," Dr. Wernig wrote in the journal *Nature*. The breakthrough could "revolutionise the future of human stem cell therapy" for the regeneration of brains, said the researchers.

In a mouse-model laboratory experiment, Dr. Wernig's team selected 19 genes involved in either genetic reprogramming or neural development and function and introduced them into mouse embryo skin cells using a virus, *The Telegraph* reported.

The team then monitored the changes in the rodents. They observed that the cells connected with other nerve cells within one week and with an efficiency of almost 20 per cent. After 32 days, some of the former skin cells had acquired the appearance of nerve cells and were producing neural proteins.

### **Headline 8: PROLOR Biotech Reports Positive Results From Comparative Study Of Its Longer-Acting Version Of Multiple Sclerosis Drug Interferon Beta In Primates.**

**Published by:** Medical News

**Date of Publication:** January 26, 2010

**Source:** <http://www.medicalnewstoday.com/>

PROLOR Biotech, Inc., (OTC Bulletin Board: PBTH) reported positive results from a comparative study in primates of its longer-acting version of the multiple sclerosis drug interferon beta (IFN-beta-1a-CTP, referred to as IFN-beta-CTP). The study was designed to measure the potential increase in durability (half-life), overall drug exposure (AUC) and biological potency of PROLOR's long-acting CTP-modified human interferon beta when compared with commercially available interferon beta. Interferon-beta-1a (referred to as IFN-beta), which is indicated for the treatment of multiple sclerosis (MS), is currently marketed by Merck Serono as Rebif® and by Biogen Idec as Avonex®, with combined annual sales estimated at more than \$3 billion worldwide.

The study results show that PROLOR's CTP-modified IFN-beta, when compared with commercially available recombinant IFN-beta, showed 13 times prolonged durability (half-life), and 55 times prolonged overall drug exposure (AUC) in primates. IFN-beta-CTP also demonstrated strong biological potency as measured by several well-validated biomarkers including anti-viral activity and changes in neopterin, and 2'-5' oligo A synthetase.

The expanded biological potency seen in this new study is consistent with the results of a previous study in mice conducted by PROLOR, which compared the anti-tumor activity of IFN-beta-CTP to

commercially available IFN-beta in a model of human cancer. In that study, IFN-beta-CTP showed 100% inhibition of human melanoma tumors implanted in nude mice after eight days and 87.5% inhibition after 10 days, versus 50% inhibition with commercially available IFN-beta after eight days and just 12.5% inhibition after 10 days.

"The results of this new primate study, together with the strong biological activity seen in our melanoma tumor growth model, further confirm the clinical potential for IFN-beta-CTP as a long-acting version for the treatment of multiple sclerosis, with the potential to provide important benefits to MS patients," said Dr. Abraham Havron, CEO of PROLOR Biotech. "Many MS patients currently rely on IFN-beta to keep their disease in check, but to do so they must inject the drug frequently, with the attendant risk of adverse reactions that often accompany these injections. By potentially allowing these patients to dramatically reduce the required injection frequency, we believe our IFN-beta-CTP could significantly enhance their quality of life."

### **Headline 9: Cells Critical to Childhood Leukemia Discovered**

**Published by:** Science daily

**Date of Publication:** January 25, 2010

**Source:** [www.sciencedaily.com/](http://www.sciencedaily.com/)

Scientists at The Royal Melbourne Hospital and the University of Melbourne in Australia have discovered the cells that cause a common type of childhood leukaemia -- T cell Acute Lymphoblastic Leukaemia (T-ALL). Targeting of these cells may lead to improved treatments for this disease and help prevent relapse. The team, led by Dr Matthew McCormack and Dr David Curtis of the Rotary Bone Marrow Research Laboratories and the University's Department of Medicine at The Royal Melbourne Hospital, made the discovery whilst studying mice prone to developing this leukaemia.

The team found that with irradiation treatment in animal models, over 99 per cent of cells in the thymus were killed, but these stem cell-like cells persisted and rapidly recovered. This suggests that these cells may survive therapy and be responsible for relapsed disease following treatment.

Currently, children with T-ALL are given extended therapy over two to three years in an attempt to stop a relapse. More targeted therapy on the thymus cells could reduce the length and toxicity of treatment and prevent relapse.

Dr McCormack, a leading international expert on childhood leukaemia, said: "The cellular origins of this leukaemia are not well understood. Our discovery that these cells are similar to normal stem cells explains why they are capable of surviving for long periods. It also explains why they are remarkably resistant to treatment."

Approximately 50 new cases of T-ALL are diagnosed every year in Australia, two thirds of these in children or adolescents. Adults also contract T-ALL, and the majority succumb to resistant or relapsed disease.

Dr Curtis, a Clinical Haematologist and head of the Leukaemia Research Program at The Royal Melbourne Hospital, said: "The identification of these cells provides an important target for the development and testing of new treatments for patients with T cell Acute Lymphoblastic Leukaemia."

The team will now focus on novel treatments capable of killing these cells, which may lead to clinical trials within the next five years. The research also involved Walter & Eliza Hall Institute of Medical Research and Leeds Institute of Molecular Medicine, UK. The research was supported by the National Health and Medical Research Council of Australia, Cancer Council Victoria, Leukaemia Foundation of Australia and the Fight Cancer Foundation (BMDI).

### **Headline 10: Doctors to carry out study on breast cancer in ethnic population**

**Published by:** The Hindu

**Date of Publication:** January 24, 2010

**Source:** <http://beta.thehindu.com/>

In an attempt to understand the root cause of breast cancer in ethnically diverse, non-caucasian population, pharma major Glaxo-Smithkline has selected two doctors from India for a global study under its Oncology International ethnic Research Initiative.

"The 26 research projects, considered for a grant globally, will include breast cancer epidemiology, ethnicity, genetics, molecular/genetic epidemiology, risk assessment, biomarkers of risk or other factors contributing to breast cancer," Sunder Rajan, General Manager, Corporate communication of the company told PTI.

All the aspects of basic research that will develop potential solutions to prevent and meet the challenges of breast cancer in diverse ethnic populations will be carried out by the researchers, he said. Dr Shona Nag, Consultant Medical Oncologist, Jehangir Hospital and Medical Centre, Pune and Dr Sudeep Gupta, Associate Professor, Department of Medical Oncology, Tata Memorial Hospital will be doing the detailed study in India.

Once the individual research projects are complete, the findings will be shared with the global scientific community to help achieve the ultimate goal of reducing and preventing breast cancer incidence, morbidity and mortality in ethnically diverse populations, Rajan said. Meanwhile, Nag and

Gupta said that ethnic variations in 1000 Indian women will be studied taking the risk factors in three sub—types between the age group of 40 and above.

The subtypes include Hormone positive with 40 per cent occurrence in India (60 per cent in western countries), HER2+ type, which has 20 to 30 per cent occurrence (20 per cent in western countries) and Triple Negative with 30 per cent of occurrence in India are of this type, compared to 10 to 15 per cent in western countries.

Gupta said so far, the studies on breast cancer was done in a general manner taking obesity, early child birth and late child birth into consideration but in this study the risk factors involving three sub—types will be looked into.

“We will also be working on viral markers in this study,” Gupta said.

The study is expected to reveal first hand information and risk factors for the subtypes will help to define preventive strategy for the Indian population, Nag said.

Of the 3.2 billion women in the world, 90 per cent are non-Caucasian. In 2002, there were more than one million new cases of breast cancer in the world, making it the most common among women, with around 40 per cent of cases in developing countries, Rajan said

### **Headline 11: How obesity ups cancer risk**

**Published by:** The Hindu

**Date of Publication:** January 24, 2010

**Source:** <http://beta.thehindu.com/>

Obesity increases risk of developing cancer. Now, a mice study has confirmed that obesity does indeed act as a “bona fide tumour promoter.” Published in the January 22nd issue of the journal Cell, a Cell Press publication, scientists also have good evidence to explain how that happens.

“Doctors always worry about our weight, but the focus is often on cardiovascular disease and type 2 diabetes, both of which can be managed pretty well with existing drugs,” said Michael Karin of the University of California, San Diego. “However, we should also worry about elevated cancer risk. If we can reduce cancer deaths by as many as 90,000 per year, that’s a lot of people - a lot of lives.”

In the study, Karin’s team showed that liver cancer is fostered by the chronic inflammatory state that goes with obesity, and two well known inflammatory factors in particular. To reach the conclusion, Karin’s team investigated mice prone to develop hepatocellular carcinoma (HCC). The mice are typically given HCC either by exposure to a chemical carcinogen, known as DEN, when they are two

weeks old, or by exposure to that same carcinogen at three months of age followed by the tumor-promoting chemical phenobarbital.

In the new study, the researchers gave two-week-old mice DEN and then divided them into two groups - one fed a normal, relatively low-fat food and the other fed on high-fat chow. "It was clear that the mice on the high fat diet developed more liver cancer," Karin said.

To further confirm the link, they gave DEN to two-week-old mice that were fed a normal diet but carried a gene that made them obesity-prone. Those mice, too, developed more liver cancers, evidence that it wasn't the high-fat diet that led to cancer, but rather something about the animal's obese state.

## Section C: Microbial

### Headline 1: This Is Your Brain on Cryptococcus: Pathogenic Fungus Loves Your Brain

#### Sugar

**Published by:** Science daily

**Date of Publication:** March 31, 2010

**Source:** <http://www.sciencedaily.com/news/>

Highly dangerous Cryptococcus fungi love sugar and will consume it anywhere because it helps them reproduce. In particular, they thrive on a sugar called inositol which is abundant in the human brain and spinal cord.

To borrow inositol from a person's brain, the fungi have an expanded set of genes that encode for sugar transporter molecules. While a typical fungus has just two such genes, Cryptococcus have almost a dozen, according to **Joseph Heitman**, Chairman of the Duke Department of Molecular Genetics and Microbiology.

"Inositol is abundant in the human brain and in the fluid that bathes it (cerebral spinal fluid), which may be why this fungus has a predilection to infect the brain and cause meningitis," Heitman said. "It has the machinery to efficiently move sugar molecules inside of its cells and thrive."

Cryptococcus' love for sugar may also be a fungal Achilles Heel, Heitman said. "Now scientists may be able to target the fungi by developing ways to put them on the fungal equivalent of an Atkin's low-carbohydrate diet so they will stop multiplying." He said researchers could use the new findings to devise different types of strategies to block Cryptococcus infections.

### Headline 2: Small Molecules Have Big Impact for TB Bacteria

**Published by:** Science daily

**Date of Publication:** March 20, 2010

**Source:** <http://www.sciencedaily.com/news/>

Mycobacterium tuberculosis (Mtb) possesses extraordinary survival ability by masking itself from the host immune system and persisting for decades inside the host. Speaking at the Society for General Microbiology's spring meeting in Edinburgh, Dr Kristine Arnvig provides further insight into how the bacterium causes tuberculosis (TB) by fine-tuning its behaviour in response to its surroundings to escape detection.

Understanding the genetic tools and tricks used by Mtb to control its behaviour is likely to give an idea how it manages to survive for such long periods. "This kind of research should give us new biological

targets upon which to base new, faster-acting drugs and vaccines and enable us to take on TB -- a respiratory infection that is one of the biggest threats to global health," suggested Dr Arnvig.

Together with her colleague Dr Douglas Young at the National Institute for Medical Research, London, Dr Arnvig demonstrated that, like other pathogenic bacteria, Mtb can produce tiny molecules called small RNAs. These molecules are able to subtly tweak the production of key bacterial components in response to environmental signals. This helps maximise the survival of the pathogen allowing it to progressively break down lung tissue.

Small RNAs float around the cell and are often the mirror image of key bacterial genes, to which they can stick to like Velcro™. This mechanism can enhance or inhibit the normal production of bacterial molecules from these genes. Other pathogenic bacteria including Salmonella spp, Staphylococcus aureus and Vibrio cholerae are already known to rely on small RNAs when adapting to their host environments and causing disease.

The small RNAs in Mtb are induced under certain stress conditions that signal as a warning to the bacterium."We think that the small RNAs may play a crucial role in allowing Mtb to alter its pattern of gene expression in response to the environmental conditions that it experiences within the host during infection," explained Dr Arnvig. "Understanding this regulatory system will help us to design new drugs that specifically attack the persistent form of Mtb which manages to hide from the immune system and resist the action of existing drugs."

### **Headline 3: Artificial Bacterial Cells Brought Closer**

**Published by:** softpedia

**Date of Publication:** February 09, 2010

**Source:** <http://news.softpedia.com/news/>

Two teams of British scientists from the Oxford University have recently managed to lay the groundwork for the development of artificial bacterial cells, capable of responding and adapting to new stimuli in their environment. This is something that only living organisms have proven to be able to do thus far, therefore doing the same thing artificially could open up a wide array of research fields to future innovation. The Oxford science groups were led by Professors Judith Armitage and David Stuart, PhysOrg reports.

The new investigation also carries considerable implications for biosensor research. The experts proved that, at least in theory, it should be possible to outfit living cells with synthetic signaling circuits. That would enable an entirely new class of sensing devices. Over millions of years of evolution and natural selection, bacterial cells have learned how to harness signaling mechanisms in a way that allows them to quickly adapt to changes in their environment. This is one of the main traits that

permitted them to spread around the globe, in the harshest environments possible where nothing else survived, and also granted them the ability to become immune to drugs we threw at them.

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They looked at the proteins with atomic-scale resolution, using X-ray crystallography. This approach creates extremely bright flashes of light that aid investigators. For this research, the UK's national synchrotron facility, the Diamond Light Source, was used. The researchers managed to crack the code in one of these pairs, which they collected from the bacterium *Rhodobacter sphaeroides*.

"This is a significant step on the road to identifying the critical amino acid interface that allows discrimination between apparently related proteins and their partners, and a step along the road to rational design of protein signaling networks," Armitage says. "The aim is to understand the system so well that you're able to change it in any way you like. The dream will be a synthetic cell that does exactly what you want," Oxford postgraduate student Christian Bell, who has been part of both science groups, adds.

## Section D: Nano Technology

### Headline 1: [New Study on Carbon Nanotubes Gives Hope for Medical Applications](#)

**Published by:** Science daily

**Date of Publication:** March 31, 2010

**Source:** <http://www.sciencedaily.com/>

A team of Swedish and American scientists has shown for the first time that carbon nanotubes can be broken down by an enzyme -- myeloperoxidase (MPO) -- found in white blood cells. Their discoveries are presented in Nature Nanotechnology and contradict what was previously believed, that carbon nanotubes are not broken down in the body or in nature. The scientists hope that this new understanding of how MPO converts carbon nanotubes into water and carbon dioxide can be of significance to medicine.

"Previous studies have shown that carbon nanotubes could be used for introducing drugs or other substances into human cells," says Bengt Fadeel, associate professor at the Swedish medical university Karolinska Institutet. "The problem has been not knowing how to control the breakdown of the nanotubes, which can caused unwanted toxicity and tissue damage. Our study now shows how they can be broken down biologically into harmless components."

Carbon nanotubes are a material consisting of a single layer of carbon atoms rolled into a tube with a diameter of only a couple of nanometres (1 nanometer = 1 billionth of a metre) and a length that can range from tens of nanometres up to several micrometers. Carbon nanotubes are lighter and stronger than steel, and have exceptional heat-conductive and electrical properties. They are manufactured on an industrial scale, mainly for engineering purposes but also for some consumer products.

Carbon nanotubes were once considered biopersistent in that they did not break down in body tissue or in nature. In recent years, research has shown that laboratory animals exposed to carbon nanotubes via inhalation or through injection into the abdominal cavity develop severe inflammation. This and the tissue changes (fibrosis) that exposure causes lead to impaired lung function and perhaps even to cancer. For example, a year or two ago, alarming reports by other scientists suggested that carbon nanotubes are very similar to asbestos fibres, which are themselves biopersistent and which can cause lung cancer (mesothelioma) in humans a considerable time after exposure.

This current study thus represents a breakthrough in nanotechnology and nanotoxicology, since it clearly shows that endogenous MPO can break down carbon nanotubes. This enzyme is expressed in certain types of white blood cell (neutrophils), which use it to neutralise harmful bacteria. Now, however, the researchers have found that the enzyme also works on carbon nanotubes, breaking them down into water and carbon dioxide. The researchers also showed that carbon nanotubes that have been broken down by MPO no longer give rise to inflammation in mice.

"This means that there might be a way to render carbon nanotubes harmless, for example in the event of an accident at a production plant," says Dr Fadeel. "But the findings are also relevant to the future use of carbon nanotubes for medical purposes."

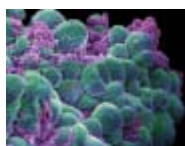
The study was led by researchers at Karolinska Institutet, the University of Pittsburgh and the National Institute for Occupational Safety and Health (NIOSH), and was financed in part through grants from the National Institutes of Health (NIH) and the Seventh Framework Programme of the European Commission. The work was conducted as part of the NANOMMUNE project, which is coordinated by associate professor Bengt Fadeel of the Institute of Environmental Medicine, Karolinska Institutet, and which comprises a total of thirteen research groups in Europe and the USA.

## Headline 2: **Nanodiscs 'Dance' Cancer Cells to Death**

**Published by:** Tudor Vieru, Science Editor

**Date of Publication:** February 18, 2010

**Source:** <http://news.softpedia.com/news/>



Experts from the US Department of Energy's (DOE) Argonne National Laboratory (ANL) have recently managed to obtain a new type of particles, that could prove to be very efficient in destroying cancer cells. The team says that their nanoscale discs can literally shake cancer cells to death, potentially providing a new avenue of research for oncologists and other researchers. Still, the new method is years from practical implementation, the experts highlight.

Thus far, trials have only been conducted in petri dishes in the tightly-controlled confines of biological laboratories. The nanodiscs are aimed at destroying brain cancer cells specifically. This is extremely important, doctors say, because this particular type of cancer is extremely difficult to treat, evolves very fast, and is generally lethal in very high percentages. Having a method that would at least halt its development would mean a lot for the thousands of people currently suffering from the condition.

The tiny disc the team created are made of iron-nickel, but are plated with gold, and therefore magnetic. The small structures are coated with a layer of cancer-specific antibodies. This means that the nanoparticles can be injected anywhere in the human body, and still find their way to the diseased cells. However, the location of the original shot determines how fast the nanodiscs make their way to their targets. This is not the first method of fighting cancer to look at nanoscale designs, but it brings a series of innovations that other methods do not carry.

For instance, after the discs bind to their cellular targets, they remain inactive for specific periods of time. They only activate when researchers begin applying a small alternating magnetic field on the

area of the tumor. At that time, they begin to oscillate strongly, and thus transfer the energy to the cells they are bound too. This forces all cells in the tumor to go into a state called "sudden death", basically destroying them. The scientists don't know exactly what happens when the cells oscillate, but they believe that the violent shaking may be disrupting the cellular membrane.

This is known to trigger a series of cellular signals and events that have the ultimate consequence of destroying whichever cell is targeted. "We are very excited about this melding of materials and life sciences, but we are still in the very early research stages. We are planning to begin testing in animals soon, but we are several years away from human trials. Everything is still experimental," says an ANL materials scientist Valentyn Novosad, quoted by LiveScience.

### **Headline 3: Cancer Tumors Can Be Labeled with Fluorescent Probes**

"The innovation could save many lives"

**Published by:** softpedia

**Date of Publication:** February 17, 2010

**Source:** <http://news.softpedia.com/news/>



Scientists at the University of California in San Diego (UCSD), and the Moores UCSD Cancer Center, announce the development of a new type of fluorescent probe. The structure is capable of affixing itself to cancer tumors specifically, evidencing them under certain lighting conditions. The new work was constructed on previous research conducted by team leader Roger Tsien, PhD, who is a professor of pharmacology, chemistry and biochemistry at UCSD, and also a Howard Hughes Medical Institute investigator. He is also the winner of the 2008 Nobel Prize in Chemistry, for developing the green fluorescent protein (GFP) marker, PhysOrg reports.

The new biological probes developed at the university were tested on unsuspecting lab mice. Experiments revealed that these structures were capable to sticking directly to tumors in the rodents, and immediately light them up for observers to see. This in turn allowed the investigators to not only observe the tumor that appeared in other imaging techniques as well, but also to discover new, hidden cancer tissue, that was not targeted by specific drugs. The mice that were surveyed with the probes survived 500 percent more often than those who were investigated using regular means.

"The development of biological probes that can guide surgeons, rather than depending only on feel and normal 'white light' to see, can provide tools to navigate the body on a molecular level," explains UCSD School of Medicine assistant professor of surgery Quyen Nguyen, MD, PhD, who is also the first author of the study. Details of the groundbreaking work appear in the February 15 early edition of the journal Proceedings of the National Academy of Sciences (PNAS). In addition to bringing the prospect of using molecular tools in the surgeries of the future, the new work will also soon allow surgeons to outline the actual contours of tumors in real-time, as they are performing extrication procedures.

The new probes, carrying fluorescent and magnetic tags, are delivered inside the body using synthetic molecules called activatable cell penetrating peptides (ACPPs), as well as a host of nanoparticles. This allows for the markers to be delivered precisely at the site of the tumor, which thus becomes visible under MRI. Scientists say that this could minimize the risk of surgeons living behind traces of the tumor. This is not at all uncommon, especially when handling the edges of a group of cancer cells. At this point, doctors conducting operations rely on experience and feel to remove tumors, but they can sometimes miss some cells, which will later increase the risk of cancer reoccurring.

#### **Headline 4: Diamond-Based Nanowire Devices Now Possible**

**Published by:** softpedia

**Date of Publication:** February 15th, 2010

**Source:** <http://news.softpedia.com/news/>

Researchers at the Harvard University have recently finished developing a new type of diamond-based nanowire devices, which hold great promise for the creation of nanomaterials based on the strong carbon compound. These materials could, in turn, be used in quantum cryptography and computing, as well as imaging methods for magnetic fields. Further applications in quantum science and technology are also possible, the team reports.

One of the greatest innovations that the new system brings is the fact that secure, light-based computing could soon be made practical. Such communication networks would rely on the nanowire devices, which are capable of producing a bright, stable source of single photons at room temperature. Details of the achievement were published yesterday, in the February 14th issue of the respected scientific journal Nature Nanotechnology. The team was led by Harvard School of Engineering and Applied Sciences (SEAS) Assistant Professor of Electrical Engineering Marko Loncar.

“Our nanowire device can channel the photons that are emitted and direct them in a convenient way,” SEAS graduate student Tom Babinec, also the lead author of the journal entry, adds. “We consider this an important step and enabling technology towards more practical optical systems based on this exciting material platform. Starting with these synthetic, nanostructured diamond samples, we can start dreaming about the diamond-based devices and systems that could one day lead to applications in quantum science and technology as well as in sensing and imaging,” Loncar believes.

The devices themselves were all constructed at the Harvard Center for Nanoscale Systems (CNS), with funding secured under the US National Science Foundation's (NSF) Nanoscale Interdisciplinary Research Team (NIRT) grant. The Defense Advanced Research Projects Agency (DARPA) also contributed to the investigation. Further advancements in this technology could see it employed inside

new generations of chemical and biological sensors, as well as in a wider variety of scientific imaging methods.

### **Headline 5: Experts Create Large-Scale DNA Origami**

**Published by:** softpedia

**Date of Publication:** February 04, 2010

**Source:** <http://news.softpedia.com/news/>

Researchers know that one of the keys that would allow for the widespread use of nanotechnology and for the production of complex nanostructures would be the creation of large-scale DNA origami. These constructs can tie nanostructures together in intricate patterns, based on chemical attraction between its four base pairs. Now, experts in the United States, have taken the first steps towards making this a reality, with the creation of a process that allows for the large-scale production of DNA origami.

“One of the practical limitations of DNA origami has been the size. We have been limited to 2D structures roughly 100 [nanometers] in size, due to the length of the scaffold strand that is used. The reason for this is because it is difficult to get long single-stranded scaffolds longer than around 7000-8000 nucleotides, inexpensively and in high yield,” Paul Rothmund, the California Institute of Technology (Caltech) researcher that originally created these structures, told Chemistry World. He explained that a technique known as Watson-Crick base pairing was used to fold long strands of viral DNA in complex patterns, via the action of small chunks of 'helper DNA.' This substance acted like a catalyst, he went on to say.

Depending on which configuration pattern is inscribed in the helper DNA, the long, viral strands can basically be woven back and forth, creating whatever type of patterns is needed. Now, a team of investigators at the Arizona State University (ASU), led by experts Hao Yan and Yan Liu, managed to make an improved production process that is able to create strands four times longer than the ones possible using the technique Rothmund developed. Instead of using helper DNA to pin the viral strands of genetic material together, the ASU team used DNA origami shaped like squares to do the same. This allowed for the creation of large structures, 5x5 to 7x8 arrangements of tiles, reaching up to 200 nanometers in size, a record.

“Whatever size we can achieve with the basic technique, Yan and Liu's technique seems likely to buy us an extra factor of scale. Importantly, this increase in size should bring us into the range of state of the art optical lithography, which will allow us to start enabling the use of this process,” the Caltech expert said of his colleagues' achievement. “I think this is a terrific idea, and I'm confident that such a hierarchical templating approach will play a key role in allowing us to build increasingly complex devices on the nanoscale. One application might possibly be a nano-breadboard for assembling nanoscale circuits,” Harvard University DNA origami expert William Shih added.

## Section E: Pharmaceuticals

### Headline 1: Drug regulators in North-East find increasing misuse of opioid pain killers

**Published by:** Pharmabiz

**Date of Publication:** March 31, 2010

**Source:** <http://www.pharmabiz.com>

Even as the Drug Technical Advisory Board (DTAB) is examining the rationality and continued marketing of the pain killer Spasmo Proxyvon, which contains an opioid dextropropoxyphene, the drug authorities in the North Eastern states are alarmed over the misuse of a similar brand – Parvon Spas manufactured by the New Delhi-based Jagsonpal Pharmaceuticals.

The state drug control officials in Mizoram, with the support of the police, have seized 4200 capsules of Parvon Spas worth around Rs 7000, being sold illegally in the state in mid-March, 2010. The product, which is a similar combination of Spasmo Proxyvon manufactured by the Mumbai-based drug major Wockhardt Ltd, contains dextropropoxyphene hydrochloride 65 mg, dicyclomine hydrochloride 10 mg and paracetamol 400 mg per capsule. The regulators feel that the misuse of dextropropoxyphene combinations for intoxication, which has reduced in last two years, is once again in a rise.

The drug abusers either mix the powder from the capsule with water and inject it into the vein or swallow 10 or more capsules at a time to get intoxicated with these products. Many a time, the large particles remain after mixing with water will cause clotting of blood inside the body and the medical practitioners has to amputate the particular part (like hands and legs). The clotting in vital parts would result in death of the person immediately.

“The abuse of these Schedule H drugs is once again getting serious now. Earlier, in a period between 2004 and 2007, the mortality due to overuse of spasmo proxyvon was very high and we were successful to restrain the illicit trade of the product in last two years. Now, we are also monitoring presence of Parvon Spas in the illegal routes,” said Lalsawma Pachuau, assistant drug controller, Food & Drug Control Authority, Mizoram.

“The main reason for the illicit drug traffickers and users to switch over from Spasmo Proxyvon to another similar brand would be due to the wide publicity given to the former product for its possibilities for misuse as a narcotic product,” said Pachuau.

Chemists’ shops hardly sell the drug without prescription as there is strict monitoring by the authorities. The 4200 capsules were seized from an illicit drug trafficker after it has been transported from neighbouring state, Assam, by goods train. He added that some other states including Punjab

have also seized Parvon Spas from illegal drug peddlers. The top official in the Jagsonpal Pharmaceuticals was not reachable for comment immediately.

As per the official report with the state drug control office, the misuse of the opioid analgesic has resulted in death of 395 people between 2004 and 2007 in Mizoram. The total death toll reported from the misuse of this drug reaches up to 535 in seven years between 2001 and 2007.

In March, 2010, the Minister of State for Health and Family Welfare, Dinesh Trivedi had informed the Rajyasabha that “the rationality and continued marketing of the drug Spasmo Proxyvon is under examination of the Drugs Technical Advisory Board (DTAB) in the context of present scientific knowledge about the utilities of the drug.” However, he added that the drug is permitted to be sold in the country on retail under prescription of Registered Medical Practitioner only.

## **Headline 2: US FDA approves Zyclara cream to treat actinic keratoses**

**Published by:** Pharmabiz

**Date of Publication:** March 31, 2010

**Source:** <http://www.pharmabiz.com>

Graceway Pharmaceuticals announced that the Food and Drug Administration (FDA) has approved the New Drug Application (NDA) for Zyclara, determining it to be safe and effective for the treatment of clinically typical, visible or palpable actinic keratoses (AK). The new treatment can be used on large areas of skin, including the full face or balding scalp on a convenient, 6-week dosing cycle.

Zyclara shares the same active ingredient as Aldara (imiquimod) Cream, 5% and while both topicals are US FDA-approved for the treatment of AK, there are notable differences between the two. Zyclara is indicated for daily use on an accelerated six-week dosing cycle comprised of two weeks of daily treatment with Zyclara, two weeks of non-treatment, followed by two weeks of daily treatment with Zyclara. Aldara is not approved for daily use and its approved dosing regimen is for a full 16 weeks. Additionally, Zyclara is indicated for use on larger areas of skin, the full face or balding scalp, while Aldara is restricted to a 25 cm<sup>2</sup> area of skin.

If there are AKs visible on the surface of the skin, it is likely that there are more AKs just below the skin's surface. Zyclara revealed these AKs, in 86 per cent of patients. In the study, Zyclara treated both types of AKs – those found at the start of the study and those unmasked during treatment. Additionally, over 40 percent of doctors reported Zyclara “significantly improved” the appearance of patients' skin.

In clinical trials, with patients averaging 11 AKs at baseline, Zyclara reduced the total number of AKs by 82 per cent. Complete clearance of all AKs (including lesions revealed during treatment) was

achieved in 36 per cent of patients as compared to only 6 per cent of those on placebo. Partial clearance (75 percent reduction or greater in AK totals) was achieved in 59 per cent of those treated with Zyclara versus 23 per cent for placebo. Additionally, over 85 per cent of patients experienced an increase in AK counts after the start of Zyclara treatment. Clearance rates reflect treatment of visible lesions at baseline, as well as new lesions revealed during treatment.

“Because AKs are pre-cancerous and can develop on skin frequently exposed to the sun, such as the face or balding scalp, an effective treatment that can be used on large areas of skin is beneficial,” said Darrell Rigel, clinical professor of dermatology, New York University Medical Center. “The approval of Zyclara may offer patients a convenient option for treating multiple AKs in a single short course of treatment.”

Zyclara will be supplied in a new 28-sachet pack comprised of single-use packets, each of which contains 250 mg of cream. Because the dose is controlled, it may make the 6-week dosing regimen more intuitive for patients.

The phase-III clinical programme was designed to evaluate safety, efficacy and optimal dosing regimen of imiquimod for the treatment of AK and was comprised of double-blind, placebo-controlled studies.

### **Headline 3: Patent pool decision heralds era of cheap HIV drugs**

**Published by:** Scidev

**Date of Publication:** March 16, 2010

**Source:** <http://www.scidev.net>

NEW DELHI: A not-for-profit patent pool will be set up later this year to allow developing countries to manufacture cheaper HIV drugs. The pool, to be based in Switzerland, is scheduled to start operating in June after formal approval by the executive board of UNITAID, the international drug purchase facility. The board met last month (5 February) to agree the broad guidelines to be followed while setting up the pool. In a patent pool, patent-holding drug companies volunteer to forgo their patent rights in selected countries, which allow local companies to make medicines generically at mutually-agreed licence fees.

UNITAID — which procures cheap drugs for HIV, malaria and tuberculosis — has start-up funding of US\$4 million for a year and officials expect that developing countries will save more than US\$1 billion a year by having access to cheaper HIV drugs.

The February meeting took into account concerns raised by humanitarian groups, including the international medical charity Médecins Sans Frontières (MSF) and Indian public health organisations,

in December 2009 that middle income countries, especially Brazil, China, India, Peru, South Africa and Thailand, would be barred from accessing the pool.

UNITAID allayed the fears, saying that both low and middle income countries would benefit.

Ellen't Hoen, senior advisor at the UNITAID patent pool, told *SciDev.Net* that the February meeting also outlined the next legal and administrative steps needed to set up and operate the pool.

The board agreed to put in place technology transfer mechanisms, capacity building and local manufacturing in developing countries. The board also said it would try to ensure it worked in a way that was consistent with other multilateral mechanisms that provide access to medicines – such as the World Trade Organization declaration on the Trade-Related Aspects of Intellectual Property Rights agreement and public health; the World Intellectual Property Organization development agenda, and the WHO strategy on public health innovation and intellectual property.

#### **Headline 4: Biogen to bring its global drug portfolio to India**

**Published by:** The Economic Times

**Date of Publication:** February 19, 2010

**Source:** <http://economictimes.indiatimes.com>

NEW DELHI: US-based Biogen Idec plans to roll out its entire range of medicines in the fast-growing, Rs 40,000-crore Indian retail drug market over the next few years through its wholly-owned Indian arm. The company has also not renewed its product distribution agreement with Piramal Healthcare which expired last December, a top company official said.

“Our five-year marketing tie-up with Piramal Healthcare for Avonex expired last year-end. The drug is now being sold by our own sales team,” said Biogen Idec Biotech India managing director Alpha Seth.

Biogen Idec, one of the largest biotech drugmakers globally, had set up its wholly-owned Indian subsidiary in 2007, but the firm was not engaged in commercial activity. Used to treat multiple sclerosis (MS), a neurological disorder, Avonex has global sales of \$2.3 billion or over half of total revenues of Biogen Idec. Besides Avonex, Biogen also markets a cancer drug Mabthera through a global marketing arrangement with Swiss company Roche. The company will continue its association with Roche.

The American company is currently awaiting regulatory approval to launch another blockbuster drug Tysarbi in India and plans to seek nod to sell Fampridine in the country in a year's time. “We have sought patents for these drugs in India and the country will be part of future global launches of all our drugs,” Ms Seth added. Biogen, which focuses on neurology, oncology, haemophilia, immunology and cardiopulmonary, has about 10 drugs in the final stages of development. While it will import these drugs from global plants, it is open to have a manufacturing plant in emerging markets. In 2007,

Biogen decided to set up subsidiaries in key emerging markets including China, India and Brazil, but revenues from these markets are currently insignificant.

Biogen is also exploring opportunities to buy new products and companies in India, though it has not identified any target, Ms Seth added.

**Headline 5: Pharma can count on better US sales, but costs still a worry**

**Published by:** The Economic Times

**Date of Publication:** February 10, 2010

**Source:** <http://economictimes.indiatimes.com>

For the pharma sector, the third quarter of this fiscal was characterised by strong growth in profits, but a rather subdued growth in revenues. While the profit growth was aided by a lower input cost, the slow growth in export revenues stunted the growth in revenues.

An ETIG analysis of aggregate results of 14 leading pharma companies shows a 46% Y-o-Y rise in net profit, although net sales grew at a modest rate of 10%. Savings on raw materials and significantly lower forex losses helped these firms post a robust Y-o-Y increase in profit. This also contributed to a healthy expansion of profit margins.

Many large companies such as Sun Pharma, Dr Reddy's (DRL) and Cipla recorded either a slow or flat growth in the US, the largest export market for local pharma companies. Rupee appreciation, of close to 3% during the September-December quarter, also contributed to the erosion in value of exports. The strong performance in the domestic market was the key growth driver for these companies. Companies such as Ranbaxy and GlaxoSmithKline Pharma, which have a December-year ending, didn't announce their results for the fourth quarter.

Contrary to expectations, companies with contract-manufacturing (CRAMS) business model continued to report a subdued growth for the third-straight quarter. While Jubilant Organosys reported a modest 10% growth in its CRAMS business, others like Piramal Healthcare reported a flat growth, while Divi's Labs & Dishman Pharma reported a drop in revenues.

Surpassing expectations, companies such as Lupin and Cadila Healthcare have emerged as outperformers in the sector for the December quarter. They have managed to register a strong growth in their overseas business.

Although most large pharma companies are working towards enriching their product pipeline in the US, complying with US FDA regulations has become a critical concern for all of them. The December quarter witnessed revenues for companies such as Sun Pharma and DRL getting impacted due to voluntary recall of certain products.

Besides, the movement of the Indian currency continues to remain a decisive factor for most companies in the sector. While an appreciating rupee keeps forex losses at bay, it also spells bad news for the export-oriented sector. Investors must be ready for such unforeseen shocks, which can impact firms in the sector.

With the savings on raw material costs fast disappearing, the profit growth in the forthcoming quarters is not likely to be as strong as seen in the past two quarters. In contrast, net sales growth may pick up, as large companies manage to sort out compliance issues with the US FDA and get their US sales back on track.

### **Headline 6: Labopharm receives US FDA nod for Oleptro to treat depressive disorder**

**Published by:** PharmaBiz

**Date of Publication:** February 05, 2010

**Source:** <http://www.pharmabiz.com/article/>

Labopharm Inc announced the US Food and Drug Administration (FDA) has approved Oleptro (trazodone hydrochloride) Extended Release tablets, a novel once-daily formulation of the antidepressant trazodone, for the treatment of major depressive disorder (MDD) in adults. Oleptro utilizes Contramid, Labopharm's clinically validated technology that controls the release of active substances within oral medications.

"Oleptro represents Labopharm's second Contramid technology-based product to receive US FDA approval in just over a year," said James R Howard-Tripp, President and Chief Executive Officer, Labopharm Inc. "We are excited about the opportunity for Oleptro and are preparing the product for launch into the US\$ 11 billion-plus US antidepressant market. We are working towards finalizing a commercialization path for Oleptro that will maximize the value of our product in this market."

MDD is a common mental illness often characterized by a combination of social and somatic symptoms. It affects more than 14 million adults in the US and is the leading cause of disability globally. Oleptro will offer physicians another therapeutic alternative for their MDD patients.

"There's a large body of evidence demonstrating the efficacy of trazodone in the treatment of MDD," said Dr Stephen Stahl, Adjunct Professor of Psychiatry, University of California, San Diego School of Medicine. "Labopharm has developed a novel formulation of trazodone that effectively treats depression and provides a tolerable adverse event profile."

Labopharm is actively exploring several alternatives for the US commercialization of Oleptro. Such alternatives range from out-licensing the product to a distribution partner while retaining the right to some degree of co-promotion, through to a full co-promotion arrangement under which Labopharm

would share the sales function with a partner. The company currently expects to finalize the commercialization plan for Oleptro in the near term.

Labopharm expects Oleptro to be available for prescription in the US later this year, with specific timing for its launch to be determined within the context of the final commercialization plan. The company believes it is well advanced in its preparations for the US launch of Oleptro. The company has completed market research with physicians and third-party payors, developed a positioning and marketing campaign for Oleptro, and finalized product manufacturing and packaging arrangements.

An eight-week randomized, double-blind, two-arm, multi-centre study in patients with unipolar major depressive disorder demonstrated Oleptro's efficacy as a treatment for depression.

"Our research in the clinical study leading up to US FDA approval showed that Oleptro was well-tolerated and demonstrated a significantly greater improvement in the HAMD-17 primary efficacy end point over placebo," said Dr David Sheehan, University Health professor and director of the Depression and Anxiety Disorders Research Institute, University of South Florida College of Medicine. "When given at the recommended daily dose range, Oleptro was an appropriate monotherapy for patients with MDD."

Labopharm will conduct a post-approval paediatric study. The US FDA has asked Labopharm to provide data from a long-term maintenance study and an additional in-vitro alcohol dissolution study.

Headquartered in Laval, Canada with US offices in Princeton, New Jersey, Labopharm is an emerging leader in optimizing the performance of existing small molecule drugs using its proprietary controlled-release technologies.

### **Headline7: Bharat Bio to pump in Rs 250 crore for vaccine facility expansion**

**Published by:** PharmaBiz

**Date of Publication:** February 05, 2010

**Source:** <http://www.pharmabiz.com/article/>

Hyderabad based vaccine major Bharat Biotech International Limited (BBIL) will invest Rs 250 crore to take its range of vaccines like rotavirus, typhoid, malaria Japanese encephalitis, chikungunya and seasonal influenza for clinical trials. It has also slated Rs 75 crore for setting up a new manufacturing facility for these vaccines that will be undergoing the clinical trials.

According to Dr Krishna M Ella, chairman and managing director, Bharat Biotech's proposed investment of Rs 250 crore would be met through internal accruals and grants from the department of science and technology and international health agencies

The company has also managed to deliver its one billionth vaccine dose which demonstrates its efforts as a global manufacturer of vaccines to protect against rabies, polio, hepatitis-B, typhoid, diphtheria, pertussis, tetanus, haemophilus influenza B and other diseases. "It has taken us 10 years to reach the one billion mark and the second billion can be reached in less than five years with the advanced processes. We realize that lives saving vaccines are still unavailable to millions of people and there is a lot more work to be done. We are committed to research and development of innovative vaccines to address global infectious diseases," he added.

The future growth strategy at Bharat Biotech will be a combination of high volume WHO pre-qualified vaccines and innovative novel vaccines catering to the needs of developing world populations. Going forward Bharat Biotech intends to further strengthen its clinical research activities through a series of investments into safety and efficacy clinical trials for its innovative vaccines and therapeutics. The company intends to inject 30 per cent of its revenues in R& D and clinical research.

The company commenced operations in October 1996 and its first product Revac-B (Hepatitis-B) Vaccine launched in 1999. It has now one of the largest production capacities as it can deliver 100 million doses of Hepatitis-B, 50 million of Typhoid Vaccine and 8 million doses of Rabies in addition to COMVAC-5.

#### **Headline 8: Indian pharma recorded 13.7% growth in first three quarters of fiscal 09-10**

**Published by:** PharmaBiz

**Date of Publication:** February 04, 2010

**Source:** [Source: http://www.pharmabiz.com/article/](http://www.pharmabiz.com/article/)

The Indian pharmaceutical industry has recorded revenue of Rs 43424 crore with 13.7 per cent for the first nine months of the fiscal 2009-10, reveals a monthly report from the market surveillance and electronics infrastructure development firm, AIOCD Pharmasofttech AWACS. The revenue for the month of December 2009 was reported at Rs 3766 crore with a growth rate of 14.4 per cent, as per a report created by the firm through its market surveillance product - PharmaTrac.

The revenue of the top ten firms contributed Rs 1596 crore out of the total market in the month of December. Cipla remains the top company in the list with a revenue of Rs 230 crore for the month with 17.6 per cent growth rate and a total of Rs 2377 crore for the first three quarters of the financial year. Ranbaxy stands second in the list with Rs 187 crore revenue for the month with 7.2 per cent growth rate and Rs 2210 crore with 7.8 per cent growth for the first nine months of the quarter.

"We are deeply thankful to all the companies who have participated in the validation exercise - covering almost 64 per cent in total market share of the pharma market. Our access with the retailers, wholesalers and the pharma firms helps us to get the figures more accurate and thus we are able to deliver reports with more precision," said Ameesh Masurekar, director, AIOCD Pharmasofttech AWACS. There are have been several changes to company rankings and value, although overall market and growth rate has broadly remained the same.

The companies - GlaxoSmithKline, Piramal Healthcare, Sun Pharmaceuticals, Zydus Cadila, Lupin, Mankind Pharma, Alkem Lab, Aristo Pharma - follows Cipla and Ranbaxy in the ranking list.

However, Mankind, Aristo, Lupin and Alkem reported as growing at more pace than the top five companies, with more than 18 to 20 per cent in December. Mankind, which has a strong sales strategy with reach to remote areas in the country has also recorded a growth of 21.7 per cent in the nine months of current fiscal, shows the report.

Out of the Rs 43424 crore market as depicted in the first nine months of 2009-10, expectorants and antitussives tops the most selling products with a market size of Rs 1286 crore occupying a market share of three per cent reporting a growth rate of 8.6 per cent. Amoxicillin + Clavulanic Acid has the second highest market, with a market revenue of Rs 676 crore holding 1.6 per cent of the market share and growing at 20.6 per cent in the period.

Calcium with calcitriol (Vitamin D3) and other ingredients follows the other two products with Rs 624 crore market revenue with a market share of 1.4 per cent and 11.7 per cent growth rate. Cefixime, other iron combinations including Liver extracts and folic acid, atorvastatin, other multivitamins with minerals, ceftriaxone, cefpodoxime and diclofenac are the products in the top ten most marketed products in the period in the country.

### **Headline 9: Infosys to partner with Elan Pharmaceuticals**

**Published by:** The Economic Times

**Date of Publication:** February 01, 2010

**Source:** <http://economictimes.indiatimes.com>

BANGALORE: Infosys Technologies Limited would design and implement the Research Informatics System (RISE) at Elan Pharmaceuticals, Inc, a leading biotechnology company, to accelerate discovery research using a co-creation engagement model that leverages Infosys' existing intellectual property in this field.

RISE will leverage Infosys' Scientific Innovation Solution for knowledge collaboration, novel ways to unlock disparate data spread across in-house research labs and other commercial or public sources, which will be presented to scientists in context of their research needs, a company press release said.

The co-creation model would enable Infosys retain ownership of co-developed IP as part of the implementation.

## **Headline 10: China Pharma Holdings, Inc. Completes Clinical Trials For Candesartan Anti-Hypertension Drug**

**Published by:** Medical News

**Date of Publication:** January 23, 2010

**Source:** <http://www.medicalnewstoday.com/articles/176923.php>

China Pharma Holdings, Inc. ("China Pharma") (NYSE Amex: CPHI), which develops, manufactures, and markets specialty pharmaceutical products in China, announced that the Company has completed clinical trials for Candesartan, an anti-hypertension drug, and submitted the generic drug production application to the SFDA.

Analysis of the clinical trial results shows that Candesartan Cilexetil is a prodrug of Candesartan. It is 10-fold stronger in effect than Losartan, has good selectivity (Candesartan has much greater affinity (>10,000-fold) for the AT1 receptor than for the AT2 receptor), and has long effective time (one administration per day in low dosage). As a prodrug, it also enables smooth release via an oral solution, which makes it an ideal hypertension drug.

Candesartan, the leading anti-hypertension drug, is an angiotensin II receptor antagonist for which 2007 worldwide sales exceeded \$2.5 billion (1). Discovered and originally synthesized by Takeda Pharmaceutical Company Limited, Candesartan was jointly developed by Takeda and AstraZeneca Pharmaceuticals for the treatment of hypertension, chronic heart failure, and left ventricular systolic dysfunction.

In China, nearly 60% of all urban adults aged 65 years and over suffer from hypertension, and prevalence in urban areas is expected to reach 100 million by 2011 (2). Candesartan is listed in the China's National (Medical) Insurance Catalog ("NIC"), allowing patients to be reimbursed by the government.

China Pharma's CEO and president, Ms. Zhilin Li, commented, "We are pleased to announce the satisfactory completion of clinical trials for Candesartan, a multi-billion dollar revenue-generating drug, ahead of schedule. Hypertension is a serious problem linked to an increased incidence of other diseases, particularly brain edema, coronary heart disease and diabetes. Candesartan is a well-established and well-tolerated anti-hypertension drug with an excellent safety record and is known to be particularly suitable for cardiovascular and diabetic patients."

Ms. Li continued, "According to the Chinese government, ninety percent of China's citizens will be covered by a universal healthcare system by the end of calendar 2010. Candesartan's presence in the NIC allows users to receive reimbursement and will provide effective treatment for a high number of Chinese patients whose medication needs are seriously unmet. We see great potential in the target

market and are excited to have an opportunity to provide this excellent anti-hypertension drug to individuals suffering from hypertension in China."

### **Headline 11: Biocon LTD signs MoU with Malaysian-based Biotech Corp**

**Published by:** The Economic Times

**Date of Publication:** January 22, 2010

**Source:** <http://economictimes.indiatimes.com/>

BANGALORE: Biocon Limited today signed an MoU with Malaysia's Biotechnology Corporation (BiotechCorp) to explore collaboration and potential investment in Malaysia's biotechnology industry. Biocon is in talks with BiotechCorp to manufacture biopharmaceutical products and formulation, within Malaysia's Nusajaya, Iskandar Malaysia, called the Bio-XCell Ecosystem, Biocon said in a statement. Biocon is also developing Biotechnology infrastructure in the Bio-XCell Ecosystem Project.

Kiran Mazumdar-Shaw Chairman and Managing Director, Biocon said, "Biocon is keen to explore Malaysia as a destination for our expansion. Malaysia and the Bio-XCell Ecosystem in Iskandar Malaysia are attractive propositions. We are interested in learning how we can leverage this offering with our commercial plans and look forward to formalising our engagement with BiotechCorp further".

The collaboration while giving Biocon a conducive ecosystem to further its biopharmaceutical activities, would also enable the transfer of knowledge to Malaysia's human capital, create employment and knowledge workers, and directly benefit the growth of similar local industry, the statement added.

### **Headline 12: Lupin plants get USFDA nod; co to sell new products**

**Published by:** The Economic Times

**Date of Publication:** January 21, 2010

**Source:** <http://economictimes.indiatimes.com>

NEW DELHI: Drug maker Lupin has received clearance from the US drug regulator for its plant at Mandideep in Madhya Pradesh, allowing the Mumbai-based company to start selling new products made at the plant to the world's largest drug market.

The company has also got clean-chit for two of its two manufacturing facilities at Aurangabad and Indore (oral solids and oral contraceptives) from the US Foods and Drugs Administration (FDA) following a recent inspection by officials of the US drug regulator, the company said.

“We have received official communication from the USFDA on the satisfactory resolution of the warning letter issued earlier to its Mandideep unit in May 2009,” Lupin said in a release, adding the facility was re inspected in November 2009.

While Lupin could continue to sell its drug made at the plant, the FDA stops approval of new drugs once a warning letter is issued. The plant has also got approval from both the UK and Australian drug regulators.

While no deficiencies were noted in the Aurangabad plant, FDA pointed out that one deviation in the Indore plant that was addressed before the close of the inspection, allowing the company to launch liquids and oral contraceptives in the US, it added. The company’s share closed at 1,420, up 0.4%, on BSE on Wednesday.

Nilesh Gupta, group president and executive director, Lupin, told ET that the Mandideep plant was an overhanging issue in the investors mind. The company plans to seek drug approval for about 30-35 new drugs in the US, one-third of which would be Para IV applications, which give six-month marketing exclusivity.

Hemant Bakhru, pharma analyst at CLSA, said the clearance is a positive development for the company, given the problems faced by some Indian companies in the recent past.

### **Headline 13: Wockhardt lenders offer to trade bonds for 26% stake**

**Published by:** The Economic Times

**Date of Publication:** January 13, 2010

**Source:** <http://economictimes.indiatimes.com>

NEW DELHI: Foreign lenders led by US hedge fund QVT — that own overseas bonds worth \$66 million in Wockhardt — have proposed a plan that would give them about 26% stake in the troubled pharmaceutical company.

As per the plan, the mandatory conversion of bonds into equity in five years would expand the capital base and shrink the promoters’ — the Khorakiwala family — stake from the current 73% to 54%, though they would still enjoy a majority stake in the company, a QVT executive said. Although the 26% stake would trigger an open offer to shareholders, the rule will not apply in this case as the new shares would be subscribed by investors not holding more than 15%. The lenders have already discussed the proposal with the Khorakiwala family who are said to have rejected the offer citing significant dilution of their stake in the company.

A Wockhardt spokesman did not comment "as the matter is sub judice". But a final decision will be taken by bankers involved in the corporate debt restructuring (CDR) programme that Wockhardt was forced to opt for after it took a Rs 1,600-crore MTM forex loss last year.

More trouble followed when the Mumbai-based company failed to pay the clutch of companies, led by QVT, part of the \$110 million borrowed as foreign currency convertible bonds (FCCBs) in 2004. When the bonds matured last October, the lenders did not convert these into shares as the Wockhardt scrip was trading at Rs 195 against the conversion price of Rs 486 per share. The agreement called for Wockhardt to repay \$140 million (along with interest) in cash, if the share price was below the conversion price.

As per the CDR package, FCCB owners were given two options to convert the bonds into shares: at a 65% discount or opt for a preferential allotment of shares, partly convertible after 5 years. State Bank of India, the country's largest lender, which held FCCBs worth \$51 million chose the latter option. Overseas investors have chosen a repayment structure whereby the FCCBs would be rolled over for five more years. At the end of that term, the bonds would be converted into an equity stake at 10% premium of the existing share price (Rs 181 on Tuesday).

Incidentally, some FCCB holders have been opposing the CDR package — which includes debt repayment through sale of assets — saying it favours Indian banks.

#### **Headline 14: Govt to build special zones for pharma at int'l terminals: Azad**

**Published by:** The Economic Times

**Date of Publication:** January 11, 2010

**Source:** <http://economictimes.indiatimes.com>

MUMBAI: The government is planning to create special zones for pharma products at international cargo terminals, Union Health Minister Ghulam Nabi Azad said in Mumbai on Monday.

"We are planning to set up zones for pharma products at international cargo terminals. These new zones will ensure appropriate storage condition, testing facility and custom clearances," Azad told reporters at the opening ceremony of the zonal FDA Bhavan here.

The minister also said, "This initiative will further boost exports from our country. We are also in the process of expanding the zonal and sub zonal network throughout the country. In next financial year, the number of zones would go up from present 8 to 15 across the country. This will help the industry in obtaining regulatory approvals faster," Azad said.

At present, annual production of pharmaceutical products in the country is worth Rs 90,000 crore and out of which exports account for about Rs 39,000 crore, he said.

To bring about transparency and good governance, office of the Drug controller General of India and the entire network of zonal and sub zonal offices will introduce electronic governance, which will not only reduce time for transaction, but also take care of confidentiality, he said.

### **Headline 15: India would see massive boost in drug manufacturing sector'**

**Published by:** The Economic Times

**Date of Publication:** January 9, 2010

**Source:** <http://economictimes.indiatimes.com>

With the country's capacity to manufacture medicines at competitive prices and drugs worth USD 80 million going off-patents soon, there is a big opportunity for investment in the drug manufacturing sector, Health Minister Ghulam Nabi Azad said on Saturday.

"With India's capacity to manufacture drugs at competitive prices, there is a big opportunity for investment in the drug manufacturing sector. Government has already cleared the desk by streamlining and strengthening of the regulatory framework with international credence," he said, addressing delegates at the Pravasi Bhartiya Divas here.

Azad said that the drug regulatory framework in the country is in the process of modernisation and strengthening.

"Regulatory norms and procedures are being harmonised with the international requirements like that of international conference on harmonisation taskforce," he said.

"Drugs worth USD 80 million are on the verge of going off-patent and with India's capacity to manufacture drugs at competitive prices, there is a big opportunity for investment in the drug manufacturing sector," he added.

Azad also invited the Indian Diasporas to invest in the areas of drugs and the medical education.

"Although NRHM has added over 15,000 MBBS and AYUSH doctors and more than 70,000 nurses in the last two years, we are still faced with a shortage of trained and qualified manpower at all levels," Azad said.

## Section F: Energy & Environmental

### Headline 1: From Oil Sector to Wind Power

**Published by:** Science Daily

**Date of Publication:** March 30, 2010

**Source:** <http://www.sciencedaily.com/news/>

Eying the vast potential for establishing wind farms at sea, companies along Norway's west coast are making the leap from offshore oil to offshore wind power.

Developing offshore wind power could prove just as profitable as petroleum industry projects, and the potential for value creation is enormous.

Statoil and Statkraft, Norway's heavyweight energy companies, recognise this potential and have already secured a key position in Great Britain, where the development of wind power is highly subsidised. The two Norwegian companies, together with the energy companies Scottish and Southern Energy and RWE npower, will develop Dogger Bank, by far the largest British wind power project to date.

West Coast firms at the starting line Other Norwegian companies are also getting in line to compete for contracts for large development projects for offshore wind farms.

More than 40 companies primarily from Hordaland and Rogaland counties have joined the Arena NOW (Norwegian Offshore Wind) network. Every member company has experience in the oil and gas industry; some have already landed their first wind power contracts and completed their first installations.

"This surge toward wind power will bring some profound changes to this region's industrial makeup," says Yngve Aabø, Chairman of Arena NOW.

German wind farm draws on Norwegian expertise The German wind farm Alpha Ventus, located off Germany's northwest coast has drawn upon Norwegian technology and expertise for the production and installation of wind turbine foundations.

Bergen-based OWEC Tower and Trøndelag-based Aker Solutions Verdal have supplied steel structures for six foundations each. Another Bergen company, NorWind, installed the OWEC foundations.

From powering platforms to power systems for wind farms Troll Power, another Bergen company, currently supplies power to the petroleum industry. Its new company Troll WindPower, together with wind power supplier NorWind, is now gearing up to supply power systems for offshore wind farms. At the Bergen Group Rosenberg shipyard in Stavanger, the first modules for a power station designed exclusively for wind farms will soon be completed.

Troll Power has developed a tool to detect risks in the power grid when various energy producers and users are connected to the grid. This new tool will be very valuable to grid operators and energy companies as more and more wind farms go online.

## **Headline 2: Private Drinking Water Supplies Pose Challenges to Public Health**

**Published by:** Science Daily

**Date of Publication:** March 26, 2010

**Source:** <http://www.sciencedaily.com/news/>

An estimated three to four million people -- about one in every eight Canadians -- drink water from private supplies.

Infrequent testing and maintenance puts consumers of these water supplies at greater risk of contamination than public systems, states an article in *CMAJ (Canadian Medical Association Journal)*. It goes on to state people need to take personal responsibility for their water quality and governments need to provide better oversight and resources in order to improve the case.

Water-borne disease outbreaks are common in the developing world but can also occur in affluent countries. In the United States, 19.5 million water-borne illnesses occur every year (all sources) and three quarters (76%) of drinking water outbreaks are associated with groundwater sources. A study from the United Kingdom found outbreaks of water-borne infectious diseases among people with private water supplies were 35 times greater than among consumers of publicly-supplied water.

While most Canadians are supplied by regulated public municipal water systems, people who live in rural areas often rely on private supplies, most of which are groundwater sources such as wells. These may not be well-maintained or regularly tested for water quality. An Ontario study found that only 8% of private water systems met the current provincial recommendation for frequency of testing.

"The perception that private systems, the majority of which come from groundwater in rural and small towns, yield higher water quality compared to municipal sources is unclear and unfounded," writes Dr. Jeffrey Charrois a research scientist with Alberta Innovates -- Technology Futures and an adjunct assistant professor with University of Alberta. "The provision of safe, secure drinking water is necessary for protecting public health and requires an understanding of the responsibility, proper technical training plus the dedication to carry out those tests."

Contamination of wells can occur from bacteria, enteric viruses and protozoa -- pathogenic organisms capable of causing water-borne-illnesses -- as well as chemicals such as pesticides, nitrate, and naturally occurring arsenic. A review of 288 water-related infectious disease outbreaks in Canada over a 27 year period found that two-thirds were associated with private or semi-private supplies. In another survey of 1292 drinking water wells on farmsteads in Ontario, 40% of the wells were found to contain one or more contaminants at levels above maximum acceptable concentrations.

Water quality oversight of public systems typically rests with the ministry of health or environment, depending on the province or territory. "Issues related to the quality of water from private wells are clearly not on the radar of most Canadians," writes the author.

"Owners of private systems must take personal responsibility for their water quality, but they need more information and better resources," concludes Dr. Charrois. "Local, provincial and federal governments must develop and deliver the education, awareness and innovative programs that encourage people to take the steps to ensure that their private water systems are safe."

### **Headline 3: Energy Crops Impact Environmental Quality, Review Finds**

**Published by:** Science Daily

**Date of Publication:** March 20, 2010

**Source:** <http://www.sciencedaily.com/news/>

Crop residues, perennial warm season grasses, and short-rotation woody crops are potential biomass sources for cellulosic ethanol production. While most research is focused on the conversion of cellulosic feedstocks into ethanol and increasing production of biomass, the impacts of growing energy crops and the removal of crop residue on soil and environmental quality have received less attention. Moreover, effects of crop residue removal on soil and environmental quality have not been compared against those of dedicated energy crops.

In the March-April 2010 issue of *Agronomy Journal*, published by the American Society of Agronomy, Dr. Humberto Blanco reviewed the impacts of crop residue removal, warm season grasses, and short-rotation woody crops on critical soil properties, carbon sequestration, and water quality as well as the performance of energy crops in marginal lands. The review found that crop residue removal from corn, wheat, and grain sorghum can adversely impact soil and environmental quality. Removal of more than 50% of crop residue can have negative consequences for soil structure, reduce soil organic carbon sequestration, increase water erosion, and reduce nutrient cycling and crop production, particularly in erodible and sloping soils.

"Crop residue removal can make no-till soils a source rather than a sink of atmospheric carbon," says Blanco, even at rates lower than 50%. Residue removal at rates of less than 25% can cause loss of sediment in runoff relative to soils without residue removal. To avoid the negative impacts on soil, perhaps only a small fraction of residue might be available for removal. This small amount of crop residues is not economically feasible nor logistically possible. Blanco recommends developing other alternative biomass feedstock sources for cellulosic ethanol production.

An alternative to crop residue removal is growing warm season grasses and short-rotation woody crops as dedicated energy crops. These crops can provide a wide range of ecosystem services over crop residue removal. Available data indicate that herbaceous and woody plants can improve

soil characteristics, reduce soil water and wind erosion, filter pollutants in runoff, sequester soil organic carbon, reduce net emissions of greenhouse gases, and improve wildlife habitat and diversity.

Whereas crop residue removal reduces carbon concentration, dedicated energy crops can increase soil organic carbon concentration while providing biofuel feedstock. Because of their deep root systems, warm season grasses also promote long-term carbon sequestration in deeper soil profile unlike row crops.

Growing dedicated energy crops in marginal and abandoned lands instead of prime agricultural fields will further benefit the soil and environment. Warm season grasses can grow in nutrient-depleted, compacted, poorly drained, acid, and eroded soils. Herbaceous and woody energy crops cannot replace natural forest and native prairie lands, but well-managed dedicated energy crops may provide a myriad of benefits to soil and environment while supplying much needed feedstocks for cellulosic ethanol production. Developing the next generation of biofuels will not only require new technologies to transform it into fuel, but new agricultural methods for growing it.

#### **Headline 4: Essential Oils to Fight Superbugs**

**Published by:** Science Daily

**Date of Publication:** March 14, 2010

**Source:** <http://www.sciencedaily.com/news/>

Essential oils could be a cheap and effective alternative to antibiotics and potentially used to combat drug-resistant hospital superbugs, according to research presented at the Society for General Microbiology's spring meeting in Edinburgh.

Professor Yiannis Samaras and Dr Effimia Eriotou, from the Technological Educational Institute of Ionian Islands, in Greece, who led the research, tested the antimicrobial activity of eight plant essential oils. They found that thyme essential oil was the most effective and was able to almost completely eliminate bacteria within 60 minutes.

The essential oils of thyme and cinnamon were found to be particularly efficient antibacterial agents against a range of *Staphylococcus* species. Strains of these bacteria are common inhabitants of the skin and some may cause infection in immunocompromised individuals. Drug-resistant strains, such as methicillin-resistant *Staphylococcus aureus* (MRSA) are extremely difficult to treat. "Not only are essential oils a cheap and effective treatment option for antibiotic-resistant strains, but decreased use of antibiotics will help minimise the risk of new strains of antibiotic resistant micro-organisms emerging," said Professor Samaras.

Essential oils have been recognised for hundreds of years for their therapeutic properties, although very little is still known about how they exert their antimicrobial effects in humans. Australian aborigines used Tea tree oil to treat colds, sore throats, skin infections and insect bites and the remedy was sold commercially as a medicinal antiseptic from the early 20th century. Various scientific

studies have demonstrated that essential oils are not only well tolerated, but are effective against a range of bacterial and fungal species. Their therapeutic value has been shown for the treatment of a variety of conditions, including acne, dandruff, head lice and oral infections.

### **Headline5: Green Food Choice May Not Be So Green**

**Published by:** Science Daily

**Date of Publication:** March 3, 2010

**Source:** <http://www.sciencedaily.com/news/>

If everyone became vegan and so ate only fruit and vegetables, then the reduction in greenhouse emissions for the whole of food consumption would be a mere 7%. The widespread adoption of vegetarianism would have even less impact, while organic food production actually leads to a net increase in greenhouse gas emissions. Those are the conclusions of a research paper published in the journal *Progress in Industrial Ecology*.

Helmi Risku-Norja and Sirpa Kurppa of MTT Agrifood Research Finland, working with Juha Helenius of the Department of Agricultural Sciences, University of Helsinki, have determined that the cultivation of soil for whatever purpose, whether growing crops or raising livestock is the primary source of greenhouse gas emissions in food production, not fertiliser production, animal husbandry, nor agricultural energy requirements.

The team explains that for current average food consumption, in Finland, emissions from soil represent 62% of the total emissions. Greenhouses gases released by cows and sheep account for 24%, and energy consumption and fertiliser manufacture about 8% each. The greenhouse emissions performance for extensive organic production is poor, they explain, despite this approach to farming being considered the "green" option, the lower efficiency requires the cultivation of greater areas of soil, which counteracts many of the benefits.

Reducing greenhouse gas emissions through food consumption would require large-scale changes among the entire population, the team points out. They suggest that rather than stressing the impact of an individual citizen's dietary choices, we should be paying more attention to social learning and to the notion of working towards food sustainability and security. In general, sustainable consumption might be possible by introducing services to substitute for material consumption. Although food itself cannot be substituted, a lot can be done at the household level to improve sustainability of food provisioning and reduce food wastage.

"There is a pressing need to design effective policy measures," says Risku-Norja. "Consumer information is important from the viewpoint of food and sustainability education, leading eventually to adopting more sustainable lifestyles in the coming generations," the team concludes.

## **Headline6: Waste tea leaves could brew up biofuel.**

**Published by:** Scidev

**Date of Publication:** March 1, 2010

**Source:** <http://www.scidev.net>

[ISLAMABAD] Waste tea leaves could be a cheap source of biofuel that does not compromise food security, according to Pakistani scientists.

Researchers from the Nanoscience and Catalysis Division at Quaid-i-Azam University used a nanocatalyst, metal nanoparticles that accelerate reactions, to produce biodiesel from used tea leaves.

The scientists converted used leaves from the tea plant *Camellia sinensis*. Firstly, in a process called gasification, the dried spent tea was mixed with a Cobalt nanocatalyst and heated in a chamber to 300 degrees Celsius. Then, the liquid extract underwent a second process to produce 40 per cent ethyl ester — the biodiesel.

The gasification also produced 28 per cent hydrocarbon gas — made up of ethane, methanol and methane — and 12 per cent charcoal. The gas is combustible so it can be used directly as a fuel, while the charcoal can be used as a fertiliser or to remove heavy metals from contaminated water, the researchers say.

In another process, Hussain and colleagues used the fungus *Aspergillus niger* to ferment the tea — a cheaper but slower way of producing biodiesel. *A. niger* was grown on waste tea leaves and after a few days, produced 57 per cent biodiesel in the form of bioethanol.

But Kausar Malik, head of the Biotechnology Department at Forman Christian College in Lahore, said the study's findings are not new and that scientists have long known that many kinds of organic matter can be made into biofuels.

Moreover, Malik called into question the efficiency of the tea conversion process. The energy costs of producing the biofuel outweigh the energy that the biodiesel itself could provide, he said.

"If we do a mass balance of input and output, we find it is not an economical option to be employed at industrial level," Malik told SciDev.Net.

Hussain disagreed, saying the high energy input is only required for the first batch of tea-derived biofuel. The researchers also argued that the tea conversion process produces more biodiesel than a similar conversion of coffee grounds (see Coffee next in line as biofuel source).

In 2008, production of black tea totalled more than 3.8 million tonnes, according to the study. The main growers of black tea are China, India, Kenya and Sri Lanka.