

**From the Desk of Chairman****Innovation : Part 3 - 49**

'Nuclear energy is energy of the future'. This adage has recently acquired added significance in the wake of continual rise in the prices of fossil fuels and their fast depleting stocks. The situation has also given rise to questions of energy security in the long run and to other related issues.

India has taken due cognizance of the emerging predicament and of the importance of nuclear energy in the short and long term perspective. Thus its nuclear programmes have always tried to forge strong synergy between basic research and technology development. This has helped India make great strides in the field of nuclear energy technology and other related areas. The backbone of the praiseworthy progress India has made in this regard is the Department of Atomic Energy of the Government of India and its various dedicated constituents, as also its pragmatic prevision and strategic planning that have been instrumental in nurturing excellence in all it does.

The Special Feature in the present issue of the **WISTA: Innovation** gives a broad perspective of nuclear energy scenario and covers the Department of Atomic Energy, its structure, current plans, progress achieved thus far, and the mandate it carries to accomplish.

Microsystems technology is gradually gaining currency in view of the characteristics it incorporates, such as small size, mobility, flexibility, energy and resource conservation, and low cost. In addition, it interlinks different functions, materials, components and integrates diverse basic technologies.

'In Focus' provides a brief description of the microsystems technology and its scope of application in cutting edge disciplines and priority areas, particularly which are relevant to our country.

Vivisection of animals in medical research has long been a controversial issue and debated extensively, some advocating its necessity to save human lives and others, specially pro-animal rightists, terming it unnecessary cruelty being inflicted on animals. While the moral issues about animal testing are debatable, the crucial point is that it is legal nearly in all the countries.

The 'Perspective' describes the various pros and cons being put forward on vivisection, and the desirability of strictly regulating its use in essential and nonessential areas.

Other features covered are: Scan Around Us; Frontier S&T; S&T for Basic Needs; Technology Development; Experts Converge; Knowledge Spreads, and Scan Around the Globe.

We welcome comments and suggestions from our readers.

*Dr K V Swaminathan***CONTENTS**

- **From the Desk of Chairman** [ P 2 ]
- **Scan Around Us:** Awards for Haryana Varsity Professors; Biodiesel from Jatropa; Detection of Lameness in Cattle; e-Waste, a Burgeoning Problem; India's Manned Space Probe; Leveraging Engineering Talent; National Innovation Foundation; Skill Development for School Dropouts. [ P 3-4 ]
- **Frontier S&T:** \**Aerospace* - CSIR-Alcatel Agreement; Radar Satellites for Navigation. \**Biotechnology* - A Biological Scale-Up Development Contract; Identifying Microbes. \**Drugs and Pharmaceuticals* -Anti-Malaria Drug Develops Resistance; Supporting SME's for Developing Medicines. \**Electronics/Communications* - ARTEMIS Technology; New Chip Design. [ P 5 - 6 ]
- **S&T for Basic Needs:** \**Building/Shelter* - Carbon Neutral Housing; Green Building Council of UK. \**Clothing/Textiles* - Fabric Care; New Challenges for Indian Garment Exporters \* *Energy* - Nuclear Energy; Reducing Dependence on Fossil Fuels. \**Food* - Improving Wheat Strains; New Rules for Processed Food. \**Health* -Defenses Against Cattle TB; Medical Expertise Online. \**Transport* - Increasing Car Fuel Efficiency; Progress in Hydrogen Fuelled Cars. [ P 7 - 9 ]
- **Special Feature:** Nuclear Energy-A Perspective. [ P 10 - 11 ]
- **In Focus:** Technology of Microsystems. [ P 12 ]
- **Perspective:** Pros and Cons of Vivisection. [ P 13 ]
- **Technology Development:** \**R&D Commercialization* - Intel Boosts Business Desktops; Motorola Teams Up with Microsoft; Plasma Arc Lamp; Recognition for Commercializing Technology. \**Intellectual Property* -Europe's Patent System Expensive; Patent Record; Seat Belt Tension Sensor; Three Million Patents in 30 Years. \**Technology Funding* - Clear Skies Initiative; Lending Activities of European Investment Bank; Research at the Intersections of Disciplines. [ P 14 - 16 ]
- **Experts Converge:** CSIR Research & Innovation Conference; Taking Innovation to Developing Countries. [ P 17 ]
- **Knowledge Spreads:** Knowledge Millennium Summit; Outsourcing R&D. [ P 17 ]
- **Scan Around the Globe:** Tree of Life for Beetles (Australia); Encouraging Entrepreneurs (Belgium); Technology and Innovation (Brazil); Agreement for Sale of Pharma Group (Canada); Nanotechnology, the Sunrise Technology (Germany); Systems Biology (Scotland); Cosmetic Surgery (Ukraine); Carbon Dioxide for Oil Recovery (UK). [ P 18-19 ]

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<b>SCAN AROUND US</b>
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**Awards for Haryana Varsity Professors**

The Indian Society for Veterinary Surgery has given two awards for the best research papers to the Faculty of the Department of Veterinary Surgery and Radiology of Haryana Agricultural University.

The awards were announced at the annual congress of the Society held at the Indian Veterinary Research Institute, Izzatnagar. The society also bestowed one fellowship on an HAU faculty member.

Dr M R Fazili; Dr S K Chawla; Dr Jit Singh; Dr S M Behl and Mr Rishi Tayal were chosen for the best research paper award in anesthesiology, while Dr R S Bisla, Dr Jit Singh, Dr S K Chawla and Dr D Krishnamurthy were announced as winners for their research article published in the Indian Journal of Veterinary Surgery. The Society also conferred on Dr Kuldip Singh, HOD, the fellowship of the Society in recognition of his contribution to the veterinary profession.

*(Tribune, Nov 25, 2006)*

**Biodiesel from Jatropha**

Biodiesel, which is oil extracted from the 'Jatropha' and 'Ratanjot' plants and mixed with diesel, is believed by many people to be the fuel of the future, but the extraction of jatropha oil on a commercial scale poses several problems.

Now two engineers in Indore have devised a low cost, easy to operate machine that can operate even at village level and extract enough oil to meet local energy needs. The machine which is five feet by three feet in size, and is portable, operates on 230 volts and 10 amperes single phase electric current, and can produce upto 300 litres of oil per batch which works out to 2400 litres per shift. The cost of this machine is only Rs 1.5 to 2 lakhs which brings it within the reach of even small villages.

The two engineers, Shri Arun Bindal and Shri Nagesh Vyas, are taking steps to file a design patent both in India and abroad, and in the meanwhile they have been flooded with distribution enquiries from Malaysia, South Africa, and Canada.

Separately, the Indian Oil Corporation in its research laboratory at Faridabad have successfully tested a blend of jatropha oil and diesel, and the

Indian Railways have operated locomotives run on biodiesel.

*(Business Line, Dec 27, 2005)*

**Detection of Lameness in Cattle**

A Maharashtrian engineer, Parimal Rajkondawar, has developed a machine which can detect lameness in cattle swiftly and accurately.

The animal is made to walk over two parallel force plate systems which constitutes the main part of the machine, and the force exerted by each limb is then mapped out onto a numerical score. These scores are then analysed over a period of time to see whether there are any deviations from the normal walking pattern. If the animal is in pain, it is bound to put less force on that particular limb, and this will then be reflected in the lameness score.

It is estimated that 10-40 percent of a herd are lame at any given moment of time, with each incident of lameness costing as much as Rs 15000 or a billion dollars just in the USA. Worldwide the figure would be staggering, and so this machine is a Godsend.

*(Agricultural News, Nov-Dec, 2006)*

**e-Waste, a Burgeoning Problem**

e-waste generally consists of materials such as discarded floppies, CDs, DVDs, chips, processors, mother boards, printed electronic boards, tapes and a whole host of other electronic parts, many of which contain toxic materials.

The bewildering rapidity with which the electronic and IT industry is spreading and is being transformed, with new innovations making many of these electronic products obsolete soon after they hit the market, the problem of e-waste is assuming serious proportions. In many large cities in India these pose danger to the environment through the spread of these toxic materials.

In the absence of proper recycling facilities, much of this e-waste is dumped in already grossly overcrowded landfills without proper steps taken to diminish its toxicity. Although experiments are being conducted on a small scale to develop eco-friendly solutions for e-waste disposal, no concerted attempt has been made to address the problem.

The Ministry of Environment and Forests is now taking initiative in the matter, and the Central Pollution

Control Board is expected to come out with a comprehensive policy to regulate e-waste shortly. Meanwhile, plans are afoot to set up e-waste recycling plants in Delhi, Hyderabad, Mumbai, and Pune.

*(APCTT, Nov-Dec 2005)*

### India's Manned Space Probe

According to Dr G Madhavan Nair, Chairman Indian Space Research Organisation (ISRO), the feasibility of an Indian manned space mission is the subject matter of serious debate in academic and government circles, in terms of the benefits that are likely to accrue, and whether our country can afford to remain outside it. A decision in this regard is likely to be taken within a year.

While an unmanned probe would cost about Rs 3000 crores, a manned space mission will be five to six times as costly and it would take 7-8 years to prepare for the mission. Those in favour of the project are of the view that the costs that are likely to be incurred will be more than made up by the benefits that are sure to flow across a diversified spectrum of scientific disciplines.

*(PTI Science Service, Feb 1-15, 2006)*

### Leveraging Engineering Talent

A report prepared by the consulting firm of Mckinsey's and released in Bangalore recently states that India with its rich engineering talent and long history in manufacturing can well become the manufacturing hub of Asia by 2015.

The skill intensive areas where India is particularly strong, according to the report, are auto-components and assembly, fabricated metal products, machinery, and the pharmaceutical and telecom equipment sectors.

The report notes that India produces 4 lakh engineering graduates annually, which is next only to China's output of 4.9 lakh, and their knowledge of English is an added asset. About 50 % of off-shore manufacturing by US companies involves skill-intensive sectors and this figure is likely to go upto 70 % by 2015. Forty percent of the manufacturing output of India is in the highly skilled sector, and the country is therefore well positioned to absorb some of the increase in out sourced manufacturing.

India is already a preferred destination for sourcing auto components and with price pressure and low profitability in the developed countries, outsourcing of speciality chemicals could rise from the present \$2 billion to \$ 15 billion during this period.

*(Chemical Weekly, Feb 21, 2006)*

### National Innovation Foundation

The Department of Science and Technology (DST) had set up the National Innovation Foundation in 2000 to encourage innovation activity and today. It has a database of over 50,000 innovators spread out in nearly 400 districts.

Realising that entrepreneurship and resource mobilization had to be linked to innovation, the Executive Chairperson of the Fund, Shri Anil Gupta, who teaches at the IIM Ahmedabad spearheaded the setting up of the Grassroots Innovation Augmentation Networks (GIAN) to pursue the tasks of value addition, market benchmarking and business development.

The results have been gratifying. A secondary school passout who also happens to be an accomplished technician has sold the rights for his natural water cooler for Rs 1 lakh and is looking forward to a bright future. Similarly, a practitioner of herbal medicines believes he has discovered a cure for diabetes and his remedy is currently being tested.

Linkages to the Foundation is provided by the Honey Bee Network which is also Shri Gupta's brainchild to look for, acknowledge and incubate innovation activity at grassroots level, which would otherwise wither away and die for lack of support.

*(Business Standard, Dec 17, 2006)*

### Skill Development for School Dropouts

Upgrading of skills is vital for innovation, and under Project Swavalamban, Hindustan Petroleum Corporation, a Central Public Sector undertaking, under its Corporate Social Responsibility Project has teamed up with the Confederation of Indian Industry (CII) for upgrading the skills of school dropouts.

In the first phase of the project, 1100 such underprivileged youths in Rajasthan, Uttar Pradesh, and Uttaranchal will be taught skills to make them employable or capable of being self-employed through courses such as plumbing, two-wheeler repair and maintenance, retail services, BP/call centre agents etc. Apart from such technical skills, customer service, health and safety will also be incorporated in the training programme.

Depending on the success of the venture and the experience gained, the project will then be extended to other parts of the country and may give rise to a new, young breed of innovators.

*(CII Communique, Feb 2, 2006)*

<b>FRONTIER S&amp;T</b>
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**AEROSPACE/SPACE****CSIR-Alcatel Agreement**

South Africa's Council for Scientific and Industrial Research (CSIR) and the French giant Alcatel have agreed to cooperate in R&D activities in the fields of satellite programmes, space data information systems and customer's requirements.

The two organisations intend to consolidate global cooperation in the space domain to strengthen their respective competitive positions and advance economic progress in both countries. For this purpose, areas of cooperation include landcover mapping, platform development and electronics and transport applications, spatial data infrastructure and development of astronomy related initiatives.

The CEO of Alcatel South Africa expressed his pleasure at the signing of the agreement and was confident that it would help to bridge the digital divide within Africa.

*(CSIR Media Release, Mar 9, 2006)*

**Radar Satellites for Navigation**

In the recently concluded Volvo Ocean Race, which takes place once every four years and is a 31,250 nautical mile round the world race, yachtsmen were able to navigate the treacherous waters off Cape Horn at the southern extremity of South America with the help of radar satellites which steered them away from dangerous icebergs.

C-Core, a Canadian company providing Earth observation based geo-information services, supplied information about the icebergs in the area, their shape, size, etc from data acquired by the European Space Agency's Envisat and the Canadian Space Agency's RADARSAT-1 satellites within a few hours of the data being collected, C-Core received and processed it using a special iceberg detection software which were then forwarded to Bedford who in turn provided it to the crews.

The information was particularly useful for sailors who had to be vigilant and wary of 'growlers', which are small bits of ice, about the size of a small car which break off from main icebergs and cannot be detected by radar, especially when travelling at full speed during rough seas at night.

*(esa, Mar 9, 2006)*

**BIOTECHNOLOGY****A Biological Scale Up Development Contract**

Industrial Biotechnology Corporation (IBC) and Angel Biotechnology Holdings plc, a biopharmaceutical contract manufacturer, have jointly announced a biological scale up development contract for fermentation scale up and optimization of IBC's proprietary production systems for selected speciality chemicals of biological origin after the designer enzyme for the specific chemical has been created. The contract calls for a combination of cash and IBC restricted stock to Angel, based upon deliverable milestones achieved.

Angel is a biopharmaceutical company offering process development services and pre-GMP and post-GMP manufacturing to support biotechnology and pharmaceutical companies worldwide. IBC commercializes proprietary technologies and intellectual property in the field of biologically produced chemicals.

Dr Gurinder Shahi, Chief Technologist IBC, stated that Angel was the perfect partner for his company with an excellent reputation and strong capabilities in areas that were synergistic to the IBC's own needs.

*(Biospace.com, Mar 4, 2006)*

**Identifying Microbes**

Scientists at the US Department of Energy's Brookhaven National Laboratory have developed a new method for identifying different species of microorganisms living in an unknown "microbial community."

The method has many applications ranging from assessing the microbes present in environmental samples and identifying species useful for cleaning up contamination, to identifying pathogens and distinguishing harmless bacteria from potential bioterror weapons.

The technique which is called "single point genome signature tagging" uses enzymes that recognize specific sequences in the genetic code. These enzymes chop the, microbial genomes into small segments that contain identifier genes common to all microbial species, plus enough genetic information to tell the microbes apart. As growing cultures of microbes to identify species is slow and error prone, scientists have been searching for a way to identify key segments in the genetic code that are short enough to be sequenced rapidly and they hit upon this method.

*(www.bnl.gov, Mar 8, 2006)*

## DRUGS AND PHARMACEUTICALS

### Anti-Malaria Drug Develops Resistance

Malaria which used to decimate entire populations in the tropics, largely came to be controlled in the 1950's with the use of chloroquine till people began to develop resistance to it. It was replaced by artemisinin, which had been developed from a Chinese herb and for the last few decades it has been widely in use. Studies now indicate that it might meet the same fate as chloroquine, unless its use is strictly regulated.

Scientists from the Pasteur Institute took blood samples from hundreds of patients in South-East Asia, and treated the samples containing the parasite *Plasmodium falciparum* to a variety of anti malaria drugs, including artemisinin. The results were then compared with a similar exercise carried out in respect of malaria patients in French Guiana. It was found that the patients of French Guiana, where the use of artemisinin was not regulated, had developed resistance to the drug unlike those in Cambodia and other South-eastern countries where there was no resistance to the treatment, because the use of the drug was regulated.

These findings underscore a warning by WHO on the need for extreme all round vigilance while prescribing artemisinin-based drugs and for its use to be carefully regulated.

*(PTI Science Service, Dec 16-31, 2005)*

### Supporting SME's for Developing Medicines

The European Commission is implementing new regulations to encourage the development of new medicinal products by small and medium sized enterprises (SME's), including easing of procedures for obtaining a Europe-wide marketing authorisation from the European Medicines Agency (EMA).

SME's in the EU had complained that the EMA procedures were too cumbersome and bureaucratic, and presupposed a level of resources and finance which was beyond their capacity. While addressing these specific concerns, the new regulations include fee exemptions and fee reductions/deferrals in respect of a number of EMA services for SME's, facilities for translation etc. Following the adoption of these regulations, EMA has launched a 'one-stop shop' SME Office to provide administrative and procedural guidance to companies seeking to develop and market new medicines.

*(CORDIS Technology Marketplace, Dec 16, 2006)*

## ELECTRONICS/COMMUNICATIONS

### ARTEMIS Technology

Many objects today have computers or microprocessors embedded in them that cannot be modified by the consumer. For instance, in the automobile industry embedded systems operate in the car engine to improve efficiency, operate satellite navigation, air conditioning etc. A whole industry has grown around these embedded systems and now the Advance Research and Technology for Embedded Intelligence and Systems (ARTEMIS) provides a platform which brings together the major companies in this industry.

There are believed to be more objects containing embedded systems than there are human beings on the earth and by 2020 the capability exists for such embedded systems to occupy much of our natural environment and react to our preferences automatically. To make this a reality the gulf between architecture and physics will have to be bridged speedily and while ARTEMIS is seeking to do this from the software side, the nano-technology platform ENIAC is trying to do the same thing from the nano-architecture side.

The embedded systems industry is growing at the rate of 10% annually, and ARTEMIS which is a public-private partnership that is open for any organisation to join has ambitious plans for the future.

*(CORDIS Tech. Marketplace, Mar 8, 2006)*

### New Chip Design

Intel Corp, the world's largest microprocessor manufacturer with nearly 77% of market share, has disclosed details of a next-generation chip that is expected to perform better and consume less power than the present ones.

The processor, code-named Conroe, based on 'Core' micro-architecture which builds on the design of Intel's Pentium M processor, will be out into the market by the middle of this year, and will be available in notebooks, desk tops, entertainment and server computers. It is expected to give 40% better performance, while consuming 40% less power than today's pentium. Intel also gave details of a new chip for computer servers based on the new design which is estimated to boost performance by 80% while consuming 35% less power compared to the 2.8 gigahertz Xeon processor.

*(Associated Press, Mar 8, 2006)*

<b>S&amp;T FOR BASIC NEEDS</b>
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**BUILDINGS****Carbon Neutral Housing**

An innovative 'carbon-neutral' community housing project has been developed by a British architect Bill Dunster. With a concentration of 120 persons per hectare, it has eliminated the use of fossil fuels and uses electric power developed onsite.

Known as the Bedlington Zero Energy Development (Bedzed) Scheme, it is located 20 miles from London and consists of 100 households, each with their own garden, recreational space, workplace, childcare facilities, green transportation network, etc. All the homes are glass fronted, south facing, and super-insulated, so that maximum use can be made of solar energy to stay warm, and keep heat loss at a minimum. The working units, however, all face north to reduce the need for air-conditioning during summer. The extra heating that is at times necessary for the households, is supplied by a centralized wood chip fueled combined heat and power plant unit which generates carbon free electricity from local tree waste.

According to Dunster, the Bedzed project's brave new features could well be the wave of the future.

*(CORDIS Tech Marketplace, Mar 8, 2006)*

**Green Building Council of UK**

A prospectus for the establishment of a Green Building Council in UK was launched recently to give focus and leadership for sustainable construction in that country.

The UK has a famous reputation for being in the vanguard of sustainable building design and construction, and the setting up of this Council will help to channelise the wealth of guidance and tools that are available in that country for more environment friendly construction.

One of the key objectives of the Council is to champion the cause of green buildings and to optimize profit for businesses by developing and enhancing UK's world class position for sustainable building design.

The Council would provide clear directions to the building industry and would be one of thirty other such national councils which are in the process of being set up, and which eventually may become members of a World Green Building Council.

*(bre, Feb 7, 2006)*

**CLOTHING/TEXTILES****Fabric Care**

An invention has been developed which relates to fabric care composition. It comprises a polycarboxylic acid or a derivative thereof, a catalyst and a thermoplastic elastomer together with a method of treating the fabric with such a composition and the use of such a composition to increase the tensile strength of a fabric to reduce ceasing and/or wrinkling of a fabric and/or to improve the elasticity and/or shape retention of a fabric.

The inventors are R J Carswell and J B Bernard, both of Merseyside, UK and the assignee is Unilever Home and Personal Care, USA.

The application for a patent was filed on 28 March 2004, and the US patent was granted on 7 March 2006.

*(US Patent Office, Mar 9, 2006)*

**New Challenges for Indian Garment Exporters**

It is more than a year since the 1974 Multifibre Agreement and its consequent quota system in the global clothing industry came to be abolished. The operation of the post quota regime has presented Indian garment exporters with both a challenge and an opportunity.

Experience over the year has shown that it is no longer sufficient to ship a well stitched garment at a competitive price. Competition has become far more keen now, and with capacity exceeding demand by nearly twofold, the world garment industry in which Indian exporters now have to navigate is the greatest buyer's market in its history.

What would make the crucial difference is the add-on services that exporters can provide, and here innovation is of the essence, whether it is in terms of material sourcing; manufacturing processes; fabric tests; or repayment methods. Already clients are pushing exporters to open full merchandising offices in the customer's cities, and many of our exporters have already done so.

Meanwhile, the coming into being of the South Asian Free Trade Agreement (SAFTA) with effect from 1 January 2006, which has yet to be ratified by Pakistan, promises to give a tremendous boost to inter-regional trade in textiles, if it is kept out of the sensitive list and trade facilitation infrastructure is strengthened.

*(Business India, Mar 12, 2006)*

## ENERGY

### Nuclear Energy

An important plank of President Bush's efforts to wean Americans away from the consumption of fossil fuels is his emphasis on nuclear energy.

On a recent visit to Battelle Memorial Institute in Columbus Ohio he observed, "America hasn't ordered a nuclear plant since the 1970s, and its time to start building again".

Answering people's concerns about the safety of nuclear power, he observed that decades of experiences and advances in technology had proven that nuclear power was reliable and secure, and for a secure energy future, nuclear power was an absolute necessity.

*(Idaho National Laboratory, Mar 8, 2006)*

### Reducing Dependence on Fossil Fuels

In his State of the Union speech on January 31, 2006 President Bush said that the USA was "addicted to oil" and must wean itself away from oil imports. This aspect was also stressed by him during his visit to the National Renewable Energy Laboratory (NREL) on 21 February 2006, where he led a panel discussion on his "Advanced Energy Initiative" which provides for a 22 % increase in clean energy research in the US Department of Energy.

President Bush stressed three ways in which drivers could change the way cars were driven; the use of hybrid vehicles; the use of E85 (85% ethanol and 15 % petrol) and the advancement of hydrogen fuel cells. Referring to the use of coal, nuclear power, solar and wind energy, he visualized the possibility of the US generating upto 20 % of its electricity needs through wind technology in the not too distant future and emphasized the need for developing a comprehensive strategy for reducing dependence on fossil fuels.

The panel discussed the use of hydrogen cells as a long term solution to reduce dependence on oil and the production of automobiles that had zero emissions. It was noted that the three major technical challenges to build a hydrogen economy, were the production and storage of hydrogen, and building a cost effective and durable fuel cell. The panelists felt that while fuel cells were not likely to be commercially viable in the next 15 -20 years, it was going to be a vital pillar of the future energy structure in the country.

*(NRE, Mar 8, 2006)*

## FOOD

### Improved Wheat Strains

Australian scientists are developing strains of wheat that contain a higher proportion of amylose, a particular form of resistant starch for incorporation into breads, cereals, and other foods to meet the deficiency caused by the excessive intake of processed and refined food by a majority of Australians.

Nowadays one of the most serious health issues in the developed world is the rise of diet-related non-infectious diseases, such as cardiac heart disease, obesity, diabetes, and colorectal cancers. The resistant starch which contains high levels of amylose, is not digested in the small intestine and passes into the colon where it is broken down by the resident bacteria, releasing short chains of fatty acids which is believed to promote bowel health and reduce the risk of colon cancer.

The inclusion of additional fibre in breads is now a routine practice, but scientists say that the benefit of using high amylose wheat in products such as bread, avoids the need to add supplementary fibre.

Trials on animals have shown that wheat with high amylose levels had significant health benefits, owing to the presence of short chain fatty acids in their bowels.

In this connection, gene technology has proved particularly useful in pinpointing the genetic changes in wheat that are required to create this new type of wheat.

*(National Academy of Sciences, Feb 27, 2006)*

### New Rules for Processed Food

The Prevention of Food Adulteration Rules, 1985, are proposed to be amended shortly in our country to make it mandatory for manufacturers of processed food products to mention details of the ingredients on the labels, including the fat content, and the technique used in its manufacture and storage.

These details will have to be provided in descending order by weight or volume. It will also be mandatory to distinguish the food from others so that consumers are not confused or deceived.

Information about energy value, protein and carbohydrate content, fats, water, colour or flavour used, and information about irradiation will also have to be supplied on the label.

*(Indian Express, Nov 14, 2005)*

**HEALTH****Defenses Against Cattle TB**

Till now cattle suffering from TB were routinely being culled, but a recent study conducted by the Wildlife Conservation Research Unit at Oxford University in UK indicates that cattle herds on farms with hedges and ungrazed lands are less likely to become infected with this disease which, after further investigations might be a pointer as to how the disease could be checked.

This 35 million pound study known as the "Krebs Trial" compared 30 randomly selected British farms that experienced TB outbreaks between 1994 and 1999 against 30 more which were disease free. Scientists used statistical methods to identify issues which differed between the two groups. Not surprisingly, more outbreaks were noticed where cattle from nearby farms had already contracted the disease. However, where hedgers were abundant, and there were ungrazed strips of land, the incidence of cattle TB was markedly less.

According to Dr Fiona Mathews, the head of the team that conducted the study, "We cannot demonstrate that if farmers changed farming practices, they would bring TB down, but we can demonstrate that there are relationships between farming practice and TB rates and these deserve further investigation".

*(BBC News, Mar 8, 2006)*

**Medical Expertise Online**

With the development of the Faculty of 1000 Medicine under the coordination thematic area of the Sixth Framework Programme (FP6); a new online facility for doctors has opened throughout the world, and could be helpful in saving many lives.

This facility is modelled on the highly successful Faculty of 1000 Biology site, which has secured subscriptions from 80 percent of the world's leading research institutions, and highlights the most interesting papers in medicine based on recommendations.

The Faculty of 1000 Medicine site divides a subject into 18 topic areas, such as nephrology and then subdivides it into 200 specific research areas, which are in turn cross-indexed, reflecting the interdisciplinary nature of medicine. Members submit summaries of the articles that they find particularly relevant along with a rating. An advisory Board of eminent experts overseas the project.

*(CORDIS Tech Marketplace, Mar 9, 2006)*

**TRANSPORTATION****Increasing Car Fuel Efficiency**

Research is underway in the USA to lower the cost of carbon fibre composites by developing high-volume renewable sources of carbon fibre which could then replace steel components in motor cars, thereby reducing the weight of the cars and increasing fuel efficiency.

At present, the main impediment in using carbon fibre composites is its high cost and the effort is on to reduce its cost to something between \$3 and \$5 per pound. If this effort is successful, it would become possible for automakers to use more than a million tons of composites annually in the manufacture of cars, at a rate of approximately 300 components per vehicle. Carbon fibre is just as tough as steel but has barely 20% of its weight, and the replacement of steel by carbon fibre composites is expected to reduce a vehicle's fuel consumption by 30%. Consequently, green house gas emissions are also expected to drop by 10-20%.

There would be no compromise in safety considerations as preliminary results of computer simulations show that cars made from carbon fibre would be just as safe, if not safer than those made from steel. Indeed today's Formula One racing cars are mandatorily required to have carbon fibre components for safety precautions.

*(Oak Ridge Nat. Lab, Mar 8, 2006)*

**Progress in Hydrogen Fuelled Cars**

Till now one of the main problems in using hydrogen as a fuel for vehicles has been that of storage. Hydrogen has very low density at normal temperature and pressure, and the concentration of hydrogen in a fuel cell has to be at least 6.5% by weight for it to be practicable. Currently, it is stored in the form of metal hydrides but the weight of such hydrides inhibits its use, particularly when it is to be fitted into a fuel cell.

Now chemists in USA have developed a new material called metallic-organic-framework (MOF), which is a form of crystal sponge with nanosize pores, which can absorb the hydrogen and then release it when required. Indeed so porous is this material that one gram of it has the surface area of a full length field. This material can store not only hydrogen but carbon dioxide too and would therefore be very useful in regulating greenhouse gas emissions. Furthermore, it can be made from zinc oxide and terephthalate, both of which are found in fair abundance.

*(The Hindu, Mar 23, 2006)*

## SPECIAL FEATURE

### NUCLEAR ENERGY -- A PERSPECTIVE

#### Introduction

It was the vision of India's first Prime Minister, Pandit Jawaharlal Nehru and the dedicated leadership in the field of nuclear energy provided by Professor Homi Bhabha that led to the setting up of the Department of Atomic Energy (DAE) on 3 August 1954 for the development of nuclear power technology and the application of radiation technologies in the fields of agriculture, medicine, industry and basic research. In keeping with this vision and leadership, the first atomic research reactor Apsara was built with indigenous efforts in 1956. Indeed in the years since Apsara was dedicated to the nation by Pandit Nehru, India has progressed considerably in the field of nuclear technology with a mandate that presently involves:

- Increasing the share of nuclear power through deployment of indigenous and other proven technologies, and also develop fast breeder reactors and thorium reactors with associated fuel cycle facilities;
- Building and operation of research reactors for production of radio isotopes and carrying out radiation technology applications in the field of medicine, agriculture, and industry;
- Developing advanced technologies such as accelerators, lasers etc. and encouraging transfer of technology to industry;
- Support to basic research in nuclear energy and related frontier areas of science, and interaction with universities and academic institutions in R&D areas having a bearing on the department's programmes;
- International cooperation in related advanced fields of research;
- Contribution to national security.

#### Structure

The department has several organisations integrated with it. These are:

- 5 R & D Centres, namely the Bhabha Atomic Research Centre, Mumbai; Indira Gandhi Centre for Atomic Research, Kalpakkam; Raja Ramanna Centre for Advanced Technology, Indore which has played a pivotal role in supplying components for the world's

largest particle accelerator being set up in Geneva); Variable Energy Cyclotron Centre, Kolkata; and the Atomic Minerals Directorate for Exploration and Research, Hyderabad.

- 3 industrial organisations: the Heavy Water Board, Mumbai; the Nuclear Fuel Complex, Hyderabad; and the Board of Radiation & Isotope Technology, Mumbai.
- 5 PSUs namely, the Nuclear Power Corp of India Mumbai; Indian Rare Earths Ltd Mumbai; Uranium Corp of India Ltd Jadugoda; Electronic Corp of India, Hyderabad; and the Bharatiya Nabhikiya Vidyut Nigam Ltd, Kalpakkam.
- 3 service organisations viz, the Directorate of Stores, Mumbai; the Directorate of Construction, Services and Estate Management, Mumbai; and the General Services Organisation, Kalpakkam.

In addition, it has two Boards for promoting and funding extramural research in nuclear and allied fields, namely the Homi Bhabha National Institute and the National Board of Higher Mathematics. It also supports 7 institutes of international repute engaged in research in basic sciences of astronomy, astrophysics, cancer research and education. These are, the Tata Institute of Fundamental Research, Mumbai; Tata Memorial Centre, Mumbai; Saha Institute of Nuclear Physics, Kolkata; Institute of Physics, Bhubaneswar; Institute, of Plasma Research, Ahmedabad; the Harish Chandra Research Institute, Hyderabad; Institute of Mathematical Sciences, Chennai; and the Atomic Energy Education Society, Mumbai that provides education to the children of DAE employees.

The department is guided by the aid and advice of the Atomic Energy Commission and receives necessary inputs from the Atomic Energy Regulatory Board and the DAE Research Council.

#### Three-Stage Nuclear Power Programme

The country's nuclear Power Programme which took off in the sixties, envisages a three stage programme with a complete Nuclear Fuel Cycle, beginning with the mineral exploration, extraction and processing of the uranium ore to be used in the reactor for generation of electricity; going onto the reprocessing of the spent uranium fuel and ending with the management of the nuclear waste.

Like other mineral ores, uranium ore is found underground and is extracted through underground or open cast mining and is then crushed and dissolved in sulphuric acid, leaving out the waste rock. The sulphuric

acid solution containing uranium is then filtered and is subjected to other processes to obtain uranium, which however contains only about 0.7% of the U235 isotope, the rest being U238. It is the splitting of the U235 isotope through fission which sets in a chain reaction, and for this purpose the uranium has to be enriched by reducing the U238 component, and increasing the share of U 235 upto 3.5 %. The enriched uranium is heated upto 1400 degrees C and in its powder form is inserted into thin hollow fuel rods which are bunched together to form a fuel assembly and are fitted into a nuclear reactor. In the reactor, the U235 isotope is split when it is bombarded with neutrons and becomes 'critical', thereby setting in a chain reaction, when the rate of production of neutrons exceeds the rate of loss by other means. The tremendous heat thus generated through the controlled chain reaction drives a turbine to generate electricity. When the reaction is uncontrolled, the energy released manifests itself as a nuclear explosion.

The first stage of our nuclear programme involves the construction and operation of pressurized heavy water reactors (PHWRs) of which the production of heavy water as a moderator and coolant is an important ancillary activity. A portion of the fuel which has been used in the reactor is taken out after some months, and it contains about 96% of the original uranium, with U233 concentration down to about 1%, spent fuel 3% and plutonium 1%. After its heat and radioactivity are allowed to decrease by immersion in ponds, the uranium is returned to the conversion plant for subsequent enrichment and can be used in the second stage of the programme which envisages the setting up of fast breeder reactors (FBRs) backed by reprocessing plants and plutonium based fuel fabrication plants. FBRs can increase uranium utilization by nearly 60 times of what is possible in PHWRs. The third stage would be based on Advanced Heavy Water Reactors (AHWRs) where thorium, of which India has plentiful supplies, and plutonium are irradiated to obtain U233 and thus start the cycle again.

The Nuclear Corp of India (NCIL) is responsible for the construction, design and operation of nuclear power reactors. To gain experience in the operation of PHWRs, an atomic power station consisting of two boiling water reactors (BWRs) was set up at Tarapur, Maharashtra in 1969 in collaboration with General Electric of USA, each with a capacity of 160 MW and these are still in operation. The first two PHWRs were built in Rawatbhata, Rajasthan, partly with Canadian collaboration and commenced commercial production in 1973 and 1981 with a capacity of 100 and 200 MW respectively. Subsequently, with the support of Indian Industry, and the R&D efforts of the Department, the indigenisation of PHWRs was taken up

which led to the building of two 220 MW reactors at Kalpakkam near Chennai in 1984 and 1986. The design of these two reactors was then standardized, and led to the construction of two reactors at Narora in UP which started commercial production in 1991 and 1992.

The indigenisation of PHWR technology and reduced gestation period led to the commissioning of two 220 MW power stations at Kakrapar in 1993 and 1995, and in 2000, four state-of-the-art 220 MW PHWR reactors were commissioned, two at Kaiga, Karnataka, and two at Rawatbhata, Rajasthan. Meanwhile, NPCIL has successfully constructed a 540 MW reactor which attained criticality on 6 March 2005 and it is now poised to design a 700 MW PHWR.

India presently has an installed generation capacity of 3310 MW through nuclear energy and a further capacity of 3420 MW is under construction. DAE has an ambitious nuclear power programme aimed at achieving an installed nuclear power capacity of 20,000 MW by 2020.

### **Radiation technologies & Applications**

The Department's programme relating to radiation technologies and applications cover building and operation of research reactors for production of radioisotopes, setting up other sources of radiation such as accelerators, and lasers, and developing and deploying radiation technology applications in the field of healthcare, agriculture, industry, besides supporting research and manpower training.

After Apsara, the research reactors set up include Cirus; Zerlina; Purnima 1-111, Dhruva; Kamini and a Fast Breeder Test Reactor at Kalpakkam. Dhruva, a 100 MW thermal research reactor, at Trombay, completed twenty years service on 11 Nov 1985.

### **National Security**

India conducted a peaceful underground nuclear experiment at Pokhran on 18 May 1974 and on 11 and 13 May 1998. It again successfully conducted five more nuclear tests. The Department is continuing to implement R&D in furtherance of the national policy of minimum nuclear deterrence.

### **The Way Forward**

Nuclear energy represents the wave of the future, and India which has made great strides in varied fields of nuclear technology, is well poised to ride the crest of the wave in the years to come.

## IN FOCUS

### TECHNOLOGY OF MICROSYSTEMS

#### Background

Innovations provide the propellant for technological advancement. Innovations in technological size today are making possible startling advancements in frontier areas such as nanotechnology and biotechnology. Indeed most new developments in these areas would not be usable without microsystems technology (MST), which brings together basic technologies such as mechanics, optics, fluidics, polymerelectronics and new materials sciences on a common platform. Microtechnology provides the interlinkages in a single system of the different functions, materials, components and technologies that go to make up a product, and supplies the interfaces which are needed to integrate into that product's innovative developments in new fields of technology.

#### Important Areas of Innovation

Microsystems technology finds support in four principal areas of innovation which is expected to have a significant impact on industrial and social policy. These areas are:

**Life Sciences:** This area which deals with preventive healthcare/wellness, diagnosis, and individualised therapies, of diseases, as well as with microsurgery and intelligent implants, can be controlled through monitoring systems such as biochips which are a classic example of microtechnology. These biochips can be used anywhere; supply diagnostic results rapidly and make expensive lab analyses unnecessary. This is also of great importance for the monitoring of food production and processing.

**Industrial Production:** The investment goods industry increasingly profits from process innovations by microsystems technology. Technical, dynamic, three dimensional viewing creates new perspectives in the area of automation and robotics. New production and integration processes enable compact hybrid systems. The mechanical and plant engineering industry is one such industry where microsystems technology provides cutting edge innovation impetus.

**Mobility:** Microsystems technology increases mobility, whether it is of technology, goods and services, or people. The miniaturized energy supply with micro fuel cells makes technical systems independent of grids and thus

accelerates mobility. Systems with self-sufficient energy supply can become interconnected and an off-shoot of this is the increased road safety for drivers of vehicles.

**Systems Integration:** Components can be successfully integrated into an intelligent overall system through microsystems technology, which can act as a bridge between the nano-world and the macro-world. Examples where such connectivity can be provided are in the fields of construction, systems integration, measuring and testing, simulation and design etc.

#### Priority Areas for Microsystems Technology

Some of the priority areas for MST which are particularly relevant to our country include:

##### *Microprocessor Technology*

*Measuring and testing technology:* which would draw upon microelectronics, precision mechanics and material analysis

##### *Computer-Aided Design and Simulation Tools*

*Smart label applications in logistics:* particularly in the consumer goods, automotive and electronic industries for creating new paths and optimizing logistics processes.

*Preventive micro-medicine:* Cardio-vascular diseases are becoming a worrying source of mortality in our country, and microsystems technology helps the prevention and monitoring of such diseases. With these technologies it becomes possible to monitor blood pressure, pulse, heart rhythm, or breathing on a 24/7 basis without the patient having to spend time in the hospital.

*Micro-fuel cells:* In the foreseeable future micro-fuel cells operated with hydrogen or methanol could well displace traditional energy supply systems.

*Microsystems for biotechnological applications:* This would facilitate the diagnosis of diseases and infections and speed up the development of life saving drugs.

#### The Road Ahead

Microsystems technology will play an increasingly important role in the coming years to integrate different technological disciplines and bring the fruits of those cutting edge disciplines to bear to improve the lives of people around the world.

<b>PERSPECTIVE</b>
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**PROS AND CONS OF VIVISECTION****Introduction**

As new drugs, pharmaceuticals, and even cosmetics come onto the market in ever increasing numbers each day, and as medical techniques, including surgical, get increasingly refined, all of us need to remember that before they were certified as fit for humans, more often than not they would have been tried out on some defenseless animals under conditions of indescribable cruelty. The voices of those who are against using animals for medical research, are now being increasingly heard through the formation of bodies like the Animal Liberation Front. Recently the location of a controversial new research laboratory in Oxford, has once again focused attention on this issue.

**Pros of Vivisection**

Those in favour of animal research, argue that the development of medicines and medical procedures would never have got to where it is today without animal experimentation. Anyone with diabetes would be dead, and anyone with cancer would have no hope of being treated had it not been for research which had first been tried out on animals. The assertion that experimentation on animals is no guarantee of predictability in humans, is sought to be assailed by the argument that just as computers cannot predict all the vagaries of nature, the effect of drugs on animals are not always good indicators of what the drug will do to humans. But still it is the closest we are going to get; and that is why we have tests on humans as the last stage. It is contended that to attempt to stop animal testing is foolish and would cost lives.

Others in support of vivisection point out that given that all drugs and medical procedures have to be tested before entering into common use, how can this be done, if not on animals? Biological scientists cite the case of the recent "wonder drug" Herceptin. This is a "humanized antibody" which is produced after immunization of a laboratory mouse, and then the "humanization" of the mouse antibody to make it safe and effective for breast cancer patients. Without animals, there would be no Herceptin and to the animal rights activists the reply is--remember, that cancer patient may well be some one who is near and dear to you. Would it be right to decline treatment with Herceptin to that person merely because some mice suffered a little discomfort or shortened life span to make it all possible?

**Animal Experimentation**

On the other hand, the animal rights activists argue that although animal experimentation has been going on for over a century, there is no proof that such experimentation was the key to medical advances or that progress could not have been made without them. Predictability is a scientific requirement and animal experimentation have no predictable value which is why they are misleading and dangerous. They point out that if animal testing were indeed so necessary and reliable as is made out, how is it that animal tested prescription drugs are killing thousands of people every year? How come a long list of side effects is given with every drug that is prescribed? The example is cited of the drug Vioxx which resulted in thousands of deaths, even after it was tried out on animals before proceeding to clinical trials. Indeed it is stressed that major health improvements have come not from medical advances but from sanitation, diet and other factors, none of which were dependant on animal experimentation.

These votaries in favour of a drug-free, holistic, and carefully planned dietary regime point out that organisations of doctors opposed to vivisection purely on scientific grounds (in addition to the hundreds formed to oppose animal cruelty) have sprung up in Austria, Belgium, France, Germany, Greece, Italy and Japan. They have been making efforts to educate the media about the sheer inadequacy and dangers of using other species as models for humans. These efforts do not capture media attention because they are far removed from the emotional threats, property damage and violence perpetrated by certain sections of the animal rights movement but are no less committed to their cause.

Others point their finger to the sheer cruelty involved in animal testing. To those that have not formed an opinion on the subject, they advise that the doors of these animal testing facilities should be opened for them to see the terrible cruelty and the waste of life that goes on there. To them, animal testing is morally and ethically wrong, for which there can be no justification, because to cause pain deliberately and make an animal suffer can never be right.

**Striking a Balance**

In the interest of scientific research, it may not be possible and indeed even desirable to prohibit animal experimentation altogether, but surely there is a strong case for strictly regulating it in all non-essential areas, such as the manufacture of cosmetics, so that the loss of life and pain caused are kept down to the absolute minimum.

## TECHNOLOGY DEVELOPMENT

### R&D COMMERCIALISATION

#### Intel Boosts Business Desktops

Intel Computer Co is developing a number of new technologies within its upcoming business desktops to increase its market presence and draw in new users.

The new computers named Averill PC's will come out into the market by the middle of this year, and will be able to receive support from a remote technician, should a hard drive failure or other hardware issue occur.

The PC has a new dual core processor and the graphics technology and virtualization of the new 965 chipset will provide far better processor performance in comparison with Intel's old business PC technology. The new PCs will be ready for Microsoft Vista as soon as businesses are prepared to upgrade. According to Intel executives, the new PCs are the biggest leap forward in end-user capabilities that has been witnessed in the last five years. It remains to be seen how soon it will be overtaken by yet more powerful processors.

*(CIO News Alerts, Mar 8, 2006)*

#### Motorola Teams Up with Microsoft

Motorola has announced that it has signed an agreement with Microsoft to use Windows technology in a new range of music phones that would sell alongside its iTunes phone developed with Apple.

Motorola had hoped to cash in on Apple's digital music success when it began producing iTune phones nearly a year ago. However, its limited storage capacity, particularly when compared to Apple's own iPod players which can store thousands of songs, its bulky design, and the fact that operators could not sell and transfer songs directly to the phone, dampened its sales.

These new music phones will be able to download music over the air by operators and also directly from a computer.

Motorola is the world's second biggest mobile phone maker after Nokia, and the two handset makers together produced more than half the 810 million phones that were sold last year.

At stake is the emerging market for legally distributed digital music which Apple Computer Inc. has opened with its iTunes music player and Apple has sold one billion tracks since iTunes was launched.

*(New York Times, Feb 13, 2006)*

#### Plasma Arc Lamp

Oak Ridge National Laboratory (ORNL), in Tennessee, USA has developed a 750 kilowatt radiant plasma arc lamp that has several times a higher heating rate and three times higher processing temperatures than is possible with conventional technologies.

These capabilities coupled with the proprietary "pulse thermal processing" technology has great potential in photovoltaics which is already a \$500 million industry. It is growing at the rate of 40 percent per year, and by 2020 is projected to generate revenues of \$15 billion worldwide.

*(ORNL, Feb 14, 2006)*

#### Recognition for Commercialising Technology

The US Department of Energy's Pacific Northwest National Laboratory is a well recognized institution for transferring technologies that can analyse massive amounts of data, neutralize toxic chemicals from the environment to increase surgical implant rates, and even find treatments for cancer.

The brachytherapy seed cancer treatment developed in the Laboratory, uses cesium -131, a radioactive isotope to provide a cancer killing dose effectively and quickly to a tumour. This technology which was patented in 2000 and is currently available in 17 centres across the USA, has been useful in treating and curing prostate and other forms of cancer.

For data analysis, Starlight visualization software, also developed in the Laboratory, is being used by nearly 40 organisations including some Fortune 500 companies. This software can integrate many different data systems and formats, perform high speed high efficiency analysis and display the results graphically.

Similarly, for the removal of toxic chemicals, a technology called SAMMS (self-assembled monolayers on mesoporous support) has been successfully commercialized which can remove metal contaminants without creating waste products. For surgical implants, a water-based thin film calcium phosphate technology has been developed which enhances bone bonding and reduces post-surgical infection.

*(PNNL Newsroom, Feb 15, 2006)*

## INTELLECTUAL PROPERTY

### Europe's Patent System Expensive

At a recent public hearing held on intellectual property, several speakers bemoaned the fact that innovation in Europe was being discouraged because of the high costs of obtaining patents.

It was pointed out that a patent from the European Patent Office or national patent offices could cost up to 100,000 euros, which was twice as much as the cost of a patent in Japan, and three times the cost of a US patent.

The lack of legal certainty in the European patent system was also criticized as a factor which inhibited innovation.

An Italian member of the European Parliament who was also the Chairman of the Legal Affairs Committee, wanted to see uniform and standardized legislation operating in Europe over patents so that it could compete effectively with the USA.

The participants noted the close linkage between IP protection and economic development, and that the 20 countries with the highest IP protection were among the 27 richest countries in the world.

*(CORDIS Technology Marketplace, Feb 2, 2006)*

### Patent Record

While the high cost of filing patents and the absence of legal certainty is hampering innovation in Europe, North Eastern Asia is witnessing a tremendous surge in this activity since 2000.

The number of patents filed by China has increased by 212 percent during this period, and the country has climbed to 10th place, overtaking Canada, Italy and Australia. South Korea has dislodged the Netherlands at position number six.

These figures are available in the records maintained under the WIPO's Patent Cooperation Treaty (PCT) which enables inventors to obtain patent protection internationally by filing one international patent application.

The USA continues to top the PCT user table, filing 33.6 percent of all patents (an increase of 3.8 percent during 2004), followed by Japan with 18.8 percent (a 24.3 percent increase); Germany; France and then the UK. Among the companies, Philips (Netherlands) filed the

largest number of patents (2492), followed by Matsuhita (Japan), Siemens (Germany), and Nokia (Finland).

*(CORDIS Technology Marketplace, Feb 7, 2006)*

### Seat Belt Tension Sensor

A sensor has been patented which can test the level of tension in a seat belt and meets the felt needs. It is small in size and provides accurate and reliable tension sensing while allowing cost-effective manufacture and installation.

The sensor includes a main plate; a travel member a magnet coupled to the travel member; the sensor which is coupled to the main plate and is adjacent to the magnet; a leaf spring which is in a fixed position relative to the main plate; and a bias spring.

The sensor provides an output in response to the relative movement indicative of the tension applied to the seat belt, the spring force being provided by the leaf spring.

The inventors are Susan M Barnabo; Ronald Frank ; and Thomas Babington, all of Massachusetts, USA and the assignee is Stoneridge Control Devices Inc. also of Massachusetts. The application for the patent was filed on 20 January 2004 and the patent was awarded in a period of a little less than two years on 27 Dec. 2005.

*(US Patent Office, Jan 20, 2006)*

### Three Million Patents in 30 Years

The US Patents and Trade Marks Office granted the seven millionth patent on 14 February 2006. It may be recalled that the four millionth patent was granted on 28 December 1976. With the five millionth patent being granted on 19 March 1991, it took over fourteen years to grant that range of million patents. With the six millionth patent being granted on 7 December 1999, it took less than 10 years in the grant of this range of patents and it took only a little over six years to the grant of the next million patents.

The seven millionth patent granted in February 2006 related to Polysaccharide fibers, the inventor being John.P.O'Brien. The patent was applied for on 19 January 2000 and it took a little more than six years for the grant of the patent.

The patent is assigned to Dupont.

*(USPTO Website)*

## TECHNOLOGY FUNDING

### Clear Skies Initiative

The renewable energy industry in the UK has responded well to the increased demands from the market that has been stimulated by the renewable energy grants scheme under the Clear Skies Initiative.

Under this Initiative, householders, non-profit organisations such as registered charities and trusts, housing associations, schools, local authorities, and hospitals are encouraged to apply for grants and assistance for realizing the benefits of renewable energy. The renewable energy technologies promoted are solar, thermal, wind, small-scale hydro, biomass, and ground source heat pumps.

Applications were considered for up to 50,000 pounds or 50% of the total project cost, whichever is lower. Householders are encouraged to apply for grants at any time for the same technologies, although the grant levels are somewhat lower and dependent on the technology to be installed.

Scotland has put up a 3.7 million pound fund separately to fund its own parallel scheme.

*(bre.co.uk, Feb 2, 2006)*

### Lending Activities of European Investment Bank

The European Investment Bank (EIB) lent a total of 47.4 billion euro in 2005 which included 10.7 billion euro for innovation and research.

All these loans went to projects for furthering the EU's political objectives, namely: economic and social cohesion in the enlarged EU; an innovative and knowledge-based European economy; trans-European networks; environmental protection; and support for EU development and cooperation policies.

Meanwhile, the European Investment Fund (EIF), the EIB's venture capital arm and guarantee provider invested 368 million euro in venture capital funds in 2005.

The EIB supports the Lisbon goal of creating an information and knowledge-based economy with its 'Innovation 2010 initiative' (i2i). The total invested in the initiative since 2000 is 34.8 billion euro, and the target is to mobilize 50 billion euro in support of the Lisbon strategy by 2010.

*(CORDIS Technology Marketplace, Feb 13, 2006)*

## Research at the Intersections of Disciplines

In a freewheeling interview given to 'Brainstorm', the Newsletter of Stanford University's Office of Technology Licensing (OTL), Dr A Bienentock who is the University's ViceProvost and Dean of Research and Graduate Policy, and is also responsible for OTL, advocated strongly in favour of facilitating and funding research at the intersections of disciplines, while maintaining the integrity of the disciplines themselves.

He emphasized that Stanford was moving to foster research in which the faculty and students from different schools and departments worked together. Sometimes the goals of different departments were in conflict, but these conflicts had to be managed so that both the disciplines and the interdisciplinary programmes remained strong.

Acknowledging that access to instrumentation was often very expensive to purchase and maintain, he cited the instance of the Stanford Synchrotron Radiation Laboratory which provided very modern instrumentation to the entire area, and indeed people from academia and industry from around the country and in fact from around the world, could come and use it for a few days and leave. This arrangement enabled those at Stanford to interact with some of the world's outstanding scientists, besides optimizing the use of such facilities. This was therefore a model which could be usefully emulated elsewhere.

He also stated that he took seriously the responsibility of universities getting their innovations out into the market place so that the nation's economy would be strengthened. The primary goal was not to make money but to get the inventions out into the market. OTL had done very well in this regard, and as a consequence, not only had Stanford made a lot of money, but it had also acquired valuable friends. The money thus earned had been used partly to give the University's young faculty an opportunity to try new things and part of it had been used to get new scientific instrumentation.

He observed that the University thrived when the economy thrived and good relationships were cemented with neighbouring industries. such as the Hewletts, the Packards, etc. He noticed a trend where industry was looking towards academia for long term basic research and were not only functioning as consortia members to provide financial assistance for long term innovative research, but were acting as spokespersons for government funding of academic research.

*(Brainstorm, Winter 2006)*

## EXPERTS CONVERGE

### CSIR Research & Innovation Conference

The South African Council for Scientific and Industrial Research (CSIR) was scheduled to host its first Innovation and Research Conference on 27-28 February 2006 to assess its technological strengths and illustrate the deployment of these strengths in meeting national needs and priorities.

The CSIR was constituted by an Act of Parliament in 1945, and has become one of the leading scientific and technology research organisations, with state of the art infrastructure and has delivered several products based on research excellence.

CSIR's core research areas are bio-sciences; defence, peace, safety and security; natural resources and the environment. The organisation has several national research centres under its umbrella, including the African Advanced Institute and the Satellite Applications Centre.

Forging local and international links to provide world class technology to boost national competitiveness in a global economy is an integral part of CSIR's goal, and it hopes to make a visible difference to science and technology in the country. The Conference is one of the steps that is being taken to achieve that goal.

*(CSIR, Mar 9, 2006)*

### Taking Innovation to Developing Countries

Friends of Europe held a public meeting on 24 January 2006 where the participants discussed 'Technology, globalisation, and inclusion: is Innovation a development tool?'

The focus of discussion was around three main themes---barriers to trade, government intervention and education with the various speakers taking different routes while exploring the three themes. The participants looked towards education as a major force for pulling the developing countries into the developed world, so that the products manufactured by them could compete in the world marketplace by being both cheaper and better. However, a note of caution was sounded as the participants acknowledged that there was yet no consensus on how to transfer the knowledge economy to the developing world.

*(CORDIS Technology Marketplace, Mar 9, 2006)*

## KNOWLEDGE SPREADS

### Knowledge Millennium Summit

New Delhi will be hosting the IV Millennium Knowledge Summit on 27-29 March 2006 on Nanotechnology and Biotechnology, when leading figures in the field of nanosciences will meet and discuss the cutting edge developments in this frontier area with particular reference to the emerging opportunities and trends in the global nanotechnology and biotechnology industry. In particular, the focus of this Knowledge Summit will be on the interface between bioscience and nanotechnologies, both of which are likely to dominate the present century.

The Millennium Speaker will be Nobel Laureate Sir Harry Kroto who won the Nobel Prize for chemistry in 1996 for his pioneering work in nanosciences. A galaxy of other eminent speakers and distinguished participants, will be gracing the occasion, and their deliberations will help disseminate knowledge about these sunrise disciplines much further afield.

*(Economic Times, Mar 21, 2006)*

### Outsourcing R&D

European pharmaceutical and biotechnology companies are outsourcing their R&D activities to an increasing degree to cope with the mounting costs of development and the ever lengthening drug discovery times.

Frost & Sullivan, a global growth consulting company in a recent study has estimated that the current level of outsourcing of R&D activity is 680 million euro per product, and the value of R&D activity which was 2.7 billion euro in 2004 is expected to rise to 4.3 billion euro by 2011. The study predicts that by then, nearly 40 percent of R&D would have been outsourced to more specialized firms. Those firms that succeed in outsourcing their R&D effectively to focused, research oriented specialists that complement their own processes, will emerge as leaders in that sector.

Pharmaceutical companies are therefore forming alliances with biotechnology firms, university research centres, contract research organizations, specialized vendors and general service providers. India and China with their low wages, and skilled manpower can expect to benefit greatly from this R&D outsourcing, while helping the European companies to reduce their costs.

*(CORDIS Technology Marketplace, Dec 11, 2005)*

## SCAN AROUND THE GLOBE

### Tree of Life For Beetles

CSIRO scientists in Australia have embarked on a Beetle Tree of Life Project which will build up an evolutionary history of beetle families and sub-families by gathering information from more than 3000 species and data on the morphology (structure and form) of adult and larval beetles. Fossils of beetles will also be used in the study to work out when major shifts in beetle life history occurred.

In Australia alone, 23000 species of beetles have been identified, and there are possibly anything from 80,000 to 100,000 such species on that continent. The shapes, colours and sizes of these beetles are truly very varied, and they form a very important part of all ecosystems, as some are plant feeders while others are predator scavengers, which feed on rotting plants, dung and carrion.

Worldwide, there are more than 350,000 described beetle species, making them the largest single branch in the tree of life. One of the most important phenomenon in the last 300 million years took place when the diversification of beetles occurred and this study will be a major step forward in deciphering the factors that led to that process.

(Australia - *CSIRO*, Mar 9, 2006)

### Encouraging Entrepreneurs

Europeans are concerned that they are way behind the Americans in the entrepreneurship stakes, but according to Margaret C Whitman, Chief Executive of the online trading site eBay, there is no lack of entrepreneurship in Europe.

According to her, Europe is one of the fastest growing markets for online trading, and she cites the example of Italy where someone sells a car or a motor cycle every 10 minutes on an average day on the website. Trading activity in Europe generated sales worth \$947 million in 2004.

However, according to her, the multiplicity of taxes in Europe is a definite disincentive to entrepreneurial activity and to spur online trading, she strongly advocates a single tax system for all the 25 EU countries.

(Belgium - *New York Times*, Feb 14, 2006)

### Technology and Innovation

The UK and Brazilian governments signed an action plan on 7 March 2006 to work together to assess the potential of collaborating with southern Africa to expand its bio-ethanol industry, as well as for forging stronger links on science, technology and innovation.

The signing ceremony took place during the state visit to Britain of the Brazilian President and the action plan envisages:

- proceeding with an analysis of the potential to expand sugarcane and sustainable bio-ethanol production in southern Africa.
- holding a 'Brazil Day' for scientists from both countries to be hosted by the Royal Society in May; and
- designating 2007 as a "UK: Brazil Year of Partnership in Science" in Brazil.

Brazil has considerable expertise in the production and use of bio-ethanol, and the benefits for southern Africa would include job creation, income generation and empowerment besides increased bio-ethanol production, which in turn will lessen the pressure on Brazil's domestic sugarcane resources.

(Brazil - *Govt. News Network*, Mar 9, 2006)

### Agreement for Sale of Pharma Group

Bioniche Life Sciences Inc, a research-based technology driven Canadian pharmaceutical company, has announced that it has entered into a purchase and sale agreement for the sale of Bioniche Pharma Group Ltd, its sterile injectables manufacturing subsidiary based in Ireland to a US company.

This transaction has a potential value to Bioniche of approx \$33 million.

The sale achieves several corporate objectives for Bioniche, which includes the elimination of a significant portion of its consolidated debt; the provision of future liquidity; and help to maximise the success of the pharma group. At the same time it will allow Bioniche an ongoing minority ownership position.

The Bioniche balance sheet is expected to improve significantly as a result of this transaction.

(Canada - *Biospace.com*, Jan 15, 2006)

### Nanotechnology - the Sunrise Technology

Nanotechnology deals with research and investigation of very small structures, and substitutes the idea of "ever higher, ever wider" with the equally potent concept of "ever smaller, ever faster". It is considered to be the technology of the future, and Germany leads Europe in this frontier area.

Nano in Greek means dwarf, and one nanometre is a millionth part of a millimetre. By way of comparison a human hair is fifty thousand times thicker. Nanotechnology is opening out into areas of both animate as well as inanimate matter and its applications are now to be found in energy technology (fuel cells and solar cells); environmental technology (materials cycles and disposal); information technology (new memories and processors); healthcare, etc.

Nanotechnology makes use of the special mechanical, optical, magnetic, electrical and chemical characteristics of microscopic structures and among its other benefits, develops the basis of increasingly small data memories, with increasingly large storage capacity.

The USA and Europe have roughly the same number of nanotechnology-related companies, and about half the European firms are German firms which makes it the European leader in this sunrise field.

(Germany - *BMBF, Mar 8, 2006*)

### Systems Biology

A pathbreaking collaboration agreement has been signed between the Systems Biology Institute in Tokyo and Edinburgh University's College of Science and Engineering to conduct research into the emerging field of "systems biology", which will help deal with some of the most difficult challenges facing medical researchers in the fields of disease treatment and drug discovery.

Systems biology goes back nearly 50 years to ideas based on developmental biology that formed what became known as "epigenetic landscape", a phrase to denote the dynamics of the biological developmental process. Now the mapping of the human genome and the availability of powerful computing technology has advanced that nascent discipline into a new research model called "Systems Biology".

Already the collaboration is attracting commercial and academic interest.

(Scotland - *Communication and Pub Affairs, 8 Mar, 2006*)

### Carbon Dioxide for Oil Recovery

UK's Shell Oil Co. and Norway's Statoil have announced plans to take carbon dioxide from a power station in Norway and pipe it into oil fields in the North Sea, to force the oil up to the surface.

The \$1.2-1.5 bn scheme, which will require major investments by the respective governments, could go on stream by 2010. It is not only expected to help the companies exploit their available oil reserves better, but is viewed by many as an important step in the battle against emitting greenhouse gas into the atmosphere. Statoil already extracts carbon dioxide from a natural gas well in one of its oil fields, and the use of compressed carbon dioxide to enhance oil recoveries is already much in use in North America.

However, some environmentalists are sceptical about the anti-pollution benefits of such carbon capture and storage, and contend that it diverts valuable funds from investment in renewable energy technology.

(UK- *BBC News, Mar 8, 2006*)

### Cosmetic Surgery

Dr R Valikhnovsky of the Valikhnovsky Surgical Clinic in Kiev, Ukraine, has commenced new cosmetic surgical procedures that use the company's live biological tissue welding technology.

To date the doctor has performed 35 cosmetic surgeries for breast reduction, breast implants, mastopexy, and abdominal plasty. He is very pleased with the results, as, according to him, the surgery time is reduced by half, and the healing time is twice as fast, with no hematoma or seroma, and the tissue welding provides a leak-proof seal.

The tissue welding /bonding technology for repair and reconnection of tissue does not lead to any heat migration or necrosis, and obviates the use of foreign matter or wound-closing devices such as staples, sutures, glue or sealants. The procedure is almost bloodless, and leaves little or no scar which is visible to the naked eye.

The doctor's patients include actors, actresses, movie stars, recording stars and some of society's most elite citizens from Ukraine, Russia, Canada and the USA.

(Ukraine - *CSMO Press Release, Mar 8, 2006*)