Highlights

- New mechanism of genomic instability revealed
- Proteins used to map ageing process in humans
- Polymers that make proteins form crystals
- Coffee ingredient protects against Alzheimer’s disease
- Fake red blood cells to deliver cancer-fighting drugs
- New strategy for drought tolerance in crops
The **Asian and Pacific Centre for Transfer of Technology (APCTT)**, a subsidiary body of ESCAP, was established on 16 July 1977 with the objectives: to assist the members and associate members of ESCAP through strengthening their capabilities to develop and manage national innovation systems; develop, transfer, adapt and apply technology; improve the terms of transfer of technology; and identify and promote the development and transfer of technologies relevant to the region.

The Centre will achieve the above objectives by undertaking such functions as:

- Research and analysis of trends, conditions and opportunities;
- Advisory services;
- Dissemination of information and good practices;
- Networking and partnership with international organizations and key stakeholders; and
- Training of national personnel, particularly national scientists and policy analysts.

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**Cover Photo**

Human embryonic stem cell colony cultured under self-renewing conditions on mouse embryonic fibroblast (MEF) feeders.

*(Credit: University of California, Los Angeles, the United States)*
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## TECH EVENTS
IN THE NEWS

United States backs new drugs and vaccines

The United States has budgeted US$1.9 billion for new biotech initiatives that can fight off the biological threats of the future. The government’s Biomedical Advanced Research and Development Authority has already handed out contracts worth potentially more than US$100 million to help accelerate work on a range of drug and vaccine development technologies.

The R&D push is occurring as the Department of Health and Human Services (DHHS) is pushing through a major revamp of its bio-defence initiative, which includes US$678 million that will go to non-profit groups, which in turn will pump money into small biotech firms working in the field, according to a report in Global Security Newswire. The goal is to create a “nimble, flexible capacity to produce medical countermeasures rapidly in the face of any attack or threat,” says DHHS Secretary Ms. Kathleen Sebelius. While much of that cash will go to new therapies for biologic weaponry like anthrax, the lion’s share of the money, US$822 million, is being spent on vaccine technology with an eye to reduce radically the amount of time it takes to deliver large stockpiles of vaccines to ward off a pandemic. (Source: www.pharmafeed.com)

Indian biotech industry to reach US$10 billion by 2015

India’s biotechnology sector is set to reach US$10 billion revenue by 2015 from US$4 billion posted in fiscal 2010-2011 through innovative products and services. Though India’s share in the US$180 billion global biotech industry is negligible, the sector grew 33 per cent in fiscal 2011 from US$3 billion. The global biotechnology industry is beginning to look towards emerging economies like India, Brazil and China to drive further growth in the industry.

Frost & Sullivan, a global research and consulting firm, reports that the Indian biotech industry missed the revenue target of US$5 billion set for the fiscal year under review. The global biotech industry will zoom US$433 billion by fiscal 2015. India ranked among the top dozen biotech destinations worldwide and third largest in the Asia-Pacific region. “Indian companies need to ensure capacity expansion and attract talent to meet the manpower shortage,” said Ms. Kiran Mazumdar Shaw, Chairperson of Biocon and the Karnataka Biotech Vision Group. Mr. Krishnan G.S., Regional President, Novozymes South Asia, opined that India’s progress in biotechnology is less than 10 per cent of that of China’s. There is tremendous opportunity in India, but it hasn’t been explored, he felt. (Source: www.siliconindia.com)

Scientists launch new insect genome project

The 5,000 Insect Genome Project, or i5k Initiative, was recently launched with a letter to Science journal from a group of ten scientists known as the i5k Ad Hoc Launch Group. The Initiative aims to sequence the genomes of 5,000 insects and other arthropods over the next five years in order to “improve our lives by contributing to a better understanding of insect biology and transforming our ability to manage arthropods that threaten our health, food supply, and economic security”.

“We hope that generating this data will lead to better models for insecticide resistance, better models for developing new pesticides, better models for understanding transmission of disease or for control of agricultural pests,” said Mr. Daniel Lawson, a coordinator at the European Bioinformatics Institute, based in Cambridge, the United Kingdom. “This will provide information that breeders would need to look at for ways of dealing with insect resistance to pesticides. It would also provide geneticists with information on what might be vulnerable points in an insect’s makeup, which could be used for novel control strategies,” noted Ms. Gene Robinson, a professor at the University of Illinois at Urbana-Champaign, the United States.

The leaders of the i5k Initiative invite entomologists around the world to sign up and to create wiki pages at http://arthropodgenomes.org/wiki/i5K in order to recommend the insect genomes that should be sequenced in the future, report the insect genomes that are already being sequenced,
and to start conversations with other scientists who are working on similar projects. (Source: www.entsoc.org)

**World's largest video data bank of proteins opened**

After four years of conducting intensive calculations in the supercomputer MareNostrum at the Barcelona Supercomputing Centre, Spain, scientists led by Mr. Modesto Orozco at the Institute for Research in Biomedicine (IRB Barcelona) have presented the world’s largest data base on protein motions. Called MoDEL, this new database holds more than 1,700 proteins and is partially accessible through Internet to researchers worldwide. MoDEL has been developed to study the basic biology of proteins and to accelerate and facilitate the design of new pharmaceutical agents. At present, MoDEL covers more than 30 per cent of human protein structures that are potential targets of a new drug.

Drugs are currently designed as if the proteins against which they are to act were static, leading to many failures in the development of new drug therapies. “With MoDEL this problem is solved because it offers the user from 10,000 to 100,000 photos per protein, and these confer movement to these structures and allow a more accurate design,” says Mr. Orozco, Head of the Molecular Modelling and Bioinformatics Group at IRB Barcelona, Director of the Life Sciences Programme of the Barcelona Supercomputing Centre and a professor at the University of Barcelona. According to him, several pharmaceutical companies are already using the MoDEL strategy to develop the first drugs against cancer and inflammatory diseases. (Source: www.proteomicsnews.com)

**Indian company provides access to biomarker database**

GVK Biosciences, an Indian contract research company, has signed a deal allowing pharmaceutical researchers across the United States to access GVK’s clinical online biomarker database GOBIOM, according to Outsourcing-Pharma. The database holds information on 12,000 biomarkers with multiple data points covering experimental, analytical, clinical and statistical information.

Under the agreement, which was facilitated by the Indiana Economic Development Corporation (IEDC), the data will be available to researchers at 55 medical centres and universities supported by the Clinical and Translational Sciences Award from the National Institutes of Health (NIH). The agreement follows a similar one that GVK signed a few months ago with the United States Food and Drug Administration (FDA), which granted FDA the right to use GOBIOM data to further develop its guidance on biomarker qualification, a draft version of which was published last October. GVK has worked with FDA since 2007, granting the agency’s genomics group access to its database of clinical biomarkers for use in the development of the Voluntary Genomics Data Submission programme. (Source: www.centerwatch.com)

**Philippines emphasizes biotech industry development**

In the Philippines, the Congressional Commission on Science, Technology & Engineering (COMSTE) has prioritized the development of Biotechnology for Health and Food Security as one of its flagship projects for 2011, recognizing its vast potential for investment. Senator Mr. Edgardo J. Angara, Chair of COMSTE, said that he has also filed the Biotechnology Industry Development Act of 2010 to support the initiative of the Commission.

The proposed Bill “intends to address the weaknesses of our system to enable the country to develop a biotechnology-based industry. The private sector is given incentives to invest in biotechnology R&D by allowing the total R&D cost and prices of shares of stocks in biotech companies as tax deductible. Majority of the government’s investments in biotechnology R&D is awarded through a government corporation so as to lessen the burden of an unwieldy accounting and auditing system.”

Mr. Angara said, “The Philippines was one of a handful of countries that kept relatively strong economic growth throughout the global recession. But as the world’s fastest growing economies have shown, it is not merely enough to stay afloat. It is more pressing now than ever to ensure that the country has the capability to create knowledge and harness innovation.” (Source: www.senate.gov.ph)
**MARKET NEWS**

**Alliance between HUYA Bioscience and Health Technology Park**

In China, HUYA Bioscience International, a leader in globalizing China’s biopharmaceutical innovations, has entered into a strategic partnership with the Zhongshan National Health Technology Park (ZNHTP). The alliance will unite the strength and resources of both parties to accelerate the pace of China’s pharmaceutical discoveries.

Under the new agreement, ZNHTP and HUYA will collaborate to promote new drug development. HUYA may attend project promotion events and actively participate in the annual health and development forums at the ZNHTP, or organize its partners to participate in the events. It will have the first opportunity to provide assistance in evaluating R&D projects conducted by pharmaceutical enterprises residing in the Park. HUYA will be able to internationalize select programmes through innovative co-development model and the company’s worldwide pharmaceutical partners, thereby introducing qualified projects from companies in the park into global markets. (Source: www.biospectrumasia.com)

**Eli Lilly and Lupin announce strategic collaboration**

In India, Eli Lilly and Lupin have entered into a strategic collaboration to promote and distribute Lilly’s Huminsulin range of products. Lupin’s India (Formulations) business unit will promote and distribute the range of diabetes care products in India and Nepal, virtually doubling the number of sales representatives pushing the products. This collaboration will double the current customer base and approximately 45,000 doctors will now be called on as a result of the new partnership.

For Eli Lilly, caring for the estimated 51 million diabetes patients (one-fifth of all patients with diabetes globally) in India is a priority. It hopes to increase access to Huminsulin products through its relationship with Lupin India, bringing one of the most basic and proven therapies for diabetes treatment to more patients. This strategic collaboration is expected to achieve major synergy arising from the strength of the product portfolio of Lilly and the promotion and distribution capabilities of Lupin. (Source: www.prnewswire.com)

**Tesaro nets US$101 million in B round capital**

In the United States, the veteran crew of cancer drug developers at MGI Pharma who went on to found Tesaro Inc. about a year ago have rounded up a whopping US$101 million B round capital raising, led by Kleiner Perkins Caufield & Byers. This gives Tesaro more cash to follow up on its late-stage plans for a lead drug programme as well as a sizeable fund for new deals.

“This new capital will fully fund the development of rolapitant through Phase III clinical trials and potential regulatory submissions, and advance the ALK (anaplastic lymphoma kinase) inhibitor programme into a clinical trial assessing safety and activity in cancer patients,” says Tesaro CEO, Mr. Lonnie Moulder. Rolapitant is described as a “Phase III-ready” neurokinin-1 receptor antagonist being developed for the prevention of nausea and vomiting induced by chemotherapy. Mr. Moulder went on to add that the capital will also “allow us to continue to leverage the experience and competencies of our team to acquire and develop promising drug candidates with the goal of commercializing meaningful products for the treatment and support of cancer patients.” (Source: www.fiercebiotech.com)

**Generics unit buy opens up huge market for Cadila**

India-based Cadila Healthcare’s United States subsidiary has acquired the assets of Nesher Pharmaceuticals, the generic unit of the United States-based KV Pharmaceutical, for US$60 million in cash. The acquisition includes Nesher’s existing and future portfolio of generics, certain manufacturing facilities and an R&D lab. The Abbreviated New Drug Application (ANDA) pipeline it acquired comprises eight filings and five products under development. These put together will open up the US$7 billion United States market for generic-controlled substances for Cadila.
Cadila’s statement also mentions acquisition of the “assumption of certain liabilities” through the transaction. KV Pharmaceutical’s total liabilities for its generics business is pegged at about US $2.5 million (financial year 2011). While the consent decree of the United States Food and Drug Administration (FDA) of the manufacturing facility of KV Pharmaceutical is a cause for concern, that FDA allowed the generics company to resume sales of potassium chloride provides confidence. (Source: www.thehindubusinessline.com)

Alder gets US$15 million in milestone payment

In the United States, Alder Biopharmaceuticals is getting a US$15 million milestone payment from Bristol-Myers Squibb (BMS), now that the latter has launched a Phase IIb study of ALD518/BMS-945429, Alder’s IL-6 blocking antibody designed to combat rheumatoid arthritis. Alder has brought in US$67 million in venture backing along with the US$85 million that BMS paid upfront to partner on the IL-6 programme. If successful, Alder stands to reap more than a billion dollars from the deal. The company also has high hopes of its own work with the antibody as a potential treatment in cancer and cancer supportive care. (Source: www.bioportfolio.com)

Gilead inks combo HIV drug pact with Tibotec

In the United States, Gilead has are joined forces with Johnson & Johnson subsidiary Tibotec on a combo human immunodeficiency virus (HIV) treatment. Under the pact, Gilead will combine its new boosting agent cobicistat with Prezista, a protease inhibitor from Tibotec. This new therapy follows a well-travelled development path, as drug companies advance new HIV drugs that require fewer pills and offer greater potency.

Interestingly, the companies also outlined ongoing talks on a separate pact on the development and commercialization of a future single-tablet regimen (STR) combining Prezista with Gilead’s Emtriva, its experimental GS 7340 and cobicistat. Gilead would be responsible for the development and commercialization of the new STR on a worldwide basis. (Source: www.pharma-marketer.com)

Lupin and Natco tie up to market generic cancer drug

In India, Lupin Ltd. has allied with Natco Pharma Ltd. to jointly commercialize the generic similar of Tykerb® tablets for the United States market. Tykerb is the brand name under which Glaxo-SmithKline’s lapatinib ditosylate is sold and the product’s patent expires in 2017, a Lupin spokesperson said. Lupin will be involved with the product’s marketing and distribution.

Natco has filed an Abbreviated New Drug Application (ANDA) seeking the approval of United States Food and Drug Administration (FDA) for marketing the generic equivalent of Tykerb 250 mg tablets, Lupin said. Natco and Lupin believe that they are the ‘first-to-file’ ANDA containing a Paragraph IV certification for lapatinib ditosylate. Para IV involves a patent challenge, and on getting regulatory approval, the company could market the drug exclusively after the patent on the original drug expires. (Source: www.moneycontrol.com)

PITDC signs deals with United States companies

The non-profit Pharmaceutical Industrial Technology Development Centre (PITDC) of Taiwan province of China, has signed a mutual cooperation agreement with PharmaNet Development Group Inc., a leading global supplier of drug development services based in the United States. PharmaNet will lend its international experience in clinical development and regulatory affairs to PITDC and send experts to organize various training programmes in Taiwan province of China, explained Ms. Isabel Desmarais, Vice President of PharmaNet. Dr. Lo, Director of PITDC, said that his organization will eventually use the wide network of experts of PharmaNet to conduct clinical trials of drugs developed in Taiwan province of China.

PITDC also signed an agreement to co-develop some of its drugs with Aihol Biomedical LLC., the United States. The deal involves the formulation development of IBD98M, PITDC’s drug candidate currently indicated for treating inflammatory bowel disease. Aihol Biomedical will co-develop this biosimilar product further with Holy Stone Healthcare of Taiwan province of China, to treat other diseases. (Source: www.biospectrumasia.com)
New mechanism of genomic instability revealed

In the United States, researchers at New York University School of Medicine have discovered the cellular mechanisms that normally generate chromosomal breaks in bacteria, showing how bacteria generate mutations and adapt to stressors like antibiotics. Mr. Evgeny A. Nudler, Julie Wilson Anderson Professor of Biochemistry and co-author of the study, said: “The study is quite unusual, as it touches on several different fields of molecular biology at the same time: replication, transcription, translation and DNA repair.”

The study examines the collision of three major cellular moving “machines”: replisome, a protein complex responsible for DNA synthesis; RNA polymerase, an enzyme responsible for RNA synthesis; and ribosome, a molecular structure responsible for protein synthesis. Collisions between replisome and RNA polymerase happen frequently in cells because the two machineries share the same DNA track, but the speed of replisome is much more than that of RNA polymerase. However, the consequences of such collisions remained unknown.

The researchers found that co-directional collisions lead to DNA double strand breaks (DSBs) or mutations. Importantly, however, such DSBs appear only if the replisome collides with backtracked RNA polymerase. Backtracking of RNA polymerase along RNA and DNA is an intrinsic property of all cellular RNA polymerases. Collisions between replisome and RNA polymerase happen frequently in cells because the two machineries share the same DNA track, but the speed of replisome is much more than that of RNA polymerase. However, the consequences of such collisions remained unknown.

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Promising gene therapy for age-related macular degeneration

A gene therapy approach using a protein called CD59 (protectin) has shown promise in slowing the signs of age-related macular degeneration (AMD), according to a study by researchers at Tufts University School of Medicine, the United States. The researchers led by senior author Mr. Rajendra Kumar-Singh demonstrated that CD59 delivered by a gene therapy approach significantly reduces the uncontrolled blood vessel growth and cell death typical of AMD, the most common cause of blindness in the elderly.

Activation of the complement system, a part of the immune system, is responsible for slowly killing cells in the back of the eye, leading to AMD. Activation of this system leads to the generation of pores or holes known as ‘membrane attack complex’ or MAC in cell membranes. CD59 blocks MAC formation. Mr. Kumar-Singh and colleagues delivered CD59 to the eye using a deactivated virus. Using an established AMD mouse model, they found that eyes treated with CD59 had 62 per cent less uncontrolled blood vessel growth and 52 per cent less MAC than controls. Gene therapy approach to treat AMD is especially attractive, according to Mr. Kumar-Singh, because it will allow patients to be treated less frequently, reducing discomfort of patients and chances of infection associated with frequent injections into the eye. (Source: www.biospectrumasia.com)

Discoveries in mitochondria open up cancer research

Researchers at Virginia Commonwealth University Massey Cancer Centre, the United States, have revealed novel mechanisms in mitochondria that have implications for cancer as well as many other age-related diseases such as Parkinson’s disease, heart disease and hypertension. This discovery by Ms. Shirley M. Taylor and her colleagues has pioneered the formation of a whole new field within epigenetics research ripe with possibilities of developing future gene therapies to treat cancer and age-associated diseases.

In mammals, all cells have two distinct genomes, which contain all hereditary information. One set exists in the nucleus and the other exists in the mitochondrion, the energy generator of the cell. Ms. Taylor’s study found two DNA modifications in the mitochondrial genome: methylated cytosine, known to function in the nucleus by “silencing” the expression of certain genes; and hydroxymethyl
cytosine, which removes the silencing mark imposed by the cytosine methylation. These modifications together act like a genetic on/off switch in a process known as DNA methylation.

Ms. Taylor’s team also showed that the enzyme responsible for DNA methylation was present in mammalian mitochondria. The presence of these DNA modifications leads the team to believe that a system of gene control similar to what occurs in the nucleus is present in mitochondria, functioning to ensure the correct levels of proteins that are needed for proper energy generation. (Source: medicalxpress.com)

**New mechanism in the regulation of human genes**

To create proteins, the gene that does protein coding must be transcribed into RNA and shortened to the correct template in the splicing process. In Germany, scientists at the Helmholtz Zentrum München and Munich’s Technical University – working with their colleagues from the European Molecular Biology Laboratory (EMBL) in Heidelberg, Germany, and Centre for Genomic Regulation in Barcelona, Spain – have discovered how the U2AF protein enables pre-mRNA to be spliced to form mRNA, which serves as a template for protein synthesis in the body.

Splicing requires the action of different proteins, or splicing factors. U2AF, one such splicing factor examined by the scientists, comprises two structural modules and binds to the RNA near the intron-exon boundary. Dr. Michael Sattler, Director of the Institute for Structural Biology at Helmholtz Zentrum München, says: “The spatial structure of the U2AF protein alternates between a closed and an open conformation. A matching RNA sequence in the intron causes the U2AF to assume an open conformation, which activates splicing and eventually leads to the removal of the intron.”

The intron’s RNA sequence determines how effectively this change can be triggered. This shift of balance between the closed and the open form of the U2AF protein occurs through a process of conformational selection, that is, the RNA binds to a small fraction of the open conformation that already exists even in the absence of RNA. The scientists presume that similar mechanisms – balanced between a closed, inactive and an open, active conformation – play an important role in the regulation of many other signal pathways in the cell. (Source: www.sciencedaily.com)

**Gene-modified stem cells help protect bone marrow**

Researchers at Fred Hutchinson Cancer Research Centre, the United States, have reported that one possible approach to reduce the toxic effect of chemotherapy on bone marrow cells is to modify the cells with a gene that makes them resistant to chemotherapy. Dr. Hans-Peter Kiem, a member of Hutchinson Centre’s Clinical Research Division, and colleagues removed bone marrow stem cells from patients with brain tumours and modified them with a retrovirus vector for introducing the chemotherapy-resistant gene. The cells were then infused back into the patients. In a clinical trial designed to evaluate safety and feasibility, patients were safely administered gene-modified blood stem cells that persisted for more than one year and did not show any apparent harmful effects.

This approach was first attempted in patients with glioblastoma, a terminal form of brain cancer. The median survival for glioblastoma patients is just 12 to 15 months currently, partly because doctors cannot effectively use existing treatment. Glioblastoma cells make a large amount of a protein called MGMT that makes them resistant to chemotherapy, so doctors use a second drug, benzylguanine, to knock down MGMT. However, benzylguanine also disables MGMT in normal blood and bone marrow cells, leaving them very susceptible to the effects of chemotherapy. The results of the trial suggest that the administration of the modified cells represent a safe method to protect marrow and blood cells from the harmful effects of chemotherapy in brain tumour patients. (Source: www.geneticstimes.com)

**Genetic mutation linked to Parkinson’s disease**

Researchers have discovered a new gene mutation they say causes Parkinson’s disease. The mutation was identified in a large Swiss family with Parkinson’s disease, using advanced DNA sequencing technology. The study was led by
neuroscientists at Mayo Clinic campus in Florida, the United States, and included other scientists from North America, Europe, Asia and the Middle East.

The scientists found that mutations in VPS35, a protein responsible for recycling other proteins within cells, caused Parkinson’s disease in the Swiss family. Mutated VPS35 may impair the ability of a cell to recycle proteins as needed, which could lead to the kind of errant build-up of protein seen in some Parkinson’s disease brains and in other diseases like Alzheimer’s disease says co-author Mr. Owen Ross, Ph.D. a neuroscientist at Mayo Clinic. The expression of VPS35 has been shown to be reduced in Alzheimer’s disease, and faulty recycling of proteins within cells has been linked to other neurodegenerative diseases as well, he says. So far, mutations in six genes have been linked to the familial forms of Parkinson’s disease.

The researchers used a new genetic sequencing technique – called exome sequencing – to look for shared variations in a pair of first cousins within a Swiss family affected by Parkinson’s disease. Collectively, exons, which provide the genetic blueprint used in protein production, forms only 1 per cent of the entire genome and so it is much easier to look for novel variations. Cousins share only about 10 per cent of their genome, whereas parents and children or siblings share much more. This narrowed the field of novel variations for the researchers, with VPS35 emerging as the latest Parkinson’s disease gene. (Source: www.medicalnewstoday.com)

**Agricultural Biotechnology Capacity Database**

The Agricultural Biotechnology Capacity Database holds information on the objectives and results of public research in agricultural biotechnology, with the aim to inform all interested stakeholders and with the aim to facilitate collaboration in public research. It is a collaborative initiative of the International Food Policy Research Institute (IFPRI) and the Public Research and Regulation Initiative (PRRI), in concert with public research institutes and other organisations worldwide. The information in the database is provided by public researchers.

For more information, access:

http://ifpri.catalog.cgiar.org/abc

## PROTEOMICS

### Proteins used to map ageing process in humans

Loss of muscle mass is part of normal aging process. New research shows that nine proteins, isolated from blood, alter with age and that the profile of some of these proteins can be reversed by testosterone treatment. In a combined study in the United States, researchers from Boston University School of Medicine and University of Texas Medical Branch compared protein levels in serum samples from two groups of healthy men – young men aged 18-35 and older men aged 60-75. Seven proteins, which were either growth factors (IGF-1, IL-7, IL-12p40, PDGFbeta), or were involved in immune response (ENA78, MIP-1beta, IP-10), and pro-collagen (PIIINP) were all reduced in older men. In contrast, the monokine MIG, also involved in immune activity, was elevated.

Testosterone treatment increased lean muscle mass, and levels of the appetite suppressing hormone leptin, in both groups of men. Testosterone also raised levels of PIIINP and IGF-1 in young men and the researchers saw a similar increase in a small group of older men. Dr. Monty Montano said, “The blood proteins we found that altered with healthy aging also have links to maintenance of muscle, such as IGF-1 and pro-collagen, or are involved in regulation of the immune system, possibly reducing T-cell and neutrophil responses with age.” Furthermore, the proteins were also involved with the signalling pathways associated with ageing. (Source: www.proteomicsnews.com)

### Protein that causes hereditary blindness identified

At Ruhr-Universitaet-Bochum in Germany, scientists from the Department of Human Genetics led by Prof. Jörg T. Epplen have found the cause of a hereditary, progressive form of blindness. They have identified the previously unknown protein CCDC66, the loss of which initially leads to night blindness and in due course usually results in total blindness. The researchers demonstrated this using a mouse model.
The occurrence of progressive retinal atrophy (degeneration) – called retinitis pigmentosa in humans – had been first identified in the breed of dogs called Schapendoes. Based on the new findings, the researchers developed a genetic test for diagnosis in Schapendoes dogs that can also be used predictively in breeding. However, the research results are also potentially significant for humans. The scientists are currently investigating whether mutations of the CCDC66 gene could also be responsible for some retinitis pigmentosa patients.

The researchers developed a mouse model with a defect in the corresponding gene to obtain basic information on the consequences of CCDC66 deficiency in order to draw conclusions on the physiological function of the protein, explained Prof. Epplen. “Fortunately, the mice showed exactly the expected defect of slow progressive impaired vision,” he said. The team of scientists was able to anatomically and functionally study the entire development of the visual defect in the mouse in just a few months, whereas the normal progress takes years in humans and dogs. They found, for example, that CCDC66 protein is only localised in certain structures of the rods. (Source: www.sciencedaily.com)

Two low-key proteins may help create artificial chromosomes

Scientists at Whitehead Institute for Biomedical Research in the United States report that two proteins once thought to have only supporting roles, are the real “stars” of the kinetochore assembly process in human cells. Kinetochore is vital to proper DNA distribution during cell division. This finding suggests that scientists may be able to stimulate kinetochore assembly in a process that could lead to new genetic research tools, such as efficient creation of artificial human chromosomes. Kinetochore begins with a few proteins, takes on additional proteins as the cell division progresses, and ends as a complex consisting of about 100 proteins.

To identify the proteins necessary for a kinetochore to self-assemble, Ms. Karen Gascoigne, a post-doctoral researcher in Cheeseman Lab, positioned three of them on the DNA of chromatids (identical copies of a replicated chromosome) and away from their normal location on the centromere (the section where the arms of an X-shaped chromosome join). Ms. Gascoigne isolated the effects of each protein from potential interactions with the centromere by moving the proteins away from their normal position, and highlighted the capabilities attributable only to that protein.

The first protein, called CENP-A, is essential for identifying where the kinetochore should locate. However, when CENP-A was moved away from the centromere, only a few kinetochore components were recruited to attach onto CENP-A, showing that this protein is not responsible for assembling an entire kinetochore. When the proteins CENP-C and CENP-T were moved away, the proteins attracted almost all of the kinetochore proteins to their new location and fostered assembly of a makeshift kinetochore capable of separating sister chromatids. This showed that CENP-C and CENP-T proteins are essential and sufficient to build the kinetochore even when CENP-A is absent. (Source: www.geneticstimes.com)

Polymers that make proteins form crystals

The number of proteins identified as potential drug targets is increasing exponentially as scientists make progress in the fields of genomics and proteomics, but with current methods, scientists have successfully obtained useful crystals for less than 20 per cent of proteins that have been tried. Getting a protein in a solution to form a crystal has been very difficult.

In the United Kingdom, researchers at Imperial College London and the University of Surrey have developed a more effective method for making proteins crystallize using ‘molecularly imprinted polymers’ (MIPs) – compounds made up of small units that bind together around the outside of a molecule. When the molecule is extracted, it leaves a cavity that retains its shape and has a strong affinity for the target molecule. This property makes MIPs ideal nucleants – substances that bind protein molecules and make it easier for them to crystallize. MIPs use the protein as a template for forming its own crystal. Once the first molecule or group of molecules is held in place, other molecules can arrange themselves around it and start to build a crystal.
In the study, led by Professor Naomi Chayen, from the Department of Surgery and Cancer at Imperial College London, and her colleagues found that six different MIPs induced crystallization of nine proteins, yielding crystals in conditions that do not give crystals otherwise. They also tested whether MIPs would be effective at producing crystals from a series of preliminary trials for three target proteins for which scientists have not previously been able to obtain crystals of sufficient quality. The presence of MIPs gave rise to crystals in 8-10 per cent of such trials, yielding crystals that would have been missed using other known nucleants. (Source: www.sciencedaily.com)

### Long-standing membrane protein mystery unravelled

Synaptophysin is the first protein and most abundant ever found on the membranes surrounding the tiny sacs called vesicles that carry chemical messengers to synapses, the gaps where communication between nerve cells occurs. But even though the loss of synaptophysin has recently been linked to learning deficits and mental retardation, scientists have been unable for more than a quarter-century to explain what it actually does.

At University of Wisconsin-Madison (UW-Madison) in the United States, a research team has now shown that synaptophysin controls the replacement of the constantly needed vesicles. According to team led by Dr. Edwin Chapman, a Howard Hughes Medical Institute professor at the UW-Madison School of Medicine and Public Health, the process in the nervous system begins when an impulse triggers exocytosis – a vesicle releasing neurotransmitter at the synapse. Then, a receiving neuron on the other side of the synapse binds to the neurotransmitter and activates a signal. To wrap up the first phase, the spent vesicle is incorporated into the donor cell membrane. In endocytosis or the recovery phase of the process, a new vesicle is taken from the donor cell surface and reloaded with neurotransmitter.

In a mouse genetically engineered to have no synaptophysin, Dr. Chapman’s graduate student Mr. Sung E. Kwon attached a fluorescent tag to a vesicle protein and examined the exocytosis-endocytosis cycle optically. Mr. Kwon also used electrophysiological methods to analyse signalling in normal versus synaptophysin-free vesicles. The experiments showed that the lack of synaptophysin did not affect exocytosis, but produced a clear deficit in the recycling of vesicles during endocytosis. Mr. Kwon was able to confirm the effect when he inserted synaptophysin and regained normal endocytosis. The study may lead to future drugs that could restore normalcy when vesicles are not utilized efficiently. (Source: www.news.wisc.edu)

### Protein levels in spinal fluid may spot Alzheimer’s disease

High levels of a protein in the spinal fluid of older people with mild memory loss may help predict which patients will develop Alzheimer’s disease, a recent study shows. The study by researchers at Germany’s Technical University Munich looked at levels of amyloid precursor protein (APPB) in patients with mild cognitive impairment (MCI). The researchers found that high levels of APPB were linked to later development of Alzheimer’s in the patients.

Elevated AAPB in combination with elevated tau protein, which indicates brain cell damage, was about 80 per cent accurate in predicting progression of Alzheimer’s disease in elderly patients who entered the study with MCI. If the findings are confirmed, cerebrospinal fluid APPB could help identify patients who will benefit from emerging Alzheimer’s treatments early in the course of their disease, says researcher Dr. Robert Perneczky.

Dr. Perneczky and colleagues took samples of cerebrospinal fluid from 58 patients with MCI and then followed the patients for three years. The fluid was tested for levels of APPB, as well as tau protein and other markers. During the follow-up study, 21 participants developed Alzheimer’s disease, 27 retained the diagnosis of MCI, and eight patients showed memory improvements. The average APPB levels for those who progressed to Alzheimer’s were much higher than for patients who did not progress. Age and levels of APPB and tau protein together were the best predictor of whether an MCI patient would develop Alzheimer’s disease: roughly 80 per cent accuracy in predicting progression to the disease. (Source: www.webmd.com)
Genetically altered pig tissue may suit human transplantation

A genetic discovery by Chinese scientists may one day allow pig tissue to be transplanted successfully into humans. The research represents a major step forward towards filling the shortage of vital organs for human transplantation. At the core of their work, the scientists showed that overexpressing the human programmed death ligand-1 (PD-L1) molecule in the endothelial cells of pig arteries reduces the conditions that lead to rejection. This strongly suggests that humans could receive altered porcine organs with fewer complications. “Genetically engineered pigs may someday overcome the severe donor organ shortage, and save human lives,” said Dr. Qing Ding, co-study author from the Shanghai Institute of Immunology at the Shanghai Jiaotong University School of Medicine in China.

To make the discovery, the scientists conducted experiments using two groups of pig vascular endothelial cells. The first group was genetically engineered to express human PD-L1, while the second group was normal. When both sets of cells were exposed to human lymphocytes, lower rejection response occurred in the group with the altered gene, while higher rejection responses were seen in the normal cells. Research results suggest that human PD-L1 could be used as a novel therapeutic agent to enhance tolerance of xenotransplants and also supports the possibility of using human PD-L1 transgenic pigs as xenotransplant donors. (Source: www.sciencedaily.com)

Coffee ingredient protects against Alzheimer’s disease

A yet unidentified component of coffee interacts with the beverage’s caffeine, and protects against Alzheimer’s disease. A new study by researchers at the University of South Florida (USF), the United States, found that this interaction boosts blood levels of a critical growth factor that seems to fight off the Alzheimer’s disease process. Using mice bred to develop symptoms mimicking Alzheimer’s disease, the USF team presented the first evidence that caffeinated coffee offers protection against the memory-robbing disease. The study shows that caffeinated coffee induces an increase in blood levels of a growth factor called granulocyte colony stimulating factor (GCSF). GCSF, which was shown to improve memory in Alzheimer’s mice, is greatly decreased in Alzheimer’s patients. “Caffeinated coffee provides a natural increase in blood GCSF levels,” said USF neuroscientist Dr. Chuanhai Cao, lead author of the study.

The scientists conclude that there is a synergistic interaction between caffeine and some mystery component of coffee that provides the beneficial increase in blood GCSF levels. The exact way that this occurs is not understood. The scientists also reported that long-term treatment with caffeinated coffee enhances memory in Alzheimer’s mice. Higher blood GCSF levels due to coffee intake were associated with better memory. The researchers identified three ways that GCSF seems to improve memory performance in the Alzheimer’s mice. GCSF recruits stem cells from bone marrow to enter the brain and remove the harmful beta-amyloid protein that initiates the disease. GCSF also creates new connections between brain cells, besides increasing the birth of new neurons in the brain. (Source: www.sciencenews.org)

Malaria vaccination strategy provides superior protection

In the United States, researchers from Seattle BioMed and the University of Iowa report results that underscore the potential of late liver stage-arresting genetically attenuated parasites (GAP) as candidates for broadly protective next-generation live-attenuated malaria vaccines. The new study shows potential as a powerful model for identifying antigens to generate protection, not only in the liver stage of the disease but in the blood stage as well.

While subunit malaria vaccines have shown only partial efficacy in clinical trials, the ability to use the entire parasite as a vaccine by weakening it through radiation has proven effective in decades past, but provides a challenge because of the variability involved in the approach. Dr. Stefan Kappe, Director of Seattle BioMed’s malaria research
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programme, had earlier developed a vaccination strategy using early liver stage-arresting GAPs. The validity of this approach of using two gene deletions has been proved in Phase I human clinical studies, demonstrating that the human malaria parasite can be severely attenuated.

In the new study, using mouse malaria models, researchers discovered that immunization with late liver-stage arresting GAP provided superior and long-lasting protection against liver-stage infection when compared with irradiated parasites or early liver-stage arresting GAP. The late liver-stage arresting GAP also provided protection at the critical blood stage of infection (when an infected human develops the classic symptoms of malaria) – and across different malaria parasite species. (Source: www.seattlebiomed.org)

**Clot-busting drug could improve stroke treatment**

A new clot-busting drug seems to improve the prospect of recovery for stroke victims. The new treatment combines minimally invasive surgery, a brain imaging technique and a clot-busting drug ‘t-PA’, according to a multi-centre clinical trial led by researchers from Johns Hopkins University School of Medicine, the United States. The novel treatment was developed for patients with intracerebral haemorrhage (ICH), a bleed in the brain that causes a clot to form within brain tissue, which can cause irreversible brain damage. The usual ICH treatments – either general supportive care such as blood pressure control and ventilation, or invasive surgeries that involve opening portions of the skull to remove the clot – have 30-80 per cent mortality rates, depending on the size of the clot.

Dr. Daniel Hanley, Professor of Neurology, and colleagues developed and tested the new treatment on 60 ICH patients at 12 hospitals in the United States, Canada, the United Kingdom and Germany. Surgeons drilled dime-sized holes in ICH patients’ skulls close to the clot location. Then, using high-tech neuro-navigational software that provides detailed brain images, the physicians threaded tubes through the holes and directly into the clots. They used these tubes to drip t-PA into the clot for up to three days in two doses, every eight hours.

The researchers then compared the results to those of 11 patients who received only supportive care. They found that clot size in patients treated with either dose shrunk by more than half, as compared with only 1 per cent in patients who received only supportive care. Those in the treatment group and the supportive care group had about a 10 per cent mortality rate at 30 days after treatment, lower than the typically high mortality rates expected for this condition. (Source: zeenews.india.com)

**Study of stem cell diseases advanced by new technique**

Dyskeratosis congenita, a rare genetic disease caused by the rapid shortening of telomeres – protective caps on the ends of chromosomes – can be mimicked through the study of undifferentiated induced pluripotent stem (iPS) cells, says a new study from Stanford University School of Medicine, the United States. Although dyskeratosis affects only about one in a million people, the findings could facilitate research into this and other diseases caused by stem cell malfunctions. The study, which used iPS cells created from the cells of patients with dyskeratosis, explains why sufferers experience a wide variety in the types and severity of symptoms, ranging from abnormal skin pigmentation and nail growth to lung scarring, bone marrow failure and cancer.

Researchers have known for some time that patients with dyskeratosis congenita have shorter-than-normal telomeres. They also often have one or more mutations in the genes that encode the proteins that make up the telomerase complex. But it has not been clear until now why some people are affected much more severely than the others. In the Stanford study, the researchers created iPS cells from the skin cells of five patients having varying severities of dyskeratosis congenita. They then grew a sufficient amount of the undifferentiated cells in the laboratory for comparing telomerase activity levels and telomere lengths.

The research team found that the cells from patients with a mutation in one of the two copies of the gene for the telomerase workhorse protein – and who typically had the less-severe clinical symptoms – had levels of telomerase activity that
were about 50 per cent of normal. In contrast, iPSC cells from male patients with a mutation in a related gene on the X chromosome (of which they have only a single copy) displayed telomerase activity levels that were about 5-15 per cent of normal. The two patients with mutations in this gene experienced the full panel of symptoms, from epidermal involvement to bone marrow failure, and had very short telomeres. The scientists concluded that the symptoms seen are likely to be caused by the gradual loss of tissue-specific stem cells in the skin, bone marrow and other organs. Without these stem cells, the body can’t replenish damaged or developing tissues. (Source: esciencenews.com)

**Fake red blood cells to deliver cancer-fighting drugs**

In the United States, researchers at the University of California San Diego (UCSD) have developed a new method of disguising nanoparticles (about the same size as a virus stuffed) as red blood cells, which will enable them to evade the body’s immune system and deliver cancer-fighting drugs straight to a tumour. The method involves collecting the membrane from a red blood cell and wrapping it like a powerful camouflaging cloak around a biodegradable polymer nanoparticle with a cocktail of small molecule drugs.

“This is the first work that combines the natural cell membrane with a synthetic nanoparticle for drug delivery applications,” said Mr. Liangfang Zhang, a nanoengineering professor at the UCSD Jacobs School of Engineering and Moores UCSD Cancer Centre. Red blood cells live in the body for up to 180 days and, as such, are “nature’s long-circulation delivery vehicle”, said Mr. Zhang’s Ph.D. student Mr. Che-Ming Hu, the first author on the paper.

Stealth nanoparticles are already used successfully in cancer treatment to deliver chemotherapy drugs. They are coated in a synthetic material, such as polyethylene glycol, to create a protection layer to suppress the immune system so that the nanoparticle has time to deliver its payload. Mr. Zhang said today’s stealth nanoparticle drug delivery vehicles can circulate in the body for hours compared to the minutes a nanoparticle might survive without this special coating. But in the current study, nanoparticles coated in the membranes of red blood cells circulated in the bodies of lab mice for nearly two days. (Source: www.biologynews.net)

**New molecule as a vehicle to image and kill brain tumours**

Glioblastomas, the most common and aggressive brain tumour found in humans, often extend beyond the well-defined tumour margins, making it extremely difficult for clinicians and radiologists to visualize with current imaging techniques. A single compound with dual function – the ability to deliver a diagnostic and therapeutic agent – may one day be used to enhance the diagnosis, imaging and treatment of such brain tumours, report research findings from Virginia Commonwealth University and Virginia Tech, the United States.

Researchers led by Mr. Panos Fatouros, former Chair of the Division of Radiation Physics and Biology in the VCU School of Medicine, demonstrated that a nanoparticle containing a magnetic resonance imaging (MRI) diagnostic agent can be effectively imaged within the brain tumour and provide radiation therapy in an animal model. The nanoparticle filled with gadolinium, a sensitive MRI contrast agent for imaging, and coupled with radioactive lutetium 177 to deliver brachytherapy, is known as a theranostic agent – a single compound capable of delivering effective treatment and imaging simultaneously. The lutetium 177 is attached to the outside of the carbon cage of the nanoparticle. “This theranostic agent could potentially provide critical data about tumour response to therapy by means of longitudinal imaging without further contrast administration,” said Mr. Fatouros. (Source: www.news.vcu.edu)

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High biomass crops as second-generation energy sources

A team of scientists led by Mr. Juan Yan from the Key Laboratory of Plant Germplasm Enhancement and Speciality Agriculture, Chinese Academy of Sciences (CAS), collected three species of *Miscanthus* from populations across China and grew these species at three separate sites with varying climates to evaluate their growth. The team found that wild populations of *Miscanthus* have high levels of genetic variation and adaptation that could provide valuable resources for the development of second-generation energy crops.

According to team member Prof. Tao Sang, from the Plant Biology Department at Michigan State University and the Director of CAS State Key Laboratory of Systematic and Evolutionary Botany at the Institute of Botany, “The domestication of *Miscanthus* should be an equally exciting, but much shorter, journey in comparison to food crop domestication.” Researchers are encouraged by the findings because in order for bio-energy crops to not compete with food production, they will have to be grown on land with poor soil quality and little irrigation. *Miscanthus* has potential as a bio-energy crop because of its high biomass yield in regions that are colder and drier than its natural habitats. (Source: www.ruralenterprisesolutions.co.uk)

In search of drought tolerance in plants

In the United States, Texas AgriLife Research scientists in Corpus Christi, led by plant physiologist Dr. Carlos Fernandez, are taking a closer look at why some cotton varieties do better than others in drought conditions, so that those traits that control water use in plants could be used to develop drought-tolerant cultivars.

To coax that information from nature, the scientists designed and constructed a unique drought-tolerance greenhouse laboratory, which is fully automated and computerized. The system closely tracks the water use and growth of various cotton varieties from planting to harvest. The scientists treat all plants equally. “They all have the exact same amount of high-absorbent soil to remove that as a variation factor. Each also gets exactly the same amount of nutrient solution. We irrigate them daily up to a point when we stop or reduce irrigation to see how the plant reacts to the water deficiency,” Dr. Fernandez said.

The researchers then precisely measures each plant’s leaf area, water conducting vessels, stomatal density, rooting systems and other characteristics to look at the effects on water use and growth, and the quality and quantity of fibre. The information and conclusions they develop are then shared with breeders and geneticists who may be able to provide growers with drought-tolerant cotton varieties. (Source: www.earthknowledge.net)

Not-so-sweet potato resists pests and disease

Scientists from Clemson University and the United States Department of Agriculture (USDA) Agricultural Research Service (ARS) have developed a new variety of not-so-sweet potato, called Liberty. A tropical sweet potato (boniato), Liberty has a dark red skin and light yellow, dry flesh with a bland flavour. Boniato potatoes, which originated in the tropical Americas, are served mashed, fried or in soup.

“We developed Liberty because other boniato varieties are susceptible to damage by nematodes,” said Mr. John Mueller, a plant pathologist and Director of Clemson’s Edisto Research and Education Centre. The Liberty potato is highly resistant to nematodes and moderately resistant to insect pests and *Fusarium* wilt, a fungal disease. Liberty potatoes have good baking quality, store well and do not darken after peeling as most boniato potatoes do. (Source: www.sciencedaily.com)

Tastier and healthier wheat

‘Sweet wheat’ has the potential for joining sweet corn as a tasty and healthful part of the diet, concludes the scientific team – led by Mr. Tomoya Shimbata of Central Laboratory, Nippon Flour Mills Co., Japan – that developed the mutant wheat. Sweet wheat (SW) originated from mutations in
field wheat. Mr. Shimbata and colleagues developed SW from two mutant types of wheat that each lack a different enzyme needed to make starch. Because the new wheat has much more sugar than regular wheat, they called it ‘sweet wheat’.

To see whether the flour from this new wheat could be used as an ingredient in foods, such as breads and cakes, the researchers analysed its components. They found that SW flour tasted sweeter, and SW seeds and flour contained higher levels of sugars, lipids and dietary fibre than seeds and flours of other wheat varieties. “The specific compositional changes that occurred in SW seed suggest that SW flour may provide health benefits when used as a food ingredient,” says the research team, noting its high levels of healthful carbohydrates termed fructans. (Source: www.physorg.com)

Molecular technique in soybean rust resistance research

A new tool is available to select for soybean rust resistance in breeding populations, said Mr. Glen Hartman, Professor of crop sciences at University of Illinois, the United States, and a scientist with the Agricultural Research Service (ARS) of United States Department of Agriculture (USDA). Mr. Hartman and his team of researchers successfully used quantitative polymerase chain reaction (Q-PCR) assays to assess fungal DNA in soybean leaf tissue to quantify the resistance level in individual plants to soybean rust.

Q-PCR allows for exact enumeration of fungal DNA in the tissue. This is particularly helpful when plants show similar visual symptoms, but colonization levels vary based on fungal DNA levels. “The eye can easily tell us if it is a plus or minus for qualitative resistance, but Q-PCR tells us the quantitative resistance or the grey area that lies between the plus and minus,” Mr. Hartman said. Often qualitative resistance doesn’t last as long as quantitative resistance because it involves a single gene. In quantitative resistance multiple genes offer resistance and it is very laborious to distinguish the grey area between susceptible and resistant when multiple genes are involved. Mr. Hartman said the new tool will be useful for plant breeders to breed soybeans for resistance to soybean rust. “In developing soybean cultivars, a large number of lines need to be evaluated, so many inferior lines have to be discarded. In terms of breeding for soybean rust resistance, this technique can help determine which lines are more resistant to rust when it comes to the grey areas or quantitative resistance,” he said. (Source: www.aces.uiuc.edu)

New strategy for drought tolerance in crops

In Belgium, scientists from VIB, the life sciences research institute, and Ghent University (UGgent) have unveiled a mechanism that can be used to develop crop varieties resistant to mild droughts. The study shows that under non-lethal stress conditions, plants inhibit growth more than absolutely necessary, opening new opportunities for yield improvement. “By applying this knowledge to the selection of new crop varieties, unnecessary yield losses through drought stress can be avoided, resulting in higher productivity,” Prof. Dirk Inzé from VIB-UGent said.

Much of the research on drought resistance has focused on improved plant survival under very severe drought. However, Ms. Aleksandra Skirycz, VIB Department of Plant Systems Biology, and Mr. Korneel Vandenbroucke, UGent Department of Plant Biotechnology and Genetics, have shown that plants that are more likely to survive these extreme conditions do not grow better in milder drought conditions. This is important as drought in the field is rarely severe enough to kill plants, but rather affects their growth. The study also shows that plants actively choose to grow slower when water is limited, although they have enough resources to keep growing.

In a follow-up study, early leaf growth, entirely driven by cell division, was chosen as a model to unravel the mechanisms underlying this active growth inhibition. Ms. Skirycz and UGent’s Mr. Hannes Claey’s showed that the plant hormone ethylene shuts down leaf growth very fast after the plant senses limited water availability; if the stress is temporary, growth resumes. These findings opens up new paths to develop crop varieties that keep on growing during mild and temporary droughts, avoiding yield losses and offering higher crop productivity. (Source: newsecology.com)
**RECENT PUBLICATIONS**

**Nuclear Reprogramming and Stem Cells (Stem Cell Biology and Regenerative Medicine)**

This volume provides a timely glimpse into the methods that have been developed to instigate, and the mechanisms that have been identified to drive, the process of nuclear reprogramming in medicine, chronicling how the field has developed over the last 50-60 years. The main content of this volume focuses on areas that have shown significant movement in recent years, are most likely to translate into personalized therapeutic application, and thus provide greatest potential for significant impact on human health in the not too distant future. The publication will be a valuable resource for all researchers in the field of stem cell biology.

**Contact:** Humana Press, 999 Riverview Drive, Suite 208, Totowa, NJ, 07512, United States of America. Tel: +973 256 1699; Fax: +973 256 8341; Website: www.humanapress.com.

**Simulations in Nanobiotechnology**

This book provides insights into computational simulations of biomolecules and nanomaterials together. It also examines novel modelling concepts at the nano-bio-interface: the interactions between biomolecules and nanomaterials, such as DNA-wrapped nanotubes, nanobiosensors, and biomimetic materials. Expert contributors from around the world address such key topics as molecular dynamics of protein translocation, coarse-grained modelling of CNT-DNA interaction, multi-scale modelling of nanowire resonator sensors, and the molecular dynamics simulation of protein mechanics.

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| 25-28 Oct  | World ADC Summit                           | Contact: Hanson Wade, Charter House, 13-15 Carteret Street, London SW1H 9DJ, United Kingdom. |
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| 12-15 Nov  | The 6th International Conference on Genomics | Contact: BGI-Shenzhen, Main Building, Beishan Industrial Zone, Yantian District, Shenzhen, China. |
| Shenzhen   |                                            | Tel: +86 (755) 2527 3340; Fax: +86 (755) 2527 3092; E-mail: meeting@service.genomics.cn; Website: www.genomeconference.org. |
| China      |                                            |                                                                                              |

| 28 Nov-01 Dec | SOMChe-ICCEIB 2011                           | Contact: ICCEIB-SOMChe 2011 Secretariat, c/o Dr. Chong Fui Chin, Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang, Lebuhraya Tun Razak, 26300 Kuantan, Pahang, Malaysia. |
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