Discover
A MAGAZINE ABOUT KNOWLEDGE AND INNOVATIONS FROM LUND UNIVERSITY

- World-leading research facilities
- Breed bacteria with the right food
- Unique method for accurate cancer diagnosis
- Human rights for children
Over 300 years of useful innovation

1707
HEALING WATER
Professor of Medicine and Provincial Doctor Johan Jacob Döbelius discovered and developed the Ramlösa healing spring at the start of the eighteenth century. According to Döbelius, the water from the spring, which was rich in minerals, cured both scurvy and vertigo as well as gout and shaky joints.

1770
NEW ORGANIC ACIDS
By releasing organic acids, scientist Anders Jahan Retzius and apothecary Carl Wilhelm Scheele managed to produce tartaric acid in crystalline form. The new method led to their subsequent discovery of other polyatomic organic acids, such as citric acid and malic acid.

1801
FIRST SWEDISH VACCINATION
At the turn of the 19th century, Professor of Medicine Eberhard Zacharias Munck af Rosenschöld carried out the first smallpox vaccination in Sweden. The discovery was not his own, however, but borrowed from Edward Jenner, who carried out the first experimental vaccination in England as early as 1790.

1813
SWEDISH MASSAGE AND GYMNASICS
Per Henrik Ling developed a system for massage and muscle stretching. Today the technique is known as Swedish or classical massage and is one of the most common forms of massage in the Western world. Ling later moved to Stockholm where he founded the Royal Central Institute for Gymnastics, now the Swedish School of Sport and Health Sciences.

1824
ALGAE RESEARCH AND NEW FINANCIAL CONCEPTS
Botanist and economist Carl Adolph Agardh founded the research branch of algology and systematised algae in a way that is largely still used today. As an economist, Agardh introduced the concept of “national debt” to Swedish thinking on economic policy.

1843
SCHEUTZIAN CALCULATION ENGINE
Per Georg Scheutz and his son Edvard Scheutz invented the first working calculation and printing machine. Scheutz received a gold medal at the World Fair in Paris in 1855 for his achievement.

1847
ICE AGE THEORY
Scientist Sven Nilsson launched the notion, epochal for its time, that Scandinavia had once been connected to the European mainland. He was also one of the first to discuss the “the great glaciation” (the Ice Age). He based the theories on studies of subfossil mammals in Skåne peat bogs.

1887
RYDBERG’S CONSTANT
Physicist Janne Rydberg discovered that the wavelengths of photons in atoms can be calculated using a certain formula. One of the constants in the formula is common to all matter and is known within the international science community as the Rydberg constant. The discovery provided fundamental knowledge on the structure of atoms.

1916
THE M SERIES AND NEW METHODS OF MEASUREMENT
Physicist Manne Siegbahn constructed new instruments which were to be of great significance for x-ray spectroscopy. For example, Siegbahn discovered the so-called M series, a new group of spectral lines in the elements, with the help of these instruments. Manne Siegbahn received the Nobel prize in 1924, by which time he had left Lund for Uppsala.

1925
NEW CROPS
By converting his research results into practical use, geneticist Herman Nilsson-Ehle was able to develop new, improved agricultural crops. This contributed to the reduction of food shortages in Sweden during World War II.

continues
Innovation is making use of research in applications that will benefit society, patients, industrial developments, etc. This is a mission given to us by the Ministry of Education, but more importantly I believe it to be our responsibility to transfer important findings for the benefit of society, partly because we are publicly funded. Consequently, I find the old notion that “we do the research but someone else has to put it into practice later” outdated and something we need to change. It is a simplification that in many cases may prevent innovations from benefiting society. It is the responsibility of LU Innovation System to educate our researchers in what innovation means and how much fun it is to see your research make a difference in the everyday lives of people. Consequently, LU Innovation System works hard to get all the faculties on board and to cover more than just the medical or technical products that traditionally spring to mind. A dream scenario would be to have an equal number of innovations from all our faculties. Finally, innovation is not an end in itself, rather it always rests on the foundation of research and education that together form Lund University’s core activities.

Again following our motto Ad utrumque parate!
Lund University was founded in 1666 and over the past 350 years has laid the foundations for many successful companies and products. Some obvious examples are world-leading companies like Gambro, Tetra Pak and Nicorette – but the greatest value lies in the large number, and breadth, of ideas from the University that come to benefit society.

LU INNOVATION SYSTEM is Lund University’s innovation office and generates growth from research. The organisation has two sections: one a part of the public authority and the other a holding company, which have functioned as one unit since 2009 with a joint goal and joint management. The goal is to contribute to increased growth in Sweden by ensuring knowledge from Lund University benefits society. Since 1999, LU Innovation System has invested in over 60 new companies, which together have generated over 2,300 full-time equivalent jobs and over SEK 635 million in tax revenue.

The link between Business and Academia
SINCE 1666, Lund University has been a seat of learning and new ideas. It is a comprehensive university which with its diversity and strong research environments can tackle complex issues and global challenges. The University has 47 000 students and 7 200 employees from around the world and has operations mainly in Lund, Malmö and Helsingborg. The University’s turnover is around SEK 7 billion, of which two thirds is in research and one third in education. Lund University collaborates with 680 partner universities in over 50 countries.

THIS PROCESS of utilising knowledge has always taken place, but it is Lund University’s responsibility to improve and simplify the opportunities for it, which is what LU Innovation System does every day. We work with all the faculties at the University and are pleased to see how researchers and students find new commercial opportunities in all fields, from engineering and science to music and humanities.

Our role is to form a link between academia and industry; to ensure that the ideas generated at the University benefit industry and the public sector – partly by providing exposure for the ideas that exist, but also by understanding the needs of business and connecting them with the right people at the University.

LUND UNIVERSITY is Sweden’s largest university, with 47 000 undergraduate and Master’s students, 3 100 doctoral students and 7 200 employees – and a turnover of almost SEK 7 billion. With such vast operations in both education and research, it is important for us that everyone at the University knows what support we can offer and that our processes and tools are adapted to their needs.

Our greatest challenge is not finding ideas – the University is overflowing with good ideas based on fantastic research and ambitious individuals. In my view, the most important task is putting together a team of people who together can pursue the idea to a successful outcome, and this often means a combination of academic expertise, an entrepreneurial spirit and industrial experience. We have an important role in bringing together people from different backgrounds to achieve these complementary teams that can ensure the idea reaches its full potential.

ONE OF THE University’s goals is for the knowledge generated at the University to benefit society, and commercial routes are an important part of this, also contributing to growth through jobs, turnover and tax revenue. The first step on the path to successful innovation is the flow of ideas – i.e. the very starting point of the journey. With this in mind, it is great that we have seen a considerable increase in the number of ideas we work with in recent years. This represents a fantastic opportunity to facilitate more knowledge transfer.

FINALLY, I want to express my admiration for the researchers behind all the fantastic research results that have the potential to change our world and how we view it, and to thank them for the opportunity we at LU Innovation System get to be a part of these fantastic journeys from idea to reality – thank you!

LINUS WIEBE
Innovation Director
at Lund University
1926  
THE FIRST RESPIRATOR  
Physiologist Torsten Thunberg constructed the barospirator, the first apparatus for artificial respiration. By increasing and decreasing the air pressure around the patient, the machine could force air in and out of the lungs. The barospirator led the way for several subsequent designs, which gradually became more and more successful.

1944  
THE TETRAHEDRON – MILK PACKAGING FOR THE MODERN ERA  
The "tetrahedron" milk package was the first step towards one of the world's most successful industrial enterprises. In 1944, laboratory assistant Erik Wallenberg came up with the idea of the package's four-sided pyramid shape and entrepreneur Ruben Rausing patented it and launched Tetra Pak in 1951.

1946  
THE ARTIFICIAL KIDNEY  
The world's first clinically useable artificial kidney was developed by professor of medicine Nils Alwall. In 1964, together with industrialist Holger Crafoord, he founded what is now a global company, Gambro, and three years later the first artificial kidney was launched.

1953  
MEDICAL ULTRASOUND  
Physicist Hellmuth Hertz and cardiologist Inge Edler were the first in the world to see a heart beating. Together, the two researchers had developed the first echocardiogram for ultrasound examination of the heart, a technology which would prove to be revolutionary for diagnostics. Edler and Hertz were nominated several times for the Nobel prize, but had to make do with the next best thing – the American Lasker award.

1955  
THE NILSSON MODEL  
Nuclear physicist Sven Gösta Nilsson developed the so-called Nilsson model, also known as the independent particle model, which made it possible to describe the energy levels and structure of atomic nuclei using mathematical calculations.

1956  
HUMAN CHROMOSOME NUMBER  
Geneticist Albert Levan succeeded, together with visiting researcher Joe Hin Tjio, in identifying the 46 chromosomes that determine human hereditary characteristics.

1957  
DOPAMINE  
Under the leadership of Arvid Carlsson, later professor in Gothenburg and Nobel Prize recipient in 2000, it was discovered that dopamine is a powerful signal substance in the brain. The discovery led to the first drug to relieve symptoms of Parkinson's disease, which is still the main treatment in use today.

1962  
THE FALCK-HILLARP METHOD  
Medics Bengt Falck and Nils Åke Hillarp developed the so-called Falck-Hillarp method to detect the presence of neurotransmitters in nerve cells. The technique came to acquire great significance for modern pharmacological treatment.

1962  
PARTIAL DIFFERENTIAL EQUATIONS  
Mathematician Lars Hörmander developed the general theory of linear partial differential equations, which are commonly used to describe physical phenomena. In 1962 Hörmander became the first, and as yet only, Swede to be awarded the Fields Medal – the mathematical equivalent of a Nobel Prize.

1963  
LACTOSE INTOLERANCE  
Professor Arne Dahlqvist observed that people lacking the enzyme lactase in the small intestine were unable to digest lactose. In doing so, he discovered the underlying factors to lactose intolerance.

1966  
ASTHMA MEDICINE  
Chemists Leif Svensson, Henry Persson and Kjell Wetterlin at the medical drugs company of the time, Draco, invented the asthma drug Bricanyl. The drug widens the respiratory passages and facilitates breathing by counteracting muscle cramps in the respiratory tract.

Over 300 years of useful innovation continues
Discover

Lund University, with its breadth, research and history, lays the foundations for lifelong learning and creativity. It is here that the knowledge generators, problem solvers and leaders of the future are made. With eight faculties, Lund University is a successful university and the interdisciplinary research that is carried out is one explanation for its success. Almost SEK 5 billion is invested in research annually and this gives the university one of the strongest and broadest ranges of research in Sweden. Regional, national and international cross-boundary collaboration helps to bring about solutions to many of the major issues facing society. Research in music education and diabetes are two contrasting examples of fields where the university is world-leading. □
Researchers form new nerve cells – directly in the brain

The field of cell therapy has taken another important step on the road towards new treatments. A report from researchers at Lund University shows that it is possible to re-programme other cells to become nerve cells directly in the brain.
Researchers at Lund University were the first in the world to re-programme human skin cells, known as fibroblasts, to dopamine-producing nerve cells – without taking a detour via the stem cell stage. The research group’s latest breakthrough has gone a step further and shown that it is possible to re-programme both skin cells and support cells directly to nerve cells in place in the brain.

– The findings are the first important evidence that it is possible to re-programme other cells to become nerve cells inside the brain, said Malin Parmar, research group leader and Reader in Neurobiology.

The researchers used genes designed to be activated or de-activated using a drug. The genes were inserted into two types of human cells: fibroblasts and glia cells – support cells that are naturally present in the brain. Once the researchers had transplanted the cells into the brains of rats, the genes were activated using a drug in the animals’ drinking water. The cells then began their transformation into nerve cells.

In a separate experiment, where similar genes were injected into the brains of mice, the research group also succeeded in re-programming the mice’s own glia cells to become nerve cells.

– The discovery has the potential to open the way for alternatives to cell transplants in the future, which would remove previous obstacles to research, such as the difficulty of getting the brain to accept foreign cells, and the risk of tumour development, said Olof Torper, a doctoral student and first author of the study.

All in all, the new technique of direct re-programming in the brain could open up new possibilities to more effectively replace dying brain cells in conditions such as Parkinson’s disease.

– We are now developing the technique so that it can be used to create new nerve cells that replace the function of damaged cells. Being able to carry out the re-programming in vivo makes it possible to imagine a future in which we form new cells directly in the human brain, without taking a detour via cell cultures and transplants, concluded Malin Parmar.
IMPORTANT DISCOVERY ON HUMAN ENZYME

An important discovery made at Lund University concerned the enzyme IDO. The substance was previously known to prevent the female body from rejecting the foetus during pregnancy, but the researchers saw a new area of application – preventing and curing autoimmune diseases. By increasing the amount of the IDO enzyme in the body, the researchers hope not only to prevent and treat autoimmune diseases, but also to prevent rejection of transplanted organs. The discovery was patented and in 2008 the pharmaceutical company Idogen was established.

NEW METHOD OF DIAGNOSING CANCER

Using new, unique technology developed at the Department of Immunotechnology and CREATE Health – the Centre for Translational Cancer Research – Immunovia is developing and commercialising blood and IHC tests. These tests will provide healthcare professionals and pharmaceutical companies with improved data to enable earlier and improved diagnosis, and to predict disease progression and therapeutic responsiveness of cancers. Immunovia AB was founded in 2007 and today focuses on the commercialisation of human antibodies and biomarkers, primarily for diagnosis of cancer and autoimmune diseases.
Two of the world’s leading materials research facilities are currently under construction in Lund: the MAX IV Laboratory, which will be the leading synchrotron radiation facility in the world, and the European research facility ESS, which will house the world’s most powerful neutron source. Both facilities will be of decisive importance for future scientific and industrial developments. Science Village Scandinavia is supporting the development of infrastructure for the two facilities.
MAX IV: MAX-lab is a national facility for materials research based on synchrotron radiation. It supports three different research fields: accelerator physics, research based on the use of synchronised radiation and atomic physics with high-energy electrons. MAX-lab is now being expanded with MAX IV, which will be 100 times more efficient than any existing comparable synchrotron radiation facility in the world. The facility will put Sweden in a class of its own in materials and nano research.

– With synchrotron radiation we can see detailed structures and tiny changes in tissue and organs more clearly, which makes it possible to study the origin and early development of different diseases, as well as how they respond to different treatments. This is of major importance for both improved diagnosis and drug development for conditions such as cancer and diabetes, said researcher Crister Ceberg.

ESS: The European Spallation Source – ESS, a unique facility for materials research, is being built on a site of two square kilometres in Lund. ESS will be an interdisciplinary research centre harnessing the world’s most powerful neutron source. Researchers will be able to study everyday materials, from plastics and proteins to medicines and molecules, in order to understand how they are structured and how they work. ESS will support future research breakthroughs in medicine, environmental science, climate, communications and transport. Along with the planned MAX IV facility, ESS will form a hub in the European research infrastructure. ESS is expected to be fully operational in 2020.

– Through innovation, the research can be converted into valuable products. We see major potential with ESS in most fields and industries. I can’t think of a single field that couldn’t get something out of this, said Axel Steuwer, a researcher at Lund University.

SCIENCE VILLAGE SCANDINAVIA: Lund University, Lund Municipality and Region Skåne have together established Science Village Scandinavia, which will support the development of infrastructure for the two new research facilities. The area will also have a strong international character with a focus on sustainable urban development.
Recipe for success: breed friendly bacteria with the right food

Obesity is an increasing problem and the health care costs for cardiovascular disease, type 2 diabetes and other lifestyle-related diseases are rocketing. At the Antidiabetic Food Centre in Lund, researchers are developing new preventive foods.

METABOLIC SYNDROME – obesity, abdominal obesity, high blood pressure, high blood fats and insulin resistance – is becoming increasingly common in the Western world. Anne Nilsson, Doctor of Applied Nutrition, who works at the Antidiabetic Food Centre (AFC) in Lund, has spent many years researching how diet can prevent this disturbance in the body and has taken a particular interest in how different types of fibre-rich food affect the bacteria of the large intestine. Researchers seem increasingly convinced that there is a connection between disturbed bacterial flora and lifestyle diseases.

– We must feed our gut bacteria with the right food. Too much fatty food has a negative impact on the bacteria, which in turn can lead to metabolic disturbances and even cancer. Beans are a good food for this, and it has been shown that fibre in barley, rye and oats lowers blood sugar and also prevents inflammation for many hours after eating it, explained Anne Nilsson.

A healthy diet rich in special dietary fibre has been shown to have positive effects in a large-scale study in Dalby, a village near Lund. Some 40 slightly overweight individuals aged between 50 and 70 ate an ‘anti-inflammatory’ diet comprising a lot of beans, barley bread, vegetables and oily fish, among other things. After just one month, the research subjects had lowered their dangerous cholesterol, blood fats, blood pressure and risk of blood clots.

– Studies show that a good diet can in some cases produce as good a result as medication, said Anne Nilsson, explaining that she has recently completed a study in which 40 individuals in middle age and older ate 3 grams of fish oil a day for five weeks. The results showed that their blood pressure and blood fats were lowered and their short-term memory improved.

Another study has been carried out using a mixed diet of a number of foods and food concepts that we know affect metabolism and lower levels of inflammation. The results were striking; the subjects’ cholesterol levels were lowered by an average of 30 per cent, and other significant risk factors for diabetes and cardiovascular disease were lowered, such as the level of inflammation in the body and blood pressure. In addition, certain aspects of the subjects’ cognitive performance increased.
1967
NICORETTE
Professor Claes Lundgren and his colleague Stefan Lichtneckert discovered that chain smokers could avoid abstinence problems by chewing tobacco. The discovery convinced them that the need to smoke depended on an addiction to nicotine and both doctors invested in developing an alternative to chewing tobacco. The result was Nicorette – the world’s first nicotine medicine.

1969
NEW X-RAY CONTRAST AGENT
Professor of radiology Torsten Almén developed new types of non-ionising x-ray contrast agents. Unlike earlier kinds of agents, which could directly harm the patient, Almén’s contrast agent was harmless and considerably less painful. Currently around 45 million people receive an injection of contrast agent every year – that is more than one injection per second.

1971
THE SERVO VENTILATOR
– THE MODERN RESPIRATOR
Through the use of flow control, medical researcher Björn Jonson and his colleague Sven Ingelstedt succeeded in creating the modern respirator. The apparatus, which was named the Servo Ventilator, represented a breakthrough for the establishment of intensive care throughout the world.

1972
THE INKJET PRINTER
Physics professor Hellmuth Hertz developed continuous inkjet technology and with it one of the first inkjet printers. The new technology made it possible to produce colour images of a quality equal to that of colour photographs. In the same year, professor Erik Stenme at Chalmers University of Technology developed another variation on inkjet technology, the so-called drop on demand-technology.

1984
NETWORK-BASED PRINTER SERVERS
Engineering student Martin Gren and Business student Mikael Karlsson started their company, Axis, from a small student room in Lund. The company’s first product was a network-based printer server which was subsequently developed into a global product. Today Axis is the market leader in network video and had a turnover of close to SEK 3.6 billion in 2011.

1987
INHALATOR FOR ASTHMA MEDICINE
Chemist Kjell Wetterlin and his colleagues at what was then Draco developed the Turbohaler – an inhalator for the dosage and inhalation of asthma medicine. The product revolutionised asthma medication and currently helps tens of millions of people the world over to control their illness.

1990
OATLY
Professor Rickard Öste discovered that oats have the right properties to replace milk products. He developed a liquid oat-base as an alternative to milk drinks and founded a company, Oatly, in 1994, then under the name Ceba. The company is now the market leader in Sweden with a turnover of just over SEK 180 million.

1991
LASER CANCER TREATMENT
Professor Karl-Göran Tranberg discovered a new method for treating so-called solid cancers in tissue such as the breast, liver and pancreas. Heating the tumour with laser beams kills it while the body’s immune response learns to attack any remaining tumours. The company Clinical Laserthermia Systems (CLS) was founded in 2006 on the basis of these research findings.

1991
PROVIVA
Researchers at Lund University’s Faculty of Engineering developed the health-promoting bacteria culture Lactobacillus. The research finding was subsequently developed into a complete consumer product and the fruit drink Proviva was launched in the early 1990s. On 1 October 2010 Proviva was sold to French dairy giant Danone for billions.

1993
QLIKTECH
Researchers Björn Berg, Staffan Gestrelius and Håkan Wolgé developed a software programme for rapid and simple analysis of information in different databases. The software became the basis for a company, Qliktech, which was listed on the Nasdaq stock exchange in the summer of 2010 with a turnover of SEK 1.540 million. Today, the company’s software, Qlikview, is used by over 26 000 enterprises in just over 100 countries.
Develop

Research at Lund University is extensive and many important discoveries are made. Discoveries need space and support to be developed further and come to good use. At the university and in its vicinity, there are many places where researchers can receive help to develop their discoveries. Lund University collaborates with Medicon Village and Ideon, among others. Medicon Village provides a unique growth environment for knowledge-intensive and development companies in life science that want to expand and become successful. At Ideon Science Park, there are over 100 R&D companies. The Ideon Innovation project is a collaboration between Lund University, Ideon, Teknopol and Lund Municipality that offers business incubators. There are many opportunities for companies originating from research discoveries at the university to develop.
HONEY CURES SERIOUS INFECTIONS

It has long been known that honey is good for health. Lund University researchers discovered why and started the company Concellae in the hope that normal honey could be used to cure serious infections. The research findings on which the company builds concern 13 healthy lactic acid bacteria that are naturally present in a bee’s honey stomach. The bacteria have various anti-microbial properties that make them effective against bacteria that cause disease, in humans as well as in bees. It is hoped that the company’s products could become important alternatives to current antibiotics or a treatment for serious infections.

EFFICIENT LEDS

Today, lighting is responsible for almost 25 per cent of all electricity consumption. By controlling how nanowires grow on silicon wafers, the nanotechnology company GLO can create light-emitting diodes that are ten times more energy-efficient than incandescent light bulbs. This could reduce total electricity consumption by up to 20 per cent.

Unique meeting place for researchers, innovators and entrepreneurs

Medicon Village in Lund is a platform for knowledge collaboration and commercial contributions to human health and well-being. This life science village was born in early 2012, and today over 850 people are based there.

The people based at Medicon Village work mainly in research, innovation, and companies in biomedical engineering, biotechnology and pharmaceuticals. They work on projects, products or services within prevention, diagnostics, health care or medical treatment. The strength of the organisation lies in its diversity. As a part of the whole, a small company has the conditions it needs to succeed – this is the essence of what Medicon Village wants to offer its members.

Working alongside and in collaboration with regional authorities, universities and the business sector, new opportunities arise. This was the idea behind the value-adding meetings and cross-boundary collaboration that formed the starting point for the foundation of Medicon Village. The multi-faceted environment includes both private and public innovation agents. In its attention to small business, it is important for Medicon Village to create a good innovation environment and help companies to grow. It is the small and medium-sized enterprises that are the future growth motors in life science. The ambition is to strengthen successful and motivated companies in the areas of health and wellbeing to stimulate their growth and development. At Medicon Village, the companies are next door to research in fields such as cancer and diabetes, to clinics and to innovation. Medicon Village offers high-quality laboratory premises and membership of a larger structure, close to knowledge-intensive service companies with cutting-edge expertise in their areas.

Being part of Medicon Village means being part of a collaborative community. Other important organisations are close by, such as Skåne University Hospital, Lund Bioimaging Centre, the Clinical Research Centre (CRC) and the Biomedical Centre (BMC). Together with the forthcoming research facilities MAX IV and ESS, Medicon Village contributes to world-class infrastructure. It provides a major boost for the whole of the Öresund region and creates breadth and growth opportunities for research and enterprise in life science in the region.
Digital learning for the very young

Fun, individualised games at an early stage can detect and address problems in children who are at risk of struggling with maths in school. The Educational Technology Group at Lund University is investing heavily in educational games for very young children and is conducting its first large-scale study in Sweden.
THE GROUP comprises researchers in cognitive science, informatics, computer science, linguistics, design and media studies. In collaboration with Swedish and American universities, they are developing educational games in subjects including mathematics.

- All research indicates that children learn better by doing the teaching, and this also improves their self-confidence. Our studies of 7 to 14-year-olds show that this type of educational game benefits children’s mathematical development and understanding of concepts. After using the game, the children got much better results on tests. The studies also show clearly that the teachable agent particularly benefits weaker pupils, said Agneta Gulz, Professor of Cognitive Science.

Her research group is now focusing on developing educational games for very young children. M-world is the name of a fun, light-hearted game for 3 to 5-year-olds in which the children help a little ‘protégé’ to solve different exercises. As they solve the problems, the playing area – a garden – becomes greener and is filled with exciting items. The games are adapted to the individual – the better the child performs, the harder the exercises become.

Research shows that it is possible to identify children at the age of 3 or 4 who have a weak interest in ‘numerosity’ and a weakly developed understanding of numbers. Studies also show how difficult it is for parents or nursery teachers to support these children’s development even if they are aware of the problems.

- Sweden could make major investments in digital learning and become a model country for schooling again. We have the knowledge and the skills. Together with other institutions, we could build up a national infrastructure and give all nurseries and schools access to evidence-based educational games for all ages at the forefront of R&D, added Agneta Gulz.

The world’s largest and best equipped digital classroom has been inaugurated at the Humanities Laboratory at Lund University’s Centre for Languages and Literature. At the laboratory, researchers will gain a better understanding of how children learn and solve problems using eye trackers. It is hoped that the research will support the development of new individualised teaching aids.

A new research project has just started in the digital classroom. The laboratory has 25 eye trackers, which register where the pupils focus their attention when faced with, for example, a maths problem. In the classroom, the researchers can listen to pupils’ discussions and the teacher’s feedback.

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Sweden could make major investments in digital learning and become a model country for schooling again.
Robot helps elderly in the home

Researchers at Lund University are developing a robot that will meet the needs and wishes of elderly users. The robot can help to pick things up from the floor, fetch glasses or medicines, or alert a neighbour if a person has fallen.

— **IF YOU ARE OLD** and a bit frail but well enough to be able to live at home, life becomes much easier if you have help with simple tasks for which you can’t keep asking for assistance. The robot can be seen as a complement to a home help – an aid that is always willing to help and creates a greater feeling of security, said Susanne Frennert, a doctoral student in rehabilitation technology at the Faculty of Engineering.

Over the past year, researchers have investigated how elderly people want to interact with the robot. Following various studies, tests in the homes of elderly people have been started. The robot will help address the issues that accompany old age: falls, dizziness, difficulty bending down, and, by extension, combat fear of moving freely in the home. It will also be flexible so as to meet the needs of the individual, for example learning to recognise important objects and where they are usually stored, and adapting to how inquisitive it should be.

— Many elderly people are sceptical initially, but also curious and are keen to test the robot. They have high expectations and they want to communicate with the robot in the same way they would with a person. Unfortunately, the technology is not sufficiently advanced to enable such well-developed communication with robots at present, so the elderly people who tested the robot often ended up using the touchscreen, said Susanne Frennert.

**IN SIZE AND SHAPE,** the robot is reminiscent of R2D2 from Star Wars: a 1.3-metre tall half egg with a head on wheels. The robot, which is known as Hobbit, is equipped with a grabber arm, which is a technical advancement. There is no comparable alternative at a reasonable price. The robot responds to voice commands, and has a touchscreen that can also be used for video calls or entertainment. The technology has mainly been developed at Vienna University of Technology as part of an EU project, which is also coordinated from Vienna.

The next prototype is being developed and will be evaluated in autumn 2014.
Every year, a million tons of environmentally harmful ash is produced in Sweden and is mostly dumped in landfill sites. The ash is what is left when rubbish has been burnt in thermal power stations. There is great potential, with 20 billion litres of hydrogen gas being released each year, or 56 gigawatt hours, which corresponds to the annual electricity requirements of around 11,000 homes.

HYDROGEN GAS is valuable and many see it as an energy source of growing importance, for instance for vehicle fuel. Researcher Aamir Ilyas from Lund University in Sweden has developed a technique to use the ash to produce hydrogen gas.

– Hydrogen gas from ash can be utilised instead of being allowed to be released into the air as at present. Our ash deposits are a goldmine. Moreover, this method can be used in many parts of Europe, where waste incineration is common, said Aamir Ilyas, doctor of water resources engineering at the Faculty of Engineering, who has developed the technology.

The technique involves placing the ash in an oxygen-free environment. The ash is dampened with water, whereupon it forms hydrogen gas. The gas is sucked up through pipes and stored in tanks.

It is the heavy, grit-like bottom ash that is used. In combustion, a lighter fly ash is also formed. The bottom ash remains in quarantine in the open air at the site for up to six months to prevent leaching of environmentally harmful metals and the risk of hydrogen gas being formed, since accumulation of hydrogen during indoor storage can result in explosion.

– A bonus of recovering hydrogen is that in this way we can avoid the risk of explosion and fires in ash storage or landfills, added Aamir Ilyas.

Today, hydrogen gas is mainly produced from natural gas. However, biogas, oil and coal can also be used as the raw material. Hydrogen gas is an important raw material in industry and is used in refineries and to manufacture ammonia. Hydrogen gas has the potential to produce electricity and heat and also to become a vehicle fuel; a number of car manufacturers are investing in hydrogen-powered fuel cell cars. Hydrogen gas is not expensive, but because there is a lack of infrastructure for the production of the gas, the production and handling costs are high.
A bonus of recovering hydrogen is that in this way we can avoid the risk of explosion and fires in ash storage or landfills.
1995

**BLUETOOTH**

Sven Mattisson and Jaap Hartsen invented the wireless technology standard for exchanging data over short distances, thereby opening a whole new world for the electronics sector. The technology was introduced onto the market in 1998 and was called Bluetooth after Viking chief Harald Blåtand (Harald Bluetooth). Currently, around five million new Bluetooth products are shipped every day.

1997

**PRECISE BIOMETRICS – FINGERPRINT READER**

Entrepreneur Christer Fåhraeus came up with the idea of combining smart cards with advanced image analysis for automatic recognition of fingerprints. Together with Mårten Öbrink and Nils Bernhard, he founded Precise Biometrics, whose technology is currently licensed to 160 million users.

1999

**DIGITAL DIAGNOSTIC SUPPORT**

Professor Lars Edenbrandt realised how one could improve the analysis of heart images using artificial intelligence, thereby facilitating the work of doctors. Currently, hundreds of doctors all over the world use digital diagnostic support to diagnose heart attacks, bone cancer, Alzheimer’s disease and dementia.

1999

**DECUMA – TECHNOLOGY THAT INTERPRETS HANDWRITTEN SYMBOLS**

In connection with an industrial project on three-dimensional image analysis, researchers Gunnar Spar, Kalle Åström and Richard Berthilsson discovered by chance a new way of interpreting human handwriting. By using the same mathematical algorithms as they applied in their industrial project, they developed an efficient program for the electronic interpretation of handwriting.

2001

**INNOVATIVE PROTEIN DRUG CANDIDATES TO FIGHT CANCER**

Biotech company Alligator Bioscience develops new drug candidates to fight cancer based on technology developed at Lund University. The company identifies and develops protein-based drug candidates to treat inflammatory diseases and cancer. The focus is on the early stages of drug development. The aim is to create long-term value and stable growth by building an attractive project portfolio of drug candidates in different development phases, from the idea stage to phase IIA.

2003

**BLOOD PURIFICATION WITH ULTRASOUND**

Researchers Henrik Jönsson, Thomas Laurell, Andreas Nilsson and Filip Petersson came up with a way of separating lipids from blood using ultrasound. The purification process can mean that patients who get their own blood back in major operations can avoid brain damage.

2004

**FACIAL RECOGNITION TECHNOLOGY**

A mathematician at Lund University’s Faculty of Engineering, Jan Erik Solem, developed a search engine with advanced image analysis and facial recognition. The search engine formed the basis of the company Polar Rose, which was sold to Apple in September 2010 for just over 20 million US dollars.

2005

**INVISIBLE CYCLING HELMET**

The Hövding cycling helmet is the result of Engineering students Anna Haupt and Terese Alstén’s joint degree project. The invisible cycling helmet – which can be compared to an inflatable airbag – rapidly earned worldwide attention, in part for winning the prestigious European Index Award for design.

2006

**INSTRUMENT FOR CANCER OPERATIONS**

Surgeons Anders Grönberg and Henrik Thorlacius constructed a new instrument which reduces suffering for patients with colon and rectal cancer. The instrument can be compared to a garden hose connector, whereby the sections of the intestine are spliced together using elastic silicone and plastic rings.

2007

**SATIETY PILL MADE OF SPINACH**

Professor Charlotte Erlanson-Albertsson succeeded in producing a satiety pill from ordinary spinach. The pill contains so-called thylacoids, which lower cholesterol levels and extend the body’s feeling of satiety while providing natural nourishment. The hope is to use this discovery to prevent obesity in the future.
An important part of the university’s responsibilities is taking advantage of important discoveries in order to benefit society, and ensuring that discoveries and ideas benefit business and the public sector. This involves understanding the needs of society and bringing representatives of business and the public sector into contact with the right people at the university. Finding commercial paths to benefit society and create growth leads to jobs and increased tax revenue. There are different types of research that could form the source of a new idea. Such an idea could be developed into a product, a service or a method that could be commercialised. This not only applies to disciplines in engineering and medicine, but also to economics, social sciences, law, humanities and art.
... the idea was born of finding new ways to spread knowledge of human rights and the United Nations Convention on the Rights of the Child via the Internet.
FinjaFive teaches children about human rights

Researchers at the Faculty of Social Sciences and the Lund University Internet Institute had an idea of spreading human rights to children. Ericsson, with its international business network, became the perfect partner. The collaboration laid the foundations for the company FinjaFive – a company that focuses on social innovation.

FINJAFive’S BUSINESS idea is to offer schools and children in developing countries a cloud-based pupil computer with a design that places children’s rights in the centre. The product is a holistic solution where online teaching support is provided via computer equipment in schools. The content is on central servers and is managed by FinjaFive with the help of its business partners.

The idea for the company was born out of a collaboration. Researchers in sociology of law and software developers at the Lund University Internet Institute had the knowledge of how norms work and how they are spread on the Internet. Having carried out education projects with Sida (the Swedish International Development Cooperation Agency) and the Swedish Institute for many years, the idea was born of finding new ways to spread knowledge of human rights and the United Nations Convention on the Rights of the Child via the Internet. Ericsson expressed an interest in the project and collaborates via a part-owned computer company in India.

The CEO of FinjaFive, Måns Svensson, says that researchers should make the most of the support structure that exists at the University in the form of LU Innovation System.

– There was a lot of interest in our cloud-based school computer when we presented it at the Mobile World Congress in Barcelona in February. It is evident that our idea of designing the system based on clear values and the UN Convention was a success. Over the next year, schools in a number of countries will start using our computers and we hope to contribute to a process in which children’s rights become a focus.

Many companies are started in medicine, engineering, science and life sciences. FinjaFive is the first university company developed from the Faculty of Social Sciences. In Måns Svensson’s view, social innovation is on the rise.

– I find that it is easy to get companies to take an interest in social innovation. A number of companies have seen that commercialisation does not conflict with social responsibility. Businesses have long worked with corporate social responsibility (CSR) as part of their image and have sponsored projects that improve life for people. However, they have not necessarily expected to make a profit out of it.

*It is evident that our idea of designing the system based on clear values and the UN Convention was a success.*
NEW TYPE OF NATURAL SKINCARE PRODUCT

By replacing chemical additives with quinoa starch in skin creams, researchers at Lund University succeeded in developing a new type of natural skincare product. The result – a more skin-friendly and stable cream with cheaper ingredients than the products available on the market today – formed the basis of research company Speximo. In order to improve consistency and prevent separation, most facial creams contain synthetic additives that are not biodegradable and that often irritate the skin.

SATIETY PILLS FROM SPINACH

A professor at Lund University has succeeded in developing a satiety pill from normal spinach. The pill – Thylabisco – contains thylakoids, which reduce levels of blood fats and extend the body’s feeling of satiety while providing natural nourishment. The hope is that this discovery could be used to prevent obesity in the future. It works on the principle of utilising a substance to stimulate a natural biological process rather than adding a hormone that only produces short-term effects, according to previous studies, because peptide hormones are quickly broken down by the body. By activating the biological systems, the satiety signals become effective and lasting.

Students get help to start and develop businesses

VentureLab is part of Lund University and has the task of inspiring entrepreneurship and helping students to start and develop their own companies. The initiative is aimed at all students regardless of subject, background or experience. All ideas are welcome; it doesn’t matter if the innovation is a product, service or concept or how far the students have got in the entrepreneurial process.

Each year, VentureLab reaches around 5 000 students at Lund University through different types of inspiration activity and holds around 350 one-to-one idea and business development meetings. Around 60 students go through the incubator process at a time and there are four intakes a year. The unique thing about the VentureLab incubator is the creative, interdisciplinary environment where the students have the opportunity to try out entrepreneurship and business leadership.

VentureLab was started in 2001 by Professor Allan T. Malm, then head of the Institute of Economic Research, as a project to support entrepreneurial students at the School of Economics and Management and to investigate what interest there was among students in starting their own companies. There turned out to be a lot of interest and the initiative has since developed into its current form, in which it is offered to all students at Lund University. The initiative is mainly funded by the university’s eight faculties and by LU Innovation System.
Endodrill – a unique new method for simpler and more accurate cancer diagnosis

Lund University researcher Charles Walther’s invention, which has the working name of Endodrill, is an instrument for cancer diagnosis. With it, doctors could perform both quicker and simpler examinations with more complete diagnosis results.
THE NUMBER of medical tests being carried out is on the rise, as the range of diseases in the population has changed and the demands for information from each individual test are constantly increasing in order to provide patients with the most accurate diagnosis possible. Endodrill is a new instrument that can test for changes outside or deep in the wall of the target organ. These changes cannot be investigated using existing instruments and there is much room for improvement for both the health service and patients. It is hoped that Endodrill can contribute to this. However, before it can become a reality, clinical trials of the instrument need to be carried out.

– If Endodrill works as intended, a lot of human suffering will be avoided and the instrument is also expected to produce financial savings. This is partly because the tests can be done quickly, and partly because surgical interventions can be avoided in some cases, said Charles Walther, MD and PhD Student in clinical genetics.

The information gained from tests is becoming increasingly decisive for both choice of treatment and prognosis. There are an increasing number of changes in the stomach and lungs that can be viewed with a camera, but the existing sampling instruments that resemble pincers cannot always reach tissue deep down. Much more invasive examinations are then required. These are more complicated, risky and expensive, and expose patients to more discomfort than an endoscopy. Sometimes, surgery has to be carried out directly because it is not possible to take a sufficiently good sample in advance, which gives a worse prognosis for the patient.

Through LU Innovation System, Charles Walther has received help with business development and a patent application for his idea. Charles Walther’s company, BIBBIInstruments, is in the process of being established.

– In the past, research at Lund University has contributed to the development of the medical use of ultrasound and the artificial kidney. We hope to be able to continue this proud tradition, said Sven Olsson, business developer at LU Innovation System.

If Endodrill works as intended, a lot of human suffering will be avoided and the instrument is also expected to produce financial savings.
cTrap helps schools with damp problems

Sweden’s local authorities have major problems with building dampness and indoor air quality, especially in schools and nurseries. Staff and pupils have to be evacuated and major costs are incurred in renting alternative premises. The cTrap covering stops and captures dangerous substances, creating a clean and healthy indoor environment.

Installation of the cTrap covering means that staff and pupils can safely remain in the buildings and major expenses are spared. There has also been interest in the covering from Finland, the USA and China. In summer 2013 a company was founded by researcher Lennart Larsson from Lund University, who has spent several years developing cTrap.

In spring 2013, the first installation was reported, and the results for the cTrap covering exceeded expectations. Today, some ten successful projects have been completed, a company has been formed and a number of tests have been carried out in collaboration with established damage assessment and damp consultants. The covering also stops radon and, unlike similar coverings, cTrap allows moisture to pass through, which prevents new damp problems arising. cTrap cannot only be laid on floors, but also on walls and ceilings, and over wall to floor joints and cavities.

– Building dampness poses a significant problem in our society and many local authorities are severely affected. We now know that cTrap works well and we can help local authorities by quickly making the indoor environment safe, giving them time to plan before more extensive renovation, said Johan Mattsson, CEO of cTrap AB.

Schools with mould problems are often built directly on a concrete base without proper damp barriers. When moisture from the ground meets the building materials, harmful substances are formed, which then force their way through walls and floors. These harmful emissions, for example products of decomposed floor adhesives and PVC floor coverings, spread in the indoor air and create a pungent smell. The cTrap covering is installed simply, and captures and contains the harmful substances at the source, thus preventing them from entering the room. This makes the indoor air both fresher and healthier. The effect is immediate and the smell disappears after a day or so.

– In lab tests, we saw that the cTrap covering reduced the air concentration of aggressive substances typically formed at building dampness by an average of 98 per cent. Certain substances, such as mould toxins, or mycotoxins, were completely eliminated. We now know that the cTrap covering works in cases of real damage, said Lennart Larsson, Professor at the division of Microbial Metabol at Lund University.
Discover
A MAGAZINE ABOUT KNOWLEDGE AND INNOVATIONS FROM LUND UNIVERSITY

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HONEY CURES SERIOUS INFECTIONS
It has long been known that honey is good for health. Lund University researchers Tobias Olofsson and Alejandra Vásquez discovered why and started the company Concellae with the hope that normal honey could be used to cure serious infections. In time, the company’s products could become important alternatives to current antibiotics for serious infections.

EFFICIENT LEDS
Lighting is currently responsible for almost 25 per cent of all electricity consumption. By controlling how nanowires grow on silicon wafers, the nanotechnology company GLO can create light-emitting diodes that are ten times more energy-efficient than incandescent light bulbs. This could reduce total electricity consumption by up to 20 per cent.

CANCER DIAGNOSIS USING MR TECHNOLOGY
Chemistry researcher Daniel Topgaard invented a new method of diagnosing cancer. Using an MR camera, the method makes it possible to distinguish healthy cells from diseased cells without having to remove tissue to examine it. In this way, the patient can get test results rapidly and avoid the worry of waiting. Chemists Karin Bryskhe and Anna Stenstam started their company Collodial Resource on the basis of the new technology.

TREATMENT OF PRE-ECLAMPSIA
Professors of Medicine Bo Åkerström and Stefan Hansson discovered that loose foetal haemoglobin is harmful if it leaks into the mother’s blood circulation. This led to the idea of how to cure pre-eclampsia – a condition that kills one woman every three minutes worldwide.

HUMAN RIGHTS TAUGHT TO CHILDREN
Researchers at the Faculty of Social Sciences and the Lund University Internet Institute had an idea of spreading human rights to children. Ericsson, with its international business network, became the perfect partner. The collaboration laid the foundations for the company FinjaFive – a company that focuses on social innovation.

COVERING TO TACKLE DAMP PROBLEMS
Professor Lennart Larsson developed a cloth that blocks dangerous substances in houses damaged by humidity. The cloth is applied directly to the damp areas, where it lets water molecules through but blocks mould particles and other harmful substances. The effect is immediate and close to one hundred percent.

QUINOA-BASED SKIN LOTION
By replacing chemical additives with quinoa starch in skin lotions, Lund University’s Faculty of Engineering researchers Malin Sjöö, Marilyn Rayner, Petr Dejmek and Anna Timgren succeeded in developing a new type of natural skincare products. The result – a more skin-friendly and stable cream with cheaper ingredients than the products available on the market today – formed the basis of research company SpeXimo.

A UNIQUE NEW METHOD FOR SIMPLER AND MORE ACCURATE CANCER DIAGNOSIS
Lund University researcher Charles Walther’s invention, Endodrill, is an instrument for cancer diagnosis. With it, doctors could perform both quicker and simpler examinations with more complete diagnosis results.

HEALTHY BREAD
Food researchers Christina Sköldebrand, Malin Sjöö and Elin Östman saw that people who avoid foods rich in carbohydrates miss out on important fibre and vitamins. The researchers got the idea of developing healthy bread that lowers blood sugar and developed a measurement method that predicts how the new bread will affect consumers’ blood sugar. The idea became the basis for the company ViscoSens.
Discover. Develop. Share.