UNIVERSITY OF OULU
– Creating innovation for the future

One of the biggest multidisciplinary universities in Finland

Operates in international science networks

Bilateral cooperation agreements with 51 foreign universities

Approx. 570 cooperation agreements and 333 partner universities in different countries in the Erasmus Network

Approx. 50,000 alumni, many of whom are in prominent expert positions in Finland and abroad

EXPERTISE

One of the most innovative regions in Europe

An ecosystem of world-class wireless technologies

Strong capacity for research and product development

Finland’s most efficient startup generator

Know-how focus areas include Printed Intelligence, Data Security, Future Radio Technology (RF), 3D Internet and Well-being Technology

Oulu Capital of Northern Scandinavia

PEOPLE

Population 194,000; city region 250,000

One of the youngest populations in Europe

33 per cent of inhabitants have a university degree

30,000 students in different educational institutions

Home town of Air Guitar World Championships

STUDENTS

15660

New students 1814

Foreign students 833

Publications 3317

FUNDING (M€) 225,5

DEGREES 2618

PERSONNEL 3014

9 faculties

70 fields of science

46 degree programmes

9 faculties

70 fields of science

46 degree programmes
n 2013, the University of Oulu carried out a structural modernisation that may be the most extensive in its history. Its goal is to reinforce the university’s profile, to improve its competitiveness and to render its activities more efficient as a multidisciplinary and international research university. To achieve this goal, the university board has decided to change the structure of the university faculties so that the University of Oulu will contain nine faculties from early 2014 onwards.

The Faculty of Science, the Faculty of Medicine and the Faculty of Technology will continue to operate as faculties, but their operations were partly combined or separated into new faculties including the Faculty of Architecture, the Faculty of Biochemistry and Molecular Medicine as well as the Faculty of Information Technology and Electrical Engineering.

The Faculty of Humanities, the Faculty of Education and the University of Oulu Business School will carry out their activities as before. The university board also decided to establish a mining faculty in late 2013: Oulu Mining School will become the university’s tenth faculty in early August 2014.

Now, faculties will be able to operate as increasingly clear disciplinary entities that can conduct their research and multidisciplinary work more effectively, for instance by developing joint and international research environments. The number of bachelor programmes can be reduced, and flexible pathways to master’s programmes can be constructed. All faculties are represented by their own boards, which also include expert members external to the university.

In connection with the faculty modernisation, a plan for the university facility arrangements was made. The Campus vision 2040 plan attempts to significantly reassess and streamline the operations and to come up with new types of solutions for the use of facilities.

The second international research assessment exercise for the University of Oulu was launched in 2012, and it continued throughout 2013. A research community oriented and future-oriented approach was used in the international research assessment exercise (RAE) process, which is intended to identify strengths and find new opportunities. Researchers were responsible for forming research communities for their work, mainly by crossing the lines between departments or even faculties. Based on the results of the RAE assessment completed by the end of the year, the research carried out at the University of Oulu is largely very good or excellent.

Success in the Academy of Finland’s top unit selections is also indicative of this: from early 2014 onwards, the university will coordinate a total of three top units, and four research groups will be involved in three top units coordinated from elsewhere.

The objectives for internationalisation will be promoted by the ECTS label granted to the University of Oulu, the first Finnish university to receive the label. They will also be supported by the AACSB international accreditation granted to the Oulu Business School, the most highly esteemed accreditation in the field worldwide. The number of foreign applications received for doctoral decree programmes indicates that the university has become internationally more attractive.

Based on this, the university has all the prerequisites for success and for becoming an increasingly modern institution both nationally and internationally, despite the decreasing resources.
MISSION

The mission of the University of Oulu is to further advance the level of internationally high ranking research, education and culture, to strengthen skills that increase well-being, and to secure the availability of highly educated labour and research personnel in its region.

VISION

The University of Oulu is an attractive and successful science university and a pioneer for innovations.

STRATEGIC FOCUS AREAS

- Internationally strong scientific profile
- Active partnership and influence
- Creative community and strong economy

GUIDING PRINCIPLES

- Community
- Pioneership
- Partnership
UNIVERSITY OF OULU – YEAR 2013

JANUARY
Professor of Medical Biochemistry Taina Pihlajaniemi won the most renowned Finnish medical research award, the Matti Åyräpää Prize.

FEBRUARY
The University of Oulu signed a cooperation agreement with the South African University of Johannesburg. The main fields for research and educational cooperation include environmental studies, geography and tourism research.

MARCH
The photography exhibition by Katja Uski on the historical gardens of Suzhou, introducing classical Chinese landscape planning, was opened at the University botanical gardens.

Professor of Medical Technology Timo Jämsä was elected board member of the European Alliance for Medical and Biological Engineering & Science (EAMBES) organisation.

The University of Oulu and the Chinese Huazhong University of Science and Technology signed a student exchange agreement.

APRIL
The open source code UbiCity software was published. They are part of Oulu’s unique information technology infrastructure, which is applicable everywhere.

Professor of Embedded Systems Juha Röning was elected to the board of directors of euRobotics, a European robotics expertise organisation.

Professor of Geography Jarkko Saarinen won the international Roy Wolfe Award in the field of tourism geography for outstanding contributions to geographical research in the field of tourism.

MAY
On the 2012 University Ranking by Academic Performance (URAP) list, the University of Oulu was ranked 338th among global universities. The number of publications is emphasised in the ranking.

The Chair of the Arctic Council and Canada’s minister for the Arctic Council Leona Aglukkaq visited the University of Oulu. She discovered the Giellagas Institute for the study of the Sami language and culture as well as the Thule Institute of Northern Studies.

In the ninth doctoral conference at the University of Oulu, a record number (289) of new doctors promoted. Honorary doctorates were given to 21 receivers. Most of them are distinguished foreign researchers.

The EU LIFE + VACCIA project received the EU Best LIFE Environment project prize. In the project, the University of Oulu and its partners study new ecosystem services in the changing climate.

JUNE
Finland’s largest radio telescope was commissioned at the KAIRA radio receiver station at Kilpisjärvi. The station was established by the centenarian Sodankylä Geophysical Observatory of the University of Oulu.

A total of 200 medical researchers gathered in Oulu for the international EU Cooperation in Science and Technology conference dealing with the defence mechanisms of the human body in response to a lack of oxygen.

A Finnish-German economical and research forum gathered in Oulu to discuss the field of life sciences. The main speaker was Guido Wolf, President of the Baden-Wuerttemberg parliament.

Professor of Biochemistry Kalervo Hiltunen was elected to represent Finland on the Management Board of the European Molecular Biology Laboratory.
Researchers studying the activities and the effects of the sun gathered in Oulu for the Space Climate-5 Symposium. The space climate is a research area established by scholars from the University of Oulu.

Professor of Mathematics Peter Hästö won the 2013 international CMFT Young Investigator award.

AUGUST
The Radamsa tool developed at the University of Oulu has already detected more than 100 previously unknown vulnerabilities in browsers. Radamsa is a fully automated data security testing instrument that detects structures and creates test cases.

University researcher Simo Saarikkala who studies arthrosis with various imaging technologies received a EUR 1.5 million ERC Starting Grant for his research.

In the international university comparison by the University of Shanghai, the University of Oulu was ranked between 301 and 400, as in previous years. The University of Oulu was particularly successful in the field of clinical medicine, scientific references and publications.

SEPTEMBER
Some 4,500 schoolchildren from the schools of Oulu found out about the research carried out at the university at Science Day workshops. Approx. 1,200 inhabitants of the city discovered the university at the evening event also held on Science Day.

The University of Oulu rose from 262nd to 253rd place in the annual international university comparison of the QS World University Rankings. The University of Oulu was ranked best in life sciences and medicine (232nd place).

The international Scandomit 2013 conference brought 90 researchers to Oulu to exchange the latest findings on mitochondrion and related diseases.

The University of Oulu and the German University of Ulm signed an agreement for launching a joint international doctoral degree programme in the field of biomedicine.

OCTOBER
The University of Oulu and the American University of North Carolina at Greensboro celebrated 20 years of cooperation.

The University of Oulu reached 378th place in the worldwide university ranking of the national University of Taiwan. According to the ranking, the university’s strongest fields are environmental sciences, clinical medicine as well as botany and zoology, which placed the University of Oulu among the best 300 universities in the world.

Professor of Microelectronics Heli Jantunen was the first Finn to be elected member of the World Academy of Ceramics. The Academy has 200 members.

The TABULA RASA project was chosen as one of the EU research funding’s success stories. Its key feature is the Local Binary Pattern (LPB) detection method developed at the University of Oulu under Professor of Information Technology Matti Pietikäinen.

NOVEMBER
Abipäivät, the largest event for introducing institutions of higher education to upper secondary school students in northern Finland, attracted more than 4,500 students to the University of Oulu Linnanmaa campus.
Focus and development areas of the University of Oulu center on humans, technology and the environment and the complex interactions among them.
Proportionally to its population, Finland has a vast network of universities and institutions of higher education. In addition to this, several universities act as highly multidisciplinary scientific communities. This is naturally an asset to our country, but it is also a system that requires major resources.

Regardless of the autonomy of universities, the Ministry of Education and Culture strongly encourages universities to closely cooperate with one another and to strongly emphasise their connections to the selected entities. At the University of Oulu, we have attempted to both focus on certain areas and to maintain some of the assets of our multidisciplinary nature when selecting focus areas by emphasizing thematic entities.

The choice of our focus areas is based on their international importance as well as the national characteristics of Finland and the local characteristics of northern Finland. Health and the environment are global issues. The interaction between people and the importance of cultural differences have always been central factors for social welfare, but in a changing world, they become increasingly important.

Information technology has made our world drastically smaller and more effective, and at the same time, it has been a central engine for the development of Oulu. The mining industry is becoming the new backbone of industry in Northern Finland, but at the same time, it also brings significant challenges for research from the point of view of technology and the environment.

Focus areas and development areas are central targets for strategic contributions. They are intended to be used to create scientifically valuable information which, at the same time, will be used as data capital for encouraging growth on a national and regional level.

In a situation of growth, it is easy to develop the selected focus areas when the increasing resources can be allocated to targets that strongly meet the strategic objectives. Unfortunately, this is not currently the case. The national economy of Finland is a cause for concern, and in its framework, the government has suggested more expenditure cuts along with more obligations for the next four-year period.

The expenditure cuts for the Academy of Finland and for Tekes also increasingly limit our freedom of action. The financial crisis that affects the whole of Europe will increase pressure and competition for EU research programmes though their allocations are increasing.

We must therefore reinforce our focus areas and our targets for development according to the strategy in situations where there is less and less to allocate. This will in turn increase the pressure to cut expenses elsewhere. This is a conscious definition of policy from the Ministry in order to oblige universities to strengthen their cooperation.

In principle, this is of course in the universities’ interest. If we cannot make contributions to quality in both teaching and research, a gradual but accelerating tailspin will inevitably begin. By cooperating, we can ensure that we have enough teaching personnel to maintain an extensive supply of education, though research and postgraduate studies are increasingly focused on the key focus areas. The university communities therefore face a common challenge: how to develop quality and influence while using fewer resources.

CHAIRMAN’S REVIEW

QUALITY AND INFLUENCE THROUGH COOPERATION

Professor Hans Söderlund
Chairman of the University Board

THE EXPENDITURE CUTS FOR THE ACADEMY OF FINLAND AND FOR TEKES ALSO INCREASINGLY LIMIT OUR FREEDOM OF ACTION.
FOCUS AREAS ARE GROWING AND BECOMING INTERNATIONAL

The University of Oulu research is intended as internationally high-quality research, particularly in the four focus areas mentioned in the scientific profile. In 2013, the key focus areas for development included e.g. research environments, the recruitment of internationally renowned researchers and the planning of activities within the university’s own doctoral programmes.

Research environments were developed by allocating strategic funding to research infrastructures in the key focus areas. Recruitment packets and tenure tracks have attracted nearly 40 internationally renowned researchers to the university. Last year, nine in-house doctoral programmes were established at the university, and 134 postgraduate students were recruited for them. Doctoral studies will be organised at the University of Oulu Graduate School UniOGS with the objective of finishing a doctoral thesis within four years and lowering the age of defending one’s doctoral thesis.

At the beginning of last year, the Eudaimonia Research Center was launched. Its purpose is to identify and unite the high-standard life sciences scattered across the university and to raise its international level.

The Medical Research Center, the cooperation organisation for the University of Oulu and the Northern Ostrobothnia Hospital District, was also launched. It promotes high-quality clinical research and its internationalisation and renders the use of medical research as well as the implementation of new technologies more efficient.
**Publications, total**

<table>
<thead>
<tr>
<th>Type</th>
<th>Quantity</th>
</tr>
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<tbody>
<tr>
<td>Scientific publications</td>
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</tr>
<tr>
<td>Other publications</td>
<td>1130</td>
</tr>
<tr>
<td>Publications, total</td>
<td>3317</td>
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**Doctoral students**

- **Doctoral degrees**: 142
- **Doctoral students**: 2406
- **Competitive research funding (M€)**: 41,073

**TWO NEW TOP RESEARCH UNITS FOR THE ACADEMY OF FINLAND**

In 2013, the Academy of Finland selected two new University of Oulu units as top research units for the period between 2014 and 2019. They include the research unit for Solar Long-Term Variability and Effects, ReSoLVE, by Professor Kalevi Mursula and the research unit for Relational and Territorial Politics of Bordering, Identities and Transnationalisation, RELATE, by Professor Anssi Paasi.

During the period between 2012 and 2017, The Centre of Excellence in Cell-Extracellular Matrix (ECM) Research operates at the University of Oulu as a top unit of the Academy of Finland.

The top units represent the very best of international research in their field. The top units have strong potential to achieve breakthroughs in their research.

**RAE CONFIRMED THE HIGH LEVEL OF RESEARCH**

The international Research Assessment Exercise RAE continued throughout the year. A total of 49 researcher communities with approx. 2,200 researchers and other staff took part in the exercise. Based on the results of the RAE assessment, the research carried out at the University of Oulu is largely very good or excellent. According to the assessment objective, 13 internationally high-standard scientific communities at various stages of their life cycle were identified.
CLEAN WATER
by combining technologies

Finland is known for thousands of lakes and its pristine nature. The abundant water supply is used as process water for industry and as urban water in households. Water is a valuable resource, and the sustainable use of water, the purification and recycling of water are among the important research topics at the University of Oulu.

In the northern hemisphere, nature is vulnerable, and it is important to take care of the water supply,” says Professor Riitta Keiski who works in the field of process and environmental technology at the University of Oulu and has extensive experience in various purification and waste water processing technologies.

With modern technology, waste water can be purified very effectively, but the most cost-effective and sustainable technologies are being actively researched. “The purification of waste water means optimising several different technologies, and extensive skills are needed,” Keiski says.

Waste water can be purified using physical, chemical and biological methods. Each method has its positive and negative aspects, and the most functional solutions are often found in the interfaces between technologies and in combining them.

The film method serves as an example of a physical method. In this method, water is filtered through a thin film. The film prevents the penetration of unwanted substances, while clean water flows through it. The method, for instance, can be used for separating heavy metals. The problem is that the film will be soiled, which decreases the flow of water. The process will slow down, and the costs will increase.

Catalysts used as workhorses

Catalytic methods can be included in the biological and chemical methods. In catalytic methods, the reactions of harmful substances contained in water will be activated with catalysts to achieve a less harmful form.

“Catalytic methods can be carefully planned in order to separate exactly what is desired from the substances,” Keiski describes. For instance, catalysts can be used to speed up the oxidation of organic substances containing carbon into carbon dioxide and water.
IN THE BEST CASE SCENARIO, METALS AND NUTRIENTS CAN BE SEPARATED FROM WATER AND REUSED.

“By using the correct type of catalysts, harmful substances can be transformed into useful ones, such as hydrogen.” Catalysts are used as workhorses that are selected according to the task.

Riitta Keiski believes that methods based on catalysis are promising for the future of developing sustainable waste water purification. Currently, several research groups are studying these methods at the University of Oulu. The most recent applications in the field include photocatalysis, where semiconductors and ultraviolet light are used as catalysts.

“For instance, photocatalysts can be used to precipitate arsenic to transform it into solid matter, which is when it will sink to the bottom of the purification basin, and it will no longer prevent the flow of water through the film. In the best case scenario, metals and nutrients can be separated from water and reused.” It is useful to combine various water purification technologies, then process waters which contain exploitable substances.

Rapid development for the future

“At the University of Oulu, issues related to water are comprehensively studied, and at best, the research is truly multidisciplinary,” Keiski says. New and innovative fields include the study of mathematical planning for water purification chemicals.

According to Keiski’s estimate, water research will advance rapidly. Innovative material solutions, such as the use of graphene in water film technology, will enable new directions in water purification.

“Purification methods must be carefully considered and have a sustainable foundation. We must remember that water is a valuable resource that must not be wasted,” Keiski emphasises.
Global water issues
CAN BE SOLVED

Every 20 seconds, a child in the world dies due to dirty water. To prevent this from happening, sufficient amounts of clean water and good water management are required. Professor Bjørn Kløve from the University of Oulu emphasises that the problem could be dealt with using current solutions, if there were willingness to do so.

Globally, 740 million people live without quality water, and 2.5 billion people live without sufficient sanitation. In developing countries, the mixing of waste water and drinking water is one of the reasons for the contamination of domestic water. This is why one of the EU Millennium objectives was to increase the global population benefiting from good sanitation by 2015.

According to Professor Bjørn Kløve, it is possible to achieve safe water management. The problem will be solved by building wells, suitable toilets and a sewer system where required. “This is above all a political question, and it can be solved.”

Professor Bjørn Kløve is leading a water and environmental technology research group at the University of Oulu. In his opinion, the shortage of clean water is not only a problem for the developing world: “Urban waste water is not even properly purified in Central Europe.”

Population growth is the key reason for the decrease in water quality despite the development of technologies. In addition to urban communities, agriculture and industry are among the worst water polluters. The natural environment also has an effect on the quality of water. Humus find its way into waterways from forest and bogs, particularly in conditions where plants decompose slowly. The use of land and the decreasing surface of groundwater can oxidise the soil, which can also contaminate waterways under certain conditions.

“We constantly study the purification of water derived from mining activities, the industry and from the production of peat. Certain purification methods are suitable for certain types of water, and certain processes require certain conditions.”

Researchers have developed mechanical, chemical and biological methods for the purification of water. Bjørn Kløve emphasises that any water can be purified with enough will and funding.

Global water resources are limited

In addition to the purification of water, researchers examine the availability of water. “Groundwater and surface waters have been used across the world with no plans for the future. People imagined that water was an inexhaustible resource. This is not the case: only a certain amount of groundwater can be replenished,” Kløve points out.

Agriculture consumes large amounts of water in the world. “In Europe, the surface of groundwater has decreased as much as 100 meters in many places due to irrigation. The Aral Sea is all but dried up. This also applies to Lake Chad in Africa and to several lakes in Turkey and Iran. On the American prairies, the ground surface has sunk dozens of meters due to the extensive use of groundwater.”

HILKKA SANDBERG
When water is used excessively, particularly along the coastal areas, well water will become salty. In this case, the water cannot even be used for irrigation. The use of water in agriculture is increasing due to the growing production of meat, which requires plenty of water and which also contaminates waterways. The extensive use of water also affects the balance of nature: in addition to drying lakes, river flows are changing, and wetlands are disappearing.

Natural climate change along with the change caused by greenhouse gases sets its own additional challenges for water sufficiency. The areas that are now deficient in water will increasingly suffer from water shortages in the future, while areas with plenty of water will receive more of it.

“Approx. 20 percent of the global population receives its drinking water from the ice water derived from glaciers. When the amount of ice decreases due to the climate change, the amount of clean drinking water will also decrease. For instance, people living by the rivers flowing from the Swiss Alps or in the Himalayas may be affected by this. This shortage of water is already apparent in California.”

Information for modernising the Groundwater Directive

At the University of Oulu, waters are studied particularly at the Faculty of Technology, the Faculty of Natural Science and at the Thule Institute. Researchers from Oulu have carried out unique cross-disciplinary research on water, taking into consideration the effect of water consumption and the changes on people and the ecosystem.

“Water is used by many operators. When conducting water research, it is important to understand the larger whole. The questions include how to best exploit water resources; how to understand the need for water in ecosystems; how to understand the recreational use of water, fishing, water transportation, the production of hydroelectric energy, irrigation and so on.”

Professor Bjørn Kløve led the recently completed Genesis EU project where research data was gathered to update the EU Groundwater Directive.

“We introduced a multidisciplinary approach to groundwater management. This has previously been studied mainly by geologists and engineers, whereas this time, the aim was to obtain a comprehensive understanding of ground waters. At Oulu, we studied waters in the framework of this EU project from the perspective of hydrology, sociology and ecology.”

The project developed various research methods and compared various mathematical models. “We also acquired plenty of information on northern ecosystems. Based on the research results, decision-makers will be able to create sustainable groundwater solutions.”

Agriculture consumes large amounts of water worldwide. As a result, The Aral Sea between Kazakhstan and Uzbekistan has all but dried up, and much of it has become desert.
The objective of the University of Oulu is to carry out its educational activity according to high standards based on its high-quality research.

International evidence on the quality management of education includes the European Credit Transfer and Accumulation System Label (ECTS) granted to the University of Oulu by the European Commission as the first Finnish University in 2013.

The ECTS label indicates that the University of Oulu operates as an open and reliable partner in international cooperation. The degree programmes and study periods have been described coherently and in a student-oriented way based on the objectives for expertise. Studies carried out in other European institutions of higher education will also be recognised based on verification using the label, and exchange students can advance in their studies at the pace expected.
QUALITY CRITERIA FOR INTERNATIONAL MASTER PROGRAMMES

Last year, 21 international Master programmes were offered at the University of Oulu. To guarantee the quality, the university drafted a set of basic criteria for these programmes.

WORKING LIFE SKILLS FROM EDUCATION

One of the important objectives for developing education is to increase its relevance for working life. Practical training in working life is already part of several educational programmes at the University of Oulu, and it is expanded to cover new areas. Training will increase the students’ motivation to study, and it will also allow them to finish their studies more quickly.

INCREASING NUMBERS OF FOREIGN STUDENTS

Internationalisation is an important objective for developing education. The number of foreign undergraduates further increased in 2013, as did the number of degrees they completed.

AN ESTEEMED AACSB ACCREDITATION FOR THE OULU BUSINESS SCHOOL

In 2013, the Oulu Business School became one of the world’s most esteemed business schools as it received the international AACSB accreditation in recognition for the high quality of its activities. The accreditation by AACSB International – The Association to Advance Collegiate Schools of Business – is the most significant recognition of high quality internationally granted to business schools. Globally, only approx. five percent of business schools meet its requirements.

For the AACSB accreditation, three areas of activities will be assessed: strategic leadership, the quality of personnel, students and processes, and the quality of educational programmes and learning.
In the 21st century, Finland has done very well according to the international PISA study measuring school children’s skills. Our high-level teacher education is believed to be one of the reasons for this. In order for us to remain at the top of the list, teacher education must continuously develop.

In Finland, all schoolteachers study at universities and hold a master’s degree. Nine universities provide education for teachers. According to many studies, university education is the most significant factor for producing highly qualified teachers.

In addition, the teacher’s profession has traditionally been held in high esteem in Finland. Even today, the number of applicants far exceeds the number of spots. Only ten percent of applicants will receive a spot at a teacher’s university. Good students are selected through competition. The students will advance in their studies and graduate within approx. five years.

“In teacher education, the University of Oulu has profiled itself as an innovator, developing new solutions for the challenges of a changing society,” explains Riitta-Liisa Korkeamäki, dean of the faculty of education. These were the grounds for selecting the teacher education provided at Oulu, which was selected as a national top unit of education for two consecutive years.

A rapid response to technological development is one important challenge. “Technology is developing at a rapid pace, and there is no denying its existence. We must attempt to keep up and even be forerunners in introducing new practices to teaching. This is why it is important to equip future teachers with the technical knowledge and skills required.”

Korkeamäki emphasises: “However, understanding the theoretical basis for learning, teaching and the related research is even more important than having practical skills. This has been central to the research-based teacher education. The goal is to foster an inquisitive attitude towards teachers’ own work and encourage them to develop it.”

New research facilities for support

The University of Oulu is about to meet the technological challenge by studying teaching and learning through technology. In 2013, a new type of research environment, LeaF, was completed. It is a facility equipped with adaptable furniture and recording technology. The technology used includes the so-called More camera equipment developed at the University of Oulu that records the events of the facility omnidirectionally at 360 degrees, and an audio recording system.

“The facility and equipment provide an excellent opportunity to carry out both applied research and basic research on learning, such as the study of interaction in various teaching and negotiating situations,” Korkeamäki describes.

In teacher education, the LeaF facility will be used by including students in the new research environment. “Thanks to the environment, the students can become familiar and reflect on various research and learning situations while working on their own activities. The goal is to encourage the students to assess their work and its results independently using various methods while developing solutions for potential problems.”

For instance, the LeaF facility can be used for studying the types of multiliteracy required for using new technologies. “Literacy is multimodal. It does not only
The study of multiliteracy is required to more fully understand what learning is and how one can learn in different environments and incorporate new technologies. Based on the research data, it is possible to take advantage of the myriad opportunities technology provides.

apply to text; there are various types of literacy such as the ability to interpret image and sound. In the new national curriculum, multiliteracy plays a central role in all types of learning. This is why more multidisciplinary research on the subject is required, and the LeaF facility provides an excellent opportunity for this.

At the University of Oulu, the educational research environment is supplemented by the Lastu research nursery, which was constructed and opened in 2013. It is used to observe the daily activities of nursery school children and to examine them in authentic situations and in a natural environment.

In addition, at the Oulu University Teacher Training School future teachers will get experience working on various pedagogical research projects, along with experimental and developmental projects. One of these is the new flexible learning environment UBIKO where teachers, students and researchers cooperate to specifically study skills associated with self-regulated learning.

In addition, the LearnLab laboratory has operated in connection with the faculty for several years in the field of basic experimental behavioural studies.

“THEORETICAL BASIS FOR LEARNING, TEACHING AND THE RELATED RESEARCH IS EVEN MORE IMPORTANT THAN HAVING PRACTICAL SKILLS.”

However, understanding the theoretical basis for learning, teaching and the related research is even more important than having practical skills.

In addition, the research environment formed by all these facilities will open up new possibilities for combining teaching and research. We attempt to improve education at all its levels from early education to university teaching.

As the research facilities are available to other sciences at the University of Oulu, Korkeamäki estimates that new multidisciplinary opportunities will be created and that teacher education will continue to be innovative.

TEXT: TIINA PISTOKOSKI
PHOTO: JUHA SARKKINEN
NEW BUSINESS ACTIVITIES BASED ON INNOVATIONS

The University of Oulu is one of Finland’s most significant innovation universities. This is indicated by dozens of annual notifications of invention and by the 40 companies established based on research projects. The University of Oulu has good connections to its operating environment as well as an extensive partnership network. Strategic cooperation continued at an intensive pace throughout 2013 under the banner of the Oulu Innovation Alliance. In addition to the university, the alliance includes the City of Oulu, Oulu University of Applied Sciences, VTT Technical Research Centre of Finland and Technopolis. The target areas of the innovation alliance include Internet research, printed electronics, international business, health and welfare as well as the environment and the energy industry.

NEW HEALTH CARE SERVICE SOLUTIONS

Centre for Health and Technology (CHT) is one of the centres of Oulu Innovation Alliance. It coordinates multidisciplinary research, development and innovation activities connected with health and well-being.

During 2013, CHT carried out the INDICO project. The project looked at the connecting of services, equipment and data transfer connected with health upkeep and treatment of diseases into a whole which supports individual and self-directed health control and connections with health professionals. The individual service solutions to be developed will also create possibilities for new business.

Research on the topic will continue in the REAdi for Health project. It aims to speed up the implementation of modern information and communication technology and digital services in the health and well-being sector. The participants of the project are Northern Ostrobothnia in Finland, Scania in Sweden, Midi-Pyrénées in France and the region of Murcia in Spain.

BUSINESS KITCHEN

FRUITFUL SUPPORT FOR COMPANIES

The Business Kitchen is an open innovation environment whose services are designed for companies and used to develop various business ideas. Its services also help established companies to make further progress. With the support of the Business Kitchen, which has been up and running for a little more than a year, 30 new companies have been established, and dozens of companies have been able to speed up their growth.

The services of the Business Kitchen transmit to companies the skills learned at the University of Oulu and the Oulu University of Applied Sciences. The city of Oulu’s enterprise, Business Oulu, will also participate in activities. It is in charge of the city’s business sector and provides the development services companies require.
The use of research results also leads to funding for research. Between 2012 and 2013, EUR 3.6 million was allocated to the University of Oulu from the TUTLI (New knowledge and business from research ideas) programme of the Finnish Funding Agency for Innovation (Tekes).
The Internet technology research and innovation centre CIE (Centre for Internet Excellence) and companies based in Oulu are making an international breakthrough in the development of the three-dimensional Internet. Among its many activities, CIE is processing the open source code to create the future Internet platform.

Examples of visualising the three-dimensional Internet as produced by various branches of activity include games, animations, facility planning programmes and stimulators. Experiencing the virtual environment largely follows the same technical and emotional principles of how surfing the net will be experienced in the future. In this field, the CIE centre operating at the University of Oulu is equipped to study, search and develop potential uses for the 3D Internet.

“Our environment includes plenty of downloadable applications, cloud services, sensors and the data these features produce, and we will interact with them. Internet connections and the devices are increasingly more powerful, which means they will soon be ready for the 3D Internet. This is why user
interfaces must also be developed," says Kari Autio, Chief Technology Officer at CIE.

**Technology from Oulu on the rise**

Recently, the research centre was included in the extensive European FIWARE project. The EU-funded project, which is worth millions of euros, will for the first time internationalise the 3D Internet know-how from Oulu on a large scale. Among the many project opportunities, the virtual universe programme platform realXtend developed in the Oulu region will have the chance to develop and expand to the whole of Europe.

For instance, the Oulu city centre and an art exhibition in Berlin have already been modelled on the realXtend virtual platform. International items will also be developed for the platform, since CIE intends to merge the platform as part of the future Internet.

Among other things, merging would simplify the use of various virtual universes. While the use of virtual universes previously required that a separate application component be downloaded on each terminal, virtual universes could be used seamlessly with the platform regardless of the browser and the terminal.

"The fact is no equivalent open source code has been developed elsewhere in Europe. With these types of features, visually impressive Internet products will become common," Autio predicts.

**Open source code as a joint asset**

The centre, which is part of Oulu’s innovation alliance, has attempted to produce internationally significant projects. According to Mika Ylianttila, the director of CIE, this is why it was extremely important for the centre to participate in the FIWARE project.

“FIWARE is without a doubt the most significant European project for the development of the future Internet platform. It will open up doors for international research cooperation and for new business activities for companies. The cooperation project between Nokia and Intel was an important forerunner in its time, and now FIWARE is part of this continuum," Ylianttila explains.

In the project, CIE’s corporate partners include the following companies based in Oulu: Admino Technologies, Cyberlightning, Ludocraft and Playsign. The project results, as well as the other research carried out by CIE, is openly available.

![Image](image-url)
The number of international personnel is increasing at the University of Oulu. In late 2013, the university employed 394 international staff members, or 12.7% of its entire personnel. There are international staff members from over 50 countries, mainly from China, Russia and India.

The internationalisation of personnel will be systematically continued, for instance by prioritising international applications during recruitment for research focus areas.

A healthy economy is an essential foundation for pushing the boundaries of research and education. The 2013 financial statement for the University of Oulu was in the black, but its financial prospects are challenging.

Investment and funding activities totalled EUR 9.4 million, which resulted in a surplus of EUR 4.8 million. The total revenue of the university was EUR 225.5 million, and the expenditure for activities totalled EUR 229.9 million, resulting in a revenue deficit of EUR 4.4 million.

The reduced budgetary funding and increased general operating costs still pose challenges to the university. An attempt is made to improve cost-effectiveness e.g. by using the facility more efficiently.

In late 2013, the University of Oulu had a total of approx. 207,000 square metres of facilities. In Oulu, the activities are concentrated on the Linnanmaa and Kontinkangas campuses.
73% of the personnel operate in faculties. 60.6% of the personnel have a Master’s degree and 28.6% have a doctorate. 48.8% of the personnel are women.
**FACULTY OF HUMANITIES**

**SUBJECTS**
- Information Studies
- Logopedics
- Finnish Language
- Sámi Language
- Sámi Culture
- English Philology
- German Philology
- Scandinavian Philology
- Literature
- History
- History of Ideas and Science
- Cultural Anthropology
- Archaeology

**UNDERGRADUATE STUDENTS** 1909
- First year students 234
- Postgraduate students 235

**DEGREES AWARDED** 392
- Bachelor's degrees 169
- Master's degrees 207
- Doctoral degrees 16

**PERSONNEL** 134
- Teaching and research personnel 119
- Other personnel 15

**PUBLICATIONS** 357
- Academic publications 183
- Other publications 174

**FACULTY OF EDUCATION**

**SUBJECTS**
- Education
- Music Education
- Early-Childhood Education
- Primary Teacher Education
- Master of Education, Intercultural Teacher Education
- Technology Oriented Primary Teacher Education
- Arts and Craft Oriented Primary Teacher Education
- Pedagogical Studies for Teaching Certificate

**UNDERGRADUATE STUDENTS** 1753
- First-year students 268
- Postgraduate students 137

**DEGREES AWARDED** 461
- Bachelor's degrees 234
- Master's degrees 218
- Doctoral degrees 9

**PERSONNEL** 159
- Teaching and research personnel 119
- Other personnel 40

**PUBLICATIONS** 180
- Academic publications 70
- Other publications 110

**FACULTY OF SCIENCE**

**SUBJECTS**
- Biochemistry
- Animal Ecology, Animal Physiology, Plant Ecology, Plant Physiology, Genetics
- Biophysics, Physics, Geophysics, Theoretical Physics, Astronomy
- Geology and Mineralogy, Surficial Geology, Geochemistry
- Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Structural Chemistry
- Geography
- Mathematics, Statistics, Applied Mathematics
- Information Processing Science

**UNDERGRADUATE STUDENTS** 3206
- First-year students 529
- Postgraduate students 377

**DEGREES AWARDED** 493
- Bachelor's degrees 218
- Master's degrees 243
- Doctoral degrees 32

**PERSONNEL** 461
- Teaching and research personnel 347
- Other personnel 114

**PUBLICATIONS** 498
- Academic publications 404
- Other publications 94
### FACULTY OF MEDICINE

#### SUBJECTS
- Dental Specialist
- Medical Specialist
- Dentistry
- Nursing Science
- Welfare Technology
- Clinical Laboratory Science
- Medicine
- Radiography
- Health Care Administration
- Health Science Teacher

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### OULU BUSINESS SCHOOL

#### SUBJECTS
- Management and Organization
- Economics
- Accounting
- Marketing
- Finance
- International Business

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### FACULTY OF TECHNOLOGY

#### SUBJECTS
- Architecture
- Mechanical Engineering
- Process Engineering
- Electronics
- Information Engineering
- Industrial Engineering and Management
- Environmental Engineering

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The work of the current and previous experts at the Finnish Institute for Verification of the Chemical Weapons Convention (VERIFIN) has served as an important basis for the entry into force in 1997 of the international disarmament agreement based on the verification or detection analytics of chemical weapons. The agreement is universal, and 190 member states have signed it.

For years, I have argued in favour of having such readiness for the verification of chemical weapons. I was saddened by the fact that the neurotoxic gas sarin was used last autumn in Syria. Its use could be arguably proven by using internationally approved methods of operation.

The samples were taken in a war zone, which makes the success of the entire process even more critical. It is extremely important for the methods of operation used in a politically delicate situation to be approved by all parties.

The most essential feature of the entire verification process is the unbroken chain of evidence from the sampling to the analysis results. The Syrian samples were analysed under great international pressure. Once we received the samples, the first analysis report was delivered to the international Organisation for the Prohibition of Chemical Weapons as early as six days after the arrival of samples. The entire cooperation was excellent. This would not have been possible without years of preparation for such situations.

The work was emotionally difficult for our working group, particularly since one-third of the victims were children. None of us has ever anticipated that chemical weapons would be used, though we are prepared to prove their existence and constantly carry out research on verification analytics. Personally, I hope that the knowledge of the existence of verification methods may prevent similar events in the future.

The Ministry for Foreign Affairs for Finland has supported the activities of VERIFIN for 40 years. High-quality national research cooperation between operators such as the universities of Oulu, Jyväskylä and Helsinki has played a key role. After this, research results have been available for testing on an international level.

At the same time, important chemical structural research expertise has developed in Finland. We can be proud of that. The cornerstones of our success have included a commitment to the objectives, hard work, a high standard of research and international cooperation.

In 2013, our work was internationally recognised as the international Organisation for the Prohibition of Chemical Weapons received the Nobel Peace Prize. We received a copy of the prize medal, which was a concrete recognition for us. I am also very proud of the University of Oulu Alumni of the Year 2013 title. It was excellent that the person selected was a chemist.

I am very interested in maintaining our ability to conduct research at international standards. We need persevering researchers and partners along with modern equipment. To be able to do this, we cannot lose heart, though the outlook may not always be bright.

RESEARCH TO PREVENT THE USE OF CHEMICAL WEAPONS
# Organisation

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