



UNIVERSITY OF HELSINKI

ANNUAL REPORT
Faculty of Pharmacy

08





THE YEAR 2008 was an exceptionally successful one for the Faculty of Pharmacy. Especially pleasing was that the faculty was designated a Centre of Excellence in University Education for 2010–2012 by an international evaluation team assigned by the Finnish Higher Education Evaluation Council. The designation is a valuable recognition of our work, since there were only a total of ten centres of excellence nominated nationwide, of which the University of Helsinki was awarded two.

Among other things, the Centres of Excellence were commended for their efforts in developing the pedagogical skills of teaching staff, making degrees meaningful wholes, interlinking research and teaching, and consideration of working life relevance. The special strengths of the Faculty of Pharmacy are its active teaching staff and systematically pursued development work. In the evaluation report, the faculty is characterised, among other things, as follows: "The unit demonstrates a strong commitment towards teaching and a focus on the pedagogical development of its staff, as demonstrated by the annual faculty award for distinguished achievement in educational development."

The faculty exceeded its degree targets in all respects. The total numbers of completed Bachelor's, Master's and Doctor's degrees were clearly above targets. In fact, the number of graduated Masters and Doctors was larger than ever. The number of completed Master's degrees was clearly affected by the degree reform, but improved thesis supervision was also of considerable significance in this regard.

The researchers at the faculty received several awards and grants. Of these, particularly noteworthy are the Millennium Distinction Award awarded to Professor Arto Urtti by the Technology Academy Foundation, and the Outstanding Graduate Student Research Award received by Researcher Sabiruddin Mirza. On the same occasion, Mirza's supervisor, Professor Jouko Yliruusi of the Division of Pharmaceutical Technology, was also awarded for his commendable work in supervising doctoral theses. The faculty granted this division an award for its distinguished postgraduate training.

The faculty also invested in staff training. Two training and development seminars were arranged for teaching and research staff. The development of budget funding is detailed in the statistics found in the last two pages. However, as far as funding is concerned, it can be noted that the share of supplementary funding was increased on the previous year.

The faculty's important Drug Discovery and Development Technology Center changed its name to the Centre for Drug Research (CDR). The faculty also welcomed a new professor when Dr. Marjo Yliperttula started as Professor of Biopharmacy. Her thoughts can be read on page 8 of this Annual Review. On the Highlights pages you can also read more about many other great moments from the past year.

Dean Raimo Hiltunen

Awards and scientific merit

Faculty of Pharmacy designated a centre of excellence in teaching

The Finnish Higher Education Evaluation Council has, for the fifth time, selected ten Centres of Excellence in University Education for 2010–2012. For the University of Helsinki, the status was awarded to the Faculty of Pharmacy and the Department of Computer Science. In its grounds for the nomination, the jury commended the selected units for, among other things, their efforts in developing the pedagogical skills of the teaching staff and making degrees meaningful wholes. Research and teaching are well integrated in the selected units, and the relevance to working life is considered in the content of the degrees, and the teaching methods and learning assessment procedures support each other.

Millennium Distinction Award to Professor Arto Urtti

Arto Urtti, Professor of Biopharmaceutics and Director of the Centre for Drug Research, received the highly esteemed Millennium Distinction Award given by the Technology Academy Foundation. He was rewarded for his pioneering work in the field of drug delivery and the development and application of new drug discovery tools. In their study

of drug delivery methods, Prof. Urtti and his team made use of nanotechnology and biomaterials. The drug discovery tools are new cell and computer models.

International dissertation award for a pharmaceutical solids crystallisation technology

The American Association of Pharmaceutical Scientists (AAPS) awarded Researcher **Sabiruddin Mirza** the 2008 Outstanding Graduate Student Research Award in Pharmaceutical Technologies. His supervisor,



Sabiruddin
Mirza



Arto Urtti

Professor **Jouko Yliruusi**, was also rewarded for his commendable work in supervising doctoral theses.

In his dissertation research, Mirza presented a new crystallisation approach that enhances the compaction properties and tableting performance of active pharmaceutical ingredients. The thesis gives an understanding of the relationship between the crystalline forms of active pharmaceutical ingredients, which is of practical importance for solid-state control during processing and storage. The suggested new tool for designing the technological properties of active pharmaceutical ingredients is of considerable practical interest.

Samuli Hirsjärvi wins the Albert Wuokko Award

The highly esteemed Albert Wuokko Award was granted to **Samuli Hirsjärvi** for a distinguished doctoral dissertation whose subject matter, nanotechnology, is of major importance in terms of future pharmaceutical applications.

The €4,000 prize is one of the most esteemed in the field of pharmaceutical science. It is awarded every other year to a junior and a senior research scientist who has demonstrated decisive and pioneering work towards the improvement of pharmaceutical instruction and research.

EUFEPS research award to Jouko K. Yliruusi

The European Federation for Pharmaceutical Sciences (EUFEPS) granted the New Safe Medicines Faster Award to Professor **Jouko K. Yliruusi** for his pioneering work in the application of PAT (Process Analytical Technology) to drug formulation and process research. The award is granted annually to a researcher or research group that has shown merit in developing new methods or technologies for accelerating or increasing the efficiency of drug production processes.

Finnish-American research article recognised among the most significant in the field

An article jointly published by a research team working at the Division of Pharmaceutical Chemistry and researchers from Purdue University in the United States was included in the Royal Society of Chemistry list of highlights for 2007. The significance of the listed research is further enhanced by the fact that it falls within the area of metabolism research. One of the principal bottlenecks in drug discovery is the slowness of the analysis of small molecules. This problem is now addressed by the newly developed direct analysis method.

The authors of the article entitled "Rapid analysis of metabolites and drugs of abuse from urine samples by desorption electrospray ionization-mass spectrometry" included **Tiina J. Kauppila, Tapio Kotiaho** and **Risto Kostiainen** from the University of Helsinki.



A stimulating seminar

A cholesterol drug from an imperial fruit tree in China?

Li Xiang Ming, a medicinal plant cultivator from China, visited the faculty at the invitation of Dean **Raimo Hiltunen**. His seminar lecture speech was entitled "A green world: conservation of endangered plants and preservation of biodiversity – a Chinese cultivator's dream and its realisation."

Li cultivates a fruit named *Citrus grandis* var. *tomentosa*, which is considered holy in traditional Chinese medicine, and whose cholesterol-lowering effects have provoked interest in the Faculty of Pharmacy. It may well constitute a clinically tested ingredient of a functional food in the future.





Dissertations of special interest during the year

Help for Alzheimer's patients from antioxidants contained in lemon balm

The doctoral dissertation by M. Pharm. **Keyvan Dastmalchi** that was examined in November 2008 revealed that Moldavian dragonhead (*Dracocephalum moldavica*) and lemon balm (*Melissa officinalis*) contain active antioxidants that may be relevant in the development of new therapies for Alzheimer's disease. The compounds contained in lemon balm also demonstrated acetylcholinesterase (AChE) inhibitory activity, which is important for the treatment of Alzheimer's disease. The results support the view that ethnopharmacological screening of plants would contribute to the development of a new type of drug treatment for Alzheimer's disease. Based on this research, Dastmalchi was awarded the 250-year jubilee grant of €16,000 from the University Pharmacy.

Passive exposure increases the risk of nicotine addiction

According to the dissertation research by M. Pharm. **Anne Tammimäki**, the formation of a nicotine addiction as a result of experimentation with smoking is more likely to take place if the person has previously been exposed to nicotine. The research also produced new information about the relationship between alcohol dependency and a COMT enzyme that participates in the breakdown of dopamine.

The research showed that forced nicotine exposure increases the amount of dopamine and dopamine metabolites, as well as the motion activity of mice. The results indicate that the sensitivity of nicotine-exposed mice to the reinforcing effects of nicotine was enhanced compared to the control mice.

No antioxidant effects involved with herbs?

The results of the dissertation research by M. Pharm. **Anna Nurmi** indicate that the phenolic compounds contained in herbs do not produce any direct antioxidant action in the human body. Antioxidant actions have been assumed to partly explain the link between a high dietary intake of fruits and vegetables and protection against chronic diseases. However, the favourable health effects of a high dietary intake of fruits and vegetables may be mediated via some other mechanism.



Personnel news

Leo Pyymäki was the Department Head of the Year 2008

The University of Helsinki staff association, HYHY, selected **Leo Pyymäki**, Head of Administration, as the 2008 Department Head of the Year. Pyymäki was described as being friendly, earnest and polite. Pyymäki is a responsible manager who adheres to sound ethical principles in his work. He understands people and their different life situations, shows warmth, empathy and relaxed humour, and is capable of giving feedback in a positive way.

A nanoscientist appointed Professor of Biopharmaceutics

Dr **Marjo Liisa Yliperttula** was appointed Professor of Biopharmaceutics from the be-

ginning of 2009. Yliperttula has worked at the University of Helsinki Faculty of Pharmacy since 2005.

Specialising in physical chemistry, she combines the study of nano-structures with drug research. Nanotechnological methods can be employed in enhancing the delivery of pharmaceutical substances into target tissues and in investigating and further developing the use of new two or three-dimensional cell structures in drug testing.

Certificate of honour awarded to a student in the Faculty of Pharmacy

The faculty awarded a certificate of honour to **Minna Saari** for her distinguished contribution to the furthering of the interaction between the faculty and students during her study time. She was particularly active near her graduation in the terms of 2007 and 2008, during which she served as the Chair of the Educational Policy Committee of the

University of Helsinki Pharmacy Student Association YFK. The certificate of honour commends Ms Saari for her contribution to the development of student tutoring and her active involvement in, among other things, student organisation activities and collection of student feedback.



Minna Saari



Division of Pharmaceutical Technology recognised for its excellent dissertations

EMPLOYING SOME thirty people, the Division of Pharmaceutical Technology is one of the largest units in the faculty. The division has merited recognition for its voluminous and high-quality dissertation production. In 2008 the faculty honoured the division with the 'Innoopeli' award for its successful and effective postgraduate education.

Professor **Jouni Hirvonen**, Vice-Dean responsible for teaching, emphasises that, insofar as dissertations are concerned, this was not only a question of quantity but definitely also of quality of research.

"Eight theses were completed in our division last year, two of which were granted an esteemed dissertation award," he says. "The American Association of Pharmaceutical Scientists (AAPS) recognised **Sabiruddin Mirza** for his dissertation on pharmaceutical solids



Professor Jouni Hirvonen with the traditional name tag of the Division of Pharmaceutical Technology – the long traditions of the discipline will provide support and inspire excellence in research in the future as well.

crystallisation technology. **Samuli Hirsjärvi**, on the other hand, won the highly esteemed Albert Wuokko Award for his dissertation in the field of nanotechnology. The Wuokko Award is granted every other year to a junior and a more senior researcher who has demonstrated decisive and pioneering work towards the improvement of pharmaceutical instruction and research."

According to Hirvonen, the large number of high-quality dissertations is not a coincidence but is based on persistent and systematic work. There will also be other

excellent dissertations completed in the near future.

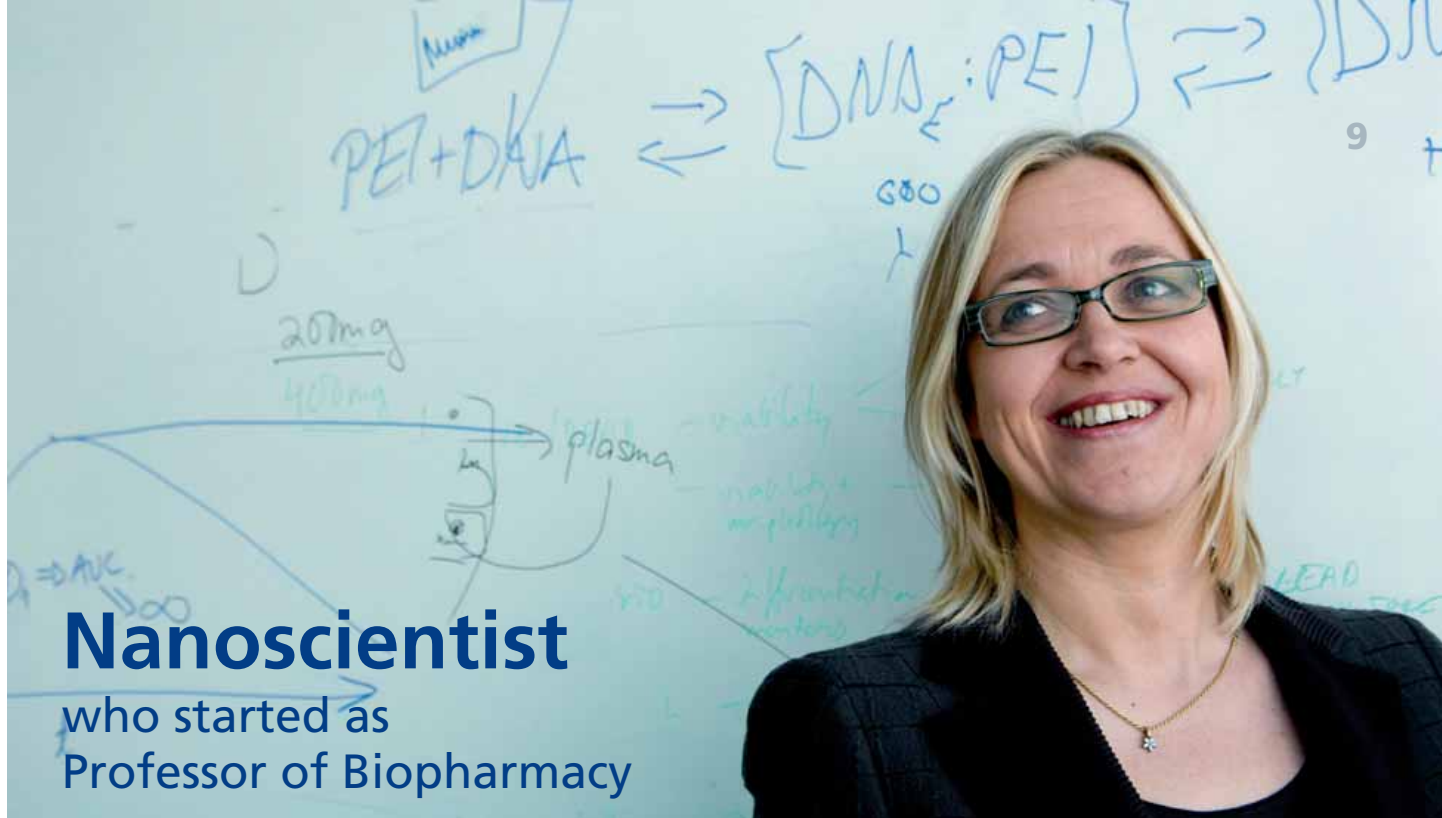
"The greatest thanks and merit go to the Head of the Division, Professor **Jouko Yliruusi**. With his leadership and inspiring example and ideas, emphasis has truly been placed on research. Dissertations are always prepared in larger groups under the supervision of professors and senior researchers. Successful recruitment also plays an important role. The number of senior researchers has been increased, and they have done a great job," he explains.

Towards new medicinal products

According to its strategy, the five principal research areas of the division are: process analytical technologies, drug delivery technologies incl. nanotechnological drugs, formulation research, ADME research, and industrial pharmacy.

"The main focus is on orally administered medication, but alternative methods of administration, such as dermally administered medicinal products, are also investigated," Hirvonen explains. "The continuous follow-up of drug manufacturing processes and the development of new methods and models for, among other things, spectroscopic and imaging methods are the focus areas of the division's research."

"Fruitful cooperation and project-inspired interaction between researchers with different backgrounds in natural or pharmaceutical science clearly yield good results to the benefit of the development and research of medicinal products. There will be an increasing demand for research on medicinal products in the future as well. The research on medicinal substances is not alone sufficient. There is still a long and arduous way to go from the discovery of a bioactive molecule to a commercial medicinal product," he concludes.



Nanoscientist who started as Professor of Biopharmacy

MARJO YLIPERTTULA IS the most recently appointed professor at the Faculty of Pharmacy. Officially, she started as Professor of Biopharmacy from the beginning of 2009, but during her two-year service as a locum post holder she had already become familiar with the duties involved with the position and amended a number of study modules.

"I was well received among colleagues, and joint thesis guidance across departments works well. We also have several jointly arranged advanced study lecture series," she says.

Yliperttula is specialised in physical chemistry. In her research she combines the study of nano-structures with biopharmaceutical drug research. Before joining the faculty she worked for a long time in the private sector.

"I worked in research and development at Orion for nearly a decade, so I still have strong networks with people in that sector. My work was mostly related to the biopharmaceutical study of the ADME properties of pharmaceutical substances. Prior to my locum tenens position as Professor, I also worked for a couple of years as a Senior Research Scientist at the Centre for Drug Research," she recalls.

Advanced studies completed and research projects initiated

Yliperttula notes that she has improved the teaching of advanced study modules in particular.

"Currently, we make more use in teaching of those who have completed their doctorates. Postgraduate students also serve as advisors for undergraduates in their assignments. Our department has two new postdoc researchers appointed who will give courses in their respective fields. They will be of great help in renewing the optional courses," she explains.

As for the past year, Yliperttula is happy to note that several new research projects have kicked off successfully.

"NAPGEN is a four-year research project funded by the Academy of Finland that studies the delivery of gene-based drugs into target cells using nanotechnological methods. Our main partner in this project is Professor **Esko Kauppinen** from the Helsinki University of Technology. Another new project is studying the suitability of paper

Yliperttula combines in her research the study of nano-structures with biopharmaceutical drug research.

printing technology with respect to Printed Cell Biomaterials array. In that effort we have as our partners Professor **Jouko Peltonen**, from the Åbo Akademi University, and Mr **Robert Langer**, from MIT, who was awarded the Millennium Technology Prize last year," she says.

Active and international students

As regards students, Yliperttula has been most happy with the motivation and effectiveness of her ten new degree students. Two doctoral theses were also completed last year.

"Our students are highly international and mobile. They have left for exchange to study in places such as London, Copenhagen and Uppsala. For its part, our department has hosted a trainee from Germany and visiting scholars from countries such as China, India, and Pakistan. A total of 30% of our staff is of foreign extraction," she notes.

For Yliperttula, one of last year's highlights was giving a lecture in the University of Helsinki's Studia Generalia series to a hall full of people. Her lecture was entitled Nanotechnical precision missiles in medicinal care.



Effective clinical practice and good working life skills

UNIVERSITY TEACHER Maaret Varunki has been co-ordinating the teaching pharmacy clinical practice in the Faculty of Pharmacy for the past five years. In 2008, the faculty was nominated as a Centre of Excellence in University Education. In particular, the students' working life skills and the good working life relevance of the studies, largely attained through the effective clinical practice system, were cited as grounds for the nomination.



"I appreciate the opportunity to present the clinical practice system to the jury selecting the centres of excellence," she says. "It is an indication of appreciation on the part of our own faculty, too. Clinical practice is regarded as an important part of the degree."

Varunki explains that each undergraduate pharmacist has to complete two clinical practice periods of three months, at least one of which must take place in a Finnish community pharmacy. As regards the other period, students are encouraged to take part in international student exchange.

Varunki has participated in the work of the development group for practical training in different faculties of the University of Helsinki.

"In the workgroup I became aware of how well we had already organised a number of things. Students get paid in accordance with the collective agreements and there are workbooks available to serve as guidelines for their studies. The implementation of the clinical practice periods has become increasingly well-structured year after year," she points out.

“We are not only demanding that the teaching pharmacies give guidance, but we are also training them to do so.
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Co-operation yields results

Varunki thinks that the extensive co-operation undertaken with the faculties of pharmacy at the Åbo Akademi University and University of Kuopio, along with teaching pharmacies and the relevant trade unions, constitutes a considerable strength.

"We are not only demanding that the teaching pharmacies give guidance, but we are also training them to do so. We arrange training days for the teaching pharmacists each autumn and spring together with people from Kuopio and Turku. Furthermore, we have also established a tradition of selecting the teaching pharmacy of the year," she adds.

Student's voice getting heard

Students are provided with support and guidance in the completion of their clinical practice, which is further improved on the basis of the feedback received from them.

"Two briefings on the clinical practice are arranged for the students, and there are debriefing sessions in small groups after both clinical practice periods. The workbooks are reviewed, in addition to which we also collect other feedback in written form. This feedback is then utilised in the further improvement of the clinical practice," Varunki explains.

An important tool in this regard is the online learning environment where all of the material related to clinical practice is collected. The same address also features a discussion area.

"In the best cases, students engage in online discussions entirely by themselves she says. "For example, they may exchange experiences and feelings related to their clinical practice periods. The online environment also provides an opportunity to ask questions anonymously, which for me serves as a channel for receiving important feedback for further improvement of the clinical practice."

A student helps develop clinical practice



JONNA KORKEAVIITA IS a third-year student who will graduate as a pharmacist this summer. Among other things, she has been active in contributing to the work of two development groups for clinical pharmacy practice, one of them operating within the faculty and another on the national level.

Together with **Maaret Varunki**, she presented the faculty's clinical practice system to the jury that selects the centres of excellence. In theory, the situation sounded daunting but in practice, it was a different story.

"The situation didn't intimidate at all," she says. "We only sought to present the relevant matters as comprehensively as possible within the time allowed."

The work of the development group for clinical pharmacy practice involves a broad range of activities.

"Among other things, we continuously develop workbooks that serve as guidelines for the students' clinical practice and adjust the guidelines intended for teaching pharmacies. The atmosphere within the workgroup has been really nice, and the students' views, too, always receive consideration," she continues.

Korkeaviita has also been actively involved in the work of the Finnish Pharmaceutical Students' Association (FiPSA), where she has handled issues related to international clinical practice.

"International clinical practice takes place in hospital pharmacies and university research groups. Within FiPSA we arrange an annual Mobility Day event that informs students of the different options available for completing the international clinical practice," she explains.

Korkeaviita is currently completing her second clinical practice period in the Laakso Hospital Pharmacy.

"After that I will leave for Germany to complete yet another month of clinical pharmacy practice. This has been a perfect time to participate in the work of the clinical practice development group, because the matters we discuss are very relevant to me personally at the moment."

DIVISION OF PHARMACEUTICAL BIOLOGY

The Division of Pharmaceutical Biology is responsible for teaching pharmacognosy, microbiology, biochemistry, cell biology, molecular biology, genetics and biotechnology. The main research interest is focused on products and substances of natural origin; isolation, analytical methods, biological activities and possible uses as medicines.

DIVISION OF PHARMACOLOGY AND TOXICOLOGY

Neuropharmacology is the main research area of the Division of Pharmacology and Toxicology. Pharmacological research forms a link between pharmaceutical sciences and medicine. The scope of research is broad, ranging from molecular level to whole animal behaviour. At the present time the research focuses on elucidating significance of enzymes as drug targets, including COMT, PKC and POP, as well as neurotrophic factors as possible therapies for Parkinson's disease. The pharmacology teaching covers all significant therapeutic drugs, including an introduction to veterinary medicine.

DIVISION OF PHARMACEUTICAL CHEMISTRY

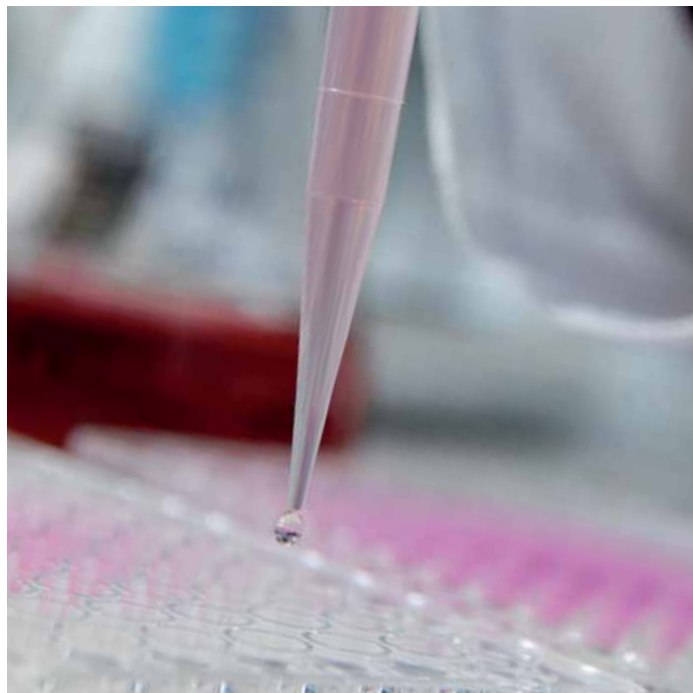
Research and teaching at the Division of Pharmaceutical Chemistry are closely linked to modern multidisciplinary drug discovery. The research combines disciplines of pharmaceutical sciences, chemistry, biology and medicine. As a major subject, pharmaceutical chemistry clarifies the discovery of new drugs and the underlying chemistry in their biology and pharmacology. In addition, the teaching in pharmaceutical chemistry deals with the chemical and physico-chemical properties, decomposition reactions, incompatibilities, metabolism and analytics of drugs offered by pharmacies.

DIVISION OF PHARMACEUTICAL TECHNOLOGY

The goal of the Division of Pharmaceutical Technology is to promote educational and scientific excellence in the fields of applied materials sciences. To accomplish this, multidisciplinary research is conducted on the development of novel drug delivery systems, ADME research, formulation studies, pharmaceutical materials research, and physical process research including process analytical technologies. The main focus areas are the pharmaceutical solid state and particle technologies towards drug delivery via the oral route - the most common way to administer drugs.

DIVISION OF BIOPHARMACEUTICS AND PHARMACOKINETICS

Biopharmacy studies and develops methods for optimising the stages a drug goes through in the body in order to create a drug that is both effective and safe. Possible objectives may include the use of a new administration route, production of a long-acting effect, development of a new chemical derivative for a drug with an enhanced ability to pass into the target tissue, or targeting of a drug using nanotechnological methods. Expertise in biopharmacy is needed not only in drug consultation in pharmacies but also in



the pharmaceutical industry (clinical pharmacokinetics, preclinical research) and in companies that develop biotechnological drugs.

Pharmacokinetics studies the mechanisms affecting the stages that drugs go through in the body. The chemical properties and formulation of a drug can be used for deliberately affecting its stages within the body.

DIVISION OF SOCIAL PHARMACY

Social Pharmacy and Pharmacoeconomics are new disciplines in the Faculty of Pharmacy that analyse the use, outcomes and costs of medications and pharmaceutical services in the society, health care systems and individuals. Current key research is in developing medicines management services and technology in health care - a system approach integrating efficiency, safety and effectiveness.

THE CENTRE FOR DRUG RESEARCH

The Centre for Drug Research (CDR) is a multidisciplinary research centre that focuses on the fields of drug discovery tools and pharmaceutical nanotechnology. It is an incubator that combines recent advances in biosciences and materials sciences to develop novel drug technologies. It also provides possibilities to generate new research groups and facilitates the career development of independent scientists.

For more information about all departments and the Centre for Drug Research, please visit the faculty website at www.helsinki.fi/farmasia.



THE FACULTY IS headed by the dean who is a professor elected by the faculty council. The dean manages and supervises the operations of the faculty, and is also the chair of the faculty council.

The dean of the faculty is Professor **Raimo Hiltunen**.

Faculty council is the highest decision-making body in the faculty. Faculty council is responsible for developing teaching and research. It also decides on the curriculum and degree regulations, funds allocation principles, appointments to important positions, issues concerning doctoral dissertations and licentiate research, and other important matters.

The faculty council consists of the Dean and 10 other members, of whom four are professors, three belong to the teaching and other personnel group and three are students. The faculty council had 12 meetings during the year.

In 2008, faculty members (vice members) were as follows:

- Professor, dean Raimo Hiltunen, chairman
- Professor, vice dean Jouni Hirvonen (Professor Jouko Yliruusi)
- Professori Raimo Tuominen (Professor Pekka T. Männistö)
- Professor Marja Airaksinen (Professor Arto Urtti)
- Professor Risto Kostiainen (Professor Jari Yli-Kauhaluoma)
- University lecturer Mia Säkkinen (Researcher Sanna Siissalo)
- Senior researcher Marjo Yliperttula (Assistant Kirsi Harju)
- Secretary Elisa Sippola (Laboratory technician Inkeri Huttunen)
- Student Henri Autio (till 11.12.) (Student Paula Juurinen till 11.12.)
- Student Paula Juurinen (from 11.12.) (Student Linda Cameron from 11.12.)
- Student Juho-Matti Renko (till 1.9.) (Student Maria Jouste till 1.9.)
- Student Maria Jouste (from 1.9.) (Student Ida Lahtinen from. 1.9.)
- Student Ira Vainikka (till 11.12.) (Student Miia Eholuoto till 15.10., Johannes Pietiläinen from 15.10.)
- Student Jouni Pietiläinen (from 11.12.) Student Jouni Baas from 11.12.

STUDENTS

	WOMEN	TOTAL
Lower degree	479	621
Higher degree	128	158
Postgraduate degree	79	105
TOTAL	686	884

DEGREES

	2004	2005	2006	2007	2008
B. Pharm.	152	150	193	166	184
M. Sc. (Pharm.)	37	39	40	45	63
Lic. Pharm.	3	4	-	1	1
Ph. D. (Pharm)	7	7	9	9	15
Ph. D.	-	-	1	1	2
TOTAL	200	201	243	221	265

PUBLICATIONS

In 2008 the personnel of the Faculty of Pharmacy published 107 articles in scientific periodicals with referee system.

Articles in scientific periodicals with referee system



Detailed information can be found in the Helsinki University Knowledge Databases (<http://www-db.helsinki.fi/osaamis-tietokannat/index.shtml>).

DOCTORAL THESIS DEFENDED IN 2008

Alkio, Martti

Purification of pharmaceuticals and nutraceutical compounds by sub- and super-critical extraction and chromatography

Bichlmaier, Ingo

Stereochemical and steric control of enzymatic glucuronidation : A rational approach for the design of novel Inhibitors for the human UDP-glucuronosyltransferase 2B7

Dastmalchi, Keyvan

Dracocephalum moldavica L. and Melissa officinalis L. : Chemistry and Bioactivities Relevant in Alzheimer's Disease Therapy

Galkin, Anna

Evaluation of natural products in apoptosis, protein kinase C activation and Caco-2 Cell permeability

Hakala, Kati

Liquid Chromatography-Mass Spectrometry in Studies of Drug Metabolism and Permeability

Hirsjärvi, Samuli

Preparation and Characterization of Poly(Lactic Acid) Nanoparticles for Pharmaceutical Use

Hoppu, Pekka

Characterisation and processing of amorphous binary mixtures with low glass transition temperature

Hänninen, Kaisa

Characterization of Ion-Exchange Fibers for Controlled Drug Delivery

Kogermann, Karin

Understanding solid-state transformations during dehydration: new insights using vibrational spectroscopy and multivariate modeling

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