EVALUATION

Pharmaceutical Research in Norway

– An Evaluation

Norges forskningsråd
The Research Council of Norway

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To the Research Council of Norway

The members of the Evaluation Committee for evaluating pharmaceutical research in Norway hereby submit the following report. The views presented in this report are expressed in consensus among the members in the Evaluation Committee. None of the panel members has declared any conflict of interest.

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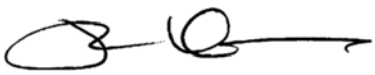

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SUMMARY

The evaluation reviews the overall state of pharmaceutical research in Norwegian schools of pharmacy and makes proposals for the future development. The scientific quality of research is reviewed in an international context.

The major weakness of pharmaceutical research in Norway is the lack of a national policy for pharmaceutical research. There is no strategy or coordination on the national level between the schools, which results in a low level of co-operation. Often, research areas are too fragmented to compete at international level. Many of the research groups are below critical mass and there are no incentives to lift up the research. Postgraduate studies in pharmaceutical sciences are not organised nationally. In general, publications in the field of pharmacy are at or above average world level when all disciplines are considered. However, in general Norwegian pharmaceutical research does not reach the same level as in other Nordic countries.

New structures for leadership have been created which lays a good basis for developing and focusing the pharmaceutical research. The quality of undergraduate level students is very good creating a strong foundation and highly qualified applicants for PhD positions nationally. There is a great enthusiasm to develop pharmaceutical science in Norway and the increased awareness of the value of pharmaceutical sciences among other disciplines offers many opportunities for the future.

The evaluation committee strongly recommends that a national coordination organ for pharmaceutical research should be established. Furthermore, development of a national strategy for pharmaceutical research is a must. On the local level, each school should make a vision and a strategy for pharmaceutical research aiming at increasing research group sizes in key areas. More focus should be put on strengthening the scientific leadership. Collaboration between the schools of pharmacy should be substantially increased, as well as local co-operation with other disciplines such as medical or technical schools in order to increase multidisciplinary co-operation.

External sources for funding pharmaceutical research should be established nationally, e.g., by the Research Council of Norway. The evaluation committee identified four research areas that would need special efforts on the national level. These areas are social and clinical pharmacy, pharmaceutics, safety pharmacology, and translational research. The evaluation committee strongly recommends the establishment of a national research school for pharmacy.

1 INTRODUCTION

The objective of this evaluation was to review the overall state of pharmaceutical research in Norwegian universities ("schools of pharmacy") and to provide specific recommendations for the future development of pharmaceutical research in Norway.

This evaluation is limited to the pharmacy institutions ("schools of pharmacy") in three Norwegian universities. The history and organisation of the pharmacy institutions differ markedly:

University of Oslo: established in 1932 under the Faculty of Mathematics and Natural Sciences
University of Tromsø: established in 1994 under the Faculty of Medicine
University of Bergen: established in 2003 under the University Board (links to both Faculty of Medicine and Faculty of Mathematics and Natural Sciences)

In previous evaluations parts of the research in these institutions have been included. However, this is the first total evaluation of their research.

Specifically, the evaluation process aimed to offer a critical review of the strengths and weaknesses of pharmaceutical research, both nationally and in each institution. The scientific quality of the research was reviewed in an international context. Research groups which have achieved a high international level in their research were identified, as well as groups which have the potential to reach such a level. Areas of research that need to be strengthened in order to ensure that the needs regarding pharmaceutical research in Norway are covered were identified. An assessment of the organisation of the pharmacy institutions in Norway was performed. Areas of co-operation and fields of division of responsibility between the pharmacy institutions in Norway were identified. The terms of reference was used as a guideline during this process. The individual research groups were evaluated on an international level and graded on a scale of "excellent, very good, good, fair, and weak".

The Evaluation Committee based its evaluation on self-assessments provided by the institutions as well as site visits to the institutions. Bibliometric analysis was provided by the Research Council. The institutions involved had an opportunity to comment on the factual parts of the preliminary report.

2 GENERAL CONCLUSIONS AND ANALYSES AT THE NATIONAL LEVEL

Strengths and weaknesses of Norwegian pharmaceutical research

The quality of undergraduate level students is very good creating a strong foundation and highly qualified applicants for PhD positions nationally. There is a need for PhDs in pharmaceutical research in Norway. Furthermore, PhD students are highly motivated and they are optimistic in their career, even though they realize that the number of intermediate positions, such as post doc positions, is scarce.

New structures for leadership have been created which lays a good basis for developing and focusing the pharmaceutical research. The opportunity for sabbaticals is unique and the system is widely used by the permanent staff. In general, publications are at or above average world level when all disciplines are considered. With some exceptions, the equipment level in the pharmaceutical units is good.

The major weakness of pharmaceutical research in Norway is the lack of a national policy for pharmaceutical research. There is no strategy or coordination on the national level between the schools, which results in a low level of co-operation. There are no external sources for funding targeted for pharmaceutical research. By tradition, education comes first before research, and the localization of pharmacy schools is based on education not research.

Many of the research groups are below critical mass and there are no incentives to lift up the research. A nationwide problem is the lack of intermediate positions, such as post docs, in the academic structure. Furthermore, there is a lack of pharmacy specific disciplines to cover all of the drug development process.

The benchmarking is done between the different units and other disciplines nationally - not internationally as it should be done in order to reach international level. Scientific leadership is often inadequate and there is no support or mandate for such leadership by the permanent staff.

Postgraduate studies on pharmaceutical sciences are not organised nationally. There are only few relevant PhD courses available, especially in the field of pharmaceutical sciences. Furthermore, there is a lack of encouragement and funding for PhD courses and research abroad.

Opportunities and threats for pharmaceutical research in Norway

There is a great enthusiasm to develop pharmaceutical science in Norway and the increased awareness of the value of pharmaceutical sciences among other disciplines offers many opportunities for the future. There is a great opportunity to increase collaboration between and also within schools. In fact, only at the national level there is an opportunity to cover all the pharmaceutical research areas, which make such

collaboration vital. There are opportunities to increase incentives on research by distributing resources according to research quality and impact.

The schools of pharmacy in Norway are small and have a limited influence on university policies, which may have economical consequences. Furthermore, there is a tendency in all of the units to try to cover all the pharmaceutical research areas, even though they are too small to do so. In general, research areas are too fragmented to compete at international level.

There is a threat that lack of pharmaceutical research and qualified people will hamper the development of national pharmaceutical companies. Furthermore, the present situation in Bergen, where teaching of pharmaceutics and pharmacy practice is outsourced abroad, counteracts the strengthening of research in these areas in Norway.

The academic research positions in the universities are not attractive due to high teaching load and low salaries compared to other pharmacy fields. The universities may not be able to recruit some highly qualified researchers because better offers are made from pharmacies and pharmaceutical industry.

2.1 General recommendations

1. Organisation and strategy for pharmaceutical research

The evaluation committee strongly recommends that a national coordination organ for pharmaceutical research should be established. All the major stakeholders should be present in such organ. Furthermore, development of a national strategy for pharmaceutical research is a must.

A national strategy for pharmaceutical research in Norway should reflect the huge opportunities that the upcoming EU programs offer to sciences involved in the drug development process. It concerns the Technological Platform for Innovative Medicines with its four themes on drug efficacy, drug safety, knowledge management, and training and education. The drug efficacy is based on research within neurodegenerative diseases, cancer, diabetes, inflammation, and infectious diseases. The expected amount of money allocated per year will be 400 million euros on average.

On the local level, each school should make a vision and a strategy for pharmaceutical research aiming at increasing research group sizes in key areas. More focus should be put on strengthening the scientific leadership.

2. Strengthening co-operation

Collaboration between the schools of pharmacy should be substantially increased, as well as local co-operation with other disciplines such as medical or technical schools in order to increase multidisciplinary co-operation.

3. Funding for pharmaceutical research

External sources for funding pharmaceutical research should be established nationally, e.g., by the Research Council of Norway. Such funding should be targeted to research in drug development and medicines use.

2.2 Areas of research that need to be strengthened

The evaluation committee identified four research areas that would need special efforts/programmes on the national level. These areas are important either from a health policy point of view or considered essential components in a comprehensive pharmaceutical research strategy. There is a need for researchers at senior, post doc and PhD level in all of these research areas.

1. Social and clinical pharmacy research

Research in social and clinical pharmacy is highly relevant for society and the pharmaceutical profession. High quality research in these areas can directly contribute to improvements in the care of patients and outcomes of treatment. The health care system in all western countries is undergoing a crisis in the funding of new and innovative drug therapy. Pharmacoeconomic research is able to contribute in a wise allocation of scarce resources. A national taskforce to look into ways and solutions to correct the situation is needed.

2. Pharmaceutics research

Pharmaceutics is among the core disciplines for pharmaceutical research and development. If Norway wants to compete on an international level in this area there is an urgent need to allocate resources and funding for research and education in pharmaceutics.

3. Safety pharmacology (toxicology) research

This area is almost completely missing at schools of pharmacy in Norway. This area would need special consideration as safety and pharmacovigilance aspects have great relevance for public health, both in understanding the role of side-effects in drug treatment and their economical consequences for drug research and society at large.

4. Translational research

The committee would also like to pinpoint the importance of translational pharmaceutical research for Norway. There is a need to have professionals who have the capacity to drive the drug development process from discovery to application in the clinic and thus facilitate product development.

Investment in translational pharmaceutical research is a political issue. If Norway wants to have start-up companies (biotech type) a prerequisite is to focus on translational research to carry the research results from basic science to products of proof of concept in the clinic. However, if the government will not promote such commercialisation, the academic pharmaceutical research may be different from mainstream of the research today (more original) if they only have to focus on basic research.

2.3 Areas of co-operation between the universities in Norway and fields of division of responsibility between the pharmacy institutions in Norway

The committee sees potential in a number of collaborations between the different schools of pharmacy. A national research school in pharmacy is suggested (see below). In the field of pharmaceutics increased collaboration between Oslo and Tromsø would be necessary and including also Bergen in the future. Similar advantages can be identified in the field of pharmacognosy between Oslo and Bergen. In the field of social pharmacy there would be clear advantages in the collaboration between Bergen and Tromsø. National coordination and collaboration in the field of social pharmacy is also needed. The best strategy to strengthen social pharmacy research in Norway, however, would be to strengthen all three units locally with multidisciplinary collaboration. This option appears better than creating a new national centre for social pharmacy research. In the field of clinical pharmacy national coordination is needed to strengthen teaching and research in all units.

In general a strategic decision would be to prioritize initiation of new groups to obtain critical mass (reorganise groups). This can be achieved by forming alliances and by building on local strengths outside of school of pharmacies. In the longer term new positions should be filled with researchers that strengthen existing groups/focus areas rather than filling unmet teaching needs.

2.4 General recommendations concerning PhD-studies

The evaluation committee had an opportunity to discuss with four PhD students in the University of Oslo, and three PhD students in the University of Tromsø. The following recommendations are based on discussions with these students, as well as discussions and self-evaluations of the three schools of pharmacy.

1. Improvements in organisation

The evaluation committee strongly recommends the establishment of a national research school for pharmacy. The research school would enable co-operation and scientific discussion between PhD students from each of the units, which was totally absent at the moment. Such a school should also include post doc positions. Furthermore, the

committee recommends developing advanced and specialized national PhD courses in pharmacy. Most conveniently such national courses could be established through the research school dividing the responsibility for different units.

The committee recommends that the PhD students would be given a representative membership in the institute boards at all three units. Furthermore, it should be emphasised that a good information flow is ensured to other PhD students by the representative student.

2. Improvements in supervision

The evaluation committee recommends that a formal system for supervisors should be established nationally. Each PhD student should have 2-3 formally appointed supervisors and one of them should be present at the university. Furthermore, more post doc positions should be established in the units in order to ensure better availability of supervision at the university. The committee recommends that a system for yearly formal monitoring how the research by the PhD students has progressed should be improved.

3. Other improvements

The committee recommends that a possibility in the means of support and funding is created for all PhD students to go abroad as a part of their studies if it fits the research project. Exchange of PhD students and post docs (e.g. 6 months) between the universities within disciplines is also recommended. At the very least it should be required that each PhD student experiences at least two different research environments during their scholarship.

An annual joint national meeting for PhD students, post docs and supervisors should be established. This would give an arena for students to present their research and to network.

3 EVALUATION OF SCHOOL OF PHARMACY IN OSLO

The School of Pharmacy is part of the Faculty of Mathematics and Natural Sciences at the University of Oslo. It consists of three scientific units: the Department of Pharmaceutical Biosciences, the Department of Pharmaceutical Chemistry and the Department of Pharmacy, and two administrative units: Administrative Affairs and the Department of Postgraduate and Continuing Education. This organisation became effective as of mid 2003 in order to improve research and personnel management and to facilitate closer interaction between the research groups to counteract fragmentation of the research.

Strengths

The School of Pharmacy in Oslo is attractive from a student point of view. There are many applicants to the school and the student mass is good. The personnel at the school is dedicated to provide high quality teaching.

The School of Pharmacy has undergone changes in leadership structure during the evaluation period. The current leadership has a sound insight into the strengths and weaknesses of the Institute. Benchmarking at faculty level reveals improved results both in quantity and quality measures and the publication rates are increasing.

Weaknesses

From a research point of view, an important weakness of the School of Pharmacy in Oslo is its strong focus on teaching. Furthermore the teaching load is high, which takes time from research. However, the high teaching load is partly self-imposed, through the introduction of a very ambitious new curriculum for the undergraduate students.

Despite the new leadership structure, there appears a lack of interest for a unified research strategy for the whole Institute. A lack of transparency in distribution of resources makes planning at the research group level difficult.

The old building where the Institute is situated is unsuitable for laboratory work and it accomplishes safety and health risks. There is no functioning ventilation system making the temperature especially in summertime unbearable. Furthermore, the storage places are insufficient leading to safety risks through crowded corridors.

Most research groups are below critical mass and spread among several topics which create difficulties to compete at the international level. Furthermore, there is a lack of international benchmarking at the department level. Co-operation with other faculties and departments is too low. There is a lack of intermediate positions, like post doc positions, which are needed in order to make the research groups competitive internationally. External funding for research projects is low.

Collaboration with other pharmacy schools in Norway is scarce. The attitudes seem to be reserved, which hampers collaboration. Furthermore, the willingness to start such collaboration is low.

Opportunities

There are great opportunities to increase co-operation between different faculties and departments within the university. An integrated curriculum provides possibilities for multidisciplinary collaboration. Furthermore, the university is located in the area where most of the pharmaceutical industry is in Norway, enabling industrial collaboration. Also a number of other research institutes, like the National Public Health Institute, are located in Oslo.

There is a potential to get more time for research by rationalizing the teaching load. A strategy, which allows more active researchers to spend more time on research and less active researchers to spend more time on teaching could be implemented. Appropriate reallocation of funding back to the Institute of Pharmacy from the Faculty enables the appointment of more academic staff. Furthermore, there are opportunities in using upcoming retirements to hire top researchers and/or strengthen the most productive current groups.

Threats

The budgeting model of the Faculty has been changed some years ago, but there are still different opinions at the faculty and department level about its fairness. There is a threat that this will negatively influence research at the Institute of Pharmacy.

The vision of the professional leadership is not supported sufficiently at the department level, which may lead to decreasing the implementation of strategic decisions.

3.1 Recommendations

1. Improvements in organisation and facilities

The evaluation committee strongly recommends that it is vital that the Institute of Pharmacy moves to the new Life Science building or to some other modern building. The committee also recommends that actions are taken to explore the possibilities to separate the Institute of Pharmacy from the Faculty of Mathematics and Natural Sciences and to build an independent Faculty of Pharmacy. Alternatively, it should become part of the Faculty of Medicine. However, if such merger is considered following prerequisites should be fulfilled before the merger 1) A free negotiation between the parties about the conditions for the transfer. 2) A worked out strategy for future areas of collaborations. 3) A strategy for strengthening of translational research.

Furthermore, the committee recommends that all three departments should have their own representative in the Institute board. PhD students should also have a full membership in the board.

2. Development of a stronger research strategy

The committee advises to continue strategic efforts to focus on research and focus the research. A stronger strategy to create larger and stronger research groups is needed. The committee recommends that the upcoming positions should be utilized for hiring persons in such research groups. More collaboration with the Medical Faculty is also needed to gain clinical perspective to the pharmaceutical research. In order to achieve strategic goals, research leadership should be strengthened. Benchmarking should be done at an international level.

3. Other recommendations

There is a need to establish common performance indicators and measures. The evaluation committee advises to monitor actual time spent on teaching, research, and administration to allow a fair distribution of resources.

The evaluation committee noticed some inconsistencies in the recruitment of new staff. The committee advises that the recruitment process should be made more transparent and systematic. Furthermore, there is a need to implement international recruitment to revitalize research in key areas.

3.2 Evaluation of departments and individual research groups

Department of Pharmaceutical Biosciences

The Department is organised in 4 groups of pharmacology and 2 groups in microbiology.

1. Individualized drug therapy

Organisation
The group consists of one professor, one associate professor, one post doc, and one professor II, and five Ph.D. students (three internal and two external). The group's research deals with core areas of modern pharmacology: Pharmacokinetics and bioanalysis, biomarkers and evaluation of drug intervention in the clinical setting. The pharmacokinetic research covers CYP´s and transporters, biomarker research global approaches with proteomic analysis of plasma and urine. Further organ transplants are the goal for the intervention studies. Methodology and equipment are up to date.

Scientific activity and quality
The activities of the group have a solid research base. An expansive strategy should be worked out building on the Department's skills and know-how. For example, pharmacokinetic research is in demand. Opportunities for international and national collaborations are many as the Department is the only one in Norway working actively in the field. The existing collaboration is narrow and includes The National Hospital, Diakonhjemmet Hospital.

Conclusion and ratings
The research of the group covers the pharmacology area very well, is up to date, and the publication flow is stable and appears in good journals. Thus, on basis of the publications and citations the overall assessment is rated good.

2. Skeletal muscle insulin resistance: Cellular mechanisms and new pharmacological targets

Organisation
The group consists of two faculty members and a couple of PhD- and Master students. There is currently no post doctoral level in the group, but a shared post doc has just been awarded, which might ameliorate the problem to some extent in the future. The group is thus relatively small, which however to some extent is countered by external collaborations with the Medical Faculty and others, in particular through participation in two international EU networks.

The group studies skeletal muscle insulin resistance using state-of-the-art techniques such as genetically modified mice, transcriptomics and proteomics. The field of diabetes and metabolism has high international focus and is very competitive. Although the group focus on a niche area within diabetes research, it will likely be difficult to compete at an international level for a group of this size.

Scientific activity and quality
The group has external collaborations with the Medical Faculty, UiO and others, in particular through participation in two international EU networks, which has led to some external funding.

The group members have a good publication rate (2-3 articles in international journals per year), albeit only a minority of the papers have the PI's as first- or last author. The journal impact of the publications is generally good to very good in the field of diabetes and metabolism. The group leaders mainly publish as middle-authors – in particular in the articles with highest impact.

Rating and conclusion
The group does research on an important topic using interesting approaches and methods. The PI's publish well, albeit mainly as middle authors, and has been able to attract some external funding through international networks.

The group should take care not to function too much as a service to other groups. Although it is very nice with the EU collaborations, a group of this size could easily be ”exploited” in such a setup. In the future the group should thus focus more on generating research that will result in publications with the PI’s as senior authors. Otherwise, it will be difficult for the group to establish an independent research profile and obtain larger external funding based on projects originating from the group.

Overall assessment is good.

3. Proteolytic enzymes as pharmacological targets

Organisation
The group consists of two professors. Currently, only one Ph.D. student works in the group. The group is considered too small and a merger with an appropriate group should after strategic considerations based on the skills and know-how of the group be taken into consideration.

The lysosomal cystein protease legumain represents the target for the research where its expression and regulation is studied in macrophages and osteosarcoma cells under the effect of pharmacological intervention. A further vision of the group was not presented.

Scientific activity and quality
The scope of the research is very narrow. A general vision beyond the specific work programme for the legumain research for the future direction of the Department’s research is absent and should be worked out. External collaboration is too narrow, it includes only University of Tromsø, and the Radium Hospital.

Rating and conclusion
Based on publications related to enzymatic work, the research of the group is considered to be fair.

4. Neurotoxicology in disease and drug treatment

Organisation
The group consists of one professor, but currently 4 Ph.D. students, one university funded and three based on external grants work in the group. With only a single permanent staff member the group is vulnerable. Accordingly, it should be enforced with more permanent staff.

The projects are pharmacologically relevant as they concern identification of the molecular mechanisms of cell death in the nervous system and the explorations of the possibilities to the protect neurons by interfering with these pathways. Glutamate induced toxicity represents the target and the downstream pathways are studied. Also cell death caused by dexamethasone has been investigated. Modern equipment is available.

Scientific activity and quality
The group environment appears as an internationally dynamic and enthusiastic team. The research is progressing well with a stable high output.

External collaboration includes Ullevål University Hospital and Oslo thematic network Centre for Cellular Stress Responses which also networks to USA. The students of the group have been of broad international origin. The group is considered strong enough to seek international collaborators and thereby getting critical mass.

Training and mobility is good with international participation. There is room for post docs, for which reason while waiting for extra permanent staff, effort to hire a post doc should be implemented.

Rating and conclusion
Based on current stable flow of papers in good journals, the research of the group is considered to be good.

5. The *Bacillus cereus* group of bacteria – modelling pathogenic spore-forming bacteria by comparative genomics and functional analyses

Organisation
The group employs one professor, two associate professors, three post doctoral fellows and several PhD students, giving enough bases for a critical mass. The group is housed in a renovated part of the buildings nicely equipped with state of the art equipment.

The research is performed in a focused research project directed on the Gram-positive bacterium *Bacillus cereus* as a model organism for spore-forming pathogens. This research group exhibits a clear research strategy, which was an interest area of two persons at the start, persuing the possibilities. The group is nicely brought together around the main goal organism *Bacillus*, seemingly leaving own focused areas for all the senior scientists. Clever and dedicated leadership by the senior professor is very much in evidence and the performance of the group as a whole during the review period has been notable.

Scientific activity and quality
The research is characterised by originality, high innovation and high potential for further development. The focus is clear and the group has successfully strengthened their research in order to become a bigger and stronger group in the School of Pharmacy. This research is of high relevance with regard to new knowledge on pathogenic microbe – human interactions. The group has shown high international productivity. A significant percentage of their publications are of a high international level and most of the papers have been published in excellent to good journals. Also funding from several national and international sources has been received by the group.

For the moment a sufficient number of post doctoral fellows (three, two from abroad) is incorporated. PhD student recruitment seemed to be easy. International and national

collaboration is evident, and therefore mobility among the PhD students should be encouraged and supported. The group has collaboration with important, international partners in their research area, such as the Pasteur Institute and in the EU-COST B16.

Conclusions and rating
Microbiology is an important subject in pharmacy as well, and this group is encouraged to increase collaboration with the Department of Pharmaceutical Chemistry (already existing with the group of bio-analysis) further with the synthetic medicinal chemistry and the bioactive natural compounds groups, to get an even stronger profile of pharmaceutical research. Not a typical full discipline area in pharmacy, and might have to be defensive in the School of Pharmacy. The strong knowledge in molecular biology and microbiology can be turned to a broad teaching background for pharmacists. This is supported by group members showing background profiles from different disciplines. Further, the group indicated a lack of trained molecular microbiologists in Norway, which could, although not the first priority of pharmacy education, be encountered in collaboration with other institutes.

The overall rating is very good, and this is definitely an area worth of strengthening, as it has potential for excellent ranking.

6. Interactions between virus and host cells

Organisation
The group consists of one professor and three PhD students, and thus is very limited. A point of concern is the fact that the group is missing intermediate positions, such as post doctoral fellows and other senior researchers, but incorporates three PhD students.

The focus is clear aiming at high quality research in the area of pharmaceuticals for aquacultures, with emphasis on infectious salmon anemia virus. The research is divided into two main streams with the same allover goal, which keeps it focused. The equipment level is sufficient for the research carried out for the moment.

Scientific activity and quality
The research presents a nice niche in the area of animal health care, in this case ending at vaccines (and/or functional foods) for fish, an important economical factor for Norway. However, the scientific impact is not very strong, yet, although funded from several national and international sources, as funding for fish research is easy in Norway. In other words, output should be higher with the existing input. This is to be expected in a near future, due to submitted works by the PhD students and a new, funded project. The mobility among the PhD students should be encouraged and supported, as the group has an extensive international and national collaboration existing via several co-funded projects

Conclusions and rating
Efforts to get post doctoral fellows should be undertaken. Also in the future a broad, active collaboration on national level to reach a critical mass is of outmost importance to

be able to compete internationally. Efforts to gain a status for pharmaceuticals in animal health care as relevant research projects at the schools of pharmacies in Norway (and internationally) should be taken to emphasize the importance.

The research of this group is at a good international level with publications in internationally recognized, specialised journals, but with limited output so far. The overall rating is good.

Department of Pharmaceutical Chemistry

The Department is organised in three research groups: 1) Bio-analysis, 2) Synthetic Medicinal Chemistry and 3) Bioactive natural products.

1. Bio-analysis

Organisation

The group of bio-analysis is currently involved in the following three major research projects: Analytical proteomics, Pharmacokinetics and bio-analysis, and Membrane technology and electrokinetic concepts for drug analysis. The group has been thinking where to focus, and the focus had been clarified, not including too broad areas. On the other hand, a clear vision for the future is still needed; what is the position of analytical science in pharmacy?

The first and third of the projects will be combined in order to reach critical mass, which is highly recommendable. A productive interface called ”Pharmacokinetics and Bio-analysis” will continue as a collaboration with a group in pharmacology. Equipment level was satisfactorial, but the facilities terrible. It would be mostly beneficial that all pharmacy would be in the same, acceptable facilities (building), which would automatically also improve collaboration and identity.

The two professors and one associate professor possess international and industrial backgrounds, which is beneficial for the further development of the research. Although 5 PhD students, more personnel is needed, and the group is missing intermediate positions and technicians. Enthusiastic people in the group.

Scientific activity and quality

The group exhibits a solid, innovative background in analytical science on membrane technology. The innovations in the membrane technology are exciting opportunities to be on the forefront of technology with direct value for the ongoing research collaborations.

The main goal in the new project, ”New technologies and strategies in Analytical Proteomics” is to find methods/tools/strategies which can contribute to diagnostics (biomarkers) and drug discovery. It is impressive how far the planning of analytical proteomics has been developed over a period of only two years. Several activities with other groups in the School of Pharmacy are supportive for a variety of pharmacological

issues to be resolved. Conditions are, basically, existing for high level science, but in terms of quantity has not yet delivered.

The group has suffered from poor funding as analytical part of pharmacy has not fit in the sciences the funding bodies have covered. Several applications have been made recently. The associate professor representing the analytical proteomics is on sabbatical in The Netherlands. Exchange of PhD students with Utrecht University, The Netherlands exists. The group has co-operation with companies in USA, but not in Norway. On the other hand, the commercial development of the membrane technology is undertaken in Norway. Collaboration with national and international research institutes exists in all research streams. Another strength of the group is its openness for any scientists needing help in analytical problems. Co-authorship is offered for helping out in the analysis.

Conclusions and rating
Funding for pharmaceutical, analytical science should be recognised as it is needed in all pharmaceutical disciplines at some stage. This group shows high potential if they can enlarge the group. Collaboration with core facilities/other analytical chemistry units should be promoted to reach critical mass (good start in analytical proteomics). Efforts to get post doctoral fellows should be undertaken. It is one of the strongest groups in the Department. In order to ensure appropriate use of the infrastructure that are currently in place, it is recommended that the School of Pharmacy gets proper facilities. This was quite clear in this case.

The overall rating is good (with all potential to very good).

2. Synthetic Medicinal Chemistry

Organisation
The group consist of 2½ PI's, ~5 PhD students and ~10 Master students and is thus approaching critical mass. There are no post docs in the group. The group has recently hired 1½ new PI's with international and pharmaceutical company experience. The group is highly motivated and the potential for future positive development is thus apparent.

The group is spread over four major projects with relatively little synergy between them, which counteracts the advantage of the "near-critical-mass" size. In addition, the group is spread over three different localizations, which also counteracts the advantage of the "near-critical-mass" size.

Scientific activity and quality
The group has a very strong patenting record and has an active collaboration with Birkeland Innovations in order to commercialize their inventions. The group has an extensive network of collaborators at the Institute of Pharmacy and at the national and international level. There is also some collaboration with pharmaceutical companies. Surprisingly, except from access to instrumentation, there is no collaboration with the Department of Chemistry. Both in terms of research and teaching, both departments should be able to benefit greatly from such a collaboration in the future.

Albeit the publication rate varies among the PI's of the group, which can partially be explained by age and background in the pharmaceutical industry, it is on average good. However, most of the publications are in journal with medium impact in their field.

The group has only been able to attract minor external funding.

Conclusions and rating
We assess that there is a potential in the group to become very good. However, in order to achieve this it is important that they focus on fewer projects in the future and are awarded better facilities (in particular co-localization). The group shows a real interest in working in integrated projects with other groups at the Faculty in the future, which we greatly encourage. Medicinal chemistry is a cornerstone of pharmaceutical research which only achieve a high international level if it is integrated with e.g. pharmacology, drug delivery and computational chemistry. The two former research areas are already present at the Institute and it should thus be possible to create common projects in the future.

Overall assessment is good to very good.

3. Bioactive natural products

Organisation
Focus of the group is clear aiming at two well defined, restricted research projects (immunomodulating polysaccharides and bioactive polyphenols) with strong historical backgrounds of personal interests. The two research streams are headed by each of the two professors respectively. The equipment level is basic.

The group is missing intermediate positions, but is aiming at changing one technical assistant to one post doctoral fellow position in a year. The group has several PhD students.

The two associate professors have not developed their own research, but they continue with different aspects of polysaccharides, and apparently they have also been heavily involved in teaching. This can be a risk for the future of research in pharmacognosy in Oslo.

Scientific activity and quality
The polysaccharide research is a nice niche research area, but of limited interest. On the other hand, there is a possibility to become a "world leader" in a not very competitive field. Thorough, detailed spectrometric work has been done on polyphenols, including several bioassay tests for their activities, representing a traditional, "safe" research project. The group has been appreciably funded from several national and international sources (external funding 70%), showing a high productivity, but the overall scientific impact is low. There is a lack of vision for the future as nothing new is happening or

coming and the topics will remain the same, only finding new ways of exhibiting the existing research.

The group has no problems in recruiting master and PhD students. The international collaboration includes mobility (mainly towards Norway) and exchange of students, which is encouraged and supported by the group. The strong international collaboration seems to lay on one person.

Extensive international collaboration on the global level exists, mainly originating from the polysaccharide research. National collaboration with the other units of pharmacy was unclear over the period covered by this assessment.

Conclusions and rating
Quantity has been reached, so the group should focus on quality. Efforts to get post doctoral fellows should be fulfilled. In the near future, the group should recruit independently thinking scientists with expertise and project lines not already covered. They must bring new and innovative research lines. The challenge of boosting the effectiveness of the group can be faced if these new researchers are put in the right position to develop new ideas and directions. The equipment level has to be improved, which could be via making the use of existing equipment in the School of Pharmacy and/or university core units more efficient. The overall rating is good.

Department of Pharmacy

The Department has 22 staff members of which 5 are professors and 9 are PhD students. The Department is organised in two research areas: pharmaceutics with 5 research groups and social pharmacy.

Pharmaceutics

Organisation
The five research groups in pharmaceutics were only briefly reviewed in the presentation and the provided material. This, together with the limited size of the groups and the fact that several of the senior scientists are active in several research groups to sometimes undefined degrees, makes it difficult to evaluate and rate the individual research groups. Below, they are therefore evaluated together. The departmental presentation also brought up some organizational issues, which are commented below.

The research in pharmaceutics is loosely organised around the theme “Stimuli-responsive drug delivery systems”. The research strategy is to investigate basic principles for drug delivery systems that are activated by external stimuli with emphasis on formulation and stability issues. With the exception for a new laboratory for tablet technology, the research facilities are unacceptable and even repulsive. At the international level, it is likely that research would be stopped for health and safety reasons in such laboratories. There is an acute need for moving the research laboratories to new facilities and this must be made the number one priority for the department leadership. In the pharmaceutics

research area there are 15 staff members of which 4 professors, one associate professor, and seven Ph.D. students. There is a lack of intermediate research positions such as post doc's, which given the limited scientific staff is a weakness. A strong effort on recruiting international post doc's should therefore be made. The research leadership in the five research groups is shared between the permanent scientific staff (five in total).

There seem to be a historical lack of recognition of the central role of research in pharmaceutics for a school of pharmacy. This is illustrated by the surprising fact that the Department of Pharmacy is not represented in the board of the School of Pharmacy! This is a unique situation (not found at international schools of pharmacy) that should be corrected immediately in order to make it possible to discuss issues related to pharmaceutical research at the board level. Such issues can not and has obviously not been covered in the past and present time by staff from other disciplines.

1. Photoactivated drugs and drug formulations

In this area, new photosensitizers are incorporated into controlled release formulations. The formulations are intended for treatment of oral infections and oral cancer. A research collaboration has been established with the Scandinavian Institute of Dental Materials. Feasibility studies for radionucleid therapy have recently been performed in pigs, using alginate formulations.

2. Formulation of micro/nanoparticulate drug delivery systems

The focus of this small research group is presented to be on liposomal drug delivery systems for drug delivery to the oral cavity. Through the addition of bioadhesive polymers to the liposomes, it is planned that formulations suitable for drug delivery to the oral cavity can be developed. The group has a low research activity with only two (good quality) publications during the last two years, both dealing with polymers and liposomes as gene delivery systems.

3. Photoachemical stability of drugs

This research area deals with the photostability of drugs in solution and in solid state, both in free form and in formulations. The influence of excipients on the photostability is also studied. A special interest has been the photostability of curcumin and curcuminoids and more than 30 papers have been published on this subject over the years. Past activities indicate international leadership in this area.

4. Hydrocolloids and specifically alginates as modified release agents for active ingredients in drug formulations

This research area focuses on the biopolymer alginate and its derivatives as matrixes for drug formulations. The release rates of from drug formulations are modified by the use of different alginates obtained through collaboration with FMC biopolymers, a

biotechnology company located in the area. Interaction mechanisms between biopolymers and drugs are also investigated. Apart from recent applications in radionucleid therapy, this research area has not been very active during recent years, as judged from the number of recent publications.

5. Site-specific drug delivery

In this project an alternative biopolymer, pectin, is used as a matrix for colon specific release of drugs after oral administration. Pectin qualities that form pellets that rapidly release the drugs have been identified. A consistent series of publications on the influence of physicochemical properties and formulation factors of pectins have been published during recent years.

Scientific activity and quality

The research at the Department of Pharmacy is focused on problems related to pharmaceutical technology and drug delivery. The scientists at the Department represent the most experienced research group in Norway in pharmaceutical technology, a core subject in the pharmaceutical sciences. If their intellectual capital can be focussed, the Department has the opportunity to develop into a more internationally recognized research department.

In general, the performed research is of a good quality but is partly focussed to smaller areas with limited impact on the pharmaceutical sciences. While the small research groups can make significant single contributions in each of the research fields, they lack the critical mass necessary for maintaining a sufficient scientific activity at the highest international level in the pharmaceutical sciences. This is reflected in the relative low citation numbers for each of the permanent five scientific staff members (ISI, July, 2006). This is also reflected by the fact that a significant proportion of the publications are made in medium impact journals within the field of the pharmaceutical sciences.

Attempts to integrate the research between the groups can be distinguished, but need to be continued in order to improve scientific quality and critical mass. A clearer research strategy with a vision for the future is necessary. This strategy should build on existing strengths in the field of pharmaceutical technology but resources for a new, more strategic and internationally more visible research area led by an externally recruited internationally recognized scientist has to be provided, if necessary at the expense of existing research resources, in order to obtain a more research driven environment and a larger international exposure.

On a direct question, the permanent scientific staff is content with the research output “under the given circumstances”. This dejected attitude can only be changed by 1) implementation of a research driven policy at the faculty level aiming at strengthening the research at the Department of Pharmacy, 2) implementation of a strategic research plan for the Department, 3) implementation of a recruitment plan for at least one

internationally recognized researcher in a strategic research area. The opportunity exists, since there are or will soon be vacant positions at the Department.

The level of external funding is low. Since the size of the pharmaceutical industry is limited in Norway, the department members should increase their efforts to obtain international funding, especially from EU. Lack of permanent funding directed to pharmaceutical research at the Norwegian Research Council does not help the situation and efforts to establish pharmaceutical research as a prioritized research area at the Council should be made. Further, a concerted action for the establishment of a national research school in the pharmaceutical sciences should be made together with the other Norwegian schools of pharmacy.

The research collaborations at the Department of Pharmacy are presented in an exhaustive list in Appendix 3 in the self-evaluation. Most of these seem to be related to single projects, rather than to integrated efforts, aiming at improving the impact of research. Thus, a strategy for international collaborations, leading to exchange of PhD students, a recruitment basis for international post doc's and exchange of research staff should be considered. National collaborations aiming at transferring the formulation research into clinical testing should continue and be expanded. Given the small size of pharmaceutical research in Norway, new efforts should be made to increase collaboration with the other departments/schools of pharmacy in Norway. Initially such collaborations could aim at research training by common post graduate courses and providing a basis for a national research school in pharmaceutical research. It is imperative that such school also include post doc positions.

Conclusions and rating

It is recommended that as a first step, that a plan for changing the departmental location and upgrading the equipment is made and presented to the Institute board. The Department is been poorly equipped, which has been recognized by the Institute and a long needed investment in a laboratory for tablet technology has recently been made. This is not sufficient and additional investments are needed in order to provide opportunities for state-of-the art research.

As a second step, a strategic research plan should be made and the research should be organised into larger research areas in order to approach critical mass and increase the opportunities for a higher international recognition. Since the Department is the most experienced in pharmaceutical technology in Norway, one possible research area is the pharmaceutical technology of biopolymers. At the same time, a plan for allocation of up to one third of the research resources should be made in order to attract an international scientist of sufficient stature in a new strategic research area, with international impact.

Previous attempts to recruit at the international level have failed due to a passive recruitment process and unattractive working conditions (low salary, high teaching load, poor infrastructure, where the research building offers particularly unattractive working

conditions). A plan for how to handle each of these problems should be made before the next recruitment is initiated.

The Department needs to increase the number of intermediate (post doc) positions.

Given the small size of pharmaceutical research in Norway, new efforts should be made to increase collaboration with the other departments/schools of pharmacy in Norway. Initially such collaborations could aim at research training by common post graduate courses and providing a basis for a national research school in pharmaceutical research.

Collectively, the research at the Department is of a good quality within the investigated niche areas, but the fact that the many scientific articles are published in journals with a medium or even low impact in the pharmaceutics combined with a low international recognition, based on citation rates, indicates need for improvements. Every effort should therefore be made to increase the fraction of publications in the primary pharmaceutical journals.

Social Pharmacy

Organisation
As the group leader was not able to participate during the site-visit due to illness, the analysis is mainly based on the self-evaluation and written documents made available to the panel and on the discussions with other persons during the site visit. The Social Pharmacy group at Oslo University has one permanent professor and the last three years also one associate professor. This position will be filled permanently from autumn 2006. There are no post-doc positions. Currently there are 3 PhD students enrolled. There is a clear lack of qualified researchers and professor level expertise in Norway, which is a barrier to recruiting new personnel. Also internationally the recruitment is difficult in social pharmacy.

The group has no secretary or technical support for research. External funding has been low. New strategies are needed to attract more external funding. Possibilities for funding should be explored within the Research Council of Norway, the Ministry of Health, and other health and reimbursement authorities. It is clear that the critical mass to do high quality research on an international level is currently missing.

Scientific activity and quality
Social pharmacy teaching and research has a history of some ten years. A strategic choice has been to focus on producing master students for professional needs in Norway. Thus Master student research has been prioritized with less focus on research at Ph.D. level. This is obviously one contributing factor to recruitment problems and the general lack of qualified scientists in social pharmacy in Norway. The group has educated more than 50 pharmacists with social pharmacy as their main subject during its existence. During the last five years no PhD student has graduated.

The current research areas focus on four different topics: 1) Use of natural products by cancer patients, 2) drug use in the elderly with special reference to compliance problems, 3) drug information provided by health personnel and 4) pharmacoeconomics, especially in the areas of reimbursement systems and knowledge about pharmacoeconomics and policy questions with regard to cost of medicines. International collaboration has been started in a couple of projects, which is highly recommended. Still, the question remains whether this collaboration supports the group's research strategy or whether it rather distracts the focus in research when taking into account the staffing situation.

Supervising master students is currently a big job for the group, therefore there is a need to restrict the number of master students until there are more staff members available or seek outside supervisors. Meanwhile a more focused approach is needed in choosing the master thesis topics in such a way that they support the research strategy. Master students have to be seen as a very valuable resource if properly utilized. The majority of the work that has been done by MSc-students has not been published and therefore it is not possible to judge the quality of that research. Some of it has been presented at international meetings and is available only as abstracts, altogether 34. The group has published only four original publications in peer-reviewed international journals during the last five years. Also the number of national publications is modest. A number of MSc projects has been done in collaboration both within and outside the university, but this collaboration is not productive in terms of publications or additional resources. A more focused and strategy oriented collaboration is a prerequisite for improving the research. This could be done within the University of Oslo, e.g. with the Medical Faculty, Institute of Health Management and Health Economics and the Health Economics Research Program and other research institutes in the Oslo area, like the Norwegian Institute of Public Health, Department of Pharmacoepidemiology. Furthermore, coordination and collaboration on a national level between the social pharmacy units is also necessary.

Conclusions and rating

Compared to other Nordic universities with pharmacy education and research the Oslo University is heavily understaffed in social pharmacy and related areas like pharmacy practice and clinical pharmacy. Additional resources are needed both from a teaching and research point of view. An awareness of the need to strengthen social pharmacy was evident at the institute level.

If the strategic choice is to do social pharmacy research on a high international level a more focused research and publication strategy is needed. Current research areas are too scattered to be able to do high quality research on an international level. Social pharmacy includes many important topics with national relevance. If an international level is the aim there is a need to concentrate on no more than two areas. Today, when there is already three different social pharmacy units in Norway it should be possible to coordinate the interest areas in a rational way in order to reach a sufficient quality of research. From a national point of view, concentrating on health policy issues within pharmacoeconomics and use of medicines could be seen as priority areas for social pharmacy research in Oslo.

The published international articles are of good quality, but due to small number of published research and of graduated PhD students, the level of research in social pharmacy is classified in an international context as “weak” to “fair”.

4 EVALUATION OF SCHOOL OF PHARMACY IN BERGEN

The pharmacy programme in Bergen is based on collaboration between Departments of Mathematics, Chemistry, Biomedicine, Medicine, Public Health, and Gades Institute. A pharmacy programme board and a coordinator are responsible for the programme in collaboration with the involved faculties and institutes. These departments and Department of Molecular Biology, Department of Economics, Centre for International Health, as well as affiliated institutes as National Institute of Nutrition and Seafood Research will supervise research projects for pharmacy students. The coordinator and the board report to the University director.

A Centre of pharmacy was established as a separate organisational unit in January 2004. The aim of the centre is to establish and develop pharmacy in collaboration with the participating institutes. The coordinator is responsible for running the centre on a daily basis. In addition to the coordinator, there has so far been one administrative coordinator attached to the centre.

Strengths

The School of Pharmacy in Bergen is attractive having many highly qualified applicants. The personnel in the school is dedicated with the heart for providing quality research.

A stronger research leadership system is being implemented in most units. There is a clear vision for research driven teaching and the priority is given for research. Leadership is enthusiastic for creating pharmaceutical research of high quality and there seems to be a strong support for pharmaceutical sciences.

The infrastructures at the biomedical and medical units are excellent. Furthermore, the close vicinity, e.g., to relevant medical disciplines, university hospital and animal facilities makes a good basis for multidisciplinary co-operation.

The organisation structure in the different departments and sections is good allowing big research groups that achieve critical mass. Furthermore, some units have an ideal balance between senior staff, post docs and PhD students.

Weaknesses

The main weakness of the School of Pharmacy in Bergen is the lack of traditions in pharmaceutical research. Understanding of the drug development process is not complete due to lack of pharmacists in the academic staff. There is no research in pharmaceutics, and because of recruitment problems, no full time staff in social pharmacy research. Furthermore, there is no central co-ordination of pharmaceutical research, i.e., a steering committee for pharmaceutical research is lacking. More generally, an advisory board for research in the field is needed. In some units, there is also a lack of intermediate research positions, such as post docs.

Opportunities

Even though the involved units collaborate well internally, there are still opportunities to increase collaboration. There are unexploited possibilities for collaboration between the units, e.g., pharmacognosy/natural product chemistry and bioprospecting groups, and possibilities for increased collaboration with research institutions like APOFORSK in the field of social pharmacy. Development of clinical pharmacy should be based on close collaboration between pharmacotherapy and social pharmacy. Early interaction between disciplines at the undergraduate level provides possibilities for multidisciplinary research collaboration in the future.

There are opportunities to create pharmaceutical research in translational medicine and in clinical pharmacy, and furthermore, pharmaceutical research based on existing strengths in surface and colloidal chemistry. Chemistry Department's willingness to provide resources for pharmaceutical research is a good opportunity for the future.

Threats

The threats follow the weaknesses of the School of Pharmacy. Because of the lack of tradition in pharmaceutical research there is a risk that pharmaceutical research will not get a profile of its own. The lack of central control on pharmaceutical research and decentralised budgeting model contain a risk that pharmaceutical research may be down prioritised in an otherwise strong research environment. Furthermore, outsourced teaching of pharmaceutics and pharmacy practice abroad counteract the strengthening of research in these areas. A shallow understanding of the opportunities to build clinical pharmacy inhibits research in this area.

4.1 Recommendations

1. Strengthening pharmaceutical research

The evaluation committee strongly recommends that a specific strategy plan and a steering committee for pharmaceutical research should be implemented. There are local examples of such a process in the field of Nutrition sciences where experiences can be obtained. Support from and collaboration with an established school of pharmacy, such as that in Tromsø should be sought, in order to implement the plan within a reasonable time frame. Also an advisory board for pharmaceutical research with external representatives should be established. The Medical Department should define focused research areas across sections with focus on pharmaceutical research. Furthermore, specific incentives to promote collaborations between research units for pharmaceutical research should be established.

2. Other recommendations

The committee recommends that continuing efforts should be taken to strengthen and to create larger and stronger research groups above critical mass. In order to achieve this, new positions should be directed to existing research groups.

There is a need to create performance indicators and measures. The evaluation committee advises to monitor actual time spent on teaching, research, and administration to allow fair distribution of resources.

4.2 Evaluation of different units participating in pharmacy research

The evaluated units and groups have been selected by the university. As the evaluation is focusing on pharmaceutical research, only relevant parts of the departments have been included in the evaluation.

Department of Chemistry

The Department of Chemistry clearly has developed a capacity to plan and to make priorities for future activities, for investment in costly instruments as well as for taking pharmacy education and research on board. Pharmacy is wanted to be looked at as a unit by the pharmacy programme board, and not from special disciplines, which needs the approving attitude from this Department. The strategic plans of the Department of Chemistry were supported by the University of Bergen including the Faculty of Science and Mathematics to join the pharmacy programme.

The Department has recently invested heavily in the instrumentation, and it is applicable for the pharmaceutical research. Focus is aiming at the best spectroscopic equipment available in Norway. Facilities have been allocated to pharmacy students at the Department of Chemistry.

1. Section for bioorganic and pharmaceutical chemistry

Organisation

Pharmacognosy and medicinal chemistry is developed at Department of Chemistry. The Department is involved in pharmaceutical research such as research on natural product chemistry (1 professor, 2 associate professors), organic synthesis (1 professor, 1 associate professor) and molecular interactions research in biophysical chemistry (1 professor). Associate professors will further be appointed in pharmacognosy and medicinal chemistry 2006. A total of nine professors, associate professors and professors II, were indicated for this section in the fact sheet. There are several master and PhD students.

Scientific activity and quality
An open willingness to develop pharmaceutical research was obvious. Section for bioorganic and pharmaceutical chemistry was established for this purpose, as the

Department of Chemistry reorganised into three scientific sections. This has been very nicely accepted by the whole staff.

A lot of activities are already happening related to pharmacy. Most research is done in multidisciplinary groups. However, pharmacy needs to build its own disciplinary science.

The Section for bioorganic and pharmaceutical chemistry indicated an ambitious willingness to take the responsibility of pharmacognosy on the national level. Lack of tradition in pharmacognosy could be compensated as the Department has been heavily involved in research on natural product chemistry in the area of Pharmacognosy/Natural product chemistry. The main expertise is in flavonoids, for which good analytical and preparative procedures exist to evaluate which molecules are suitable for pharmaceuticals. The research in this area has been published in journals often used by pharmacognosists involved in phytochemistry. Compounds are studied for biological activities in collaboration. This makes a natural interface to the Department of Biomedicine, and has also turned out to a joint project entitled ”Bioprospecting and strategies for industrial utilization of anthocyanins and other flavonoids from plants” with external funding. Possibilities of interactions with for example the groups in this Department are not yet totally exploited. The whole section should take the advantage of the great opportunities that the new, still flexible pharmacy programme offers. It offers to explore new avenues and exploit novel methodologies as merging different disciplines. Also the other two areas in this section, Synthesis and Biophysical chemistry, show features in their research well suited for pharmacy, and the existing research subjects include already a pharmaceutical flair. Both areas have the benefit of high level senior professors, supported by associate professors (in synthesis just recently) performing actively.

Conclusions and rating

The Department of Chemistry has invested in pharmaceutical research, developed and put effort. Efforts to get post doctoral fellows should be undertaken jointly inside the pharmacy programme, enabling more support for those groups which can cooperate in the future. Also in the future a broad, active collaboration on national level to reach a critical mass is of outmost importance to be able to compete internationally.

In brief, the Section for bioorganic and pharmaceutical chemistry will have the demanding task of competing in the open market for research funds in pharmaceutical subjects whilst adequately nurturing its human resources at the Department of Chemistry. Aim, will and strategic plans are there, future will tell if the funding/resources will be sufficient.

The overall rating is good with potential to very good.

Institute of Medicine

The Institute of Medicine is huge and the focus of research has not been pharmaceutical. Thus, the committee felt that the evaluation should be made on a very general level, not at the individual research group level. An overall description and rating of the Institute is given.

Organisation
This is an integrated modern Institute covering the 11 major therapy areas plus sections for pharmacology, clinical cell biology and collaborations hospitals of human medicine. The total staff of the Institute covers 28 professors, 4 associate professors and 26 professors II´s, 7 post doctoral research fellows and 8 doctoral fellows. The section of pharmacology has 6 professors which is considered satisfactory for the educational purpose. The research groups have access to three excellent supporting facilities: Medical Research Centre (New laboratory building), the Vivarium, and six scientific loci covering experimental cancer research, register based epidemiology research, homocysteine and vitamin research, cardiac research and circulation research.

The laboratory seems instrument wise well equipped, but focus is needed for investments corresponding to the pharmaceutical requirements.

Many international collaborative research projects are ongoing and formalised external collaborations are established to Clinical Research Office for Cancer, Norwegian Kidney Register, National Centre of Tropical Medicine, National Centre of Home Ventilation, National Centre for Ultrasound in Gastroenterology, and Allogenic Stem Cell Transplantation.

The leadership and visions for the Institute are impressive. Such an institute represent a scale of difference to the pharmaceutical research environment of the other two pharmaceutical universities.

All the research groups we talked to expressed their great interest in integrating pharmaceutical expertise in their sections as they feel a strong need for that peculiar expertise. This is a good starting point for a newly established pharmacy school.

Scientific activity and quality
The scientific activity level is high with good international collaboration. Clear focus on pharmaceutical relevant research topics is needed then the possibility for synergy is great. In this connection pharmaceutical PhD fellowship should be implemented and their mobility should be drawn upon to establish connections to international and national expertises.

Conclusions and rating
The overall assessment of the research of the Institute based on the selected CV´s and publication lists presented is considered to be from good to excellent.

Department of Biomedicine

The Department has a total staff of 28 professors, 16 associate professors, 4 adjunct professors (20% positions), 35 postdoctoral fellows, 65 Ph.D. students, and 12 externally financed research positions. The Department has recently reorganized into ten research groups. Three of these research groups were considered particularly relevant for the evaluation of pharmaceutical research and therefore participated in the evaluation.

The Department of Biomedicine has recently undertaken a bottom-up re-organisation with the aim of creating larger groups with formal leadership and sizes above critical mass. Although some of the groups that have arisen from the re-organisation have yet to fully integrate we strongly support the strategy. The leadership of the Department has a strong focus on research relative to teaching, which is genuinely supported at the group leader level. The Department has been successful in hiring strong permanent staff from abroad and is participating in several national and international networks. The Department does thus have an international working environment. Finally, the Department is situated in a modern building and has access to state-of-the-art equipment.

In many ways the Department of Biomedicine represents the ideal to which others should strive. Several of the departments and institutes we have evaluated would greatly benefit from doing a similar bottom-up re-organisation and in that respect the Department is a role model that shows how it can be done in a way that is supported by the staff.

1. Biorecognition group

Organisation
The group has achieved critical mass and consists of 2 PI's, 7 post docs, 7 PhD students and 1 master student. There is a very good balance between the various levels of investigators, although the group has surprisingly few master students from UiB. The group is internationalized and has currently 6 visiting students from abroad.

Scientific activity and quality
The group elegantly integrates structural methods into investigations of biological systems. Both PI's have excellent publication records although they have very few publications together and appear to have relatively distant fields of interest based on the submitted publications/CV's. The group should thus focus on integration after the re-organisation with the goal of creating synergistic projects. However, one of the PI's will soon retire, which creates the possibility of hiring a person that fits into a common research strategy of the group. In order to keep the momentum of the group intact it is important to fill the coming vacancy with an equally strong researcher.

The group has an extensive network of collaborations which has led to common publications. The new focus on pharmaceutical research at UiB is a possibility for the group to increase synergistic interactions with related groups at UiB such as integration of the current research on aromatic amino acid hydroxylase with medicinal chemistry efforts.

Conclusions and rating
Like the other groups in the Department of Biomedicine, this group in many ways represents the ideal to which others should strive. It has access to modern equipment and infrastructure and a size that allows it to integrate several life science disciplines and apply them to problems related to human diseases and treatments hereof. The results are generally published in the best biological journals with the PI's as senior authors. The group collaborates extensively with other groups in Norway and abroad but it seems that additional collaborations with medicinal chemists could be a great positive opportunity for the future.

Overall assessment is very good to excellent.

2. Cellular Networks

Organisation
The group has achieved critical mass and consists of 3 PI's, 5 post docs, 6-7 PhD students and 4 master students. There is a very good balance between the various levels of investigators and the group is internationalized. The group has extensive experience from international pharmaceutical companies, and has currently several ongoing collaborations with European pharmaceutical companies and US biotechnology companies.

Scientific activity and quality
The group employs several research fields to study cell signaling and gene regulation from a multidisciplinary angle. The research topic and the methods employed are highly relevant albeit complex in nature. However, the previous broad experience of the group leader is an excellent platform for success on the projects, and the group leader has previously published on such "complex methodologies" in high impact journals. The group has recently been established and has yet to prove that its approach will lead to results with sufficient impact to be published in high-ranking journals.

There are possibilities for synergistic interactions with related groups within the Department of Biomedicine.

Conclusions and rating
Like the other groups in the Department of Biomedicine, this group in many ways represents the ideal to which others should strive. It has access to modern equipment and infrastructure and a size that allows it to integrate several life science disciplines and apply them to problems related to human diseases and treatments hereof. The group leader moved from the pharmaceutical industry to UiB three years ago and, in spite of a nice publication and patenting record, has yet to publish his first paper originating from UiB. The international impact of the Cellular Networks Group thus looks promising, but has yet to reveal its true potential.

Overall assessment is very good.

3. Translational Signaling

Organisation
The group has achieved critical mass and consists of 3 PI's, 5 post docs, 6-7 PhD students and 4 master students. There is a very good balance between the various levels of investigators.

Scientific activity and quality
The group is multi disciplinary and is very well integrated into the major Norwegian FUGE program and also participates in EU projects. It has access to state-of-the-art equipment in a modern building. In particular the access to proteomics equipments is excellent.

The group leader has an excellent publication record but seems to be split between two major projects: *Translational Signaling* (described in the self-evaluation report) and *Bioprospecting* (described in the CV). The priorities among the two major projects are unclear from the documents submitted to the evaluation committee, but as pointed out in the description in the CV, there is potential for synergistic interactions between the two projects, which should be pursued.

Conclusions and rating
Like the other groups in the Department of Biomedicine, this group in many ways represents the ideal to which others should strive. It has access to modern equipment and infrastructure and a size that allows it to integrate several life science disciplines and apply them to problems related to human diseases and treatments hereof. Both projects (Translational Signaling and Bioprospecting) are at a very high international level. The latter utilize the marine resources of Norway in an innovative way and takes natural products chemistry to a new level. The bioprospecting project has a lot in common with projects undergoing at the Section for bioorganic and pharmaceutical chemistry at the Department of Chemistry and a closer collaboration between the two groups would thus be very beneficial.

Overall assessment is very good to excellent.

Department of Public Health and Primary Health Care

Organisation
Social pharmacy research at university of Bergen is mainly done at the Department of Public Health and Primary Health Care in collaboration with an independent research institute called APOFORSK. Social pharmacy is assigned a full professor, but due to recruitment problems, a 50% associate professorship is so far established for social pharmacy teaching and research. In addition one person with an associate professorship is doing pharmacoepidemiological research in the field of medication use in the elderly. Three PhD students are currently doing research in the field of social pharmacy.

Scientific activity and quality
It is evident that a clear leadership and a full professor in Social pharmacy is missing. The Department needs a person with a clear vision of the role of social pharmacy in pharmacy education and research. The research environment is excellent for doing high class multidisciplinary research with a social pharmacy focus. Especially in the field of epidemiology the research environment and methodological know-how is very strong with good opportunities for collaboration in important areas. The research areas of persons involved in social pharmacy research, Norwegian women and Cancer (NOWAC) and medicine use in the elderly are highly relevant.

On a national level there would be good opportunities for collaboration with Tromsø, especially in the field of pharmacoepidemiology. There are also good opportunities of starting to develop pharmacoeconomics as a research area. This area is highly topical, but some kind of coordination on national level is needed if all of the social pharmacy units are getting involved in pharmacoeconomics. A dedicated person is needed to develop this type of research. Social pharmacy research can to a certain extent be integrated with already established groups but an own profile is needed. The critical mass can be reached only through collaboration but a strategy is needed how to do it in practice.

There might be opportunities to collaborate with University of East Anglia in the field of pharmacy practice research. Such collaboration should also include Apoforsk in order to create a critical mass in the field. With good collaboration Bergen could become a national centre of excellence in pharmacy practice research. The main problem at the moment seems to be the lack of qualified researchers in the field. Recruitment of potential PhD students is one way of increasing the pool of experts in social pharmacy.

Conclusions and rating
As there is no specific research group dedicated to social pharmacy research no grading can be done on group level. However, on the individual level, research done by those involved in social pharmacy in Bergen is of good international standard.

5 EVALUATION OF SCHOOL OF PHARMACY IN TROMSØ

The Institute of Pharmacy (Institutt for farmasi; IFA) is one of five institutes at the Faculty of Medicine. The integrated Master's program in pharmacy started in 1994. The Institute is organised in four departments: Department of Pharmaceutics and Biopharmaceutics, Department of Medicinal Chemistry, Department of Pharmacology, and Department of Social Pharmacy.

Strengths

The School of Pharmacy in Tromsø is attractive having good applicants, although some positions have not been possible to fill. The personnel in the school is dedicated for providing high quality teaching.

The infrastructure at the School of Pharmacy is good. All the disciplines are in the same building, which provides a good ground for multi-disciplinary research collaboration. Furthermore, the close location to medical, natural science faculties and to the university hospital makes such co-operation easy. There is a willingness to create an international atmosphere in some units. Furthermore, a system for sabbaticals is very well developed and used.

Weaknesses

The main weakness of the Institute of Pharmacy is the lack of research staff. There is a problem in recruiting people which, results in very small departments. In such an environment there are no good opportunities to operate due to heavy teaching and administrative load. Furthermore, the Institute seems to be teaching driven. Pharmacy education and research in Tromsø is not new anymore and the Institute needs to move into the next phase of its existence.

There is no finalized research strategy and the leadership structure is weak. However, a new structure for leadership has recently been decided at the University, aiming at strengthening the leadership in general as well as to focus more strongly on research. As a consequence of the new structure, the University has started a training program for their leaders, who are now given the opportunity to prioritize a promising researcher in favour of less teaching and more room for research. Most research groups are below critical mass and spread among several topics which create difficulties to compete at the international level. In most groups, there is a lack of intermediate positions, like post docs. Furthermore, there is a lack of international benchmarking at the department level. Currently, there is no full time staff members dedicated in social pharmacy research.

Opportunities

There are possibilities for increased collaboration, e.g., with other faculties and departments in the University. Similar opportunities are apparent with the Drug Information Centre, situated in the same building, and with the FUGE platform (MarBio,

MarBank). The research on pharmaceutics and its infrastructure is an asset for the future, and may open good possibilities for co-operation with the University of Bergen. A prerequisite for such collaboration is that the University of Bergen allocates adequate resources for the establishment of pharmaceutics and biopharmaceutics as a new research area. The collaboration could initially concern e.g. shared PhD courses and supervision of PhD students.

The unfilled positions create opportunities to act fast to recruit and hire highly qualified international researchers. There are good facilities for additional researchers.

Threats

The University of Tromsø is marginalized because of its geographic location. Due to the recruitment problems, the Institute of Pharmacy has implemented a strategy aiming to hire local graduate PhDs who are willing to stay in Tromsø. However, such strategy is too slow and does not create an international research environment. Leadership has good intentions and ideas but has difficulties in implementing the plans discussed. Furthermore, there is a threat in the field of medical chemistry that too much service work may take focus away from the key research projects of the Department.

5.1 Recommendations

1. Improvements in organisation and facilities

The evaluation committee strongly recommends that the departments in the Institute of Pharmacy should be merged to two bigger units in order to create critical mass and enhance co-operation. The already existing collaboration between the Departments of Medicinal Chemistry and Pharmaceutics, and on the other hand between the Departments of Social Pharmacy and Pharmacology would be the natural way to merge these departments. During such organisational change, reassessment of the number of permanent staff between different departments (sections) should be critically done.

The evaluation committee strongly feels that it is vital for the Institute and for the region that the already financed sterile lab be established immediately.

The committee recommends that more formal organisation and meeting structure would be established to make personnel at all levels engaged in the mission of the Institute. Furthermore, there is a need to strengthen representation of the Institution at the faculty level.

2. Development of a stronger research strategy

The evaluation committee recommends that a strategy to create larger and stronger research groups would be created. The upcoming and available positions should be utilized for hiring persons in such research groups. In the future the Institute should adhere to the recruitment strategy and build on the strong groups in order to become

internationally competitive in a few selected areas such as drug transport and delivery, medicinal chemistry and microbiology.

Research leadership should be strengthened by distributing power to department heads in order to implement developed strategies. Benchmarking should be done both at an international and national level. There should be a more aggressive strategy to advertise positions in international arenas to revitalize research in key areas. A deeper and better collaboration with the Institute of Community Medicine in the field of social pharmacy research is encouraged.

3. Other recommendations

There is a need to create performance indicators and measures. The evaluation committee advises to monitor actual time spent on teaching, research, and administration to allow fair distribution on resources.

5.2 Evaluation of departments and individual research groups

Department of Pharmacology

The Department is organised into four research groups: 1) Basic pharmacology 2) Clinical pharmacy 3) Microbiology and 4) Molecular genetics

1. Basic pharmacology

Organisation
The staffing of the group consists of one professor and one associate professor, of which one professor also is covering clinical pharmacy. The group also has one senior engineer, and two Ph.D. students. The professor has for the last five years been head of the Institute and head of the Department of Pharmacology, in addition to having teaching responsibilities. The critical mass of the group is for obvious reasons too small. A merger with, e.g., the clinical pharmacy group would be beneficial.

The research of the groups concerns the biological roles of matrix metalloproteinases for cancer cell invasion. Two cell lines with high and low metastatic activity expressing different level of the protein S100A4 serve as model systems. These studies lead to the identification of the associate involvement of the proteinase legumain. On this basis a subsequent collaboration has been established to Institute of Pharmacy, University of Oslo, which has worked with this protease for years. External collaborations include also Institute of Medical Biology, University of Tromsø and The Norwegian Cancer Hospital, Oslo.

A new study on “Oropharyngeal carcinoma - clinical and biological aspects” has recently been initiated involving 10 researchers at the Institute of Medical Biology and the University hospital, Tromsø. Thus the groups collaborate with local and national

institutes and train Ph.D. students. Regarding mobility only one master student has worked in Oslo.

Scientific activity and quality
A clear vision for the research is absent. The scientific productivity is low. Training and mobility must be intensified. International and national collaboration is very weak.

Conclusions and rating
Based on publication lists, the research of the basic pharmacology group is assessed to be fair.

2. Clinical pharmacy

Organisation
The group consists of one professor, one associate professor, one adjunct professor, and two PhD students. The professor is the same person as the professor given under the heading "Basic pharmacology" which for the last five years has been head of the Institute. There is a need for more Ph.D. students and post-docs. The clinical pharmacy group is working with various clinical pharmacy projects i.e. warfarin regimens, pain management.

The research comprises various clinical pharmacy projects with the purpose to optimise therapeutic regimens for individual patients within cardiology (warfarin) and oncology (pain).

The group feels that it represents a spearhead for the introduction of clinical pharmacy in Norway as a new important field for managing the increasingly complexity of pharmacotherapies in the health care system. The panel supports this view point. Accordingly, a national activity plan has to be worked out.

Scientific activity and quality
External collaboration includes University of Strathclyde, University Hospital of Tromsø (Heart Failure Clinic, Renal Unit and Oncology Unit), recently collaboration with St. Olavs Hospital in Trondheim has been established.

Extended collaboration with clinicians is recommended. There is potential for valid and interesting research projects. In the same way international collaboration has to be intensified.

Conclusions and rating
The drive of the research should be followed up and a clear strategy formulated which should form the basis for grant applications. The research of the group is assessed to be fair to good with potential.

3. Microbiology

Organisation

The group consists of 1 professor, 2 post doctoral fellows and 4 PhD students. It is housed in a modern building and equipped with state of the art equipment.

The focus of the research is well defined and ambitious, i.e. understanding how bacteria adapt and evolve to changing environments with main impact on horizontal gene transfer, malaria, and antibiotic resistance. The head of the group has shown a good strategy in building up the research environment, gaining high level education himself abroad and then building up the group, first with PhD students, but very soon post doctoral fellows as well (last extremely important when the professor is the only permanent staff, internationally active, and on leave for sabbaticals every 5 years). The head of the group has a profound post doctoral study period of 2 years at Wageningen University and Research Centrum in The Netherlands and 3 years at Harvard University in Cambridge, USA and several short stays in Germany, Italy, Tokyo and Peru, supplying the knowledge for building up this research group.

The team spirit and general enthusiasm flowing from the PhD students is especially commendable. Indeed, it is clear that the sense of common cause and the excitement of participating in front-line research is experienced by the PhD students, as they seemed very eager, productive, creative and proud.

Looking at the concept of the group, a critical mass is achieved / can be maintained via the continuing close collaborations and contacts with the international, forefront research groups, in addition to enlargement of the group itself.

Scientific activity and quality

The highly relevant research subjects of the group are important questions in the pharmaceutical point of view. The research group has been established only in 2001 and the first PhD students employed 2003. The overwhelming majority of publications from this group appeared in high class international journals and a significant number of these were published in the most prominent journals. This is very impressive and gives a strong basis for the research started. Evidently important has been funding from national sources to build up the group settings. Noteworthy is the research approach taking advantage of the unique position in north by exploring gene reservoirs in a range of arctic terrestrial and aquatic environments, including the gastrointestinal tract of polar bears and hooded seals, which collaboration has recently started. The strong scientific growth of this group shows all perspectives and all potential for reaching excellent ranking in a short time period (for the moment most of the works developed originally from outside Institute of Pharmacy).

Several guest researchers from abroad have visited the group. PhD and master student recruitments have been successful including students from abroad. International mobility among the PhD students has transpired. For the moment a sufficient number of post doctoral fellows (two) exists. The group has a profound international cooperation (e.g.

Japan, USA, The Netherlands, UK, Italy, and New Zealand) due to the background of the head. Local collaboration via joint projects has emerged.

Conclusions and rating
Continue with the impressive work, following the strategies of keeping it beneficial for pharmacy in Tromsø! If the group is expanding, and it shows all potential to do so, it should have more permanent staff. This group is a treat for the University of Tromsø, which should be notified by ensuring the development of the group. This is a great example of how a focused area can not only survive, but be prosperous anywhere. This project shows that with high impact research it is possible to attract students, also from abroad, and in a short time-period build up a good, functioning research group. Such needs the support of the Institute and University and the external funding bodies.

Although the time period had not yet allowed the group to show all its own potential, the overall rating ranks excellent.

4. Molecular genetics
Given that this group currently consists of one associate professor and we specifically have been instructed not to evaluate people individually, we will not submit a specific evaluation of this group. Nevertheless, we do have a few comments related to the recruitment strategy of the Institute.

It has been stated by the Institute that their recruitment strategy is to hire new people, which fit into existing projects in order to obtain critical mass in the future. This is a very wise strategy, which has recently been successfully employed in the Department of Medicinal Chemistry. However, in the case of Molecular genetics, the Institute has hired a young promising researcher with several high impact publications to work in the complex and competitive field of molecular genetics completely separated from the existing activities at the Institute. Not surprisingly, it has been an uphill struggle to establish the new field and in addition the person has recently been appointed Head of Department of Pharmacology, which leaves even less time for establishing the new field. Given the conditions that the molecular genetics group has been given by the Institute we envision that it will be very hard to become competitive internationally and we thus recommend a restructuring that will allow the group to merge with one of the existing groups. Alternatively, the group should receive significant additional resources and research time in order to get the research quick-started and thus enable future external funding and recruitment.

Department of Medicinal Chemistry

Organisation
The group consist of 4 PI's (one of the PI's will join the group soon), 2 Ph.D. students and two senior engineers. 3 of the 4 PI's have decided to focus on a joint project and thereby achieve critical mass. There are no post docs in the group. However, the PI that will join the group as an associate professor is a former Ph.D. student from the Department and has after that spent one and a half years as a post-doc in USA.

The group has access to state-of-the-art equipment in a modern building. In particular the access to analytical and parallel synthesis equipment is very good.

Scientific activity and quality
There are several fruitful collaborations with external academic and commercial groups. The Department has previously been collaborating with external collaborators on too many projects. However, they are aware of this issue, and have already initiated measures to increase focus in the future and develop a stronger internal research profile. In that respect it would be greatly beneficial if all 4 PI's agreed on a common future research profile, which does not seem to be the case right now. The group has significant know how in the field of structure elucidation and parallel synthesis and it thus seems natural that the common project(s) center around these technologies.

The publication record of the group is good but varies considerably between the individual PI's.

Conclusions and rating
The group shows a real interest in working in integrated projects with other groups at the Institute in the future, which we greatly encourage. There are already established collaborations with the "Drug Transport and Delivery" group but more could be done in the future – in particular in the field of pharmacology. The Department has listed quite a number of ongoing projects considering the number of researchers. There is thus a risk that the Department loses focus and spends too much time on servicing external groups. An increased focus on fewer projects and on internal rather than external collaborations is thus recommended for the future. The Department has recently recruited a young associate professor with a research profile that fits into the current research strategy. This fits very well with the overall recruitment strategy of the Institute and thus serves as a positive role model.

Overall assessment is good with the potential of very good in the future.

Department of Pharmaceutics and Biopharmaceutics

Drug transport and delivery

In this research group, barriers that influence drug transport processes are investigated and drug delivery systems aiming at improving the transport of "difficult" drugs are developed. Investigations into the dissolution, solvation, partitioning and passive transport of drug molecules are performed. Through collaboration within the Institute, the active transport of new peptideomimetics is studied. The drug delivery part is focused on phospholipids, but also pellets and minitablets. Recently, an alternative artificial membrane model has been developed and new approaches for basic studies into the thermodynamics of drug solvation have been possible through an international collaboration. The latter research has recently been awarded.

The group has established an interdepartmental collaboration with the Department of Medicinal Chemistry. Investigations into the dissolution, solvation, partitioning and passive transport of drug molecules are performed. In collaboration with medicinal chemistry, the active transport of new peptideomimetics is studied. The drug delivery part is focussed on phospholipids, but also pellets and minitablets.

Organisation
The Department has 15 staff members of which 2 are professors and 8 are PhD students. There is a lack of intermediate research positions such as post doc's, which given the limited scientific staff is a weakness. This situation is partly relieved by the successful recruitment of a previous post doc after completion of a post doc abroad. Efforts should be made to incorporate this researcher into the existing research strategy in order to avoid dilution of resources and to obtain critical mass in concerted actions e.g. with regard to funding initiatives. The recruitment of international PhD students and staff gives the Department an international flavour, which in the long run will have a positive impact on both international collaborations and international recruitment.

The strategy of the research in drug transport and technology is to provide scientific insights and tools to understand drug transport processes better and to use these insights as a platform for the development of new drug delivery systems. The strategy is clear and focussed and the research is of general interest for drug development. The interdepartmental collaboration with medicinal chemistry is an asset and should be further developed. The permanent scientific staff also has a clear and ambitious vision for the growth of the Department. The Department is comparably well equipped, but further investments are needed in order to make it a full fledged department for pharmaceutical research (and education). Surprisingly, the Department does not have a sterile laboratory, despite that this has been recognized by the leadership and money has been allocated for such a laboratory since a long time. Since a sterile laboratory is an important prerequisite in pharmaceutical research, this issue should be solved immediately. Joint projects between the senior scientific staff members, with other departments (Medicinal Chemistry) at the Institute and internationally has clearly contributed to the quality of research.

Scientific activity and quality
The research is of a good quality and focussed on basic research issues of significant relevance for drug discovery and development. A united research strategy has made it possible maintain the research within one group. If the free position, now converted to two PhD scholarships, can be filled with a senior researcher fit into the research strategy it is reasonable to expect that this research group will become competitive at the highest international level within the pharmaceutical sciences.

The Department has been able to generate external funding and 4 out of 8 PhD students and the one post-doc are externally financed, another two PhDs by temporary conversion of a permanent scientific staff position. While this is a good result, further efforts to obtain external funding should be made, in particular from EU. Lack of permanent

funding directed to pharmaceutical research at the Norwegian Research Council does not help the situation.

The Department has established international and local collaborations that have beneficial effects on the research. The recruitment of international researchers and PhD students provides a platform for further internationalization of the Department. In general, the (so far few) PhD graduates from the Department has continued with international post docs, which indicates that the students maintain an interest for a research career also after the PhD studies. The professors take advantage of the possibility to perform sabbaticals abroad, which assists in bringing new ideas and competences to the Department. A clear limitation is that there are no ongoing collaborations with other schools of pharmacy in Norway – this decreases the possibilities to influence the national research policy in pharmaceutical research.

Conclusions and rating

The Department has a positive development with engaged and strong leaders with a vision for the future. The output from the inter-departmental collaboration with medicinal chemistry is of limited volume, but of a high quality and illustrates the added value of such collaborations. More could be done to strengthen this collaboration.

Historically, the research has had a limited impact, illustrated by rather low citation numbers and publication in secondary international journals within the field of pharmaceutical sciences but provided that the current positive developments can be maintained, this should not be worrying. Every effort should, however, be made to increase the fraction of publications in the primary pharmaceutical journals.

The research focus on drug transport and delivery should be maintained. The strategy is clear and should be followed. The research group is the only one in Norway, performing research in biopharmaceutics, a subject of high relevance for drug discovery and development. The research collaboration in the thermodynamic area is of a high quality and should be strengthened.

To keep up the volume of research, two of the PhD positions are financed from vacant positions at the Department. While this may be a solution over a limited time period, there is a threat that the resulting increase in teaching burden on the staff may be exhaustive in the long run. A strategy to solve this emerging problem should be outlined.

The Department needs to increase the number of intermediate (post doc) positions.

A research department in pharmaceutics is not complete without a sterile lab. The administrative error that has stopped the construction of this already approved sterile laboratory should be identified and the sterile laboratory should be built immediately thereafter.

Given the small size of pharmaceutical research in Norway, new efforts should be made to increase collaboration with the other departments/schools of pharmacy in Norway. Initially such collaborations could aim at research training by common post graduate courses and providing a basis for a national research school in pharmaceutical research.

The performed research can be rated as good according to the criteria provided by the Norwegian research council. Single contributions are at a very good level, and the research has a clear potential to develop into an internationally recognized department, that can compete at the highest international level within the pharmaceutical research field.

Social Pharmacy

Organisation

The current situation with social pharmacy in Tromsø needs serious consideration from the leadership of School of Pharmacy. The historical emphasis on social pharmacy in Tromsø is reflected in the fact that an own department has been established for the subject. At the moment the Department is without full time permanent leadership and staff. One PhD student is currently enrolled. The current situation with a part time professor spending a limited time (20%) in the unit is not enough to run a department with both teaching and research. Recruitment problems and difficulties in keeping staff have characterized social pharmacy in Tromsø. It seems that the only way of getting permanent staff who are willing to stay in Tromsø is to build it up from own PhD students with post-doc experience from abroad at some center of excellence in social pharmacy.

At the moment serious consideration should be put on how to continue. The organisational structure in the future could be based on research groups rather than an own department. The Department should be merged with the Department of Pharmacology, where there are possibilities for collaboration in the area of clinical pharmacy and medication review. A drug information center is also situated in the same premises, which would give opportunities for research collaboration in the area of drug information.

In addition, also other ways of dealing with the issue need to be considered for example intensified collaboration with the Institute of Community Medicine. A well-functioning research and teaching collaboration is necessary with community medicine if social pharmacy is to continue in Tromsø. With the available personal resources today it is too ambitious to run both basic education and an own research program. There is a good research history in pharmacoepidemiology in Tromsø that should be continued in collaboration with community medicine. Doctoral students in social pharmacy have been supervised by researchers from the Institute of Community Medicine which is a very positive thing. The Faculty of Medicine is announcing money for thematic groups and this could be also a possibility for scientists in social pharmacy to apply.

National collaboration with Bergen and Oslo should be explored as there are natural links with persons working fulltime in other institutions like the Norwegian Institute of Public Health in Oslo with a department of pharmacoepidemiology, and a large research group working with register-based research.

Conclusion and rating

Currently, the lack of a functioning research group in social pharmacy does not allow an overall grading of social pharmacy research, however, individually the current staff is doing research at a good international level, the problem being that it is mainly done elsewhere.

Appendix 1: Terms of reference

The Research Council of Norway:
Evaluation of Pharmaceutical Research in Norway

I. Introduction

Three Norwegian universities educate pharmacists. The history and organisation of the pharmacy institutions differ markedly:

University of Oslo: established in 1932 under the Faculty of Mathematics and Natural Sciences
University of Tromsø: established in 1994 under the Faculty of Medicine
University of Bergen: established in 2003 under the University Board (links to both Faculty of Medicine and Faculty of Mathematics and Natural Sciences)

In previous evaluations parts of the research in the pharmacy institutions have been included. However, a total evaluation of their research is still lacking. For this reason, the Division for Science at the Research Council of Norway has decided to evaluate pharmaceutical research in Norway. The evaluation is limited to the pharmacy institutions at the University of Oslo, University of Tromsø and University of Bergen ("schools of pharmacy").

The objective of the evaluation

The objective of this evaluation is to review the overall state of pharmaceutical research in Norwegian universities ("schools of pharmacy").

Specifically, the evaluation process should:

- Offer a critical review of the strengths and weaknesses of pharmaceutical research, both nationally and in each institution. The scientific quality of the research should be reviewed in an international context.
- Identify research groups which have achieved a high international level in their research, or which have the potential to reach such a level.
- Identify areas of research that need to be strengthened in order to ensure that the needs regarding pharmaceutical research in Norway are covered.
- Give an assessment of the organisation of the pharmacy institutions in Norway.
- Identify areas of co-operation and fields of division of responsibility between the pharmacy institutions in Norway.

Further, the evaluation aims to:

- Provide the institutions concerned with the knowledge required to raise their own research standards
- Provide the institutions concerned with feedback regarding the scientific performance of individual groups, as well as suggestions for improvements and priorities

- Improve the knowledge base for organisational and strategic development of the research at the pharmacy institutions
- Improve the knowledge base for strategic decision-making by the Research Council

More generally, the evaluation is designed to function as a platform for future work on developing pharmaceutical research and to give the institutions as well as the Research Council and relevant ministries a better basis for determining future priorities.

Methods
An international Evaluation Committee will be appointed. The Evaluation Committee should base its evaluation on self-assessments provided by the institutions as well as site visits to the institutions. A part of the self-assessments will be information about the institutions' organisation and resources, including their history, development and future plans, as well as CVs and publication lists of the scientific staff. Bibliometric analysis will be provided by the Research Council. The Committee is requested to write a report with a set of specific recommendations. A preliminary report will be sent to the institutions for comments. The Committee's final report will be submitted to the Research Board of the Division for Science.

II. Mandate for the Evaluation Committee

Based on the self-assessments provided by the institutions and site visits the Evaluation Committee is expected to present the evaluation in a written report with a set of specific recommendations for the future development of the field, including means of improvement when required. The Committee is requested to evaluate scientific activities with respect to their quality, relevance and international and national collaboration. The Committee is further requested to evaluate the way in which pharmaceutical research is organised and managed.

The history and organisation of the pharmacy institutions in the Norwegian universities differ markedly. Correspondingly, the institutions are very different with regard to scientific staff, resources and research acitivities. The evaluation and the Committee's recommendations must take these differences into consideration.

Organisation of the pharmacy institutions in Norway
The Committee is requested to assess the organisation of the pharmacy institutions in Norway, specifically regarding their positions in the university setting. The evaluation should be related to an international context.

- Does the different organisation of the pharmacy institutions represent a strength or a weakness?
- Should the institutions have different scientific profiles? Division of labour regarding research activities?
- Do the institutions have an adequate complementarity?

- Do the institutions altogether cover Norway's needs regarding the range of research activities as well as to the education of pharmacists?
- Do the pharmacy institutions have adequate interaction/collaboration?
- Does the organisation affect collaboration with other important partners?

Scientific quality and relevance

Major topics:

- International position of Norwegian pharmaceutical research
- Quality of the departments and appropriateness of their funding
- Strong and weak areas
- Relevance of the research

Questions to be considered:

- Which fields of research have a strong scientific position in Norway and which have a weak position?
- Is Norwegian research being carried out in fields that are regarded as relevant by the international research community?
- Are new developments on the international scene represented on the research agenda?
- Is Norwegian pharmaceutical research ahead of scientific developments internationally within specific areas?
- Do the research groups maintain a high scientific quality judged by the significance of contribution to their field, prominence of the leader and team members, scientific impact of their research?
- Are the results currently being produced, e.g. number of fellowships awarded, articles published and patents awarded, reasonable in terms of the resources available?
- Is there a reasonable balance between the various fields of Norwegian pharmaceutical research?
- Are some research areas absent, over- or underrepresented?
- Do the research activities meet the institutions' needs in relation to the education of pharmacists?
- Is Norwegian pharmaceutical research regarded to be of adequate relevance and innovation for the Norwegian society:
    - the needs of the health sector?
    - the needs of pharmaceutical industry?
    - the needs of Norwegian authorities?
    - the research community?

Staff, research organisation, scientific leadership and strategy

Questions to be considered:

- How are the institutions' human resources in relation to their scientific needs and responsibilities and in relation to the development of the institution?
- Are the pharmacy institutions adequately organised and is the size and organisation of the research groups reasonable?
- Is scientific leadership being exercised in an appropriate way?
- Do the institutions have strategies with specific plans for their research, and are such plans being followed up?

Doctoral and postdoctoral recruitment

- Is recruitment to doctoral training programmes satisfactory, or should greater emphasis be put on recruitment in the future?

Academic career structure, gender and age

Questions to be considered:

- How is the career path for young researchers?
- Do the institutions/specific fields face a depletion problem?
- How is the balance between men and women in academic positions?

Scientific contacts and collaboration

Questions to be considered:

- Is there sufficient contact and collaboration among research groups at national and international level, both in general and within specific subfields of pharmaceutical research?
- Do research groups take part in international programmes or use facilities abroad, or could utilisation be improved by introducing special measures?
- Is there an adequate degree of national and international mobility?

Interaction with stakeholders

Questions to be considered:

- Do the institutions maintain sufficient contact and interaction with the health sector and industry?
- Do the institutions contribute to the building of intellectual capital in pharmaceutical industry?
- Do the research groups have joint projects with pharmaceutical industry?

Research infrastructure incl. scientific equipment

Questions to be considered:

- How is the status with regard to laboratories and research infrastructure and do the researchers demonstrate ability to make use of the infrastructure?
- Is there sufficient co-operation related to the use of expensive equipment?

Financial support/Funding

Questions to be considered:

- How is the general financial situation for pharmaceutical research?
- How is the balance between positions, projects and equipment?

Future developments and needs

The Committee's written report is expected to be based on the elements and questions above. The assessments and recommendations should be at both research group, institutional and national level.

Miscellaneous

Are there any other important aspects of Norwegian pharmaceutical research that ought to be given consideration?

Appendix 2: Rating scale used in the evaluation

Excellent: Research at a very high international level; of great international interest with broad impact and with publications in internationally leading journals.

Very good: Research at a high international level; of international interest with impact within its sub-field and with publications in internationally leading journals.

Good: Research at a good international level with publications in internationally recognized, specialised journals.

Fair: Research that only partly meets good international standard and is only partly published in recognized international journals.

Weak: Research of insufficient quality; without international scientific interest and with only limited national significance.

Appendix 3: Letters to the institutions

Letter 1

Farmasøytisk instiutt, Universitetet i Oslo
Instiutt for farmasi, Universitetet i Tromsø
Senter for farmasi, Universitetet i Bergen

Vår saksbehandler/tlf.	**Vår ref.**	**Oslo,**
Hans Hellebostad, 22 03 71 72	2005/07853	09.02.2006
	Deres ref.	

Evaluering av farmasøytisk forskning

Det vises til brev av 14.10.05 og 20.12.05 fra Norges forskningsråd og møte 09.11.05 angående evaluering av farmasøytisk forskning. Divisjonsstyret for Vitenskap har nå godkjent mandat og plan for evauleringen. Som tidligere opplyst, er intensjonen å gjennomføre evalueringen i løpet av 2006. Videre er det besluttet at evalueringen avgrenses til de enhetene ved universitetene som har ansvar for profesjonsutdanning i farmasi.

Plan for evalueringen
Tidsplan for evalueringen følger vedlagt. Pga. de store forskjellene med hensyn til historikk og organisering ved de farmasøytiske institusjonene vil evalueringen fokusere på både selve forskningsaktivitetene og på organisatoriske forhold, jfr. vedlagte mandat. Evalueringen knyttes også opp mot institusjonenes ansvar for profesjonsutdanningen i farmasi.

Evalueringen vil bli gjennomført ved hjelp av en internasjonal ekspertkomité. Et viktig grunnlag for komitéens arbeid vil være innsendte egenvurderinger fra instituttene/enhetene (se under). Videre legges det opp til at evalueringskomitéen møter fagmiljøene i forbindelse med *site visits* til institusjonene. Etter planen vil disse gjennomføres i slutten av mai 2006. Nærmere informasjon om dette vil bli ettersendt.

Når utkast til evalueringsrapport foreligger, vil instituttet/enheten få tilsendt egen omtale for faktakontroll før den endelige rapporten offentliggjøres. Evalueringen begrenses til vurderinger og anbefalinger på institutt-/forskergruppenivå, og enkeltforskere vil ikke bli omtalt ved angivelse av personnavn.

Faktaark. Frist for innsendelse <u>01.04.2006</u>
Hvert institutt/enhet skal fylle ut et faktaark. Hensikten med faktaarket er å lette evalueringskomitéens arbeid med egenvurderingene, se vedlagte faktaark med veiledning.
Faktaarket kan lastes ned fra Forskningsrådets nettside http://www.forskningsradet.no

Som det går fram av faktaarket og veiledningen, spørres det primært etter informasjon om stillinger/ansatte ved det aktuelle instituttet/enheten. Imidlertid er vi klar over at enkelte personer som har sin stilling ved annet institutt/enhet, i stor grad er trukket inn i den farmasøytiske enhetens oppgaver/ansvar knyttet til profesjonsutdanning og forskning. Det ønskes at også disse omfattes av evalueringen. Disse personene føres derfor også opp i faktaarket med en merknad om stillingens tilhørighet.

Navneliste
Sammen med faktaarket skal det vedlegges en liste med navn og adresse (e-post og vanlig adresse) for alt fast vitenskapelig personale og postdoktorstipendiater (alle de personer som skal sende inn CV). Dette er for å kunne oppfylle Datatilsynets krav om å informere direkte de personer som omfattes av evalueringen.

Frist for innsending av faktaark og navneliste til Forskningsrådet er **01.04.2006**. Arket sendes elektronisk til Merethe Moe: mm@forskningsradet.no.

Egenvurdering. Frist for innsendelse 01.04.2006
Egenvurderinger fra instituttene/enhetene vil utgjøre viktig grunnleggende informasjon for evalueringskomitéen. Det er viktig at egenvurderingen, inklusive CVer og publikasjonslister fra det vitenskapelige personalet, er utfyllende og kvalitetskontrollert, da disse vil ha stor betydning for komitéens vurdering av forskningen og dens rammebetingelser og for evalueringsrapportens samlede kvalitet.

Vi ber om at instituttene/enhetene utarbeider egenvurderinger i henhold til vedlagte disposisjon med beskrivelse. I utgangspunktet ønskes én egenvurdering pr. institutt/enhet. Eventuelt kan Farmasøytisk institutt, Universitetet i Oslo, som del av sin egenvurdering, legge ved inntil to sider egenvurdering (med tilsvarende disposisjon) for hver av instituttets avdelinger, hvis instituttet finner dette hensiktsmessig.

Egenvurderingen inkludert alle vedleggene bes innsendt på papir.
Frist for innsendelse av egenvurderingen er **01.04.2006**.

Før egenvurderingen utformes anbefaler vi at vedlagte mandat leses igjennom. Videre minner vi om at evalueringskomitéen vil foreta vurderinger på både forskergruppe-, institusjons- og nasjonalt nivå.

Egenvurderingene vil bli gjennomgått av Forskningsrådet før materialet oversendes evaluerings-komitéen. Som tidligere nevnt, vil møter mellom komitéen og fagmiljøene etter planen bli avholdt i slutten av mai d.å.

Nærmere informasjon
Forskningsrådet legger vekt på at hver enkelt forsker som omfattes av evalueringen, skal få god informasjon, blant annet vil hver vitenskapelig ansatt få tilsendt brev om evalueringen. Vi viser også til Forskningsrådets nettsider hvor informasjon om evalueringen vil bli lagt ut.

Kontaktpersoner
Spørsmål i tilknytning til evalueringen kan rettes til:

- Hans Hellebostad, tlf. 22 03 71 72, e-post: hh@forskningsradet.no
- Merethe Moe, tlf 22 03 71 59, mm@forskningsradet.no

I det videre arbeidet bes hvert institutt/enhet om å utpeke en kontaktperson for evalueringen.

Med vennlig hilsen
Norges forskningsråd

Roy H. Gabrielsen
direktør
Divisjon for vitenskap

Hilde Jerkø
avdelingsdirektør
Divisjon for vitenskap

Vedlegg:
- Faktaark med veiledning
- Disposisjon for egenvurderingen
- Mandat
- Tidsplan

Kopi av brev: Rektor og universitetsdirektør, UiO, UiB, UiT, NTNU, UiS og UMB
Det matematisk-naturvitenskapelige fakultet, UiO/UiB/UiT
Fakultet for naturvitenskap og teknologi, NTNU
Det medisinske fakultet, UiO/UiB/UiT/NTNU

Letter 2

……

Vår saksbehandler/tlf.	**Vår ref.**	**Oslo,**
Hans Hellebostad, 22 03 71 72	2005/07853	05.05.2006
	Deres ref.	

Evaluering av farmasøytisk forskning – Timeplan og retningslinjer for høringsmøte

Vi viser til kontakt per brev og e-post om ovennevnte evaluering og tidspunkt for høringsmøte mellom instituttet og evalueringskomitéen.

Som tidligere avtalt, finner møtet sted mandag **... mai 2006**. Vedlagt følger tidsskjema for møtet. Pga. komitéens tette program i evalueringsuken og av hensyn til likebehandling av miljøene er det viktig at tidsskjemaet holdes av alle parter.

Informasjon og inntrykk fra høringsmøtet er å betrakte som tilleggsinformasjon til det materialet som allerede er innsendt fra instituttet, og som utgjør hovedmaterialet for evalueringen.

Forberedelser
Hver sesjon i høringsmøtet vil ha en todelt oppbygging med innledning/presentasjon fra instituttet/avdelingen og påfølgende spørsmål fra evalueringskomitéen. Komitéen er godt kjent med det innsendte materialet. Det er derfor viktig at komitéen får god tid til å stille spørsmål. Minimum ¾ av tiden skal settes av til dette i hver sesjon. For å sikre tilstrekkelig tid til spørsmålstilling forbeholder komitéen seg retten til å avbryte innlederne dersom de går ut over den skisserte tidsrammen.

I innledningen bør det primært gis utfyllende tilleggsinformasjon til det som allerede er beskrevet i innsendt materiale. Særlig ønskes det at presentasjonen konsentreres om sterke og svake sider ved instituttet/avdelingen, og at disse ses i et framtidsperspektiv. Vi er oppmerksomme på at framtidsperspektivet har en naturlig kobling til både nåtid og fortid. Vi ber om at framstillingen gjøres så konkret og oversiktlig som mulig, og minner om at den skal være på **engelsk**.

Vi anbefaler at innlederne benytter PowerPoint-presentasjon eller lysark slik at informasjonen kommer tydelig fram. Videre bes det om at 7 papirkopier av presentasjonen tas med, slik at denne er tilgjengelig for komitéen i det videre arbeidet.

Deltakelse
Det er nødvendig å begrense antallet deltakere under høringsmøtet. For hver sesjon (”Generell presentasjon av instituttet” samt møtene med de ulike avdelingene) er maksimalt antall deltakere fra instituttet/avdelingen 7 personer. I møtet med ph.d.-studenter ønskes det at en ph.d.-student fra hver avdeling deltar. Vi ber om at en liste over instituttets deltakere i de ulike sesjonene, med navn og tittel, sendes Hans Hellebostad per e-post (hh@forskningsradet.no) innen **22. mai 2006**.

Praktiske forhold
Høringsmøtet vil finne sted på Farmasøytisk institutt, og vi håper på et godt samarbeid om gjennomføringen av dette. Forskningsrådets kontaktperson i denne forbindelse er Merethe Moe, tlf. 22 03 71 59, mm@forskningsradet.no

Med vennlig hilsen
Norges forskningsråd

Hilde Jerkø
avdelingsdirektør
Divisjon for vitenskap

Hans Hellebostad
seniorrådgiver
Divisjon for vitenskap

Kopi: Fakultetsledelsen

Vedlegg: Tidsskjema for høringsmøtet

Appendix 4: Time schedule

Meetings at the Universities of Oslo, Bergen and Tromsø

University of Oslo – 29 May 2006:

Hour	
09.00	Wellcome/Introduction
09.10	*School of Pharmacy – Presentation*
09.55	Break
10.10	*Department of Pharmacy*
11.25	*Site visit*
12.15	Lunch
13.15	*Department of Pharmaceutical Chemistry*
14.45	Break
15.00	*Department of Pharmaceutical Biosciences*
16.45	Break
17.00	*Meeting with Ph.D. Students*
17.30	Break
17.50	Committee Meeting

University of Bergen – 30 May 2006:

Hour	
10.00	Wellcome/Introduction
10.10	*Pharmacy at University of Bergen – Presentation*
10.55	Break
11.10	*Department of Biomedicine*
11.55	Lunch
12.55	*Site visit* (Biomedicine & Medicine)
13.45	*Institute of Medicine*
14.30	Break
14.45	*Department of Chemistry*
15.30	Break
15.45	*Department of Public Health and Primary Health Care*
16.15	Committee Meeting

Universitety of Tromsø – 31 May 2006:

Hour	
09.00	Wellcome/Introduction
09.10	*Institute of Pharmacy – Presentation*
09.40	Break
09.55	*Department of Pharmacology*
10.55	*Site visit*
11.40	Lunch
12.40	*Department of Medicinal Chemistry* and *Department of Pharmaceutics and Biopharmaceutics*
14.10	Break
14.25	*Department of Social Pharmacy*
14.45	Break
15.00	*Meeting with Ph.D. Students*
15.20	Committee Meeting

Final Committee Meeting: 1 June 2006 (09.00-17.00) at Gardermoen

Appendix 5: CV's of the Committee Members

Artursson Per, born 1956
Professor of Dosage Form Design, Uppsala University (since 1992)
Education
M. Pharm 1981, PhD 1985 (Biochemistry), Docent1990 (Pharmaceutics), Uppsala University
Appointments
Medical Products Agency, Uppsala, Sweden, 1986 (Drug targeting),
Advanced Drug Delivery Research, Ciba Geigy, Horsham, England, 1987 (Drug targeting),
Lecturer: Department of Pharmaceutics, Faculty of Pharmacy, Uppsala University, 1988-1991
Sabbatical: Genemedicine, The Woodlands, Texas, U.S.A., 1996 (non-viral gene delivery systems)
Research fields/areas of expertise
Research is focused on drug absorption, transport and delivery combining computational chemistry, cell biology, pharmacogenomics, biopharmaceutics and pharmaceutics
Publications
Author of more than 120 original articles, 16 review articles, 17 book chapters, 1 book and 4 patents/patent applications. Among 100 most cited scientists in Pharmacology and Toxicology (ISI, 2006). Invited presentations 70.
Other relevant information
Editorial boards: European Journal of Pharmaceutical Sciences, Editor-in-chief 1998-2001, Pharmaceutical Research, Journal of Pharmaceutical Sciences, Current Drug Delivery, American Journal of Drug Delivery
Scientific Advisory Boards: Navicyte, Inc, Swedish Medical Products Agency, BeCe Med AB, Xenerate AB
Executive Boards: Globalization of Pharmaceutics Education, Network Inc. (GPEN), Principles in Drug Development: a strategic national research programme, Linneus Center for Bioinformatics, Uppsala University
Peer reviews: Reviewer of grant applications to major international grant bodies.
External examiner of numerous national and international PhD theses
Supervision: 21 PhD theses
Research grants: Medical Research Council (since 1990), The Swedish Board for Technical Development, Swedish Foundation for Strategic Research, AstraZeneca, Pharmacia & Upjohn, Rhône-Poulenc-Rorer, SmithKline Beecham, Bristol Mayer Squibb and Novartis. During the last years, the yearly value of these grants amounts to approximately US $ 300,000 - 500,000
Major awards: 1997 years Ebert Prize from the American Pharmaceutical Association
2001 Fellow of the American Association of Pharmaceutical Scientists, 2001 Oroborus award from the European Federation of Pharmaceutical Scientists, 2004 Best paper award from European Journal of Pharmaceutical Sciences, 2005 Meritorius Manuscript Award from the American Association of Pharmaceutical Scientists, 2005 New Safe Medicines Faster Award from EUFEPS
Scientific meetings and courses: Member or chairman of organising committees for several national and international meetings and courses in the pharmaceutical sciences

Bjerrum Ole, born 1944
Professor of Pharmacology, Danish University of Pharmaceutical Sciences, Denmark (since 2002)
Education
M.D. (cand.med.), 1969, Doctor of Medical Sciences (DMSc/dr.med.), 1978

Appointments
Visiting professor, Dept. of Biochem. & Mol. Biology. Northwestern Univ., USA 1980-81
Director, Protein Laboratory, University of Copenhagen, 1982-87
Director, Biolabs and Immunotechnology, Novo Nordisk A/S, 1987-91
Principal Research Scientist, Assay and Cell Technology, Novo Nordisk A/S, 1991-96
Research Counsellor, Corporate Research Affairs, Novo Nordisk A/S, 1996-2001
Research fields/Areas of expertise
Cell biology, Protein chemistry, Immunotechnology, Drug discovery, *in vitro*/*in vivo* pharmacology
Publications
Author of 138 publications (97 are original papers in international refereed journals)
Editor of "Electroimmunochemical Analysis of Membrane proteins", 481 pp, Elsevier
Editor with N.H. Heegaard of "Handbook of Immunoblotting of Proteins", 479 pp, CRC Press
Invited presentations 43.
Other relevant information
Editorial Boards: J. Biochem. Biophys. Electrophoresis, Methods, Appl. Theoret. Electrophoresis, Eur. J. Pharm. Sci
Board member: Danish Biochemical Society (chairman 1984-86); Scandinavian Electrophoresis Society (chairman 1989-93); Danish Society Theoret. & Applied Medicine (chairman 1996-97); Eur. Fed. Pharm. Sciences, president 2003-05 (EUFEPS); Committee of European Ethics Network (EEN); Committee on Industrial Relations (EUFEPS); International Electrophoresis Society; Eur. Assoc. for Promotion of Sci. & Tech. (Euroscience)
Fellow: Danish Academy of Natural Sciences, Danish Academy of Technical Sciences
Appointed member: Danish Medical Research Council, Advisory Research Council, Ministry of Health, DK, National Biotechnology Committee, Ministry of Research, DK
Board of Directors: PNA Diagnostics A/S
Danish delegate: EU 4th Framework Programme Committee on Biotechnology, Brussels, European Science and Technology Assembly (ESTA), EU 5th Framework Programme Management Committee on Quality of Life, Memberstate contact Group for the EU FP7 Innovative Medicines Initiative
Awards: Danish Academy for Natural Sciences' Industry prize 2006
Organizer and co-organizer: Several international courses, workshops, conferences and congresses

Bräuner-Osborne Hans, born 1967
Professor of Molecuar Pharmacology, Danish University of Pharmaceutical Sciences (since 2002)
Education
M.Sc. (Pharm), 1993, PhD, 1996, D.Sc. 2002
Appointments
Research Assistant Professor, Department of Medicinal Chemistry, Danish University of Pharmaceutical Sciences 1997-1999
Research Associate Professor, Department of Medicinal Chemistry, Danish University of Pharmaceutical Sciences 2000-2001
Guest scientist for six months in Dr. Bernhard Bettler's laboratory, Novartis Pharma, Basel, Switzerland 2001
Research fields/Areas of expertise
Medicinal chemistry, molecular pharmacology, transgenic animals

Publications
Total number of international publications: 94 (89 peer reviewed). Invited presentations 15.
Other relevant information
Editorial boards: Eur J Pharm Sci (assoc. editor)
Board member: Danish Society for Pharmacology and Toxicology, Management Comittee of the European Federation for Medicinal Chemistry, Molecular Models of Disease (MoMeD) research school, Danish Medical Research Council
Member: Royal Danish Society for Science and Letters
Peer review: Member of assessment committees of 3 professorships, 2 assistant professorships and 8 PhD defenses, Review Committee of the Carlsberg Bequest Scholarship program, Ad hoc grant reviewer for the European Science Foundation, the Research Council of Norway and the Netherlands Organisation for Scientific Research
Supervision: Has been/is main advisor for 10 PhD students
Awards and Honors: Fulbright Fellowship 1992, H.C. Ørsted Medal, Danish University of Pharmaceutical Sciences 1994, The Danish Academy of Natural Sciences PhD award1997, The Benzon Foundation 50th Anniversary Honorary Prize 2002,The Torkil Holm Foundation Research Prize 2006, The Lundbeck Foundation Research Prize for Young Investigators 2006
Research grants: Recipient of research grants of approx. 11.750.000 DKK from external foundations and councils. Current funding from the Lundbeck Foundation, the Danish Medical Research Council, Apotekerfonden and the Novo Nordisk Foundation
Organizer and co-organizer: Main or co-organizer of 12 post graduate courses, XVIII'th International Symposium on Medicinal Chemistry 2004, WorldPharma2010/IUPHAR congress

Enlund Hannes, born 1953
Professor of Social Pharmacy, University of Kuopio, Finland (since 1989)
Education
Master of Science (Pharmacy) 1978, PhD 1983 (Social Pharmacy)
Appointments
Lecturer, University of Kuopio, 1982-1988
Visiting scientist, Welsh School of Pharmacy, Cardiff, UK, 1986-87
Visiting professor, United States Pharmacopeia, Rockville and University of Maryland 1990-1991
Dean, Faculty of Pharmacy, Kuopio University, 1994
Consultant, United Nations International Narcotics Control Board, 1995
Professor of Pharmacy Practice, University of Kuwait, 2000-2003
Research field/Area of expertise
Social pharmacy, clinical pharmacy, pharmacy practise
Publications
More than 100 original scientific papers, 20 reviews and editorials, 30 practice related articles on social and behavioral aspects of drug use and prescribing. Invited presentations 12.
Other relevant information
Editorial board: Journal of Social and Administrative Pharmacy, International Journal of Pharmacy Practice, Journal of Applied Therapeutic Research
Board member: European Society of Clinical Pharmacy, Advisory Committee on Pharmaceutical Education, European Commission, Panel member, United States Pharmacopeia
Peer review: National Agency for Medicines, Finland, National Agency for Higher Education, Sweden, Research Council of Norway, Universities of Helsinki, Uppsala, Kalmar, Karlstad,

Gothenburg, Oslo, Tromsø, Sydney, United Nations International Narcotics Control Board, World Health Organisation, Association of Schools of Public Health in the European Region
Supervision: 10 PhD theses
Grants: University of Kuopio, Academy of Finland, Finnish Funding Agency for Technology and Innovation (TEKES), Social Insurance Institution, European Social Fund, Council of Europe
Organizer and co-organizer: 20 international workshops and congresses

Vuorela Pia, born 1961
Professor of Pharmaceutical Chemistry, Åbo Akademi University, Finland (since 2005)
Education
MSc (Pharm.) 1988, PhD (Pharm.) 1991 (highest degree laudatur), Docent (Pharmacognosy) University of Helsinki 1994, Docent (Pharmaceutical Chemistry), Åbo Akademi University 2003
Appointments
Assistant, senior assistant, project manager, university lecturer, University of Helsinki1991-2003
Responsible director, Instrumentarium Oy / Medinovum 1995-96
Chief research scientist 2000-2004, and director 2005, Drug Discovery and Development Technology Center, DDTC, University of Helsinki
Research fields/areas of expertise
Natural product drug discovery including pharmaceutical biology, natural product chemistry and bioactivity assay development.
Publications
More than 80 original research papers, 4 patents/patent applications, and almost 200 proceedings and abstracts. Invited presentations 12.
Other relevant information/experience
Member of Board: Finnish pharmacopoeia-committee (Ministry of Health), Finnish Pharmaceutical Society, vicepresident 1997, president 1998-2006; European Federation for Pharmaceutical Sciences (EUFEPS), council 1996-2005, executive committee 2005-; Section Pharmacognosy, Swedish Academy of Pharmaceutical Sciences 2003-7; Research Council for Health, Academy of Finland 2007-09
Peer review: National Agency for Medicines; 1 professorship, 5 docentships, 6 dissertations, 3 PhD defenses, nationally and internationally. Different funding bodies in Finland; International Foundation for Science (IFS), Sweden.
Supervision: 9 PhD theses
Awards: Albert Wuokko award 1992, Finnish Pharmaceutical Society; Young doctor´s award, Finnish Academy of Science 1993; Highest ranking doctoral candidate 1994, Promotio Ordinis Philosophorum Universitatis Helsingiensis MCMXCIV.
Grants: Since year 2000 I have achieved external money about 2.000.000 euros (net sum) from Academy of Finland, Finnish Cultural Foundation, Finnish Funding Agency for Technology and Innovation (TEKES), EU/FP5-6, and university fundings.
Organizer and co-organizer: Member or chairman of organising committees for several national and international meetings and courses.

Norges forskningsråd
The Research Council of Norway

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