

Estonian Higher Education Accreditation Centre

Evaluation of Research in Pharmacy, Pharmacology and Toxicology (3.2) in Estonia

Institutes evaluated

**University of Tartu
Institute of Pharmacology**

Faculty of Medicine, Department of Pharmacy

**Evaluation dates
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Part I

General Overview

Introduction

At the request of the Estonian Higher Education Accreditation Centre, Tallinn (EHEAC), an evaluation team (hereafter named the “Evaluators”) visited institutes in Estonia carrying out research activities in pharmacy, pharmacology and toxicology (3.2). The evaluating team consisted of Prof. Graham Sewell (University of Bath), Prof. Olavi Pelkonen (University of Oulu) and Prof. Hartmut Porzig (University of Bern).

The institutions to be evaluated were:

University of Tartu

- Institute of Pharmacology
- Faculty of Medicine, Department of Pharmacy

The evaluators were provided in advance with self-assessment reports from the institutions, prepared by the members of their groups.

After a brief orientation meeting at EHEAC, the evaluators visited the institutions to be evaluated in Tartu during two days. At these meetings staff members of the various departments presented their work. During these presentations as well as during the subsequent discussions additional information about the research activities was provided. This included additional documents such as copies of published papers.

Approach to the evaluation

The evaluators were asked to:

- 1) Judge the activities of research and development in the units evaluated and the research topics implemented by them to ensure the governmental funding for internationally recognised research and development. The Team was asked to concentrate on research units (university departments, laboratories) with specific comments to sub-units, groups if necessary.
- 2) Identify deficiencies in the activities of research and development units.
- 3) Give recommendations on the development concerning research and development and research areas to the state of Estonia.

The Team received the following materials: A working schedule, principles and criteria for evaluation of the research units, evaluation guidelines for the ranking of research units, and self-evaluation reports created by the research units themselves.

On a first evaluation point, the *quality of the research activities* was considered. This assessment is largely based on the records of scientific publications.

<i>Excellent</i>	<i>The majority of the submitted works are at a high international level and virtually all others at a good international level.</i>
<i>Excellent to</i>	<i>At least one third of the submitted works are at a high international</i>

<i>good</i>	<i>level and many others at a good international level, these together comprise a clear majority.</i>
Good	<i>The majority of the submitted works are at least at a good international level and virtually all others at a fair international level</i>
<i>Good to satisfactory</i>	<i>At least one third of the submitted works are at a good international level and many others at a fair international level, these together comprise a clear majority</i>
Satisfactory	<i>The majority of the submitted works are at least at a fair international level</i>
<i>Satisfactory to unsatisfactory</i>	<i>A minority of the submitted works are at a fair international level</i>
Unsatisfactory	<i>None, or virtually none, of the submitted works are at a fair international level</i>

Regarding the grading of the research activities, the evaluation team was instructed by the EHEAC to reserve the term **excellent** for groups, which were found to be among the best 10% of the European groups in the corresponding field. Similarly, the term **excellent to good** should be used if the evaluated group was found to be among the best 25 % of corresponding European groups. The full scale comprised 7 levels, in addition to the highest ones the grades are **good, good to satisfactory, satisfactory, satisfactory to unsatisfactory, and unsatisfactory.**

Secondly, the ***over-all capability*** of a research unit was evaluated based on a the combined assessment of the following criteria (each graded in three levels):

- The originality/novelty of past and ongoing research activities
- The strategy and perspective of the research
- Multidisciplinarity and relevance for other research areas
- The competence of the research groups and their capacity for development
- National and international co-operation
- Success in applying for grants

As the result of this assessment one of the four grades **excellent, good, satisfactory or unsatisfactory** was given for the group.

Thirdly, the ***implementation opportunities*** for the research results and their importance for the Estonian society were commented upon.

Finally, on a fourth evaluation point ***the critical comments and recommendations*** were asked to be given by the evaluation team.

Part II

General Comments

Introduction

For this evaluation we focussed specifically on assessing the past scientific output of the evaluated departments in terms of their original contributions to the international pharmacological and pharmaceutical literature. In addition the present activities and prospects of the individual research groups were critically reviewed. However, the aspects of scientific productivity could not be judged without taking into account the general situation of the two departments with respect to funding, to equipment, to infrastructure and to the human resources available for research in view of a heavy teaching load.

With respect to all aspects of the evaluation the Departments of Pharmacy and Pharmacology differed significantly. Indeed, Estonian traditions tended to shape research and education in Pharmacy more prominently than in Pharmacology which made it much easier to judge the latter department on the basis of international standards. Nevertheless, we feel that in a situation where both departments have a monopoly within the national educational system, the only valid base for an assessment of research quality is the recognised contribution to the international scientific literature.

There are several major constraints that limit the output and also restrict an optimal use of the human resources affecting both departments but to a different extent.

- The national funding system on the one hand supports established groups via `targeted projects` and on the other hand provides rather small grants to individual researchers. Within this structure it seems very difficult to create a new group around a successful individual. The individual grants, although a potentially very useful instrument to promote scientific independence of promising young scientists, tend to favour an inflation of small projects that are not always well connected to the main research interests of the department.
- Access to current scientific literature seems to be difficult especially since the number of international high impact journals available on line seems to be rather limited. All of the PhD students appeared to share concerns about how to obtain the most current information in their respective fields.
- Recruiting gifted young graduates from within and from outside the department into the PhD curriculum seems to be limited more by a lack of suitable applicants than by lack of available positions. This is a serious problem, since attracting good people into the postgraduate programs is the only way by which the departments can build up a pool of future staff members. The low level salaries in general and of PhD stipends in particular makes it impossible to create a `market` by recruiting graduates from outside Estonia and aggravates the danger of `postdoctoral brain drain`.
- The somewhat artificially strict separation of research and teaching staff promoted by the funding system has created inherent incentives to extend the overall time

spent in formal lecturing. We consider this development as being neither in the best interest of staff members that try to build a scientific career nor in the interest of the students that should be encouraged to develop their own responsibilities in acquiring knowledge and skills.

Part III

Evaluation of institutions and research groups

1. Institute of Pharmacology, University of Tartu (*Head: Prof. Alexander Zharkovsky*)

Main research fields

- Pharmacology of the neurodegenerative diseases
- Pharmacology of novel antidepressants and antipsychotics
- Mechanisms of drug addiction
- Clinical Pharmacokinetics and optimization of drug treatment

Structure of the Institute of Pharmacology

1. Chair of Pharmacology (Head: Prof. Alexander Zharkovsky)
2. Chair of Pharmacotherapy and Toxicology (Head: Prof. Alexander Zharkovsky)
3. Chair of Clinical Pharmacology (Head: Docent Rein Pähkla)

Target-financed projects:

TARFR 0415 TITLE: DRUG DEPENDENCE AND DAMAGE OF THE NEURONS: MECHANISMS AND PHARMACOLOGICAL PREVENTION. Terms: 1998-2001. Principal investigator: Alexander Zharkovsky, MD, PhD, D.Sci.

TARFR 0414 TITLE: THE NEUROBIOLOGY OF AFFECTIVE DISORDERS AND PHARMACOKINETICS AND MECHANISM OF ACTION OF NEW ANTIDEPRESSANTS. Terms: 1998-2001. Principal investigator: Lembit Allikmets, MD, PhD, D.Sci., D.h.c., professor-emeritus of pharmacology

TARFR 2136 TITLE: THE PATHOGENESIS OF AFFECTIVE DISORDERS AND PHARMACOTHERAPY: THE PHARMACOKINETICS AND MECHANISM OF ACTION OF THE 2ND GENERATION ANTIDEPRESSANTS AND ANTIPSYCHOTICS Terms 2002-2006. Principal investigator: Lembit Allikmets, MD, PhD, D.Sci., D.h.c., professor-emeritus of pharmacology

TARFR 2135 TITLE: NEURODEGENERATION IN THE CNS PATHOLOGIES AND ITS PHARMACOLOGICAL PREVENTION. Terms: 2002-2006. Principal investigator: Alexander Zharkovsky, MD, PhD, D.Sci., professor of pharmacology

EU 5FWP Grant QLG3-CT-2000-01405:

TITLE: PROGRESSIVE MYOCLONIC EPILEPSY AND NEURONAL APOPTOSIS. A GENETIC, MOLECULAR BIOLOGICAL, BIOCHEMICAL AND PHARMACOLOGICAL APPROACH TO CYSTATIN B AND CYSTEINE PROTEASES. Terms: 2001-2003. Grant holder (consortium member): Alexander Zharkovsky

General Comments

The Department has a commendable track record at the University of Tartu. Currently the Department is in a transition period in the sense that the long-time Head has retired about 1½ years ago (although he is still actively working and participating) and a number of senior and junior scientists are on leave or otherwise in such a state in their careers not able to contribute to the department. However, the Department has several strong long-term projects and has been able to raise support from both national and international (EU) sources. There is no guarantee, however, that this support would be renewed after expiration. We appreciate uncertainties and problems in the planning for the future in the current situation, which were reflected constantly during discussions with the staff of the Department. However, we would like to urge the Department to continue its strong commitment to raise its already relatively high standard of research and to participate as a full member of the national, European and international scientific community.

The research group consists of 14 academic/research persons: 1 professor, 2 docents (associate professors), 3 senior assistants, 1 assistant, 3 senior researchers, 4 researchers, and 6 persons of technical personel. Furthermore, there are 5 PhD students. Two persons are currently on leave on fellowships abroad. Taking into account that there are three major research projects in the Department, there remains a question about really achieving a “critical mass”. Also, compared with the previous establishment, several professorships are vacant and in our view, this could impede the future progress.

Evaluation of Research Activities

The team of evaluators judged the overall quality of the research to be *good*.

The output of the Department has been very good indeed, 90 original peer-reviewed international articles (plus 54 other scientific articles) over a five-year period, although the number of publications has been decreasing during the last two-three years. On the other hand, the average impact factor of journals where the papers have been published, has increased during the same period. In any case, the decreased output should be taken as a warning sign when making decisions about the future. The output is divided between three major research areas, neuropharmacology, receptor research and clinical pharmacology. We have not made a closer analysis between these areas, although we suggest that the Department should do this in the future when discussing future plans.

Evaluation of Overall Capability

The team of evaluators judged the overall capability to be *excellent*.

The Department works on topics which are of great interest and significance for their respective research areas. The Department has also paid some attention to reorganizing and focussing its current research portfolio to achieve “critical mass” in main research areas. The Department uses approaches and methods which are modern and up-to-date, although without additional resources for infrastructure in the future, this advantage might be easily lost. The Department attracts young PhD students and apparently takes a good care of them. There is considerable national and international collaboration, which should be judiciously cultivated. The Department participates in new initiatives within the Faculty of Medicine, which aim to strenghten research collaboration (Centre of Excellence) and scientific training (graduate school of neurosciences). At this moment the resources are relatively good (as judged against Estonian situation in

general), but one threat in the near future is the termination of the EU contract. The Department has made a new bid as a partner of a new consortium, but keeping in mind the fierce competition within EU R & D, the success is not assured. The Department should make realistic contingency plans for a case where resources would drop considerably.

The implementation opportunities for the research results and their importance for the Estonian society

Research at the Department of Pharmacology has natural connections with both drug discovery and development and also with registration evaluation and surveillance of pharmaceuticals. In the absence of pharmaceutical industry in Estonia the discovery and development of original pharmaceuticals is not an immediate prospect, but nevertheless the research work at the Department should also be looked at this point of view. It is possible that some advanced approaches and techniques might become of interest to pharmaceutical companies, which would outsource some discovery and development functions. In addition, staff of the Department could provide expert advice to the Medicines Evaluation Agency. With respect to contract research in clinical pharmacology, it is an option to get some additional resources for the Department, but the evaluation team is of the opinion that contract research should benefit also basic research at the Department. We suggest that this topic should be discussed in wider circles between Faculty, University Hospital, University and other relevant Authorities.

Recommendations

Strategic considerations

- Long traditions of the Department in the area of neuropsychopharmacology and drug addiction make this field an obvious topic of further concentration and development. In this respect, we recommend that the Centre of Excellence, in which the Department is participating, should serve as a positive example for collaborative research, but also as an “experimental” project for the Estonian style of managing research, what to do and what not to do, what could be learned etc
- Plans by the Department to incorporate molecular biological approaches and techniques into the neurosciences project are sound and would enhance capabilities of department for collaboration and financial support. We recommend that the Department goes ahead with these plans. However, we would like to draw attention to the fact that maintaining critical mass in multiple areas may lead to a risk of fragmentation. This relates also to the next point.
- While the Department has expressed its wish to develop clinical pharmacology as one of the main areas of research, the Department should very carefully ponder upon merits and problems of subtopics: basic research in pharmacogenetics and pharmacogenomics vs pharmacoepidemiology including drug utilization. Based on past work, both areas already offer opportunities for strengthening national and international collaboration. The evaluators are not in a position to suggest any selection, this is for the Department, but would like to draw attention to this crucial and promising research area.
- Current chairs are defined by teaching, which might be appropriate in the current general situation in Estonia. However, we strongly recommend that the organization according to teaching areas should be critically assessed, especially in

the light of probable future developments in the integration of Estonian science into the European Research Area.

- Service and contract research in clinical pharmacology offers some possibilities to obtain further support to the Department. While this might be beneficial financially, we recommend that the Department should search ways of how service and contract work would fit into the current activities in an optimal way. One possibility is to create a service laboratory within the departmental organization, which would handle the commercial collaboration between the Department and private industry.

Postgraduate training

- Although the Department has already done much to support postgraduate training, partially through collaboration with the Centre of Excellence and the Graduate School of Neurosciences, there is still a need to secure the access of students to international journals and to strengthen both formal and informal interaction between students of various disciplines by creating journal clubs, student research days, PhD courses and participation in international congresses and visits overseas. While we are aware of financial limitations, we strongly express our conviction that efficient postgraduate training is the best way to achieve future international visibility and integration of Estonian science in the European and global setting.

2. Department of Pharmacy, University of Tartu (*Head: Prof. Peep Veski*)

2.1 The Chair of Pharmaceutical Technology and Biopharmaceutics (Chair: Prof. Peep Veski)

Main research fields

- The improvement of the increasing pH-methods for investigations of drug release from modified-release solid dosage forms in vitro
- The quality control of the peroral solid formulations in the Estonian market and of those waiting for the registration on the basis of in vitro release of active substances
- Peroral drug delivery of peptide and peptidomimetic drugs via prodrug approach to increase drug stability and bioavailability
- Characterization of F VIII antibodies in haemophilia A patients treated with plasma derived F VIII preparations
- X-ray diffractometric analysis of active substances, excipients and drug formulations
- Determination of lead and some other metals on plants using atomic absorption spectrophotometry
- Biopharmaceutical evaluation of time-controlled press-coated tablets, colon-specific drug delivery systems and site-specific modified release formulations
- Evaluation of peroral solid formulations (hard gelatin capsules) for Estonian pharmaceutical industry and improvement of the biopharmaceutical characteristics of the peroral solid formulations by changing of the composition of formulations

Target-financed themes:

TARFA 0413. INVESTIGATIONS AND IMPROVEMENT OF BIOPHARMACEUTICAL CHARACTERISTICS OF PHARMACEUTICAL FORMULATIONS. Terms: 1998-2002. Principal investigator: Prof. P. Veski. Research staff: E.-I. Lepist, A. Kallas, T. Hinrikus, P. Kreutzwald, M. Paavo

TARFA 2137. CHEMICAL, PSYCHOCHEMICAL AND BIOPHARMACEUTICAL INVESTIGATIONS OF PHARMACEUTICAL FORMULATIONS – DETERMINATION AND IMPROVEMENT OF QUALITY. Terms: 2002-2006. Principal investigator: Prof. P. Veski. Research staff: A. Kallas, T. Hinrikus, P. Kreutzwald, A. Meos, M. Paavo

General Comments

Although the Self-Assessment report lists 7 personnel in this Group, only 3 were research-active (1 professor, 2x assistant/researcher). The Evaluators were not able to meet one of the assistants/researchers, who was overseas at the time of the evaluation (Postdoctoral Fellowship, New York State University, Buffalo, USA).

Studies in the Biopharmaceutics area focussed mainly on drug delivery studies in collaboration with several Scandinavian centres, and were published in good quality international journals. The same applied to work at the biopharmaceutics : clinical pharmacy interface, but with fewer publications to date.

Work in the area of Factor VIII Antibodies in Haemophilia also provided evidence of quality publications and international collaboration, although the lack of research facilities in the Department of Pharmacy required most of this work to be conducted elsewhere.

There was no measurable research output in the area of Pharmaceutical Chemistry, and little evidence that academic staff working in this area is engaged in meaningful collaboration with other researchers in this Group.

Evaluation of Research Activities

The team of evaluators judged the overall quality of the research to be *Good to Satisfactory*.

The above rating is made in the context of the international journals in the biopharmaceutics and related fields and their relatively low impact factors (typically <3). Full publications were supported by a number of peer-reviewed abstracts relating to international conferences, which is an indicator of continued output and emerging research activity.

Collaboration with overseas researchers was extensive and also necessary, since none of the sub-groups under this Chair were of critical mass. One of the most productive streams of research (haemophilia) had developed essentially through the interest and initiative of one individual. The lack of collaboration within the Pharmacy Department and with other Departments in the Medical Faculty was perceived as a weakness.

The lack of resources imposes a major limitation on research in this area. The state of repair of the building, lack of modern equipment (particularly analytical equipment)

and shortage of research space can only be described as *critical*. Similar deficiencies were noted for the availability of some journals and on-line subscriptions in the pharmaceutical sciences and the absence of technical support to maintain and repair research equipment.

Although the Group has achieved success in publication and grant income, its activity has been restricted by the fact that only part of the Group is research - active. The research interests of this Group have international application and efforts should be directed towards fewer national publications and an increase in high-quality material submitted to international journals. Given the collaborative nature of the research, there is no reason why this Group should not seek partnership for overseas funding, for example EU grants.

Evaluation of Overall Capability

The Evaluation Team judged the overall capability of the group to be *Good*.

Originality in the bio-pharmaceutics field is difficult to achieve, particularly in the absence of research-based pharmaceutical industry in Estonia. However, work in the areas of drug targeting, and the delivery of biological pro-drugs is encouraging in this respect. The current strategy of this Group seems dispersed and key research themes for the future have not been fully identified. This may reflect the funding mechanism, which seems to encourage the proliferation of small, diverse projects, and also the Group structure within the Department (see Recommendations).

Much of the output from this Group is dependent upon two young researchers, one of whom is currently working overseas. Retaining these key personnel in the Department will be a major challenge, particularly in view of the research facilities and support available.

The Group has been successful in obtaining research funds from the Estonian Ministry of Education and the Estonian Science Foundation, together with some smaller overseas and industrial grants, and clearly has the potential to attract EU funding through its well-established collaborative network.

The implementation opportunities for the research results and their importance for the Estonian society

The importance of pharmaceutical research is well established in the international community for its contribution to healthcare and economic prosperity. The availability of well-qualified research trained staff would be a pre-requisite for the pharmaceutical industry to establish operations in Estonia. Also, the education of future pharmacists in Estonia is dependent upon a strong research - base in this discipline, where constant development in drug therapies require that teaching is informed by high - quality research. The production of dynamic, research-oriented pharmacists is essential for Estonia to develop healthcare systems compatible with the EU in terms of safe, cost-effective use of medicines and evidence-based practice.

Recommendations

These recommendations are not listed in any particular order and, in some cases, relate not only to the Group but to the Pharmacy Department as a whole.

- The building, facilities and equipment available to the Department must be improved as a matter of urgency. High quality research, the recruitment, retention

and motivation of research staff is critically dependent upon this issue. The Expert Team were encouraged by the support of the Dean of the Medical Faculty for the re-location of the Pharmacy Department and the possibility of accommodation in a re-furbished building close to the Biomedicum which should promote inter-departmental collaboration.

- The Department should develop a strategy to encourage pharmacy students to undertake doctoral research. The introduction of more research-based project work during undergraduate training and a regular series of research seminars and /or journal club discussions are possible suggestions to establish a research culture in the Department.
- Re-structure the Groups within the Department. The current structure is based on the teaching activities of staff, but does not reflect research interests. We realise the Head of Department already has plans to re-organise the Groups, but we feel this needs to be done as soon as possible. In particular, it seems that by combining the developing interest in Clinical Pharmacy with the more established Social Pharmacy group, a critical mass in closely related areas could be formed. Likewise for Pharmacognosy and Pharmaceutical Chemistry. A suggested structure is based on 3 Groups or Chairs:
 - Biopharmaceutics
 - Clinical and Social Pharmacy
 - Pharmacognosy and Pharmaceutical Chemistry
- Devise a strategy to support and encourage research-active staff and younger staff with research potential. This could include protection from excessive teaching load and providing opportunities to work overseas with established research groups.

2.2 The Chair of Pharmacognosy and Pharmaceutical Management (Former Chair: Docent Elmar Arak)

Fields of study

Pharmacognosy

- The cultivation of medicinal plants and its influence on the dynamic of the active substances' content
- The study of the production of tropane alkaloids in the field and tissue cultures of herbs
- Comparison of chemical composition of essential oil herbs widely used in Estonia with abroad analogs
- Collection and conservation of genetic resources of medicinal plants and spices
- Action of Aqueous extracts of Bearberry (*Arctostaphylos uva-ursi*) and Cowberry (*Vaccinium vitis-idaea*) leaves and Wild Camomile (*Matricaria recutita*) and Pineapple-weed (*Matricaria matricarioides*) flowers on *Escherichia coli* surface structures

Social Pharmacy and Pharmaceutical Management

- Estonian community pharmacies on the way to the European Union
- Drug information, the necessity and possible functions of a drug information centre
- International programme *Ask About Your Medicines*
- The factors influencing drug utilization”

General Comments

The Self-Assessment report for this Groups lists only 7 members, but for the purposes of this report we have included a current PhD student and a research assistant who also works with the Medicines Evaluation Agency. The interests of this Group span traditional Pharmacognosy and Social Pharmacy and for the purposes of this assessment these have designated as sub-groups.

There is some evidence that the Pharmacognosy sub-group is beginning to modernise its research to include phytochemistry and more specific and sensitive analytical methodologies. A PhD project in this area appears particularly productive. A large proportion of the research output is published in Estonian, rather than international, journals, but this may reflect cultural traditions on the use of herbal medicines which are specific to Estonia.

The Social Pharmacy sub-group has a shorter history in the Department, but the two active members in this area (1 x Assistant, 1 x part-time Research Assistant) were positive and knowledgeable with very clear ideas on the direction of their research. Again, this area of research will, in most cases, be specific to Estonia and the proportion of national, as opposed to international publications, will reflect this.

Evaluation of Research Activities

The Evaluation Team judged the overall quality of the research to be *Satisfactory*

The Group is composed of two very disparate sub-groups and contains few members, so that in an international context, neither sub-group is viable. This is reflected in the limited publication output in international journals, although the points previously described in the General Comments section will also influence this. There is evidence of collaboration at all levels, and the collaborative effort in Drug Use Review with the Institute of Pharmacology in Tartu is particularly promising.

Evaluation of Overall Capability

The team of evaluators judged the overall capability of the research group to be *Good*.

It is inevitable that some of the research in this Group will be descriptive, but there is also some evidence of more original work emerging in both sub-group areas. The strategy in the Social Pharmacy area seemed very clear and in terms of data collection, this area is well-resourced by the Medicines Evaluation Agency. The strategy of the pharmacognosy sub-group is less clear, although a current PhD project in this sub-group indicates a future direction in the phytochemistry area.

Grant income from the Estonian Ministry of Education and the Estonian Science Foundation is limited and a significant portion of this funding is held by a docent emeritus, so consideration must be given to future research funding. Co-operation and collaboration, on the other hand, is promising.

The implementation opportunities for the research results and their importance for the Estonian society

The comments in this section under 2.1 also apply for this Group. The long tradition of herbal medication in Estonia, the revival of phytochemistry as a source of novel pharmaceuticals and planned EU regulations on the quality and standardisation of herbal medicines lend support to the importance of pharmacognosy as a research topic. The drug-use and pharmacy practice evaluation research are of obvious importance in any society attempting to manage expenditure on pharmaceuticals and promoting safe and effective prescribing practice.

Recommendations

The recommendations under 2.1 (Chair of Pharmaceutical Technology and Biopharmaceutics) also apply to this Group. Additionally:

- Collaboration between Pharmaceutical Chemistry (currently of limited research activity) and Pharmacognosy could provide a viable cluster of researchers in areas of contemporary importance, for example the quality control of herbal medicines.
- Every encouragement (including sabbatical leave) should be offered to young researchers in both sub-groups to develop their independent research and to ensure there is a future for these studies within the Department.
- Social Pharmacy should engage with practising pharmacists and medical doctors in Estonia to develop part-time PhD programmes of the direct relevance to the Estonian health care system.

Part IV

Summary of evaluation

The research at the Department of Pharmacology of Tartu University was evaluated as good and its overall capability as excellent.

The research at the Chair of the Pharmaceutical Chemistry and Biopharmacy at the Department of Pharmacy of Tartu University was evaluated as good to satisfactory and its overall capability as good.

The research at the Chair of Pharmacognosy and Pharmaceutical Management of the Department of Pharmacy of Tartu University was evaluated as satisfactory and its overall capability as good.

Part V

General recommendations

The evaluation team judged the self-evaluation reports submitted by the two departments as being in general informative and clear. After having had first hand contact with the Faculty authorities, the Department Heads and all members of the research and lecturing staff, we felt that the reports truthfully reflect the overall situation even though it might have been helpful to discuss the obvious problems more extensively. The situations in Pharmacy and Pharmacology are rather different and our general recommendations might not be equally applicable to both Departments. However, specific recommendations are provided for each Department in Part III of this report.

It is anticipated that Estonian science will face much more intense collaboration and competition within European Union. In consequence, Estonian scientists should adopt even more extensively than thus far European and global standards of writing grant applications, reports and publications and presenting their results in wider audiences. It is of importance that good writing practices were adopted from the start and this should be taken into consideration during graduate and postgraduate training.

We see it as a critical requirement to enhance the attractiveness of research positions (including PhD positions) in both Departments to facilitate the recruitment of fresh staff and to secure the support from scientists returning from an overseas training period. One of the possible means is certainly the formation of networks between interested groups from different Departments. One such initiative is already implemented with the designation of a centre of excellence in the neurosciences. Such platforms are also eminently suited to improve the exchange of expertise, to favour joint use of expensive equipment and, in particular, to create a stimulating environment for doctoral students.

Modern experimental science cannot thrive without access to up-to-date instrumentation and good-quality facilities. We trust that improving the serious deficiencies of the infrastructure in the Pharmacy Department will significantly enhance the attractiveness of pharmaceutical studies and is an indispensable prerequisite for reaching an internationally more competitive level of research.

We appreciate the rather strong efforts invested in international co-operation. However, we feel that bringing international expertise to Estonia would profit significantly by joint appointments of scientists from other European universities to the Departments of Pharmacy and Pharmacology. Among other possibilities, such exchange might be supported via grants from European scientific societies like EBRO or EMBO.

It was the impression of the evaluators that the limited financial and human resources required a more rigorous focussing of the research on fewer core projects. This would enable the formation of more vigorous groups that could produce higher impact research and facilitate separate applications for target funding. Formation of these groups might need some difficult internal reorganisation but this seems inevitable in view of financial constraints and of the impending competition on the European level.

VI. Acknowledgements

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