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DENTAL RESEARCH IN FINLAND 2001–2005



International Evaluation



ACADEMY OF FINLAND
RESEARCH FUNDING AND EXPERTISE

DENTAL RESEARCH
IN FINLAND
2001–2005
International Evaluation

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Description

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| Abstract | <p>The report presents the evaluation of Finnish dental/odontological research including research from certain other areas of medical sciences, natural sciences as well as technical sciences, if directly linked to dental research. The evaluation was performed at the Institutes of Dentistry in Helsinki, Oulu and Turku, and at the independent research institutes or relative parts of them that had received Academy funding for dental research or related projects: the Institute of Biotechnology (BI), Helsinki, and the National Public Health Institute (NPHI), Helsinki.</p> <p>The evaluation panel found the overall standard of science good, in some parts even excellent. The panel gave special recognition to the craniofacial biology group at the Institute of Biotechnology, which is out-standing in terms of the scientific quality of research and which also stands out for devoting their research effort into one field. In Finland, dental research activities are dependent on rather few individuals and in many cases based upon comparatively small research groups, with only limited collaboration between dif-ferent groups. The panel felt that one of the basic problems is the outsourcing of clinical teaching of dental students that has seen as a loss of junior academic posts in dental schools.</p> <p>According to the panel, the Finns should focus on two issues in particular in order to further strengthen the field. First, the major challenge is to recruit future staff members and scientists, e.g. to initiate attractive research and teacher career programmes for young dentists including a National Research School for post-graduate students and a doctoral training programme. Second, the effects of outsourcing the clinical teach-ing posts in the community dental service should be reconsidered, since it seems to have a negative impact on clinical research in dentistry by reducing the academic posts in Dental Schools. In addition, there should be a joint review of funding of Dental Schools by the Ministries (Ministry of Education and Ministry of Social Affairs and Health) to identify a) junior posts lost from the universities when clinical teaching was outsourced, b) the value of EVO funding in comparison to the junior posts lost, and c) to consider how EVO funding can be assessed across the range of clinical dental research including dental public health. Further, both international and national collaboration with other groups in medicine, biomedicine, social sciences and natural sciences are encouraged in research communities in order to bring new knowledge into the field, and, thereby to increase their scientific potential and ability to compete for research funds.</p> | | |
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| Tiivistelmä | <p>Raportti esittelee Suomen hammaslääketieteellisen tutkimuksen sekä eräiden muiden, hammaslääketieteen tutkimukseen suoraan liittyvien lääketieteen, luonnontieteiden sekä teknisten tieteiden alojen tutkimuksen arvioinnin. Arviointi suoritettiin Helsingin, Oulun ja Turun hammaslääketieteen laitoksilla sekä niillä itsenäisillä tutkimuslaitoksilla (Biotekniikan Instituutti, Helsinki ja Kansanterveyslaitos, Helsinki), jotka ovat saaneet Akatemialta rahoitusta hammaslääketieteelliseen tutkimukseen tai siihen liittyviin hankkeisiin.</p> <p>Arviointipaneeli totesi tutkimuksen yleisen tason hyväksi, joiltakin osin erinomaiseksi. Paneeli antoi erityistunnustusta Biotekniikan Instituutin pään- ja kasvojen alueen kehitysbiologian ryhmälle, jonka tutkimuksen tieteellinen laatu on erinomaista ja joka erottuu myös siinä, että sen tutkimus kohdistuu yhdelle tietylle alueelle. Suomessa hammaslääketieteen tutkimus on melko harvojen yksittäisten tutkijoiden ja monissa tapauksissa suhteellisten pienten tutkimusryhmien varassa, ja ryhmien välillä on vain vähäistä yhteistyötä. Paneelin mielestä yksi perusongelma on hammaslääketieteen opiskelijoiden kliinisen opetuksen ulkoistaminen, josta on seurannut alempien akateemisten virkojen menetys hammaslääketieteen laitoksilla.</p> <p>Paneelin mukaan suomalaisten tulisi kiinnittää huomiota erityisesti kahteen seikkaan alan vahvistamiseksi. Ensinnäkin, suurena haasteena on tulevan henkilöstön ja tutkijoiden rekrytoiminen, ja sitä varten olisi käynnistettävä houkuttelevia tutkimus- ja opettajankoulutusohjelmia nuorille hammaslääkäreille, mm. kansallinen tutkijakoulu ja tohtorinkoulutusohjelma. Toiseksi, kliinisten opettajavirkojen ulkoistamista kunnallisen hammashoidon yhteydessä olisi harkittava uudelleen, koska ulkoistaminen on vähentänyt akateemisia virkoja hammaslääketieteen laitoksilla ja siten vaikuttanut kielteisesti kliinisen hammaslääketieteen tutkimukseen. Lisäksi opetusministeriön ja sosiaali- ja terveysministeriön tulisi yhdessä arvioida hammaslääketieteen laitoksille menevää rahoitusta, jotta selvitetäisiin a) kliinisen opetuksen ulkoistamisen myötä yliopistoilta poistuneet nuorempien tutkijoiden virat, b) EVO-rahoituksen merkitys verrattuna poistuneisiin nuoremman tutkijan virkoihin, ja c) miten EVO-rahoitusta voidaan arvioida kliinisen hammaslääketieteellisen, myös kansanterveyden, tutkimuksen alueella. Kansainvälistä ja kansallista yhteistyötä muiden lääketieteen, biolääketieteen, yhteiskuntatieteiden ja luonnontieteiden alojen tutkimusryhmien kanssa tulisi rohkaista uuden tiedon tuottamiseksi alalle, ja siten lisätä mahdollisuuksia ja kykyä kilpailla tutkimusrahoituksesta.</p> | |
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PREFACE

The Health Research Council of the Academy of Finland made in December 2005 a decision to evaluate the current status and scientific quality of Finnish dental research. The decision to launch the evaluation was based on discussions and on an increasing concern among the dental research community about the future prospects of dental research and researcher training in Finland. These discussions indicated that we may in the near future face a severe lack of competent dental researchers and trainers of researchers, if we are not able to create more interest in basic and clinical dental research.

In October 2006, the Academy of Finland appointed an international evaluation panel, chaired by Professor Ulf Lerner, for this demanding task. The evaluation panel performed a detailed analysis of the scientific production and research structures and also made site visits to all major Dental Departments before it formulated its conclusions and recommendations concerning research funding, researcher training and several other important aspects of future dental research. It is a prime time for researchers and funding organisations, including the Academy of Finland, as well as other involved parties to carefully analyse and seriously consider the recommendations made by the evaluation panel. It is obvious that the evaluation panel has presented several challenging tasks that should and could be solved during the years to come. This document gives a number of new ideas and suggestions to draw up a successful strategy to further improve Finnish dental research.

Finally, I like to present my sincere thanks to the evaluation panel and to all members of the research community who have participated in the evaluation.

Helsinki, 3 December 2007

Kalervo Väänänen
Chair of the Research Council for Health
Academy of Finland

EXECUTIVE SUMMARY OF PANEL RECOMMENDATIONS

Several dental research groups at all three dental schools in Finland perform internationally-recognised clinical and biomedical research, some of which is judged to be excellent; notably the dental research group at the Institute for Biotechnology. As in many countries, these activities are dependent on rather a few individuals, and in many cases are based upon comparatively small research groups. It is notable that there are only a few major collaborations between research groups in Helsinki, Oulu and Turku. In modern biomedical research, of which dental research is a part, it is most important to develop functional networks, to focus on specific research areas and to have well organised postgraduate and postdoctoral training programmes. The competition for national, European and international funds has become much greater over the last decade and it is, therefore, most important that dental research units develop strategic plans to be able to compete effectively. Within dental institutions, budgetary systems need to be transparent and fit to deliver the strategic plans of institutes to optimise research activity. In practice, processes need to be in place to allow the Dean working with the director of research and heads of units to be able to be responsive to meet new demands, making it possible to allocate money and resources to the more productive research groups and to recruit new staff members.

A major challenge facing Finnish dental research is the significant problem of recruiting future staff members, a problem which will be compounded, if a fourth dental school is to be opened in Kuopio. It is critical that those responsible for the future of dental research in Finland initiate attractive research and teacher career programmes for young dentists including a National Research School for postgraduate students and a postdoc training programme.

The outsourcing of clinical teaching of dental students that has seen the loss of junior academic posts in dental schools to clinical teaching posts in the community dental service will continue to have a negative impact on clinical research in dentistry. This should be considered urgently. The Evaluation Panel has suggested several steps that could be taken in order to improve the situation including a review of how the EVO money is used to support research.

The recommendations given by the Panel should be read in the light of the above, briefly summarised impressions. However, it is important to read the full text in this report to fully evaluate and understand the basis of our opinions.

Recommendations

- Heads of Dental Schools should be encouraged to develop research strategies for their Schools with priority areas identified.
- There should be a joint review of the funding of Dental Schools by the Ministry of Social Affairs and Health and the Ministry of Education to identify junior posts lost from the universities when clinical teaching was outsourced; the value of EVO funding in comparison to the junior posts lost; and to consider how EVO funding can be accessed across the range of clinical dental research including dental public health.

- As the change in clinical teaching is embedded and may well have many educational advantages, consideration could be given to the establishment of some joint junior posts between the university and the community dental service; with research being an explicit component of the joint contract.
- A National Graduate School for Oral Disease and Health should be opened based upon an initiative by the Academy of Finland which should organise the School and appoint the leader/coordinator. A certain number of the positions should be allocated to dentally-qualified PhD students. The Graduate School should also be joined with positions for postdocs. There should be a common PhD programme with, for instance, core curriculum courses, follow-up of students with annual reports, and specified rules for the PhD thesis. The opportunity to establish networks internationally in the postgraduate's chosen field of research should be encouraged and financially supported.
- The Academy should consider the possibility of making the proposed Finnish Graduate School a joint undertaking with other Medical Research Councils in the Nordic countries.
- The heads of the dental institutes and dental research groups should be encouraged to work more collaboratively with other groups in medicine, biomedicine, social sciences and natural sciences in order to bring new knowledge into the field; and, thereby increase their scientific potential and ability to compete for research funds.
- It is also recommended that clinical training pathways to promote interdisciplinary and translational research initiatives are established.

I BACKGROUND AND PURPOSE

The Academy of Finland appointed in October 2006 an international panel to evaluate the quality and status of Finnish dental research during 2001–2005. The evaluation covered the discipline of odontology nationwide with a view to assess the strengths and weaknesses of Finnish dental research and of securing internationally high standards of research and researchers in the future. The participating units conducted internal self-assessment. The international team conducted a field evaluation during the week of 11–14 June 2007. The schedule of the site visit week is enclosed as Appendix F.

2 DEFINITION OF THE FIELD TO BE EVALUATED

The field to be evaluated consisted of odontological/dental research. It may also have included research from certain other areas of medical sciences (e.g. medicine, biomedicine, social medicine, health care), natural sciences (e.g. cell and developmental biology, physiology, biochemistry, molecular biology, microbiology, genetics), as well as more technical sciences (e.g. chemistry and tissue technology), if they were directly linked to dental research. The evaluation focused mainly on the field, not on a unit, research group or individual researchers, although these structures formed the basic tools for the evaluation.

The basic unit to be evaluated by the Panel was a university institute or a relevant part of it. The units are mainly interdisciplinary research environments. The units to be evaluated were the Institutes of Dentistry in Helsinki, Oulu and Turku, and the independent research institutes or relative parts of them, which have received the Academy's funding for dental research or related projects; Institute of Biotechnology (BI), Helsinki, and National Public Health Institute (NPHI), Helsinki.

3 OBJECTIVES OF THE EVALUATION AND EVALUATION CRITERIA

The primary objective of the review was to determine the strengths and weaknesses of the discipline in Finland by evaluating the quality of the odontological/dental research activities of the units as well as closely related medical or natural science research. The evaluation period was 2001–2005. The review is based on the written reports and site visits, and provides recommendations on the research and organisational requirements needed to advance the impact of the field nationally and internationally.

The specific objectives were to:

- 1) evaluate the scientific quality of dentistry in Finland as compared to the international level
- 2) identify the strengths and weaknesses of the research
- 3) estimate communication and collaboration with key partners at home and abroad
- 4) estimate the significance of dentistry to Finnish society
- 5) evaluate the efficacy of the research, i.e. how much scientific output is produced in relation to the resources invested
- 6) evaluate the quality of researcher training
- 7) make suggestions and recommendations to ensure the supply of qualified academic professionals in Finland in the future
- 8) make suggestions and recommendations for the further development of dental research and research policy in Finland

4 EXECUTION OF EVALUATION

The initiative for this evaluation came from the dental scientists in Finland and the Academy of Finland because of their concerns for dental research in the country due to the obvious decline in research activities within the dental institutes. An initial pre-evaluation meeting was held on 27 October 2005 with representatives from the dental institutes and the Academy of Finland. It was concluded that there was a need for an evaluation, not primarily of the dental researchers but rather of the dental institutes with the hope that identification of the causes for the decline would help with the formulation of nationwide measures for its solution.

The Research Council for Health, together with the President of the Academy of Finland, in its performance agreement for the year 2006 decided to perform an international evaluation of the quality and status of dental research in Finland. A steering group including members of the Academy of Finland was appointed with Professor Kalervo Väänänen as the Chair. Riitta Pakkala, Deputy Chief Dentist from Kuopio University Hospital, together with Science Adviser Hannele Lahtinen and Director Riitta Mustonen from the Health Research Unit of the Academy of Finland were designated as members of the coordinating group. A panel of internationally well recognised dental researchers was identified representing both clinical and pre-clinical fields in dentistry with Professor Ulf Lerner, Umeå University, Sweden (oral biology) as the Chair, Professor Cynthia M. Pine, Liverpool University School of Dentistry, UK (epidemiology, dental public health, evidence-based dental research) as the Vice Chair, Professor Anne Christine Johannessen, University of Bergen, Norway (oral pathology), Professor Mogens Kilian, University of Aarhus, Denmark (oral microbiology and immunology), Professor Rainer Schmelzeisen, Albert-Ludwig-University Freiburg, Germany (oral and maxillofacial surgery), and Professor Katherine Vig, Ohio State University, USA (orthodontics). The evaluation was carried out in collaboration with the Ministry of Social Affairs and Health, the Ministry of Education, Finnish Funding Agency for Technology and Innovation (Tekes) and the Finnish Dental Association (Apollonia).

A planning meeting with the steering group, coordinator, representatives from the Academy of Finland and the Chair of the Evaluation Panel was held in Helsinki on 25 August 2006. Based upon the discussions at this meeting, a preliminary edition of the Evaluation Form was generated and on 15 December 2006, a seminar was organised at the Academy of Finland to have an open discussion on the evaluation criteria and procedure. All dental researchers in Finland, as well as representatives from the Ministry of Health and Social Affairs, the Ministry of Education and Apollonia were invited to the meeting. The Chair of the Evaluation Panel, together with two representatives from the Research Council for Medicine in Sweden, presented two recently performed evaluations of dental research in Sweden at this meeting. It was apparent that dental research in Finland and Sweden share many problems and that there are similar concerns for the future.

The final Evaluation Form included detailed information on staff members, postdoctoral training, funding, publications and research profiles according to IADR classifications. The material was compiled by the Academy of Finland and all the forms and the compilations served as the written information for the evaluation panel.

In addition to the written documents, the Evaluation Panel made site visits to Dental Institutes in Turku, Oulu and Helsinki, as well as to the Institute of Biotechnology in Helsinki. The Panel also had a meeting with one dental researcher from the National Public Health Institute in Helsinki. The local hosts planned the programmes for the individual site visits, but the Panel had emphasised that they would like to meet representatives from the board including the Dean, representatives of the principal investigators, post docs, and postgraduate students. Short visits were also made to the local research facilities.

During the site visits it became apparent for the Evaluation Panel that it was not possible to evaluate research activities without also taking into account the organisation of undergraduate teaching activities.

5 EVALUATION OF FINNISH DENTAL RESEARCH

5.1 Scientific quality of research

A comparison of the relative impact of publications by Finnish dental scientists in dental journals over the last 25 years (1981–2005) with the World's average (=1.0) and with other European countries (Fig. 1) demonstrates that Finland has performed similarly to Denmark, Sweden and Norway, over the last ten years, with all these countries being slightly above the mean. However, in contrast to Denmark and Sweden, which both show a dramatic negative trend over the years, presumably due to significant reductions in budgets, the relative impact factor for Finland varied over the 25 year period. While the relative impact factor for Finnish dental research increased substantially from 1987 to 1999, a clear decrease is apparent for the most recent period.

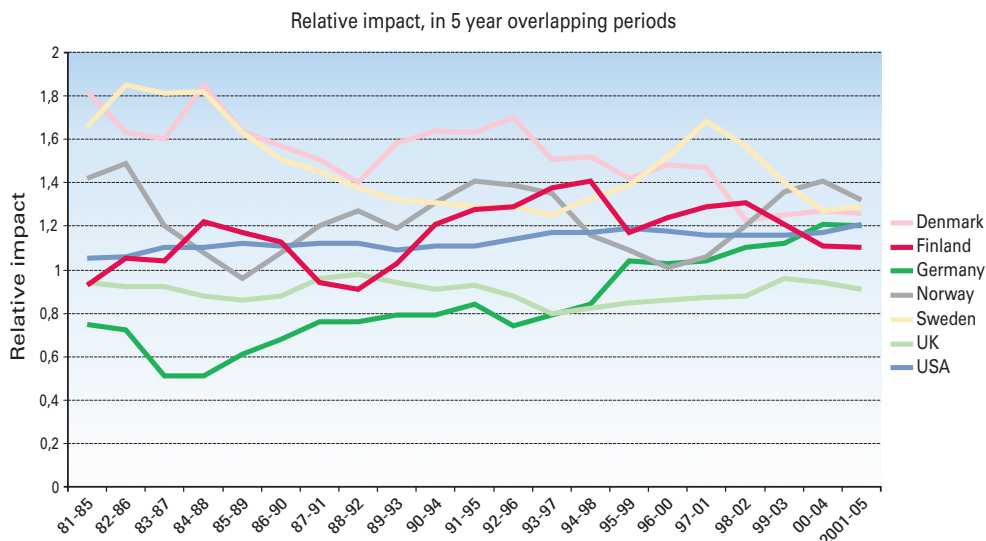


Figure 1. Impact relative to dental research field¹⁾, compared to selected European countries. Source: Thomson Scientific, NSI 1981–2005: Dentistry Category.

¹⁾ Citation impact for country in a field divided by citation impact for the field as a whole, worldwide.

As expected, the majority of publications by Finnish dental researchers 2001–2005 appear in dental journals (Appendix E, Table I). Thus, the 26 most frequently used journals are dental journals, in which a total number of 468 papers were published. The Evaluation Panel notes that 50 out of the 468 papers (11%) were published in the *Journal of Dental Research*, the dental journal with the highest impact factor. In addition, a substantial number of papers (138) were published in medical and natural science journals with impact factors between 3 and 5, with 44 papers in journals with high impact factors (5–10) and three papers in some of the most prestigious biomedical journals (*American Journal of Human Genetics* [12.7], *Developmental Cell* [14.6]). This means that several dental scientists in Finland produce competitive science appreciated by editorial boards worldwide. This does not imply that science published by Finnish dental researchers in less prestigious journals is not necessarily well recognised internationally. A substantial part of the papers (77%) was published in non-dental journals (n=239), while 23 per cent was published in dental journals (JCR dental journals n=40 and other dental journals n=31). These papers are in many different fields, rendering this part inaccessible for direct comparative bibliometric analysis. However, publication in dental journals can be easily compared using the ISI Webb database, which includes publications in 46–50 (varies over the years 2001–2005) different dental journals.

A compilation of the number of publications by Finnish dental scientists in 2001–2005 in different fields of dentistry (according to the IADR classification) shows that the most prominent fields are oral medicine and oral pathology (13.5%), craniofacial biology (10.9%), microbiology (9.4%), dental materials (9.0%) and oral and maxillofacial surgery (7.4%) (Table 1, Fig. 2). It is surprising to note that traditional dental research areas like caries (4.7%) and periodontology (4.9%) are much less prominent. One possible explanation may be that research in caries and, in particular

Table 1. The number of international publications (n) in each research field (IADR) of Dentistry in 2001–2005.

| Research field (IADR) | n | % |
|------------------------------|-------------|------|
| Behavioural sciences etc. | 68 | 6.4 |
| Cariology research | 50 | 4.7 |
| Craniofacial biology | 115 | 10.9 |
| Dental Materials | 95 | 9.0 |
| Diagnostic systems | 15 | 1.4 |
| Geriatric oral research | 21 | 2.0 |
| Implantology research | 31 | 2.9 |
| Microbiology etc. | 99 | 9.4 |
| Mineralized tissue | 12 | 1.1 |
| Neurosciences/TMD/Pain | 58 | 5.5 |
| Oral health research | 46 | 4.3 |
| Oral medicine & pathology | 143 | 13.5 |
| Oral & maxillofacial surgery | 78 | 7.4 |
| Periodontal research | 52 | 4.9 |
| Pharmacol, Therap & Toxicol | 56 | 5.3 |
| Prosthodontics research | 8 | 0.8 |
| Pulp biology | 17 | 1.6 |
| Salivary research | 13 | 1.2 |
| Evidence-based dentistry | 10 | 0.9 |
| Other | 71 | 6.7 |
| Total | 1058 | |

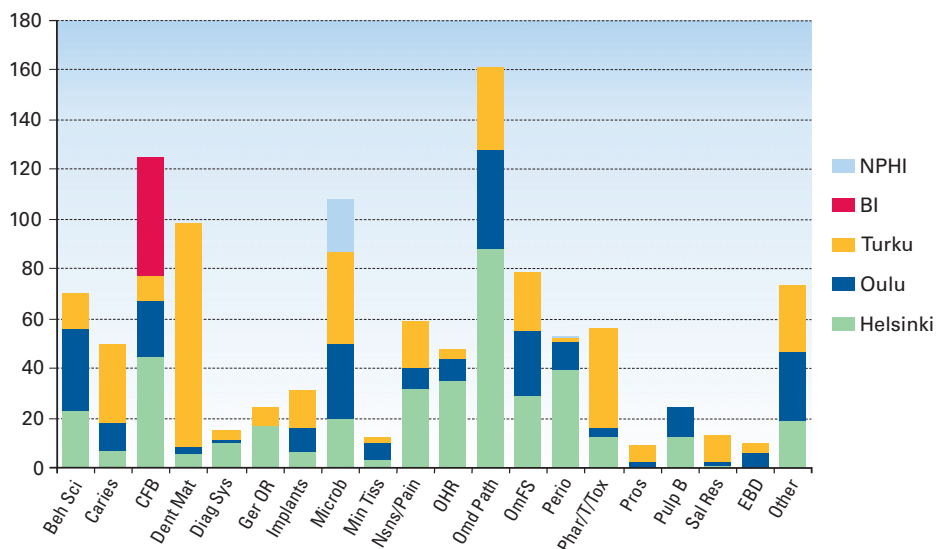


Figure 2. The volume of international publications of dental research in Finland by IADR classification (See Appendix, Table II). The numbers of the publications by field may differ from that in Table 1 since some publications are registered in two units.

periodontology, has been broadened and, therefore, is not primarily classified according to traditional nomenclature. If so, it is a positive trend. However, if it means that dental researchers no longer devote their time to these significant areas in clinical dentistry, which still have very many unsolved problems, it is problematic.

When the number of publications is compared it is noticeable that each unit has 1–2 groups that, during 2001–2005, published a remarkably high number papers (48–92) (Appendix E, Table IV. With two exceptions, the publications from the different groups were classified into 5–9 areas according to the IADR classification, although some areas are more frequently reported. The same picture appears for all groups, i.e. each group devotes their interests to a surprisingly large number of different fields. In contrast, the group at the Institute for Biotechnology at the University of Helsinki solely focus on one field, craniofacial biology. Similarly, the FRC (Fiber Reinforced Composite) group in Turku work on two closely related fields, namely biomaterials and prosthodontic research. Internationally, success in scientific research and in obtaining funds is very dependent on developing and demonstrating expertise in a defined area. Therefore, the Panel was surprised to note that several researchers, when challenged, did not consider fragmentation of their research activities to be a problem. Although some of the scientists are able to publish frequently in reasonably good journals, top-class research and competition with other biomedical scientists for national and international grants requires strongly focused work.

Using journal impact factors as a parameter for research quality has clear limitations, especially for the evaluation of individual researchers. Another parameter, which is used often in bibliometric analysis, is citation frequency of individual publications, although this index should also be used with caution. However, both journal impact factors and citations of publications are regarded as useful for comparisons over time, between institutes and when comparing research achievements by different countries. When the number of citations of publications in dental journals by Finnish dental scientists is compared to global figures (Fig. 3a), it is clear that Finland is above the average.

A long-term (1981–2005) analysis of citation frequency shows that the citations of Finnish dental papers increased from 1988 to 1998, but since then have been stable. As shown in Figure 3b, the citation frequency for all Nordic countries was very similar over recent years.

The bibliometric analyses show that, on average, dental researchers in Finland, are productive and that their publications are well recognised. When analysed in more detail, and when all publications are used, it becomes clear that there are certain groups at all institutes that are more successful than others. The Evaluation Panel is very much impressed, in particular, by the outstanding achievements of the dental research group at the Institute of Biotechnology, University of Helsinki, led by Professor Irma Thesleff. This group has for many years focused on molecular regulation in craniofacial biology. Their research activities include projects ranging from basic molecular genetics in mice to medical genetics in clinical dentistry. Professor Thesleff has extensive international collaboration and is highly recognised with numerous invitations to international meetings, scientific boards and organisations' committees for research meetings. The group has been very competitive in

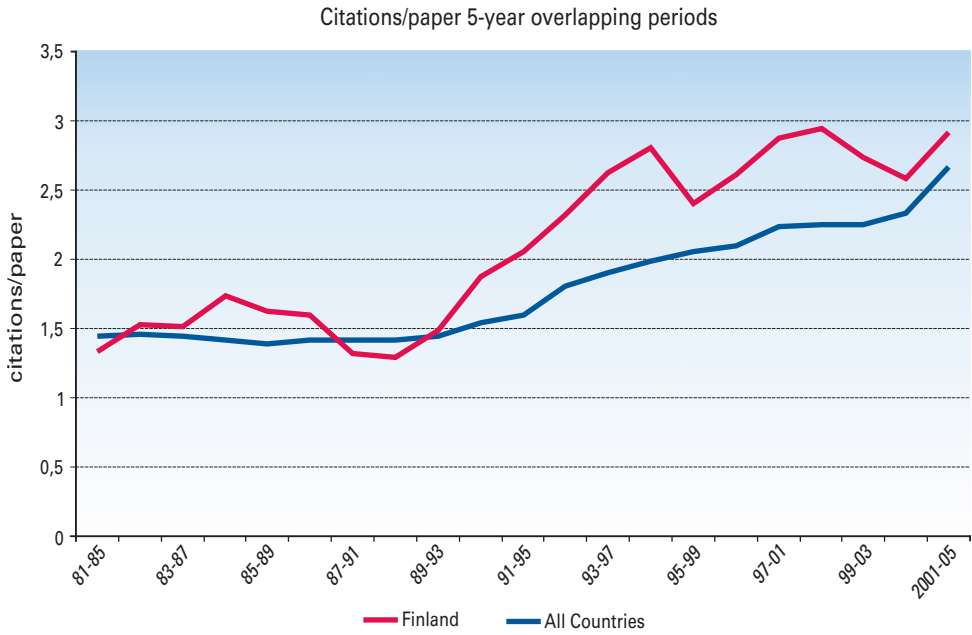


Figure 3a. Citation impact of Finnish dental research publications compared to the impact of all dental research publications globally. *Source: Thomson Scientific, NSI 1981–2005: Dentistry Category.*

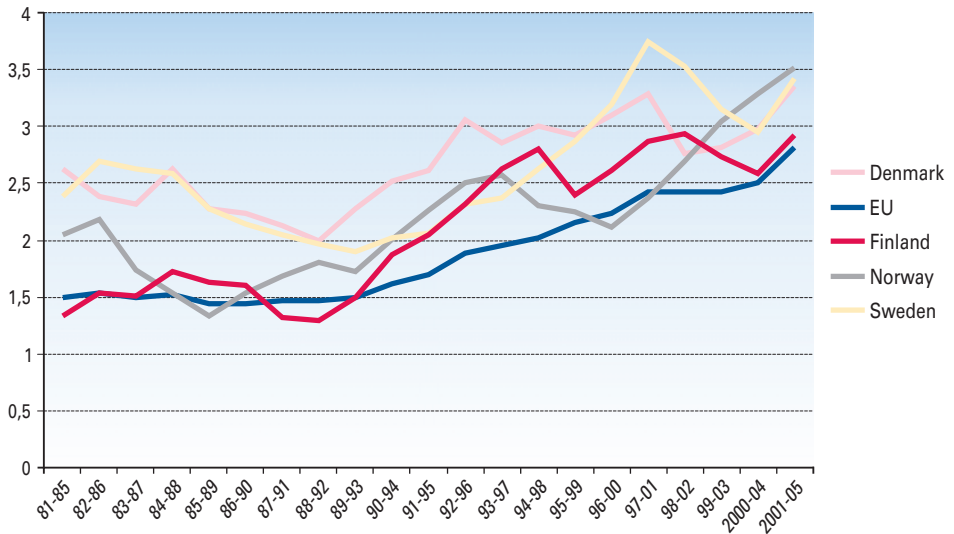


Figure 3b. Citation impact of Finnish dental research publications compared to the impact of dental research publications in other Nordic countries. *Source: Thomson Scientific, NSI 1981–2005: Dentistry Category.*

receiving grants from the Academy of Finland, the EU and NIH. The group is highly recognised internationally and must, without doubt, be considered the most prestigious dental research group in Finland. During 1988–2005, Professor Thesleff published 159 papers, many in the most prestigious journals, which have been cited about 9,000 times. Accordingly, her h-index is 53. During the time period 2001–2005, Professor Thesleff has published 48 papers, many of which have appeared in high or very high-impact factor journals. The fact that Professor Thesleff has recently been appointed to a permanent position at this most competitive institute also demonstrates her excellence. National and international graduate students and post-docs are recruited to her group and their training is very well organised both within the group and within the Institute. The group has had successful collaboration with one group at the Dental Institute in Helsinki, but the Panel is surprised to note the limited collaboration with other Finnish groups.

Another highly productive group in Helsinki is led by Professor Timo Sorsa at the Dental Institute. Professor Sorsa has published 272 papers during 1988–2007, which have been cited about 6,800 times and his h-index is 42. The h-index of Professor Sorsa shows that the publications by the group are well appreciated internationally. During 2001–2005, Professor Sorsa has published 87 papers, several of which have been published in internationally highly respected journals. Professor Sorsa has been a member of the board of the *Journal of Dental Research* (1997–2000), has been invited to a Gordon Conference and is a Visiting Adjunctive Associate Professor in oral biology at Stony Brook University Dental School. Professor Sorsa is also the inventor of ten patents. The Panel was impressed by the intense activity in this group. The main topic is proteolysis in oral diseases, mainly the role of matrix metalloproteinases. It is, however, evident that the group devotes their activities in diverse areas with publications categorised into eight different IADR classifications. The Panel is convinced that this group would be even more successful if they developed a stronger focus by reducing the dispersion of their activities, so generating more depth, and by establishing collaborations with some of the more experienced molecular biologists. The fact that the group has basic science and clinical expertise, the latter not only in clinical dentistry but also in clinical medicine, argues for the possibility of enhancing the translational aspects of their research.

There are several other groups in Helsinki (Alaluusua, Hietanen, Lindqvist, Meurman, Uitto) that are productive (> 30 publications 2001–2005) and well recognised internationally (h-index 20–25). Some of these groups are rather small and their research activities appear too diversified evidenced both from evaluation of their publications and that the publications from each group were classified into many IADR research topics. In order to be more competitive with research groups in biomedicine in general, it is advisable that all the groups increase their focus and develop joint research programmes. Although some collaboration with basic science groups exists, there is a clear need for more extensive collaboration with pre-clinical groups. With the exception of Professor Alaluusua's group, and previously Professor Emerita Sinikka Pirinen's group, none of the groups collaborate with the dental research group at the Institute of Biotechnology in order to benefit from their cutting-edge expertise in experimental basic dentistry. The outcome of the fruitful collaboration between Pirinen's and Thesleff's groups has been extended by a current

collaboration between Dr Arte's (orthodontist and PhD) and Dr Thesleff's group. They are researching a condition recognised in clinical dentistry—tooth agenesis. This demonstrates clearly how such collaborations can generate excellent translational research. The fruitful collaborations between Alaluusua and Thesleff on gene mutations in dentinogenesis imperfecta and on dioxin-tooth development are other interesting examples. Similar collaborations could be established for several of the groups at the dental institute.

At the Dental Institute in Turku, the research groups led by Professor Stina Syrjänen and Professor Pekka Vallittu clearly stand out. Professor Syrjänen published 58 papers during 2001–2005, has been cited about 4,470 times since 1988 and her h-index is 40. The group is surprisingly small and devotes their research interest to tumour biology with a principal focus on the human papilloma virus. The publications from this group also tend to be diversified with their publications classified into six IADR groups. The group leader is highly recognised internationally with many invitations to present their data at meetings. Syrjänen is frequently asked to review professorships and grants, is a member of the editorial board for several international journals and has been a member of the organisation committee for many scientific meetings. Professor Syrjänen has been a coordinator for EU projects.

The FRC group led by Professor Vallittu published 92 papers during 2001–2005. The papers from 1992–2005 were cited about 1,600 times and his h-index is 25. When evaluating the data one should take into account that the group is rather recently established with the bulk of their activities only undertaken in recent years. Professor Vallittu has gathered a comparatively large research group, which appears buoyant and strong with research focused in only two IADR classifications. The fact that the group works with basic science in close collaboration with clinical dentistry is probably the reason why the group has been internationally recognised rapidly. Vallittu has received an EU grant for which he is the coordinator. The group has been well financed by Tekes and by a grant for a Centre of Excellence by the Academy of Finland.

There are four other groups at the Institute in Turku (Alanen, Happonen, Närhi, Tenovuo) with comparatively large research activities 2001–2005. Of these, Happonen's and Tenovuo's groups are the most well-recognized internationally with h-indices around 20. However, these groups are small and their publications are covering rather too many fields (6 and 8 different IADR categories, respectively).

At the Dental Institute in Oulu, the group led by Professor Tuula Salo is outstanding in terms of publications and recognitions. Professor Salo has published 73 papers during the last five years (2001–2005; more than 14 papers per year) and her 1988–2007 papers have been cited more than 5,300 times and her h-index is 38. The research is devoted to matrix metalloproteinases and extracellular matrix molecules. She collaborates extensively with Professor Sorsa's group in Helsinki working in the same field and also with many other colleagues in Europe and USA. However, the concern about excessive diversification also extends to Salo's group; her publications can be categorised into nine different IADR groups. It is clear from the self-report of the group, which is relatively small in terms of the number of senior researchers and postdocs, that they work in several fields. Therefore, this diversification may reflect the collaborative nature of their approach, since all publications have aspects related

to MMPs and ECM proteins. It is apparent that Professor Salo is highly recognised internationally being invited to many meetings and to editorial boards of four journals and several of her publications appear in highly respected journals. Professor Salo is supported by a research grant from the Academy of Finland.

At the Dental Institute in Oulu there are also three other groups (Oikarinen, Knuutila and Raustia) that publish frequently, but their activities are fairly fragmented and the scientific recognition in terms of citation frequency and h-index is less impressive (citations per group about 400–500 and h-index around 12).

In summary, dental research in Finland has some strong and internationally recognised research groups, but surprisingly limited front-line research in the traditionally clinically significant areas, caries and periodontal research. There is one group – the craniofacial biology group at the Institute of Biotechnology led by Professor Irma Thesleff – which is outstanding in terms of the scientific quality of research and which also stands out for devoting their research effort into one field. This group also combines basic science in animals with clinical translational research and has extensive collaborations internationally. The group is well funded both by national and international grants. The leading groups at the three dental institutes, are highly productive and are well recognised internationally within the dental field. These groups are clearly less well funded and the group leaders expressed significant concern about the difficulties in obtaining research funds and argued that special funds in the Academy of Finland should be allocated for dental research. The Evaluation Panel agrees that productive and internationally recognised research groups should be funded by national funds. However, it is conceivable that the problem in fund-raising, by at least some of the groups, is related to their tendency to run too many small, loosely connected projects. Without in depth-focused work answering specific research questions to establish a line of scientific development, dental research will not be able to compete for funds with other areas of biomedicine of which dentistry has become a naturally integrated part.

These observations have led to the following recommendations:

- The Panel encourages the dental groups and the heads of the dental institutes to work more collaboratively with other groups in medicine, biomedicine, social sciences, medical statistics and natural sciences in order to bring in new knowledge into the field and, by such means, to increase scientific potential and their ability to compete for research funds.
- The Panel encourages the groups to enhance their research focus and to follow subjects in depth to become more competitive when applying for research funds.
- The Panel encourages the research groups at the three dental research units and the dental research group at the Institute for Biotechnology to establish functional networks in order to reduce the number of small research projects and to build up a larger critical mass in areas in which translational dental research can be performed. This recommendation will be enhanced if national initiatives are established with this aim.

5.2 Consequences of outsourcing of clinical training system

Some years ago, all clinical teaching for dental students in Finland was outsourced to the community dental service. This had the benefit of providing some staff with more time for research. However, prior to outsourcing clinical teaching, junior clinical academic posts existed within universities with the post holders undertaking a mixture of clinical teaching and research. When the teaching was outsourced, these posts ceased to exist. Now, clinical teachers are employees of the community dental service, not the university and, in general, although some may be released part-time to undertake research, no permanent posts appear to have research built into their posts and there are no formal established joint posts between the university and community dental service. In order to ensure some funding for dental hospital-based research following these changes, clinical academics can have their output recognised by accessing a clinical funding stream, sourced from the Ministry of Social Affairs and Health, EVO funding.

However, the annual income from the EVO monies is firstly, significantly less than the financial value of the previous junior academic posts; and secondly, not within the Dean's budget as substantial EVO funds are controlled by the lead clinician in the clinical area of the hospital. As core funding within Dental Schools appears to be very restricted, considerable reliance is placed on EVO funding by several groups. In addition, the funding is granted on the basis of outputs in high impact journals. Both these conditions tend to have the consequence of a focus on medically-applied dental research, perhaps partly accounting for the lack of significant research groups in the traditional dental fields as noted in the previous section.

Some groups are explicitly excluded from EVO as a funding source, as they do not have a joint appointment with the hospital. The groups most notably excluded are those in dental public health. Historically, Finland has been noted for its excellence in dental public health research. Since public health dentists do not have a patient base, their research income is now comparatively limited due to the mechanism of EVO funding. Therefore, it is an unfortunate consequence that dental public health research is disadvantaged in comparison to clinical academic colleagues within Finland. Other funding options for these researchers are uncertain, as researchers in Finland informally identify three broad categories of research linked to specific funding sources. The majority of funding from the Academy is seen as for "basic science" research; funding from Tekes as "applied technical" research and funding from EVO for "clinical, patient-based" research.

Therefore, outsourcing clinical teaching appears to have had three major consequences for research:

- All junior staff posts (at Lecturer level) within Dental Schools have been lost; so eliminating the career track for dental post doctoral students.
- The overall university dental budget has reduced; although the teaching element has been replaced by the community dental service, the research element has been mainly lost.

- EVO funds are not used in relation to an overall research strategy for the School, as the majority can be controlled by groups of clinicians not under the line management of the Dean; and the sum is often greater than the whole of the Dental School's non-pay budget.

These observations have led to the following recommendations:

- There should be a joint review of the funding of Dental Schools by the Ministry of Social Affairs and Health and the Ministry of Education to identify junior posts lost from the universities when clinical teaching was outsourced; the value of EVO funding in comparison to the junior posts lost; and to consider how EVO funding can be accessed across the range of clinical dental research including dental public health.
- As the change in clinical teaching is embedded and may well have many educational advantages, consideration could be given to the establishment of some joint junior posts between the university and the community dental service; with research being an explicit component of the joint contract.

5.3 Graduate students and postdoctoral training

Background and rationale

During the evaluation period 2001–2005, the total annual number of PhD degrees at the Institutes of Dentistry in Finland varied from 11 to 21 (Table 2). Annually there were about 120 registered PhD students at the Units. It is noted that only seven out of 87 PhD students completed their doctoral dissertation before 30 years of age (Fig. 4).

The pathway for students enrolling in PhD programmes and their progress during their postgraduate experience was variable and not standardised. In a discussion with postgraduate students at Turku, Oulu, Helsinki and BI there was the perception, for those who had completed their dental education, that enrolment in a PhD programme would enhance their chances of being accepted into a specialist

Table 2. Annual number of doctoral degrees, registered postgraduate students and PhD staff at the Institutes of Dentistry.

| University | 2001 | 2002 | 2003 | 2004 | 2005 | Total (female/male) |
|------------------------|------|------|------|------|------|------------------------|
| Helsinki | | | | | | |
| PhD degrees | 5 | 3 | 6 | 8 | 5 | 27 (22/5) |
| PhD staff in the dept. | 24 | 24 | 23 | 22 | 23 | |
| Postgraduate students | 53 | 59 | 57 | 55 | 57 | |
| Oulu | | | | | | |
| PhD degrees | 1 | 4 | 6 | 4 | 5 | 20 (14/6) |
| PhD staff in the dept. | 23 | 23 | 21 | 20 | 20 | |
| Postgraduate students | 19 | 20 | 24 | 27 | 24 | |
| Turku | | | | | | |
| PhD degrees | 8 | 4 | 4 | 4 | 11 | 31 (21/10) |
| PhD staff in the dept. | 24,1 | 22 | 26 | 25,4 | 25,1 | |
| Postgraduate students | 42 | 46 | 42 | 37 | 37 | |

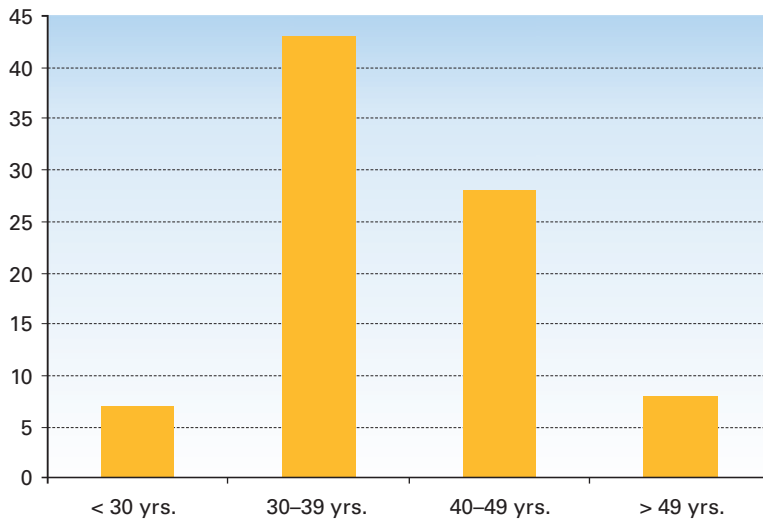


Figure 4. Number of doctoral dissertations in Finland by age in 2001–2005.

training programme. Additionally, several of the students enrolled in specialty programmes or who had completed their specialty training were continuing their PhD research in a part-time capacity. This could extend indefinitely with no formal tracking of the candidates' progress or setting time limits for attaining the PhD degree.

Those postgraduates who were basic scientists with no clinical training in dentistry or medicine were more committed to completing their PhD in a specified time period, but there did not appear to be any defined time line for expected completion of the PhD degree, and progress was largely determined by the postgraduate student's advisor. Additionally, the different programmes did not have an established core curriculum nor a structured review of progress of their postgraduate students, which depended solely on their advisor. There was no graduate oversight committee to track the progress of those enrolled in PhD programmes.

There was a lack of emphasis on collaboration both nationally and internationally. Postgraduate students were generally not being encouraged to visit other laboratories or having a funded experience at a different site/laboratory during their PhD training. This has been a core value of academia to enrich a postgraduate experience and provide networking both in translational clinical research and academic enrichment.

These observations have led to the following recommendations:

Pathways for the programmes should support interdisciplinary approaches for solving significant and complex biomedical problems, particularly those that have been resistant to traditional approaches. Opportunities for new research approaches to improving dental and human health include not only new methodological or technical approaches, but also new intellectual frameworks from which to consider the problem.

1. Each of the three universities has different strengths, research facilities and expertise. A collaborative approach to allocating funds for research support

should be encouraged rather than the current independent approach to the Academy of Finland.

2. Establish a graduate school in Finland for standardisation of policies and procedures for training and graduating PhD students on a national basis. This would provide a more equitable and comparable final product of a PhD training programme with defined pathways.
3. The current lack of recognised pathways and basic or core curricula impacts on the perceived product of the PhD training. This results in a different quality of odontological research at the different programmes in Finland with variable parameters for what constitutes a PhD thesis.
4. Pathways should be developed on a national basis for available opportunities including positions at the faculty, postdoctoral and postgraduate student levels for those seeking academic positions both in Finland and abroad.
5. The opportunity to establish networks internationally in the postgraduate's chosen field of research should be encouraged and financially supported. This pathway may include a research experience in a different but related laboratory to provide the student with a more global approach while encouraging collaborative research.
6. Establish a clinical training pathway to promote interdisciplinary and translational research initiatives. A pathway designed for clinical research training needs to develop competencies and identify outcomes to predict and tract academic success for oral health care professionals as they transition into an academic career. Immersion in the conduct of an intensive research experience provides opportunities to enhance scientific knowledge and skills to equip the individual for developing future translational and applied research in the fields of oral and craniofacial health and disease.

Future initiatives

In addition to the biological sciences, biomedical research often involves participation by other scientific disciplines, including the behavioural, quantitative, social, epidemiological, computational/information, engineering, and physical sciences. Distinct disciplinary perspectives represent significant sources of strength to the overall research enterprise, because each discipline has its own intellectual history, experimental and analytic approaches and theoretical context that produce a unique way of addressing a problem. Nevertheless, as scientific capabilities move forward, increasingly sophisticated questions arise, and these often require the convergence of perspectives from multiple disciplines. The Academy of Finland may wish to consider initiatives, mechanisms and programmes to support either disciplinary or multidisciplinary research (where multidisciplinary research is defined as bringing together different disciplines to focus on a defined problem, but keeping the disciplines distinct). Like multidisciplinary research, interdisciplinary research brings together different disciplines to address a particular issue. Unlike multidisciplinary research, interdisciplinary research takes specific attributes from the contributing disciplines and integrates them to produce a new conceptual framework. Integrating different disciplines holds the promise of opening up currently unimagined scientific

pathways of inquiry, and in the process, may form new disciplines. Historical examples include the development of genomics, which was formed from genetics, molecular biology, analytical chemistry, and informatics. The Academy of Finland may consider establishing pathways for interdisciplinary research to develop new technical and intellectual approaches to conceptualise future research problem. This would be particularly innovative in fostering careers for clinical scientists in research academia to promote a better understanding of oral and craniofacial health and disease.

5.4 Research environment and organisation

All dental schools in Finland have successfully integrated facilities for part of their research activities shared with other research groups in biomedicine and biotechnology. Only the Turku Institute maintained biomedical research facilities within the School, but instead integrated their activities in technology within the framework of a more general environment. With the limited resources that are available to Finnish Dental Schools, and to Scandinavian Dental Schools in general, this is a wise development, which will strengthen the experimental part of dental research provided that sufficient funds are available to dental researchers for them to become true part holders of the shared research facilities. The drawback of this development is that the dental research environment becomes fragmented and separated from clinical dentistry including clinical dental research, most obviously visible in Helsinki. This problem is further emphasised in Finland by the mentioned outsourcing of the clinical activities and clinical training. Keeping the different activities together to allow regular interactions between the clinical and experimental research groups is a major challenge of the leaders.

5.5 Mobility

Interactions between research groups nationally and internationally are more and more crucial to expand knowledge and to be able to create networks that can collaborate and apply for research money. Such networking also includes opportunities for postgraduate students and postdocs to visit laboratories abroad and for senior scientist to spend sabbatical periods at other laboratories.

The information obtained about visits to other laboratories and visits to the Finnish laboratories was not separated by all Institutes into activities for students, junior and senior scientists, respectively, and, therefore, cannot be analysed in detail. There were, however, rather few examples of such visits although as shown in Figures 5a–5c, which are compilations of all reported exchanges during 2001–2005.

These observations have led to the following recommendation:

- The units should incorporate into their strategic plans visits abroad by young and senior researchers which are important for their career development.
- The units should identify separate money for postgraduate and postdocs who wish to visit laboratories abroad.

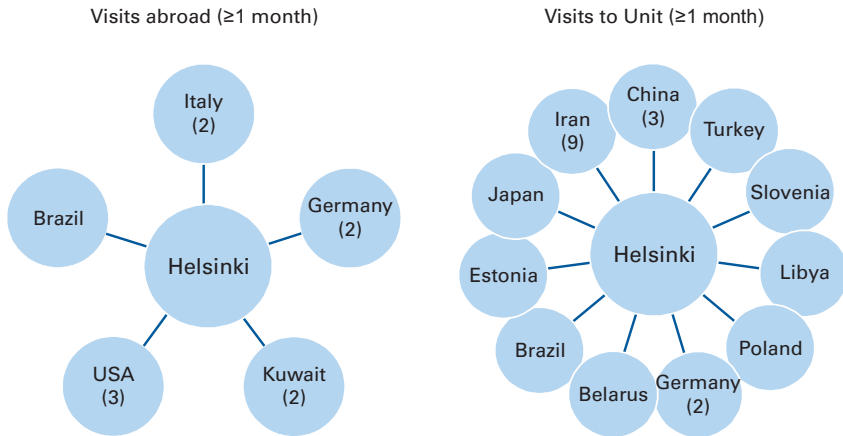


Figure 5a. International collaboration contacts (number of visitors) of the Dental Institute at the University of Helsinki in 2001–2005

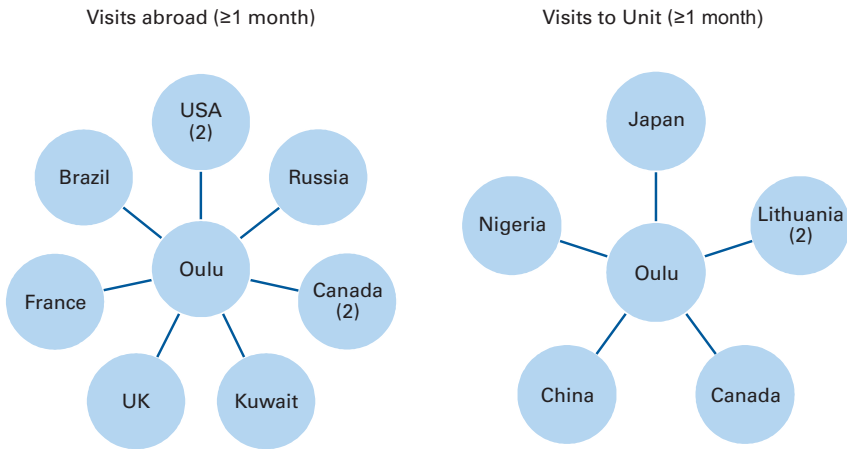


Figure 5b. International collaboration contacts (number of visitors) of the Dental Institute at the University of Oulu in 2001–2005

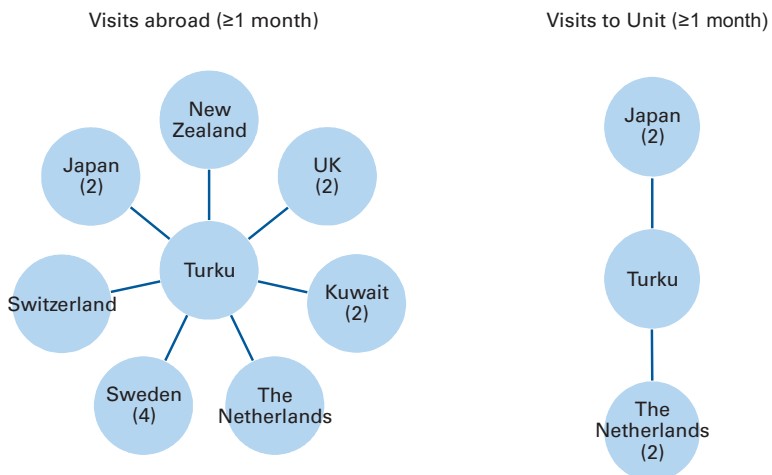


Figure 5c. International collaboration contacts (number of visitors) of the Dental Institute at the University of Turku in 2001–2005

5.6 Economy in general, budget for research, strategic plans and management

The Evaluation Panel noted that there were large differences between the three Dental Schools in the proportion of external and internal funds (Fig. 6a). Turku had proportionally much larger external grants compared to Helsinki and Oulu, although the relative amount of external grants in Turku has decreased during the last years. These figures show that it is possible for Dental Schools in Helsinki and Oulu to enhance their external funding.

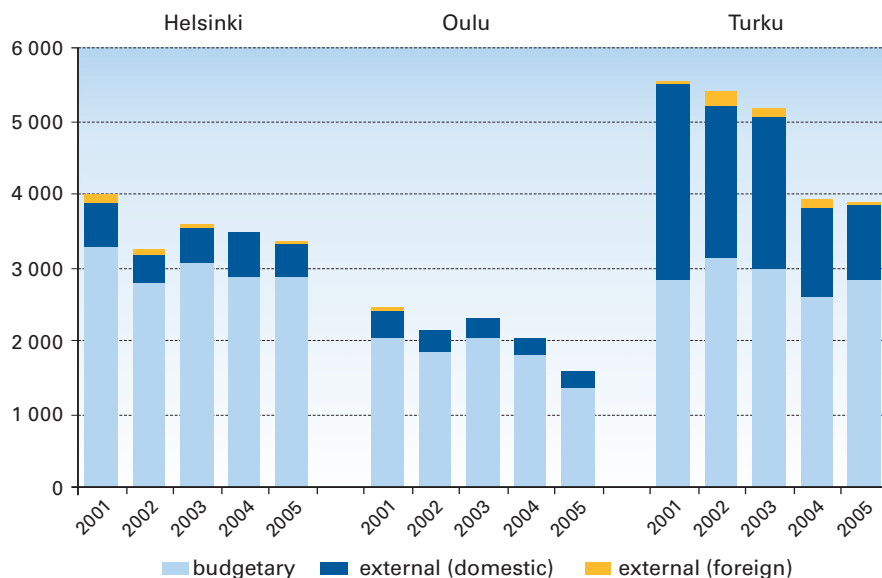


Figure 6a. Funding obtained by Institutes of Dentistry in 2001–2005 (hundred thousand €)

The craniofacial development group at the Institute for Biotechnology is, to a large extent, financed by external grants, which usually is the case for groups at such institutes (Fig. 6b). However, it is interesting to note that dental research can also attract significant income. Therefore, the Panel recommends that research groups at the three Dental Schools arrange joint meetings to learn from the dental research group at the Institute for Biotechnology how to successfully approach funding organisations and how to build up research teams to carry out competitive research projects/programmes.

Table 3 shows the annual average staff numbers, doctoral dissertations and funds for the period 2001–2005. It is evident that the total funding for Turku is almost twice as much as for Helsinki and Oulu, mainly due the fact they have been successfully attracting external grants. It has resulted in recruitment of many more researchers and technical/administrative staff. However, the outcome of research activities, as assessed by the number of publications during the 2001–2005 period, seem to be equal with Helsinki, and about 40 per cent larger than Oulu. It may be that proportionally more publications will follow after 2005, given the delay between data collection and publication. The difference could also be explained, if the type of research activities conducted in Turku at the Institute for Biotechnology is more expensive than those at the other dental schools.

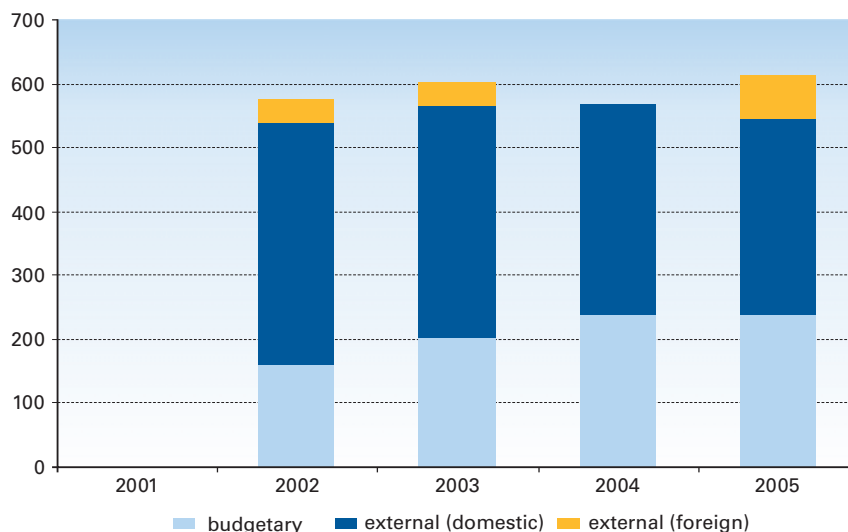


Figure 6b. Funding obtained by the Institute of Biotechnology/Molecular Regulation on Craniofacial Development group in 2002–2005 (hundred thousand €).

This section of the report considers some of the structural economic issues of dental education in Finland; some specific budgetary matters, strategic planning and management. It is noteworthy that the only permanently funded positions are at professorial level. All professors are expected to undertake research. There are commonly two senior lecturer positions, which may be designated as one for teaching, one for research dependent on the institute. These positions appear to be available on five-yearly renewable contracts. No positions seem to be available at the lecturer or postdoctoral level.

The lack of junior academic positions within University Dental Schools has several consequences, for example:

- Results in a comparably older age profile for permanent dental academics;
- Restricts succession planning;
- Considerably reduces the attractiveness of an academic career to young dentists completing their PhDs;
- Professorial positions tend to be limited to the main dental disciplines;
- Research activity is often dispersed across many separate areas with only one or two people involved.

In general, there was a notable absence of strategic planning by Deans of Dental Schools, for example, none had a written overall research strategy for the School. Management appeared to be focused on disposing of the non-pay budget and there was a general lack of School-wide management of research activities. Essentially, each professor was seen as responsible for their own research area only, with no cross-cutting research programmes agreed as School-wide priorities. This had some clear advantages. For example, able researchers who were successful in securing external funding, e.g. from the Academy, EVO, Tekes, had the academic and physical space to grow their groups. A disadvantage was the existence of several small groups, essentially lone researchers who inevitably could not compete in the same way. This was confounded as noted above by the fixed subject areas of professorial posts.

Table 3. Some productivity indicators of dental researchers in Finland: annual averages during 2001–2005. *Note:* The numbers in doctoral training as well as core funding are not directly comparable between the left (Helsinki, Oulu, Turku) and right section (BI, NPHI) of the Table.

| | | Helsinki ¹ | Oulu | Turku ² | BI ^{3,4} | NPHI ³ |
|-----------------------|-------------------------------------|-----------------------|-----------|--------------------|-------------------|-------------------|
| Staff, FTE | Professors | 9,0 | 6,8 | 7,3 | 1,0 | 0,5 |
| | Researchers | 27,0 | 25,2 | 47,1 | 10,0 | 3,0 |
| | Techn & Adm Staff | 5,0 | 9,8 | 28,3 | 3,0 | |
| | Total Staff | 41,0 | 41,8 | 82,7 | 14,0 | 3,5 |
| Doctoral training | PhD Degrees | 5,4 | 4,0 | 6,2 | 7,0 | 2,0 |
| | PhD students | 56,2 | 22,8 | 40,8 | 13,0 | 5,0 |
| | PhD degrees/all profs | 0,60 | 0,59 | 0,85 | 7,00 | 4,00 |
| | PhD students/prof | 6,24 | 3,35 | 5,59 | 13,00 | 10,00 |
| Funding | Total Budget | 3 783 400 | 2 197 796 | 6 369 659 | 2 959 737 | 149 609 |
| | Core funding ⁵ | 2 976 800 | 1 824 000 | 2 878 000 | 1 002 600 | 57 540 |
| | Basic share | 79 % | 83 % | 45 % | 34 % | 38 % |
| | External funding, total | 554 600 | 280 640 | 1 899 592 | 1 907 133 | 92 069 |
| | Academy funding | 199 000 | 59 240 | 113 188 | 1 053 933 | 26 051 |
| | Academy share | 5 % | 3 % | 2 % | 36 % | 17 % |
| | Tekes funding | 1 600 | 30 616 | 1 464 291 | | |
| | EU funding | 51 400 | 3 269 | 14 534 | 67 500 | |
| Scientific publishing | Aver. of peer reviewed publications | 74,2 | 50,6 | 71,8 | 9,4 | 4,4 |
| | Publ/Prof, FTE | 8,2 | 7,4 | 9,8 | 9,4 | 8,8 |
| | Publ/Staff, FTE | 1,8 | 1,2 | 0,9 | 0,7 | 1,3 |
| | Core+AF fund/publ, € | 2 979 482 | 1 825 171 | 2 879 576 | 1 114 721 | 63 461 |
| | Tot fund/publ, € | 50 989 | 43 435 | 88 714 | 314 866 | 34 002 |

¹ Doctoral training numbers may include also doctoral degrees supervised by other institutes (BI, NPHI)

² No undergraduate facility until the year 2004

³ Doctoral training numbers indicate the number of supervised thesis, since doctoral degrees are not granted by these institutes.

⁴ Funding for the year 2001 was estimated according to details given for the years 2002-2005.

⁵ Total core funding numbers given according to KOTA data base for the Dental Institutes in Helsinki, Oulu and Turku include also funding not connected to research, and this amount varies between the actors. In Turku, core funding number contains 450.000 euro of the EVO-compensation funding allocated to the Hospital District of the Southwest Finland. For BI and NPHI, the core funding numbers are not straightly available in KOTA data base.

Abbreviations:

BI = Biotechnology Institute, University of Helsinki

FTE = full-time equivalent of a man-year (a min of 36 hours/week)

KOTA = Finnish university data base

A key reason cited for the lack of strategic planning was that they considered they had very little funding available from which to plan. They identified that the vast majority of their budget was taken up by salaries with little disposable income, that is, a small non-pay budget. It was evident that Deans and their senior colleagues did not consider salaries as part of the budget available to deploy. Re-allocation of staff time to meet institutional research objectives would require staff annual review with specific performance targets and allocating staff time to particular activities including directing support staff to priority research areas. This approach could result in

targeted growth of productive teams. The Panel did note particular funding difficulties at Turku where dental education has re-started but full funding is awaited as it is only granted on exit numbers.

The findings from these considerations have led to the following recommendations:

- Heads of Dental Schools should be encouraged to develop research strategies for their Schools with priority areas identified.
- Appropriate support and management training should be made available to Heads of Schools, particularly in staff development and budgetary matters from an institutional perspective in order to support the delivery of research strategies.
- Research groups in Finland should take advantage of the experience of the experimental dental research group at the Institute of Biotechnology in their knowledge of how to develop competitive research activities.

5.7 Recruitment of researcher/teacher

Despite difficulties in recruiting dentists to undertake research leading to a PhD, the Evaluation Panel met a number of young dentists who were doctoral students. Very few planned to follow an academic career, several cited the lack of junior faculty positions, while a few saw a PhD as an advantage in applying for subsequent specialty training rather than entry into an academic career. Several senior faculty members noted that they had a network of former PhD students who were now engaged in the community dental service. Some of these community dentists were teaching students on outreach placements. However, very few had the opportunity to undertake any substantive further research as their time was fully taken up with providing clinical service or teaching. In most instances, dental doctoral students were undertaking their PhD part-time over many years, providing a further limitation to efficient entry to an academic position.

These three factors, namely:

- Limited number of dentists undertaking doctoral research
- Very lengthy part-time doctoral study
- Lack of permanent junior positions in Dental Schools

Combine to act as a barrier to the recruitment of academic dental staff.

Without correcting these factors, the ageing profile of clinical academics in the three Dental Schools, depicted in Figure 7, will continue to the point where most dental academics will have retired. This will mean that there will be very few senior dentists remaining to supervise new doctoral students, to be mentors for career and research development, and this will result in further decline of the academic base. This problem can only be confounded by potential plans to open a fourth Dental School. If this plan were to go ahead under current circumstances, the Evaluation Panel has concerns that this will lead to further erosion of the academic base supporting dental research.

In taking these factors into account, the following recommendations are made:

- A new generation of research-led academic clinical dental staff should be developed and a National Research School should incorporate this objective in its strategy.
- Some permanent junior clinical academic posts should be established in each Dental School to provide a career path for existing dentists who have completed their doctoral research and who have the potential to become future academics.
- The structure of programmes and support for dentists undertaking PhDs should be re-examined with a view to ensuring that those undertaking research part-time complete in a timely fashion, e.g. within a maximum of seven years. In some instances, this may require closer cooperation with the Ministry of Social Affairs and Health, so that dentists can be funded to be released from clinical duties to undertake research.

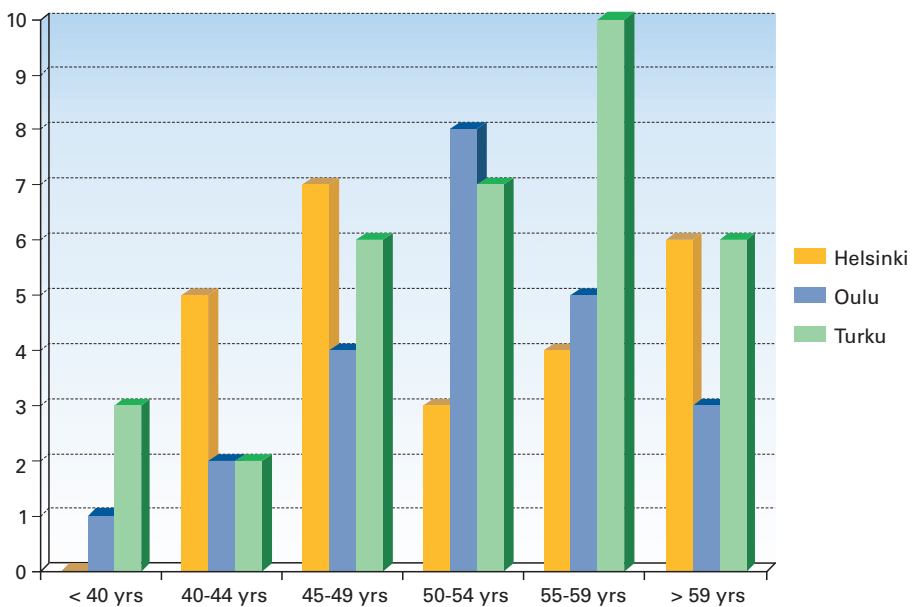


Figure 7. Number of professors and senior teachers in Finland by age in 2007.

6 FUNDING OF DENTAL RESEARCH BY THE ACADEMY OF FINLAND

The number of applications submitted to the Academy of Finland by dental researchers during 2001–2005 is shown in Table 4, including details for the different categories. These data show that dental scientists in Finland apply for funding and that their applications are funded. In total, 42 applications were funded in 2001–2005 and received 3,788,175 euros. Therefore, dental research was supported by approximately 760,000 euros annually from the Academy of Finland.

Many dental scientists expressed their disappointment during the site visits because of the perceived difficulty in obtaining grants from the Academy. However, when the success rates for dental applications are compared to those of all applications (Table 5), it is clear that for some categories (Academy Professors, Academy Research Fellows), dental researchers are considerably more successful than the average; and, that for other categories (Senior Scientists, Postdoctoral Researchers, Research Projects), the success rate is very close to the average. Given that so many researchers expressed the opinion that they could not compete with other biomedical researchers, the Evaluation Panel was very surprised to see these figures.

Nevertheless, Table 4 does show that the numbers of applications from the dental field are rather small. Dental researchers should be encouraged to apply more often from the Academy of Finland in view of the comparatively high success rates. In fact, the cumulative success rate during 2001–2005 was 35–37 per cent for dental applications, which is a high success rate compared to those in general, and for research councils in other countries. The cumulative average of 24 per cent for all applications submitted to the Academy of Finland is, however, more in the usual range obtained internationally.

The findings from these considerations have led to the following recommendations:

- Dental research groups should apply more often funding from the Academy of Finland.

Table 4. The Academy of Finland's funding for odontological research in 2001–2005. These numbers are calculated according to given researchers and their project collaborators during the evaluation.

| Academy of Finland's funding form | Funding applied | | Funding granted | |
|---|-------------------|-----------|------------------|-----------|
| | € | Number | € | Number |
| Research posts | | | | |
| Academy Professors | 620 771 | 3 | 190 616 | 1 |
| Project funding for Academy Professors | 341 981 | | 341 982 | |
| Academy Research Fellows ¹ | 2 593 849 | 15 | 790 435 | 9 |
| Project funding for Academy Research Fellows | 306 626 | | 225 490 | |
| Postdoctoral Researchers ² | 1 909 959 | 21 | 376 329 | 6 |
| Project funding for Postdoctoral Researchers | 136 809 | | 65 067 | |
| Subtotal | 5 909 995 | 39 | 1 989 919 | 16 |
| Research programmes | | | | |
| Center of Excellence (CoE) ³ | 1 065 655 | 1 | 450 000 | 1 |
| Digital Data Resources Research (DIGI), Russia in Flux, Environmental Health Research (YMPTER), Infrastructure (INFRA), Health Promotion Research (TERVE), Health Services Research (TERTTU), Life 2000, Microbes and Man Research (MICMAN), Research Programme on Biological Functions, Systems Biology and Bioinformatics Research (SYSBIO) | 1 937 838 | 10 | 512 550 | 3 |
| Subtotal | 3 003 493 | 11 | 962 550 | 4 |
| Research funding | | | | |
| Research projects | 5 818 842 | 28 | 562 900 | 7 |
| Senior Scientists | 806 793 | 5 | 116 360 | 2 |
| Funding for returning researchers | 90 305 | 1 | 21 980 | 1 |
| Invitation of foreign researchers to Finland | 8 500 | 1 | 9 630 | 1 |
| International conferences | 96 122 | 4 | 84 169 | 4 |
| Subtotal | 6 820 562 | 39 | 795 039 | 15 |
| International researcher training | | | | |
| Researcher training and research abroad | 134 661 | 4 | 17 325 | 2 |
| Bilateral exchange programmes ⁴ | 24 939 | 5 | 23 342 | 5 |
| Subtotal | 159 600 | 9 | 40 667 | 7 |
| Total | 15 893 650 | 98 | 3 788 175 | 42 |

¹ Includes Academy Research Fellows and the former Senior Researcher's post forms of funding.

² Includes Postdoctoral Researcher post (for single researchers, groups and public administration/ industry) as well as Postdoctoral Researcher's project forms of funding.

³ Funding for the whole CoE: 3,196,964 euros applied, 1,323,716 euros granted

⁴ Includes bilateral exchange programmes with Germany (DAAD), Japan and the Netherlands (NWO).

Table 5. Success rates for odontology vs. other fields within the Research Council for Health of the Academy of Finland during 2001–2005.

| Funding during 2001–2005 ¹ | AF category: Odontology ² | | | Researchers Evaluated ³ | | | Total, Health Research Council | | |
|---------------------------------------|--------------------------------------|---------|------------------|------------------------------------|---------|------------------|--------------------------------|---------|------------------|
| | Applied | Granted | Success rate (%) | Applied | Granted | Success rate (%) | Applied | Granted | Success rate (%) |
| Academy Professors | 3 | 1 | 33 | 3 | 1 | 33 | 106 | 7 | 7 |
| Academy Research Fellows ⁴ | 8 | 4 | 50 | 15 | 9 | 60 | 385 | 58 | 15 |
| Senior Scientists | 6 | 2 | 33 | 5 | 2 | 40 | 143 | 48 | 34 |
| Postdoctoral Researchers ⁵ | 11 | 3 | 27 | 21 | 6 | 29 | 558 | 182 | 33 |
| Research projects ⁶ | 27 | 8 | 30 | 28 | 7 | 25 | 852 | 273 | 32 |
| Total/success rate mean | 55 | 18 | 35 | 72 | 25 | 37 | 2 044 | 568 | 24 |

¹) Generally, the call for research posts has been open during the previous year than the decision has been made.

²) Discipline or research field

³) Main actors and project collaborators

⁴) Includes Academy Research Fellows and the former Senior Researcher's post forms of funding

⁵) Includes Postdoctoral Researcher post (for single researchers, groups and public administration/industry) as well as Postdoctoral Researcher's project forms of funding

⁶) General Research Grants

A. TERMS OF REFERENCE

This document sets out the standard Terms of Reference applicable to the Panel as well as to the coordinator. The contents of this document are relevant both to the evaluators and the units being assessed. This document should be read in conjunction with the Instructions to Submission Form, which will be used by the units being assessed (hereafter referred to as the unit) when preparing their evaluation documents. The unit refers to the institute or equivalent that is involved in the evaluation.

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1 Background and purpose

Discipline and research field evaluations at the Academy of Finland are one of the key elements in the long-term development of research and science policy in Finland. In its performance agreement for the year 2006, the Research Council for Health together with the President of the Academy of Finland decided that the quality and status of Finnish dental research be evaluated with respect to the international level. The field of Finnish dental sciences has not been comprehensively evaluated before, so the evaluation was considered highly relevant and justified. In addition, the original proposal for this evaluation came from researchers in the field. It was estimated that approximately two hundred researchers would be involved in the evaluation.

The evaluation should cover the discipline of odontology nationwide with a view of assessing the strengths and weaknesses of Finnish dental research and of securing internationally high-standard research/researchers in the future.

The present evaluation combines an external assessment by an international Evaluation Panel with an internal self-assessment exercise. The purpose of the evaluation is to support the development of this research field in the future. The main objectives of the external evaluation are: to examine the quality of the research of the units during 2001–2005; and to provide recommendations on how to develop the research and researcher posts of the field in the future.

2 Definition of the field to be evaluated

The field to be evaluated consists of odontological/dental research. It may also include research from certain other areas of medical sciences (e.g. medicine, biomedicine, social medicine, health care), natural sciences (e.g. cell and developmental biology, physiology, biochemistry, molecular biology, microbiology, genetics), as well as more technical sciences (e.g. chemistry and tissue technology), if they are vitally linked to dental research. The evaluation should be focused mainly on the field, not on a unit, research group or individual researchers, although these structures form the basic tools for the evaluation.

3 Organisation

The evaluation is commissioned by the Research Council for Health of the Academy of Finland. The Council appointed a Steering Group to lead and support the execution of the evaluation.

The evaluation is carried out in cooperation with other organisations providing funding for the field, including the Ministry of Social Affairs and Health (STM), the Ministry of Education (OPM), Tekes – Finnish Funding Agency for Technology and Innovation and the Finnish Dental Society, Apollonia.

The members of the Steering Group in 2006 were:

Kalervo Väänänen, Professor, Chair of the Research Council for Health, Academy of Finland, Chair of the Steering Group
Hilke Soininen, Professor, Research Council for Health, Vice Chair of the Steering Group
Tuula Salo, Professor, Research Council for Health

The members of the Steering Group in 2007 are:

Kalervo Väänänen, Professor, Chair of the Research Council for Health, Academy of Finland, Chair of the Steering Group
Anna-Elina Lehesjoki, Professor, Research Council for Health, Vice Chair of the Steering Group
Tatu Juvonen, Professor, Research Council for Health

The appointed coordinator, a list of the invited Panel members, a list of the evaluation documents to be submitted, and the initial Terms of Reference have been reviewed and approved by the Steering Group 2006. The Terms of Reference have been finally approved by the Steering Group 2007, after compiling the experiences received from the researcher seminar held in December 2006.

4 International Evaluation Panel

The external evaluation will be carried out by an international Panel of independent high-level experts.

The Academy of Finland has invited six renowned scientists as Evaluators:

Chair

Professor Ulf Lerner, University of Umeå, Sweden
(oral biology, basic odontological research)

Vice Chair

Professor Cynthia M. Pine, Liverpool University School of Dentistry, UK
(epidemiology, evidence-based dental research)

Members

Professor Anne Christine Johannessen, University of Bergen, Norway
(oral pathology)

Professor Mogens Kilian, University of Aarhus, Denmark (dental microbiology)

Professor Rainer Schmelzeisen, Albert-Ludwig-University Freiburg, Germany
(oral and facial surgery)

Professor Katherine Vig, Ohio State University, USA (orthodontics)

5 Objectives of the evaluation

The purpose of this exercise is to evaluate Finnish odontological/dental research as well as medical or natural science related research close to it. The evaluation period is 2001–2005, on which the future recommendations to be provided will be based.

The objectives of the evaluation are:

- 1) To evaluate the scientific quality of dentistry in Finland as compared to the international level
- 2) To identify the strengths and weaknesses of the research
- 3) To estimate communication and collaboration with key partners at home and abroad
- 4) To estimate the significance of dentistry to Finnish society
- 5) To evaluate the efficacy of the research, i.e. how much scientific output is produced in relation to the resources invested
- 6) To evaluate the quality of researcher training
- 7) To make suggestions and recommendations to ensure the supply of qualified academic professionals in Finland in the future
- 8) To make suggestions and recommendations for the further development of dental research and research policy in Finland

6 Evaluation criteria

The basic unit to be evaluated by the Panel is a university institute or a relevant part of it (Appendix 1: Instructions to Submission Form). The units are mainly interdisciplinary research environments. Each unit will be evaluated as such, but the focus is on the research field as a whole.

The Panel is asked to give:

- A written statement of the quality of the research, achieved results, scientific contribution as well as doctoral training,
- A written statement of the quality and efficiency of the research environment and organisation,
- Written feedback about the interaction between research and society, and the impact of it,
- Recommendations for the future of the field.

The main emphasis is on scientific evaluation. The Panel should ensure that the evaluation takes into account all relevant material available.

6.1 Scientific quality of the research

The Panel's main role is to evaluate the quality of research. The quality statement is based on the evaluation documents submitted by the units. The Panel members will have the opportunity to complete this information during their site visits. All research, whether basic or applied, should be given equal weight.

The quality statement must reflect the work of all the research staff listed in a unit.

Important issues to be considered include:

- What is the international quality and status of the unit's research?
- What are the competence and cooperation relationships of the research group?
- What is the significance of the research projects to the professional promotion of the research career?
- How innovative and challenging are the research programmes and research lines?
- What is the impact and status of the research within each research sub-field?

6.2 Research environment and organisation

The evaluation deals with research environments, prevailing research practices and collaborative networks.

Important issues to be considered include:

- What kind of research environment facilitates the research in terms of funding, infrastructure and mobility (strengths, weaknesses, needs for improvement)?
- What is characteristic to the activity, management and administration in the field?
- Are the national and international networks sufficient (universities, research centres, enterprises)?
- How does the research of the research group interrelate with the strategies of the parent organisation?
- What is the role of interdisciplinarity within the research groups as well as in the whole field?

6.3 Interaction between research and society

The Panel is asked to write feedback about the interaction between research and society. The feedback is to be based on all the evaluation documents as well as interviews. The Panel should especially consider other activities such as expert tasks,

health care improvements, popularised works, patenting, technology transfer and cooperation with other sectors of society. Bearing in mind that the assessed research field is dentistry, the Panel should pay special attention to the contribution of each unit to treatment or health-political regulations and norms as well as to the relevance of the research on a national and international level.

The questions to be asked are “How actively and efficiently does the unit communicate its points and findings to various stakeholders and the rest of society?” and “In what way has the research of the unit and its cooperation with other actors of society contributed to the success of these actors?”. The Panel should consider this issue from the point of view of, for example, development of dental health care systems, production and use of novel technical/treatment solutions, social and health-political actions, establishment of new regulations and norms (e.g. Current Care recommendations), common understanding on dental care, industry, enterprises etc. The Panel is asked to discuss the interaction between the research of the unit and society from the relevant aspects.

Important issues:

- How fruitful is cooperation between the unit and the communities ultimately applying the results of the research, and what kinds of results have been achieved?
- Is the research of the field relevantly focused with respect to the future scenarios of the national as well as international developments?
- What is the academic and non-academic (business R&D, administration) need for research doctorates in the field, and how well is it met with the current intensity of doctoral training?
- In case of innovations, how promptly and efficiently are the intellectual property rights protected to enable rapid technology transfer to parties capable of developing new products for the market?
- Is sufficient and systematic effort made to find suitable collaborators for commercialising innovations?

6.4 Panel recommendations for the future

The Panel is asked to provide recommendations for the future development of the research field. The Panel will need to consider that the recommendations should be focused mainly on the field, not on single units, research groups or researchers.

Key issues to be addressed are:

- What strengths and weaknesses does the field have in Finland, for example is there missing expertise in certain sub-fields or overrepresentation compared to the total research volume?
- What opportunities and challenges does the field have?
- How should the field improve its performance in carrying out its research?
- What kinds of means could be recommended to improve and strengthen the research performance at various levels?

The Panel should provide recommendations on:

- Research representing single-, multi- and interdisciplinarity
- Development of research: staff, environment and infrastructure

- Strengthening the effectiveness and impact of the research on society
- Development and securing of training and research enthusiasm
- Suggestions for how to guarantee enough research-active staff in the future?
- Other issues

7 Tasks, responsibilities and working arrangements of the Panel

In conducting the expert evaluation, the Panel members will base their examination on desk research at home on the basis of the background information to be provided. Ultimately, this will supplement their view during the site visits in Finland.

The Panel members will set responsibilities within the panel and together with the evaluation office at the Academy of Finland. All evaluation documents are provided by the evaluation office. For the full description of the research-active staff and the evaluation documents please see the Instructions to Submission Form (Appendix 1), which will be used by the units being assessed when preparing their evaluation documents.

7.1 Desk research

Desk research will be carried out before the site visits. The material includes facts about

- the research staff and funding.
- list of publications
- collection of the best publications of senior researchers
- list of doctoral theses
- lists of visits and collaborations
- self-assessment exercise of the unit
- lists of research fields classified by IADR

7.2 Site visits and interviews

The site visits will consist of the following sessions:

- A session for presentations organised and selected by the institute
- Interview of a subset of researchers during the site visit, for example:
 - Heads of Units (research)
 - Professors, senior staff, postdoctoral researchers, visiting foreign scholars
 - PhD students, junior researchers

The specific timetable and instructions will be provided by the evaluation office at the Academy of Finland in due time.

7.3 Confidentiality and secrecy

The Panel members undertake not to make any use of and not to divulge to third parties any public or non-public facts, such as information, knowledge, documents or other matters communicated to them or brought to their attention during the performance of the evaluation. Confidentiality must also be maintained after the evaluation process has been completed.

7.4 Publicity of the evaluation material

The evaluation and the ratings are confidential and for official use only. Once the evaluation has been completed, panellists are required to destroy all evaluation documents and any copies made of them, or return them to the Academy. The evaluation report is confidential and only for official use until publication.

The evaluation report including the main recommendations is based on the evaluation criteria defined by the Academy of Finland. The evaluation report will be written and edited by the Panel members (main responsibility of the Panel Chair) with the assistance of the Evaluation Coordinator. Prior to final editing and publishing, the units being assessed are given the opportunity to review the report to correct any factual errors. The Academy will publish the final evaluation report in the Publication series of the Academy of Finland in both printed and electronic form (www.aka.fi/publications).

7.5 Conflicts of interest

The Panel members are required to declare any personal conflicts of interest. They must disqualify themselves if they can in any way benefit from a positive or a negative statement concerning the research group under evaluation. They must also disqualify themselves in the following circumstances:

- They have close collaboration with the research group to be evaluated (e.g. have co-authored a scientific article, research plan or funding application during the past three years, or are planning to co-author one/some of these during the near future).
- They have acted as a superior, subordinate or instructor of the research group during the past three years
- The member of the research group is a close person to them. A close person is:
 - 1) their spouse (also *de facto*), child, grandchild, sibling, parent, grandparent or a person otherwise especially close to them (e.g. fiancé/e or a close friend), as well as their spouses (also *de facto*),
 - 2) a sibling of their parent or his/her spouse (also *de facto*), a child of their sibling, their previous spouse (also *de facto*),
 - 3) a child, grandchild, sibling, parent or grandparent of their spouse as well as their spouses (also *de facto*), a child of a sibling of their spouse,
 - 4) or a half-relative comparable to the above mentioned.

The Panel member is also disqualified if his/her impartiality may otherwise be endangered, or if they feel that he/she has a conflict of interest and is therefore disqualified to evaluate the research group.

Therefore, if you feel that you are unable to evaluate a research group, you must notify the Academy as well as the other Panel members of it as soon as possible. The clarification of all conflict of interest matters must preferably be done during the first Panel meeting.

7.6 Declaration

Accepting the task as a member of an evaluation Panel, I guarantee not to disclose the information I get as panel member and not to use it for anybody's benefit or disadvantage as it is stipulated in paragraph "Confidentiality". Further, I affirm that if

I have a conflict of interest I will immediately inform the Academy as well as the other panel members of it.

8 Timetable of the evaluation process

| | |
|---------------------|---|
| 2005 <i>Dec</i> | Hearing of the representatives in the field |
| 2006 <i>May</i> | Appointment of the Steering? Group |
| 2006 <i>Sep</i> | Appointment of the Evaluation Coordinator |
| 2006 <i>Oct-Nov</i> | Appointment of the Evaluation Panel |
| 2006 <i>Dec</i> | Definition of evaluation criteria |
| 2006 <i>Dec</i> | Onset seminar |
| 2007 <i>Jan-Mar</i> | Preparation and delivery of evaluation documents |
| 2007 <i>Jun</i> | Site visits to the units being assessed |
| 2007 <i>Aug-Oct</i> | Preparation of the report |
| 2007 <i>Nov-Dec</i> | Publication and release of the report |
| 2008- | Follow-up of the implementation of the provided recommendations |

9 Coordination of evaluation

The evaluation process is operationally coordinated by the Evaluation Team: Coordinator Riitta Pahkala from Kuopio University Hospital, Science Adviser Hannele Lahtinen and Director Riitta Mustonen from the Health Research Unit of the Academy of Finland (evaluation office). The duties of the Coordinator are to compile the evaluation documents collected from the field as well as to assist the Panel during the site visits and the report editing. The administrative support and assistance for the evaluation Steering Group and Coordinator as well as the practical details of the seminars and site visits are organised by the Academy of Finland.

10 Funds

The evaluation is funded by the Research Council for Health of the Academy of Finland. The Academy will pay an expert fee to the Panel members. All travel expenses related to the Panel's visits and accommodation in Finland will be covered or reimbursed by the Academy of Finland.

Helsinki, 30 January 2007

Kalervo Väänänen
Chair of the Steering Group
Research Council for Health
Academy of Finland

B. MEMBERS OF THE EVALUATION PANEL

Brief introduction

Ulf Lerner (Chair of the Evaluation Panel)

Professor and Chair of the Oral Cell Biology
(Oral Biology, Basic Odontological Research),
Faculty of Medicine, Umeå University, Sweden

Ulf Lerner received his DDS degree from the Dental Faculty, Umeå University, in 1971 and a PhD degree in Oral Pathology in 1980. He is trained in oral histopathology and served as senior consultant in oral pathology diagnostic service until 1991 and held a position as Associate Professor in Oral Pathology until 1991, when he took up a position as Professor in Oral Cell Biology at Umeå University. He has experienced in clinical dentistry as a general practitioner in both the county council system and in private dentistry and is still serving part time as general practitioner. He has been Vice Dean at the Faculty of Odontology at Umeå University and was the first head of the Department of Odontology, when the Faculties of Odontology and Medicine merged in 1999. He is currently a member of the Board for the Faculty of Medicine. His primary research interest is in bone biology and pathology from a clinical, cellular and molecular perspective with main interest in inflammation and hormonal induced bone remodelling, which has resulted in more than 200 original publications, book chapters and reviews. He has been a member of the Board of the Medical Research Council for Medicine and currently serves at the Board of the Swedish Research Council for Medicine. He has served as an evaluator for research councils in several countries and as a regular reviewer for more than 25 scientific journals. He has received several awards including SalusAnsvar's Nordic Price in Medicine.

Cynthia Pine (Vice Chair of the Evaluation Panel)

Professor and Consultant in Dental Public Health
(Epidemiology, Dental Public Health, Evidence-Based Dental Research),
Dean of Dental Studies, University of Liverpool, England, UK

Cynthia Pine is Professor of Dental Public Health and Primary Dental Care, School of Dental Sciences, University of Liverpool. She graduated in dentistry (BDS) in 1976 and received her PhD in 1982 both from the University of Manchester and a Master's in Business Administration in 2001 from the University of Dundee. She has been a Lecturer at the University of Manchester, and at the University of Dundee: Senior Lecturer, Reader and awarded a Personal Chair. She has been a Visiting Research Fellow at the National Institutes of Dento-Craniofacial Research (NIDCR) of NIH working with Dr Albert Kingman, Head of Biostatistics. She is a dental epidemiologist with a focus on childhood dental caries and the evaluation of caries preventive agents and procedures through randomised controlled trials. Her research

extends into evaluations of behaviour change in relation to dental health behaviours in children and families. She is Director of the WHO Collaborating Centre for Research in Oral Health of Deprived Communities. She is the editor of the international textbook *Community Oral Health*, and Founding President of the European Association of Dental Public Health. She has published widely and received research grants from NIDCR, the Departments of Health in the UK and industry. She is a member of the College of Experts of the UK Medical Research Council and a member of the Dentistry Panel of the UK Research Assessment Exercise (2008). In 2006, she was honoured by the Queen for *Services to Dentistry* and made a Commander of the British Empire, CBE.

Anne Christine Johannessen

Professor and Consultant in Oral Pathology (Oral Pathology),
Institute of Oral Sciences – Oral Pathology and Forensic Odontology,
Faculty of Dentistry, University of Bergen and Haukeland University Hospital,
Bergen, Norway.

Anne Christine Johannessen graduated in both dentistry (1977) and medicine (1988) from the University of Bergen and received a PhD (Dr Odont.) from the same university (1990). Since then, she has worked as Associate Professor and later as Professor (1995) in Oral Pathology at the Faculty of Dentistry, University of Bergen. She has been a member of the University Board and is in her second term as Vice Dean for research and research education at the Faculty. Her research focus is on immune defence of oral mucosa and oral cancer. She has also extensive research experience from developing countries, especially in Africa. Professor Johannessen has published more than 100 peer-reviewed scientific papers in international journals.

Mogens Kilian

Professor and Chair (Oral Microbiology and Immunology),
Institute of Medical Microbiology and Immunology,
University of Aarhus, Denmark

Mogens Kilian received his DDS degree from the Royal Dental College, Aarhus, in 1968 and his DSc degree in 1976. After one year of clinical dentistry he carried out formal training in molecular biology and in clinical microbiology. He was a visiting Associate Professor for two years in the Department of Microbiology, University of Alabama at Birmingham, USA, in 1977–1979. From 1981 to 1991, he was Professor and Chairman of the Department of Oral Biology, Royal Dental College, Aarhus, and since 1991 Professor and Chair of Medical Microbiology at the University of Aarhus, where he also served as a member of the University Senate for many years. His primary research interests are bacterial population genetics as a tool in the understanding of the aetiology of oral and medical infections, mucosal immunology, bacterial genomics and evolution reported in more than 170 original publications and 60 book chapters and reviews. He has been a member of several advisory boards at the National Institutes of Dental and Craniofacial Research and in the European Union, and served as chair of an international committee, which evaluated Swedish

dental research. He has been a member of several editorial boards of scientific journals in dentistry and medical microbiology, and serves as a regular reviewer for more than 20 journals. He has received many awards and is an elected fellow of the American Academy of Microbiology.

Rainer Schmelzeisen

MD, DDS, FRCS, Professor and Chair (Oral and Maxillofacial Surgery),
Department of Oral and Maxillofacial Surgery,
University Clinic Freiburg, Germany

Rainer Schmelzeisen graduated in both medicine (1982) and dentistry (1983) from the Johannes-Gutenberg-University Mainz. In 1988, he specialised in Oral and Maxillofacial Surgery (Medical University Hanover), where he worked as Assistant Professor from 1985–1996. In 1997, he became Professor and Chair of the Department of Oral and Maxillofacial Surgery of the University Clinic Freiburg. In 1992, he received the annual award of the German Association for Plastic and Reconstructive Surgery, in 1995 the Hans-Pichler-Award of the Austrian Society for Oral and Maxillofacial Surgery, in 1996, the Rudolf-Schoen-Award of the Society of Friends of the Medical University Clinic Hannover, in 2001–2002, he was Chair of the German Austrian Swiss Association for the Study of Tumours of the Face and Jaw. Since 1999, he is Chair of the Maxillofacial Expert Group of the AO Foundation. In 2004, he became Fellow of the Royal College of Surgeons, London (FRCS). In 2006, he was elected for the 16th Annual Daniel E. Waite Lectureship, Minnesota. Since 2005, Prof. Schmelzeisen is Chair of the German Association of Skull Base Surgery.

Katherine W.L. Vig

BDS, MS, D.Orth., FDS RSC, Professor Emeritus (Orthodontics),
Former Head of Orthodontics and Chief of Orthodontic Services
at Columbus Children's Hospital,
The Ohio State University, Columbus, Ohio, USA

Katherine Vig received her degree in dentistry from the University of St Andrews, Dundee Dental School (1961) and her specialty orthodontic training at the Eastman Dental Institute in London (1964), where she held NHS appointments as a Registrar, Senior Registrar and was appointed to a Consultant position before moving to the United States, where she has served on the Faculty of the University of North Carolina for eight years and the University of Michigan for six years, where her interest in translational research developed. This resulted in her earning a Master's degree in Anatomy and Cell Biology from Michigan (1986) before she was appointed Chair of the Orthodontic Department at the University of Pittsburgh and Head of Paediatrics and Developmental Sciences. For the past twelve years, she has served as Head of Orthodontics at the Ohio State University and Chief of Orthodontic Services for Craniofacial Anomalies at Children's Hospital. Her research has focussed on the clinical evaluative sciences and craniofacial anomalies for which she has been

consistently funded for the past 25 years as Co-Investigator on four grants and Principle Investigator for two NIH/NIDCR grants. She serves as a grant reviewer for the Medical Research Council and for the National Institutes of Health and as a consultant for the Commission on Dental Accreditation and for the American Board of Orthodontics. She has over 80 publications in peer-reviewed journals, has co-authored two textbooks and two monographs, written 25 book chapters and has 135 abstracts. She is a reviewer for eight journals and also serves on the editorial board of one journal.



Figure 1. The Evaluation Panel from left to right: Professor Reiner Schmelzeisen, Professor Cynthia Pine (Vice Chair), Professor Ulf Lerner (Chair), Professor Anne Christine Johannessen, Professor Mogens Kilian, and Professor Katherine Vig.

C. EXECUTION OF EVALUATION

Steering Group and Evaluation Team

Members of the Steering Group

The members of the Steering Group in 2006 were:

Kalervo Väänänen, Professor, Chair of the Research Council for Health,
Academy of Finland, Chair of the Steering Group

Hilkka Soininen, Professor, Research Council for Health,
Vice Chair of the Steering Group

Tuula Salo, Professor, Research Council for Health

The members of the Steering Group in 2007 were:

Kalervo Väänänen, Professor, Chair of the Research Council for Health,
Academy of Finland, Chair of the Steering Group

Anna-Elina Lehesjoki, Professor, Research Council for Health,
Vice Chair of the Steering Group

Tatu Juvonen, Professor, Research Council for Health

Evaluation Team

Riitta Pahkala, Evaluation Coordinator, Deputy Chief Dentist,
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Riitta Mustonen, Director,
Health Research Unit; from 1 June 2007,
Vice President, Research, Academy of Finland,
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Kaisa Koli, Project Secretary, Academy of Finland,
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FI-00501 Helsinki, Finland

D. EVALUATION FORM FOR RESEARCH ON DENTISTRY 2001–2005

I GENERAL INFORMATION ON INSTITUTE OR EQUIVALENT

| | |
|---------------------------------|---------|
| Organisation | |
| Institute or equivalent | |
| Address | |
| Phone | |
| Website | http:// |
| Head of institute or equivalent | |
| Phone | |
| Email | |
| Contact person | |
| Phone | |
| Email | |

1 Staff in 2001–2005

| Academic position/Task | Number of persons in institute or equivalent | | | | |
|----------------------------|--|------|------|------|------|
| | 2001 | 2002 | 2003 | 2004 | 2005 |
| Professor | | | | | |
| Docent/Lecturer | | | | | |
| Post doc | | | | | |
| DDS, MD, MSc or equivalent | | | | | |
| Researcher (pre-doctoral) | | | | | |
| Other, identify _____ | | | | | |
| Technical personnel | | | | | |
| Administrative personnel | | | | | |
| Total | | | | | |

2 Research profile

2.1 List of research groups working at institute or equivalent.

| Name of group | Head of group |
|---------------|---------------|
| | |
| | |
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2.2 Overall description of the research of institute or equivalent and aims and outcomes of the research since 2001 (max length two pages).

3 Doctoral training

3.1 List of doctoral dissertations 2001–2005.

| Name (family name, given name) | Year of birth | Gender (F/M) | Topic of dissertation | Site of PhD employment |
|--------------------------------|---------------|--------------|-----------------------|------------------------|
| | | | | |
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3.2 Completed doctoral degrees (in order of completion, per year).

| Name (family name, given name) | Year of birth | Gender (F/M) | Year of completing degree/organisation |
|--------------------------------|---------------|--------------|--|
| | | | |
| | | | |
| | | | |
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3.3 Employment of PhDs

| Name | Year of dissertation | Present employment (job description, organisation) |
|------|----------------------|--|
| | | |
| | | |
| | | |
| | | |

3.4 Registered postgraduate PhD students.

| PhD students | 2001 | 2002 | 2003 | 2004 | 2005 |
|---|------|------|------|------|------|
| Annual number of registered postgraduate PhD students | | | | | |
| Annual intake (PhD) | | | | | |
| International student mobility: outgoing | | | | | |
| International student mobility: incoming | | | | | |

3.5 Institute's or equivalent's self-assessment concerning academic and societal need for doctoral training within Unit's research fields as well as Unit's role in doctoral training (max length half an A4).

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3.6 Abstracts (in English) of doctoral dissertations (APPENDIX I).

4 Funding

4.1 Unit's core and external funding received from parent organisation.

| Funding by source in euros | | 2001 | 2002 | 2003 | 2004 | 2005 | Total |
|----------------------------|--|------|------|------|------|------|-------|
| Core funding | Budget funding for research | | | | | | |
| External funding | Academy of Finland | | | | | | |
| | Tekes | | | | | | |
| | Ministry of Social Affairs and Health | | | | | | |
| | Other public sources | | | | | | |
| | Industry | | | | | | |
| | Private foundations | | | | | | |
| | EVO ¹ | | | | | | |
| | EU | | | | | | |
| | Other organisations (domestic/foreign, identify _____) | | | | | | |
| Total | | | | | | | |

¹ EVO is a special funding mechanism of the Ministry of Social Affairs and Health for university hospitals.

4.2 Role of the Academy of Finland in promoting scientific and societal impacts of research (max length half an A4).

4.3 Role of funding awarded by different funding organisations in promoting scientific and societal impacts of research, excluding funding from the Academy of Finland (max length half an A4).

II RESEARCH GROUP DATA

| | |
|------------------------------------|--|
| Name of group | |
| Parent organisation | |
| Head of group | |
| Contact person | |
| Phone | |
| Email | |
| Group website (if there is one) | |

5 Research active staff 2001–2005

| Member of group Name | Position | Academic degree | Period of membership | Working time spent on research (% of full-time) |
|-------------------------|----------|--------------------|-------------------------|---|
| | | | | |
| | | | | |
| | | | | |
| | | | | |

6 Scientific publishing 2001–2005

6.1 Overall description of research group, its strategies, priority areas and outcomes since 2001 (max length one page).

6.2 Number of scientific publications and other outputs.

| Type of output | 2001 | 2002 | 2003 | 2004 | 2005 |
|--|------|------|------|------|------|
| 1 Articles in refereed international journals | | | | | |
| 2 Articles in refereed international edited volumes and conference proceedings | | | | | |
| 3 Articles in refereed Finnish scientific journals | | | | | |
| 4 Articles in refereed Finnish edited volumes and conference proceedings | | | | | |
| 5 Scientific monographs | | | | | |
| 6 Other scientific publications | | | | | |
| 7 Patents | | | | | |
| 8 Computer programs and algorithms | | | | | |
| 9 Visiting lectures | | | | | |
| 10 Radio and television programmes and journals popularising science | | | | | |
| 11 Other outputs | | | | | |

6.3 Lists of publications (original research article, review paper or book chapter) of each research group in 2001–2005 (APPENDIX II; full articles, identify each article by IADR classification; see instructions).

6.4 Lists and copies of senior researchers' five key publications (APPENDIX III).

7 Research group's collaboration contacts 2001–2005

7.1 Visits abroad (min. duration of visit: one month).

| Name | Target organisation | Country | Topic of visit | Duration (months) |
|------|---------------------|---------|----------------|-------------------|
| | | | | |
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7.2 Visits to Unit (min. duration of visit: one month).

| Name of visitor | Home organisation | Country | Topic of visit | Duration (months) |
|-----------------|-------------------|---------|----------------|-------------------|
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| | | | | |
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7.3 Short but particularly important visits.

| Name of visitor | Home organisation | Country | Topic of visit |
|-----------------|-------------------|---------|----------------|
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7.4 Most important collaborators in Finland and abroad.

| Name | Organisation | Country |
|------|--------------|---------|
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| | | |

7.5 Describe the most important outcomes of visits and collaboration contacts (max length one page).

8 Other scientific and societal activities

8.1 Invited presentations in scientific conferences 2001–2005.

| Name | Topic of presentation | Name and time of conference |
|------|-----------------------|-----------------------------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

8.2 Memberships in editorial boards of scientific journals (last ten years).

| Name | Journal | Period |
|------|---------|--------|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

8.3 Prizes awarded to researchers, honours and scientific positions of trust (last ten years).

| Name | Prize, position etc. |
|------|----------------------|
| | |
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8.4 Other significant activities in the field (last ten years), e.g. memberships in committees and scientific advisory boards or other similar tasks of no primarily academic nature.

| Name | Tasks | Period |
|------|-------|--------|
| | | |
| | | |
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9 Research group's self-assessment

9.1 SWOT evaluation of the group's scientific Strengths, Weaknesses, Opportunities and Threats (expertise, funding, facilities, organisation; max length one page).

9.2 Benchmarking, evaluate the group in relation to its leading international scientific competitors (funding/results/opportunities/restrictions; max length one page).

9.3 Group’s research strategy 2007–2009 (in relation to parent organisation’s strategy, priority areas in research, development measures; max length one page).

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9.4 Societal impact of group’s activities (max length one page).

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9.5 In the dental community there is a growing concern about that there will be not enough academic clinicians in the future; assess the main threats for this; make suggestions to improve the situation (max length one page).

Checking list

| | |
|---|--|
| <i>Evaluation Form</i> | |
| General information on institute or equivalent | |
| Staff | |
| Research profile | |
| Doctoral training | |
| Funding | |
| | |
| Research group data | |
| Research active staff | |
| Scientific publishing | |
| Collaboration contacts | |
| Other scientific and societal activities | |
| Research group’s self-assessment (SWOT) | |
| | |
| <i>Appendices</i> | |
| Appendix I. Abstracts of doctoral dissertations | |
| Appendix II. Lists of publications of each research group | |
| Appendix III. Lists and copies of senior researchers’ five key publications | |

INSTRUCTIONS FOR SUBMITTING EVALUATION MATERIAL

Please submit the evaluation form with the requested appendices to the Academy of Finland in **four (4) hard copies** and in **one (1) electronic copy** (for panellists, e.g. CD-ROM; all files in pdf format). We kindly ask you to make sure that the files in pdf format correspond to the hard copy files (archivable format) and that the material is clearly organised according to research groups. Send the material to the Academy of Finland, Science Adviser Hannele Lahtinen, POB 99 (Vilhonvuorenkatu 6), 00501 Helsinki.

In addition, **the evaluation form and all requested appendices – excluding copies of publications** – shall also be sent by email to Coordinator Riitta Pahkala, riitta.pahkala@kuh.fi.

The evaluation form with all requested appendices shall be submitted no later than 30 March 2007.

For further details, please contact Coordinator Riitta Pahkala (riitta.pahkala@kuh.fi, tel. +358 (0)17 174037).

Instructions for Filling in the Form And Preparing Appendices

The answers shall be in English, the minimum type size is Arial 11.

Who answers?

The first part of the form *General information on institute or equivalent* (Items 1–4) describes the activities of the whole institute or research community. ***The research groups need not fill in these data but they are to be filled in by the head of the institute or equivalent only.***

The latter part of the form *Research group data* (Items 5–9) describes the activities of the research groups. ***The institute or equivalent shall not fill in these data but they are to be filled in by the research group only.*** If there are several groups at the institute of equivalent, each group shall fill in its own form.

The head of the institute or equivalent is responsible for that the evaluation form and the instructions for filling in the form are forwarded to all the research groups that are cooperating with the institute, including emeritus senior researchers. Each group, for their part, shall forward the completed forms with the requested appendices to the head of the institute of equivalent who then forwards the whole material further to the Academy of Finland and the asked documents to Coordinator.

I General Information on Institute or Equivalent

1 Staff in 2001–2005

Use Table 1 to indicate the number of research active staff at the institute or equivalent in 2001–2005. The data on staff is indicated in person-years. A person-year refers to full-time annual work including annual holidays and other public statutory

holidays. Other holidays, leaves of absence etc. are deducted from the calculatory working time.

Research-active staff includes people who plan, produce and publish new knowledge, theories, methods as well as products and processes based on these, and lead research projects. Technical staff includes people who are involved, under the supervision of research active staff, in carrying out projects but do not participate in the theoretical planning, publishing, or equivalent, of the research.

Administrative staff includes people who take care of administrative tasks related to research, such as financial and personnel administration or other office tasks, but do not normally participate in the technical implementation of projects.

2 Research profile

2.1 List of research groups working at institute or equivalent.

The name of the research group refers to the name used for a research group or research field. A research group involves at least one researcher with a PhD and at least one researcher under supervision.

2.2 Overall description of the research of institute or equivalent and aims and outcomes of the research since 2001.

Give a short description of the institute's or equivalent's research, its strategies, priority areas, aims and outcomes since 2001 (max two pages).

3 Doctoral training

3.1 List of doctoral dissertations 2001–2005.

If at least half of the doctoral dissertation has been supervised and done at a research institute, the research institute can also list the doctoral dissertation as its own outcome. In this case, also indicate the university where the doctoral dissertation has been presented for approval.

3.2 Completed doctoral degrees (listed per year).

Indicate only degree-awarding organisations.

3.3 Employment of PhDs.

In addition to the name of the organisation, indicate the type of organisation (university, business company, research institute, state, municipality or other).

3.4 Registered *postgraduate* PhD students.

Indicate the number of registered postgraduate students. In Item *Annual intake* indicate separately the annual intake of postgraduate students. Regarding international student mobility, give the number of outgoing Finnish postgraduate students and that of incoming foreign postgraduate students within the exchange of a minimum length of one semester.

3.5 Institute's or equivalent's self-assessment concerning the academic and societal need for doctoral training within the Unit's research fields and the Unit's role in doctoral training.

3.6 Abstracts (in English) of doctoral dissertations

Enclose the abstracts in English of the doctoral dissertations completed at the institute in 2001–2005 (Appendix 1). Of the article dissertations, also enclose lists of sub-articles.

4 Funding

4.1 Unit's core funding (received from parent organisation) and external funding.

Core funding refers to budget funding received by the Unit and possible other funding allocated by the parent organisation. The funding covers both the salary costs with social charges of the staff and the operational costs which include consumption costs and investment costs for research activities. Indicate also the annual amount/use of any external funding received for research from other sources.

4.2 Role of the Academy of Finland in promoting scientific and societal impacts of research.

Describe how the funding awarded by the Academy has promoted the scientific and societal impact of the Unit's activities. Scientific impact refers to the contribution of research carried out by the Unit to the development of the field. Societal impact refers to the ability of the research activities to promote values that are considered important in society.

4.3 Role of funding awarded by different funding organisations in promoting scientific and societal impacts of research, excluding funding from the Academy of Finland.

Describe the contribution of the funding awarded by different funding organisations to scientific and societal impacts.

II RESEARCH GROUP DATA

Indicate the name of the research group and the name and contact data of the person in charge of the group. Groups working elsewhere than at university institutes of dentistry shall fill in the front page of the form and Items 1–4.

5 Research active staff 2001–2005

Use Table 5 to indicate the members of the research group (including students), their academic degrees and position in the group as well as the time they have been involved in the group. The time in the group can be given in months or years; exact dates need not be indicated. If the person has been a member of the group during 2001–2005 and is still in the same position in the group, time need not be given but this space can be left empty. If his/her position has changed during these years, indicate either the present position in the group or the post he/she has. Further, the working time spent on research shall be assessed.

6 Scientific publishing 2001–2005

6.1 Overall description of research group, its strategies, priority areas and outcomes since 2001.

The aim is to survey the impacts the research done at the Unit has had on research in the field. Describe the orientation of the publishing, most important research results

and approaches as well as the role of multidisciplinary or interdisciplinarity in the projects. Describe also the links of the Unit's research with the strategies of the organisation.

6.2 Number of scientific publications and other outputs.

Use Table 6.2 to indicate the annual number of publications and scientific monographs with referee practice and other outputs produced by the research group in 2001–2005.

6.3 List of publications of each research group 2001–2005 (full articles, review paper or book chapter).

Each research group submit a list of their refereed publications in 2001–2005 (Appendix 2). If a researcher acts for example in two separate groups, his/her publications should be listed in both research groups. *In the compilation table (Table 6.2.) each publication of that research group can be listed only once.*

List the publications in accordance with the following practice adopted by most medical and natural science journals: Give the names and initials of all authors (unless there are more than six, when only the first six should be given followed by et al). The authors' names are followed by the title of the article; the title of the journal abbreviated according to the style of Index Medicus; the year of publication; the volume number; and the first and last page numbers. (If abbreviation is not known, use the journal's whole title) References to books should give the names of any editors, place of publication, editor, and year.

Asked format:

Soter A, Wasserman SI, Austen KF. Cold urticaria: release into the circulation of histamine and eosinophil chemotactic factor of anaphylaxis during cold challenge. *N Engl J Med* 1976;294:687–90
Osler AG. Complement: mechanisms and functions. Englewood Cliffs: Prentice-Hall, 1976.

Further, identify, in bold, each article with IADR (International Association for Dental Research) classification (see Appendix to Instructions). Choose only one (primary) category, to which the article belongs, and add this number clearly after the publication data of each article.

6.4 List and copies of senior researchers' five key publications.

Each senior researcher of the group lists and submits copies of five of his/her key publications during the period under review, indicated in the order of quality (Appendix 3).

7 Research group's collaboration contacts 2001–2005

7.1–7.3 Visits abroad.

List the visits of each year by country in the alphabetical order. The minimum duration of a visit to be indicated is one month (7.1 and 7.2). In Item *Topic of visit* indicate clearly the objective of the visit, for example regarding a post doc period describe what were the content objectives related to the visit.

7.4 Most important collaborators in Finland and abroad.

Collaborator refers to a person or a research team with whom cooperation has either been generated or is expected to generate, within the next three (3) years, one of the outcomes indicated in Item 6.2.

7.5 Describe the most important outcomes of the visits and collaborations (max one page).

Describe here e.g. key joint publications, researcher training, adoption and use of new technologies or new approaches.

8 Other scientific and societal activities

8.1 Invited presentations in scientific conferences in 2001–2005.

8.2 Membership in editorial boards of scientific journals (last ten years).

8.3 Prizes awarded to researchers, honours and scientific positions of trust (last ten years).

8.4 Other significant activities in the field e.g. memberships in committees and in scientific advisory boards or other similar tasks of no primarily academic nature (last ten years).

9 Research group's self-assessment

9.1 SWOT evaluation of the group's scientific Strengths, Weaknesses, Opportunities and Threats (expertise, funding, facilities, organisation).

9.2 Benchmarking, evaluate the group in relation to its leading international scientific competitors (funding/results/opportunities/restrictions).

9.3 Group's research strategy 2007–2009 (in relation to parent organisation's strategy, priority areas in research, development measures).

9.4 Societal impact of group's activities.

9.5 In the dental community, there is a growing concern about that there will be not enough academic clinicians in the future (assess the main threats for this, make suggestions to improve the situation).

Instructions:

9.1 and 9.2 in addition to the strengths and weaknesses it is also important to assess what the present strengths or developable strengths enable in the future and what kinds of threats are related to the weaknesses.

9.3 Describe the group's research programme for the next few years, the key research objectives and means to achieve these objectives. What is the role of basic and applied research? Is there need for new knowledge or facilities? Is the present level of funding sufficient for attaining the objectives laid down? Do the strategies of the parent organisation and the group support each other?

9.4 Describe how the Unit's research and cooperation with other actors in society have promoted their activities, for example how research and cooperation have advanced pharmaceutical industries, SMEs' activities, drafting of new legislation and regulations, general health science knowledge, etc.

APPENDIX

IADR classification to identify the research field of each publication

| | RESEARCH FIELD |
|----|--|
| 1 | Behavioural Sciences & Health Services Research / Epidemiology |
| 2 | Cariology Research |
| 3 | Craniofacial Biology |
| 4 | Dental Anesthesiology Research |
| 5 | Dental Materials |
| 6 | Diagnostic Systems |
| 7 | Education Research |
| 8 | Geriatric Oral Research |
| 9 | Implantology Research |
| 10 | Microbiology/Immunology and Infection Control |
| 11 | Mineralized Tissue |
| 12 | Neuroscience/TMD/Pain |
| 13 | Nutrition |
| 14 | Oral Health Research |
| 15 | Oral Medicine & Pathology |
| 16 | Oral & Maxillofacial Surgery |
| 17 | Periodontal Research |
| 18 | Pharmacology, Therapeutics, & Toxicology |
| 19 | Prosthodontics Research |
| 20 | Pulp Biology |
| 21 | Salivary Research |
| 22 | Evidence-based Dentistry |
| 23 | Other (identify), _____ |

E. SUMMARY OF RESEARCH RESOURCES – TABLES I–IV

Table I. List of Journals (language: English) used by dental researchers for publication in 2001–2005.

| JOURNAL | Impact factor | Cited Half Life | Immediate index | Dental Institute, University of Helsinki | Dental Institute, University of Turku | Dental Institute, University of Oulu | Institute of Biotechnology and National Public Health Institute, Helsinki | Total number of peer reviewed articles |
|------------------------------|---------------|-----------------|-----------------|--|---------------------------------------|--------------------------------------|---|--|
| Acta Odont Scand | 0.783 | >10.0 | 0.036 | 29 | 23 | 11 | | 63 |
| J Dent Res | 3.192 | >10 | 0.389 | 22 | 10 | 13 | 5 | 50 |
| Oral Surg Oral Med O | 1.193 | >10 | 0.152 | 16 | 5 | 8 | | 29 |
| J Periodontol | 1.784 | 9.30 | 0.104 | 8 | 3 | 12 | | 23 |
| Int J Oral Max Surg | 1.123 | 9.80 | 0.082 | 8 | 9 | 4 | | 21 |
| J Mater Sci Mater Med | 1.248 | 6.70 | 0.093 | 4 | 17 | | | 21 |
| Community Dent Oral | 1.631 | 9.90 | 0.132 | 5 | 3 | 12 | | 20 |
| Caries Res | 1.721 | 9.60 | 0.173 | 3 | 7 | 7 | | 17 |
| Dent Mater | 2.056 | 6.50 | 0.290 | 1 | 15 | 1 | | 17 |
| Eur J Oral Sci | 1.784 | 5.40 | 0.205 | 4 | 3 | 7 | 2 | 16 |
| J Oral Rehabil | 0.717 | 7.10 | 0.066 | 4 | 10 | 2 | | 16 |
| Biomaterials | 4.698 | 4.60 | 1.083 | | 15 | | | 15 |
| Eur J Orthodont | 0.651 | >10 | 0.034 | 5 | 1 | 8 | 1 | 15 |
| Key Eng Mater (Biocheramics) | 0.224 | 3.90 | 0.029 | | 15 | | | 15 |
| Archs Oral Biol | 1.288 | >10.0 | 0.142 | 4 | 5 | 3 | 1 | 13 |
| Int J Prosthodont | 1.346 | 6.20 | 0.092 | 2 | 10 | | | 12 |
| J Oral Pathol Med | 1.661 | 8.90 | 0.257 | 6 | 2 | 4 | | 12 |
| Gerodontology | | | | 8 | 3 | | | 11 |
| J Endodont | 1.933 | 7.90 | 0.209 | 3 | 5 | 3 | | 11 |
| Oral Dis | 1.445 | 4.50 | 0.262 | 8 | 1 | 2 | | 11 |
| Community Dental Health | | | | 3 | 2 | 5 | | 10 |
| Eur J Dent Educ | | | | 9 | | 1 | | 10 |
| Int Endod J | 1.606 | 5.90 | 0.126 | 3 | 5 | 2 | | 10 |
| J Biomed Mater Res | 2.743 | 2.30 | 0.122 | | 10 | | | 10 |
| J Orofac Pain | 1.932 | 6.10 | 0.000 | 5 | 4 | 1 | | 10 |
| J Periodontal Res | 1.947 | >10 | 0.258 | 5 | | 4 | 1 | 10 |
| Pain | 4.309 | 7.90 | 0.848 | 2 | 7 | 1 | | 10 |
| Anaerobe | 0.776 | 6.20 | 0.119 | 2 | 1 | | 6 | 9 |
| Dent Traumatol | 0.716 | 3.50 | 0.308 | | | 9 | | 9 |
| Int J Oral Max Impl | 1.412 | 7.90 | 0.102 | 2 | 2 | 4 | 1 | 9 |
| J Clin Mikrobiol | 3.537 | 6.10 | 0.498 | 3 | 4 | | 2 | 9 |
| J Oral Maxil Surg | 1.246 | 10.00 | 0.180 | 6 | 3 | | | 9 |
| Dev Biol | 5.234 | 6.60 | 0.908 | 1 | | | 7 | 8 |
| Evid Based dent | | | | | | 7 | 1 | 8 |
| Cranio | 0.522 | 8.70 | 0.057 | 1 | | 6 | | 7 |

| | | | | | | | | |
|--------------------------------------|--------|-------|-------|---|---|---|---|---|
| Eur J Paediatric Dent | | | | 2 | 2 | 3 | | 7 |
| Int Dent J | 0.908 | >10.0 | 0.100 | 3 | 3 | 1 | | 7 |
| J Clin Periodontol | 2.225 | 8.50 | 0.348 | 3 | | 4 | | 7 |
| J Pathol | 6.213 | 5.60 | 1.184 | 4 | | 3 | | 7 |
| J Prosthet Dent | 0.748 | >10 | 0.101 | 1 | 6 | | | 7 |
| Special care in Dentistry | | | | 4 | 3 | | | 7 |
| Eur Spine J | 1.763 | 5.10 | 0.138 | 6 | | | | 6 |
| Exp Cell Res | 4.148 | 6.80 | 0.567 | 3 | | 2 | 1 | 6 |
| Toxicol Appl Pharm | 3.148 | 8.50 | 0.506 | 6 | | | | 6 |
| Adv Dent Res | | | | 1 | | 3 | 1 | 5 |
| Arch Dermatol Res | 1.219 | 8.80 | 0.139 | 1 | 2 | 2 | | 5 |
| Biochem Bioph Res Co | 3.000 | 6.40 | 0.448 | 3 | | 2 | | 5 |
| Brit J Dermatol | 2.978 | 7.20 | 0.400 | 2 | 1 | 2 | | 5 |
| Clin Exp Rheumatol | 2.366 | 5.10 | 0.298 | 3 | 2 | | | 5 |
| Clin Oral Implan Res | 1.897 | 5.60 | 0.147 | 3 | 1 | 1 | | 5 |
| Dev Dynam | 3.333 | 5.20 | 0.651 | 1 | | | 4 | 5 |
| Development | 7.603 | 6.50 | 1.729 | 1 | 1 | | 3 | 5 |
| Int J Adult Orthod Orthognath Surg | | | | 1 | 2 | 2 | | 5 |
| J Med Mikrobiol | 2.318 | 6.10 | 0.413 | | 2 | | 3 | 5 |
| Oral Health and Preventive Dentistry | | | | 4 | | 1 | | 5 |
| Anticancer Res | 1.604 | 5.7 | 0.116 | | 4 | | | 4 |
| Calcified Tissue Int | 2.487 | 9.50 | 0.150 | 1 | | 3 | | 4 |
| Cleft Palate-Cran J | 0.574 | >10.0 | 0.144 | | | 4 | | 4 |
| Clin Exp Immunol | 2.805 | 7.50 | 0.409 | | | 4 | | 4 |
| Curr Med Chem | 4.904 | 3.40 | 0.542 | 2 | | 2 | | 4 |
| Equine Veterinary Journal | | | | 2 | | 2 | | 4 |
| Eur J Hum Genet | 3.251 | 4.10 | 1.083 | 2 | | | 2 | 4 |
| Infect Immun | 3.933 | 6.70 | 0.648 | 3 | 1 | | | 4 |
| J Biol Chem | 5.854 | 6.20 | 1.265 | 1 | | 2 | 1 | 4 |
| J Biomater Appl | 1.116 | 7.30 | 0.053 | | 4 | | | 4 |
| J Dent | 1.636 | 7.20 | 0.115 | 1 | 3 | | | 4 |
| Matrix Biol | 4.469 | 5.50 | 0.492 | 2 | | 2 | | 4 |
| Med Princ Pract | 0.566 | 3.00 | 0.056 | | 3 | 1 | | 4 |
| Allergy | 24.120 | 5.40 | 0.886 | 2 | | 1 | | 3 |
| Angle Orthod | 0.778 | >10.0 | 0.050 | 1 | 2 | | | 3 |
| Ann Med | 3.838 | 5.60 | 0.390 | 2 | | 1 | | 3 |
| Arch Otolaryngol | 1.586 | >10 | 0.174 | | 3 | | | 3 |
| Arterioscler Thromb Vasc Biol | 6.883 | 5.80 | 1.391 | 3 | | | | 3 |
| Brit J Cancer | 4.115 | 6.20 | 0.580 | 1 | 1 | 1 | | 3 |
| Cancer | 4.800 | 9.70 | 0.641 | 3 | | | | 3 |
| Crit Rev Oral Biol M | 3.933 | 6.20 | | 2 | 1 | | | 3 |
| Digest Dis Sci | 1.388 | 8.60 | 0.163 | 1 | | 2 | | 3 |
| Int J Antimicrob Ag | 2.428 | 3.60 | 0.519 | | 1 | | 2 | 3 |
| Int J Cancer | 4.700 | 5.90 | 1.016 | 1 | 1 | 1 | | 3 |
| Int J Paediat Dent | | | | 2 | 1 | | | 3 |
| Int J STD AIDS | 1.211 | 5.20 | 0.232 | | 3 | | | 3 |
| J Adhes Dent | 2.216 | 4.30 | 0.125 | | 3 | | | 3 |
| J Bone Miner Res | 6.527 | 6.20 | 0.965 | 2 | | | 1 | 3 |
| J Cranio-Maxill Surg | 1.102 | 7.60 | 0.156 | 2 | | 1 | | 3 |
| J Forensic Sci | 1.026 | 7.60 | 0.092 | 3 | | | | 3 |
| J Histochem Cytochem | 2.208 | 9.80 | 0.433 | | | 1 | 2 | 3 |

| | | | | | | | | |
|-----------------------------------|--------|--------|-------|---|---|---|---|---|
| J Med Genet | 4.330 | 5.40 | 1.124 | 2 | | | 1 | 3 |
| J Surg Res | 1.956 | 6.70 | 0.287 | 2 | | 1 | | 3 |
| Lab Invest | 3.859 | 8.80 | 0.828 | 1 | 1 | 1 | | 3 |
| Oral Health | | | | | | 3 | | 3 |
| Oral Oncol | 0.171 | 4.60 | 2.266 | 1 | 2 | | | 3 |
| Pediatr Allergy Immu | 2.126 | 4.40 | 0.265 | | | 3 | | 3 |
| Scand J Infect Dis | 1.308 | 7.50 | 0.153 | 1 | 2 | | | 3 |
| Scand J Plast Recons | 0.500 | >10 | 0.039 | 3 | | | | 3 |
| Acta Pediatr | | | | | 1 | 1 | | 2 |
| Am J Clin Pathol | 2.942 | >10 | 0.391 | | 2 | | | 2 |
| Am J Hum Genet | 12.649 | 5.60 | 2.959 | 1 | | | 1 | 2 |
| Am J Med Genet A | 1.913 | 2.00 | 0.317 | 2 | | | | 2 |
| Am J Orthod Dentofac | 0.916 | >10.0 | 0.129 | | 2 | | | 2 |
| Anti-Cancer Drugs | 1.907 | 5.40 | 0.372 | 1 | | 1 | | 2 |
| APMIS | 0.145 | 6.30 | 2.123 | 1 | | 1 | | 2 |
| Arch Environ Health | 0.588 | >10 | | 1 | 1 | | | 2 |
| Arthritis Rheumatism | 7.421 | 5.80 | 1.386 | 1 | | 1 | | 2 |
| Aust Endod Journal | | | | 1 | | 1 | | 2 |
| Biochemistry | 3.848 | 8.30 | 0.777 | 1 | | 1 | | 2 |
| BMC Oral Health | | | | | 2 | | | 2 |
| Bone Marrow Transplantation | 2.643 | 6.00 | 0.505 | 2 | | | | 2 |
| Cancer Genet Cytogen | 1.640 | 6.90 | 0.246 | | 2 | | | 2 |
| Cancer Res | 7.616 | 6.20 | 1.001 | | | 2 | | 2 |
| Cephalalgia | 4.657 | 5.90 | 0.431 | | 2 | | | 2 |
| Clin Oral Investigations | | | | | 2 | | | 2 |
| Connect Tissue Res | 2.119 | 9.70 | 0.103 | 1 | | 1 | | 2 |
| Dent News | | | | | 2 | | | 2 |
| Diagn Mikrob Infec Dis | 2.738 | 4.70 | 0.546 | | | | 2 | 2 |
| Early Hum Dev | 1.282 | 8.80 | 0.186 | | | 2 | | 2 |
| Endod | | | | | 2 | | | 2 |
| Environ Health Persp | 5.342 | 5.80 | 0.955 | 2 | | | | 2 |
| Eur Arch Oto-Rhino-L | 0.895 | 9.70 | 0.084 | 2 | | | | 2 |
| Eur J Prosthodont Restor Dent | | | | | 2 | | | 2 |
| Eur Respir J | 3.947 | 6.10 | 0.916 | 2 | | | | 2 |
| Folia Phoniater Logo | 0.339 | >10..0 | 0.000 | 2 | | | | 2 |
| Gene Expr Patterns | 1.794 | 2.30 | 0.359 | | | | 2 | 2 |
| Gynecol Oncol | 2.251 | 6.30 | 0.351 | | 2 | | | 2 |
| Implant Dentistry | | | | 1 | | 1 | | 2 |
| Int J Exp Pathol | 1.942 | 5.70 | 0.359 | | 2 | | | 2 |
| Int J Rehab Res | | | | | 2 | | | 2 |
| J Can Dent Ass | | | | | | 2 | | 2 |
| J Clin Invest | 15.053 | 8.20 | 2.887 | | | 1 | 1 | 2 |
| J Clin Peadiatr Dent | | | | | 2 | | | 2 |
| J Oral Implantol | | | | | | 2 | | 2 |
| Mikrob Ecol Health Dis | | | | | 1 | | 1 | 2 |
| Nature | 29.273 | 7.50 | 5.825 | | 1 | | 1 | 2 |
| Neurology | 5.065 | 6.70 | 1.115 | | 2 | | | 2 |
| NeurSci Lett | 1.898 | 7.10 | 0.333 | 1 | 1 | | | 2 |
| Oral Maxillofacial Surg Clin N Am | | | | 1 | | 1 | | 2 |
| Oral Mikrobiol Immunol | 2.210 | 6.90 | 0.266 | | 2 | | | 2 |
| Otolaryng Head Neck | 1.218 | 9.60 | 0.134 | | 2 | | | 2 |
| Pediatrics | 4.272 | 6.60 | 1.005 | 2 | | | | 2 |

| | | | | | | | | |
|---|--------|-------|-------|---|---|---|---|---|
| Scand J Gastroentero | 1.790 | 8.40 | 0.183 | | | 2 | | 2 |
| Scand J Stat | 0.822 | >10 | 0.091 | 1 | | 1 | | 2 |
| Surf Interface Anal | 0.918 | 7.70 | 0.247 | | 2 | | | 2 |
| Swed Dent J | 0.568 | >10 | 0.118 | 1 | 1 | | | 2 |
| Acta Anaest Scand | 1.837 | 6.80 | 0.321 | | 1 | | | 1 |
| Acta Biomater | | | 0.338 | | 1 | | | 1 |
| Acta Cytol | 1.022 | 9.80 | 0.140 | | 1 | | | 1 |
| Acta Derm-Venereol | 1.741 | >10 | 0.188 | 1 | | | | 1 |
| Acta Neurol Scand | 1.982 | >10 | 0.269 | 1 | | | | 1 |
| Am J Ind Med | 1.307 | 8.10 | 0.549 | | | 1 | | 1 |
| Am j Pathol | 5.796 | 6.40 | 0.956 | 1 | | | | 1 |
| Am J Perinat | 0.685 | 8.40 | 0.051 | | 1 | | | 1 |
| Am J Reprod Immunol | 1.416 | 7.00 | 0.274 | | | 1 | | 1 |
| Am J Resp Crit Care | 8.689 | 5.60 | 1.883 | 1 | | | | 1 |
| Am J Vet Res | 1.222 | >10 | 0.207 | 1 | | | | 1 |
| Anal Qyant Cytol | 0.616 | 8.50 | 0.047 | | 1 | | | 1 |
| Anest Prog | | | | 1 | | | | 1 |
| Ann Acad Med Singap | 0.419 | 7.60 | 0.186 | | 1 | | | 1 |
| Ann NY Acad Sci | 1.971 | 6.80 | 0.237 | 1 | | | | 1 |
| Ann Rheum Dis | 6.956 | 5.00 | 1.885 | 1 | | | | 1 |
| Ann Thorac Surg | 2.229 | 6.30 | 0.369 | | | 1 | | 1 |
| Appl Compos Mater | 0.841 | 5.60 | 0.000 | | 1 | | | 1 |
| Appl Environ Mikrob | 3.919 | 7.20 | 0.464 | | | | 1 | 1 |
| Arch Immun Ther Ex | 1.000 | 6.10 | 0.218 | | | 1 | | 1 |
| Arch Virol | 1.819 | 7.50 | 0.339 | | 1 | | | 1 |
| Arch Intern Med | 8.016 | 6.90 | 1.782 | 1 | | | | 1 |
| Bioesseys | 6.787 | 5.30 | 1.021 | | | | 1 | 1 |
| Biomed Mater Eng | 0.485 | 6.40 | 0.000 | 1 | | | | 1 |
| Biostatistics | 4.529 | 2.90 | 0.933 | 1 | | | | 1 |
| Bone | 3.939 | 6.20 | 0.507 | | | | 1 | 1 |
| Brit Dent J | 0.658 | >10.0 | 0.350 | | | 1 | | 1 |
| Brit J Gen Pract | 1.730 | 6.30 | 1.198 | | | 1 | | 1 |
| Brain Res Cogn Brain Res | | | | | 1 | | | 1 |
| Brit Med J | 9.052 | 7.50 | 4.248 | 1 | | | | 1 |
| Carcinogenesis | 5.108 | 6.70 | 0.935 | | 1 | | | 1 |
| Cell Biol Toxicol | 1.548 | 6.60 | 0.263 | | 1 | | | 1 |
| Cell Tissue Bank | | | | | 1 | | | 1 |
| Cell Tissue Res | 2.383 | 9.40 | 0.337 | | | 1 | | 1 |
| Circulation | 11.632 | 5.60 | 1.641 | 1 | | | | 1 |
| Clin Diagn Lab Immun | 2.056 | 4.60 | 0.302 | 1 | | | | 1 |
| Clin Genet | 3.276 | 6.80 | 0.496 | 1 | | | | 1 |
| Clin Infect Dis | 6.510 | 4.70 | 1.750 | | 1 | | | 1 |
| Clin Mikrobiol Infec | 2.679 | 3.20 | 0.706 | | | | 1 | 1 |
| Cochrane Database of Systematic Reviews | | | | | | 1 | | 1 |
| Craniofacial Research | | | | | | 1 | | 1 |
| Current Topics in Nutraceutical Res | | | | | | 1 | | 1 |
| Cytokine | 2.012 | 5.60 | 0.246 | | | 1 | | 1 |
| Cytokine Growth F R | 9.075 | 4.00 | 1.213 | | | | 1 | 1 |
| Dent Hygiene | | | | | 1 | | | 1 |
| Dent Pract | | | | | 1 | | | 1 |
| Dent Society J | | | | 1 | | | | 1 |

| | | | | | | | | |
|---|--------|-------|-------|---|---|---|---|---|
| Dentomaxillofac Rad | 0.640 | 6.30 | 0.070 | 1 | | | | 1 |
| Dev Cell | 14.609 | 2.70 | 3.338 | | | | 1 | 1 |
| Diagn Mol Pathol | 2.104 | 6.60 | 0.282 | | 1 | | | 1 |
| East Afr Med | | | | | 1 | | | 1 |
| Eur J Cancer | 3.706 | 6.70 | 0.484 | | 1 | | | 1 |
| Eur J Cardiovasc Prev R | 2.333 | 1.80 | 0.206 | 1 | | | | 1 |
| Eur J Clin Invest | 2.684 | 6.70 | 0.484 | | | 1 | | 1 |
| Eur J Clin Microbiol | 2.061 | 6.70 | 0.442 | | | | 1 | 1 |
| Eur J Gynaecol Oncol | 0.591 | 5.30 | 0.070 | | 1 | | | 1 |
| Eur J Immunogenet (2005– Int J Immunogenetics) | 1.479 | 6.00 | 0.000 | | | 1 | | 1 |
| Eur J Immunol | 4.876 | 6.50 | 1.000 | 1 | | | | 1 |
| Eur J Morphol | | | | | | 1 | | 1 |
| Eur J Obstet Gyn R B | 1.141 | 6.10 | 0.146 | | 1 | | | 1 |
| Eur J Pain | 2.460 | 3.50 | 0.405 | 1 | | | | 1 |
| Eur J Pharmacol | 2.477 | 7.40 | 0.261 | | 1 | | | 1 |
| Eur J Public Health | 1.118 | 4.10 | 0.447 | | | 1 | | 1 |
| Eur J Surg | | | | | | 1 | | 1 |
| Exp Clin Immunogenet | | | | | | 1 | | 1 |
| FEMS Immunol Med Mic | 2.371 | 5.40 | 0.272 | | | 1 | | 1 |
| Fertil Steril | 3.114 | 7.00 | 0.583 | | | 1 | | 1 |
| Food Hydrocolloid | 1.949 | 5.80 | 0.523 | | 1 | | | 1 |
| Gastroenterology | 12.386 | 6.90 | 2.226 | 1 | | | | 1 |
| Gene | 2.694 | 8.40 | 0.431 | | 1 | | | 1 |
| Gerontology | 1.636 | 7.90 | 0.123 | | | 1 | | 1 |
| Gut | 7.692 | 6.50 | 1.955 | | | 1 | | 1 |
| Histochem Cell Biol | 2.239 | 4.70 | 1.148 | | | 1 | | 1 |
| Histopathology | 2.608 | 7.80 | 0.356 | 1 | | | | 1 |
| Homeopathy | | | | | 1 | | | 1 |
| Hum Pathol | 2.550 | 8.30 | 0.414 | | | 1 | | 1 |
| Hum Reprod | 3.669 | 6.00 | 0.693 | | | 1 | | 1 |
| Immunology | 3.507 | 7.90 | 0.444 | 1 | | | | 1 |
| Infect Dis Obstetr Gynecol | | | | 1 | | | | 1 |
| Inflamm Res | 1.210 | 5.50 | 0.110 | 1 | | | | 1 |
| Int Immunopharmacol | 2.008 | 3.30 | 0.305 | 1 | | | | 1 |
| Int J Adhes Adhes | 1.009 | 6.60 | 0.183 | | 1 | | | 1 |
| Int J Audiol | 0.896 | 2.60 | 0.076 | | 1 | | | 1 |
| Int J Biochem Cell B | 3.871 | 4.90 | 0.669 | 1 | | | | 1 |
| Int J Dev Biol | 2.051 | 5.90 | 0.287 | 1 | | | | 1 |
| Int J Pediatr Otorhi | 0.754 | 6.00 | 0.074 | | 1 | | | 1 |
| Int Rev Cytol | 4.481 | 8.90 | 0.919 | | | | 1 | 1 |
| Invest Ophth Vis Sci | 3.643 | 5.80 | 0.533 | 1 | | | | 1 |
| J Allergy Clin Immun | 7.667 | 5.40 | 2.402 | | | 1 | | 1 |
| J Antimikrob Chemoth | 3.886 | 4.90 | 0.749 | | | | 1 | 1 |
| J Appl Polym Sci | 1.072 | 7.60 | 0.142 | | 1 | | | 1 |
| J Biomat Sci Polym E | 1.409 | 6.10 | 0.231 | | 1 | | | 1 |
| J Bone Joint Surg Am | 2.339 | >10.0 | 0.351 | 1 | | | | 1 |
| J Cell Sci | 6.543 | 5.00 | 0.990 | | | | 1 | 1 |
| J Clin Oncol | 11.810 | 4.90 | 2.831 | 1 | | | | 1 |
| J Clin Pathol | 2.170 | 8.70 | 0.288 | | 1 | | | 1 |
| J Clin Virol | 2.623 | 2.90 | 0.396 | | 1 | | | 1 |

| | | | | | | | | |
|---|-------|------|-------|---|---|---|---|---|
| J Contemp Dent Pract | | | | | 1 | | | 1 |
| J Craniofac Surg | 0.827 | 5.90 | 0.059 | 1 | | | | 1 |
| J Dent for Children | | | | | | 1 | | 1 |
| J Dent Traumatol | | | | 1 | | | | 1 |
| J Diasabil Oral Health | | | | | 1 | | | 1 |
| J Endocrinol | 3.059 | 7.40 | 0.465 | | 1 | | | 1 |
| J Epid Biostat | | | | 1 | | | | 1 |
| J Eur Acad Dermatol | 1.638 | 3.80 | 0.160 | | 1 | | | 1 |
| J Gen Virol | 3.013 | 7.60 | 0.599 | | 1 | | | 1 |
| J Glaucoma | 1.426 | 5.60 | 0.157 | 1 | | | | 1 |
| J Infect Dis | 4.953 | 6.60 | 1.547 | | 1 | | | 1 |
| J Lipid Res | 3.909 | 7.80 | 0.855 | 1 | | | | 1 |
| J Lower Genital Tract Dis | | | | | 1 | | | 1 |
| J Med Chem | 4.926 | 6.80 | 0.937 | | 1 | | | 1 |
| J Med Screen | 2.483 | 5.60 | 0.217 | | 1 | | | 1 |
| J Med Virol | 2.520 | 5.20 | 0.558 | | 1 | | | 1 |
| J Neuropath Exp Neur | 4.471 | 7.10 | 0.479 | 1 | | | | 1 |
| J Oral Sci | | | | | 1 | | | 1 |
| J Pediatr Res | | | | | 1 | | | 1 |
| J Phys Esomech | | | | | 1 | | | 1 |
| J Psychophysiology | | | | | 1 | | | 1 |
| J Psychosom Res | | | | 1 | | | | 1 |
| J Public Health | 1.031 | 1.60 | 0.156 | | | 1 | | 1 |
| J Rheumatol | 3.010 | 7.50 | 0.588 | 1 | | | | 1 |
| J Vet Intern Med | 1.649 | 6.00 | 0.229 | 1 | | | | 1 |
| Laryngoscope | 1.617 | 8.00 | 0.200 | 1 | | | | 1 |
| Legoped Phoniatr Vocol | | | | | 1 | | | 1 |
| Mat Tech & Adv Perform Mat | | | | | 1 | | | 1 |
| Mech Develop | 3.838 | 5.60 | 1.543 | | | | 1 | 1 |
| Med Mikrobiol Immun | 2.185 | 7.20 | 0.310 | | 1 | | | 1 |
| Metabolism | 2.294 | 8.70 | 0.359 | | | 1 | | 1 |
| Metabolism Clin And Exp | | | | | | 1 | | 1 |
| Mol Biol Cell | 6.520 | 4.40 | 1.556 | | | | 1 | 1 |
| Molec Hum Reprod | 6.520 | 4.40 | 1.556 | | | 1 | | 1 |
| Neurobiol Dis | 4.048 | 3.70 | 0.576 | 1 | | | | 1 |
| Neuropath Appl Neurol | 3.266 | 7.10 | 0.552 | 1 | | | | 1 |
| Neuroreport | 1.995 | 6.00 | 0.294 | 1 | | | | 1 |
| Neuroscience | 3.410 | 7.00 | 0.555 | 1 | | | | 1 |
| Nordia Geographical Publications | | | | | | 1 | | 1 |
| Nordic Dentistry | | | | 1 | | | | 1 |
| Occup Med –Oxford | 1.127 | 4.90 | 0.471 | 1 | | | | 1 |
| Oncol Rep | 1.572 | 5.30 | 0.255 | | 1 | | | 1 |
| Oral Biol Sci Med | | | | | | | 1 | 1 |
| Otol Neurotol | 1.340 | 9.90 | 0.114 | 1 | | | | 1 |
| Papillovirus Raport | | | | | 1 | | | 1 |
| Pediatr Res | 2.875 | 7.30 | 0.375 | 1 | | | | 1 |
| Prog Nat Acad Sci USA | | | | | | | 1 | 1 |
| Progress in Colloid and Polymer Science | | | | | 1 | | | 1 |
| Prophylaxe Impuls | | | | | 1 | | | 1 |
| Rheumatology | 4.226 | 3.60 | 0.886 | | | 1 | | 1 |

| | | | | | | | | |
|------------------------|--------|------|-------|---|---|---|---|---|
| S Afr Dent | | | | | 1 | | | 1 |
| Scand J Immunol | 2.023 | 7.00 | 0.463 | 1 | | | | 1 |
| Scand J Rheumatol | 1.687 | 9.10 | 0.139 | 1 | | | | 1 |
| Scand J Work Env Hea | 1.820 | 9.50 | 0.371 | | | 1 | | 1 |
| Science | 30.927 | 7.30 | 6.398 | | | | 1 | 1 |
| Sex Transm Dis | 2.738 | 5.60 | 0.659 | | 1 | | | 1 |
| Shock | 3.122 | 4.40 | 0.718 | 1 | | | | 1 |
| Skin Res Technol | 1.280 | 4.10 | 0.150 | | 1 | | | 1 |
| Sleep Med | 2.711 | 3.00 | 0.434 | 1 | | | | 1 |
| Spine | 2.187 | 8.20 | 0.190 | 1 | | | | 1 |
| Stroke | 5.855 | 6.50 | 1.039 | 1 | | | | 1 |
| The Cochrane Library | | | | | 1 | | | 1 |
| The Veterinary Journal | | | | 1 | | | | 1 |
| Tissue Eng | 2.887 | 3.80 | 0.389 | | 1 | | | 1 |
| Toxicol Sci | 3.088 | 3.80 | 0.617 | 1 | | | | 1 |
| Toxicol Lett | 2.430 | 5.50 | 0.335 | 1 | | | | 1 |
| Tumor Biol | 1.235 | 5.90 | 0.167 | 1 | | | | 1 |
| Urology | 2.139 | 5.90 | 0.181 | | 1 | | | 1 |
| Vet Immunol Immunop | 1.626 | 6.70 | 0.297 | 1 | | | | 1 |
| Wound Repair Regen | 2.204 | 4.70 | 0.284 | 1 | | | | 1 |

| | | | | |
|-----|-------|------|---------|-------|
| Hki | Turku | Oulu | BI+NPHI | TOT |
| 371 | 359 | 253 | 71 | 1,054 |

Table II. IADR classification to identify the research fields of Dentistry.

| Abbreviation | RESEARCH FIELD (number of the class) |
|--------------|--|
| Beh Sci | Behavioural Sciences & Health Services Research/Epidemiology (1) |
| Caries | Cariology Research (2) |
| CFB | Craniofacial Biology (3) |
| | Dental Anesthesiology Research (<i>relocated to class Other; only one publication</i>) (4) |
| Dent Mat | Dental Material (5) |
| Diag Sys | Diagnostic Systems (6) |
| | Education Research (<i>relocated to class Beh Sci; only few publications</i>) (7) |
| Ger OR | Geriatric Oral Research (8) |
| Implants | Implantology Research (9) |
| Microb | Microbiology/Immunology and Infection Control (10) |
| Min Tiss | Mineralized Tissue (11) |
| Nsns/Pain | Neuroscience/TMD/Pain (12) |
| | Nutrition (<i>relocated to class Pulp B, only two publications</i>) (13) |
| OHR | Oral Health Research (14) |
| Omd Path | Oral Medicine & Pathology (15) |
| OmFS | Oral & Maxillofacial Surgery (16) |
| Perio | Periodontal Research (17) |
| Phar/T/Tox | Pharmacology, Therapeutics, & Toxicology (18) |
| Pros | Prosthodontics Research (19) |
| Pulp B | Pulp Biology (20) |
| Sal Res | Salivary Research (21) |
| EBD | Evidence-based Dentistry (22) |
| Other | Other (23) |

Table III. Tekes (Finnish Funding Agency for Technology and Innovation) funding for applied dental research

| Tekes funding for dental projects* during 2001–2005 | | | | |
|---|---|--|-------------------|--------------------------------|
| Site of Research | Unit | Principal Investigators (dentist underlined) | Funding | Form of Funding |
| Helsinki University of Technology | Laboratory of Polymer Technology | Seppälä Jukka, Lampinen Markku | 1 350 752 | NCoE, FREE |
| Stadia Helsinki Polytechnic | Dental Technology | Kotamies Juha | 27 751 | iWell |
| Tampere University of Technology | Institute of Biomaterials, Institute of Materials Science | Kellomäki Minna, Törmälä Pertti, Mäntylä Tapio | 1 089 000 | COMBIO, NCoE |
| University of Jyväskylä | Department of Chemistry | Rissanen Kari | 479 671 | POTRA |
| University of Oulu | Institute of Dentistry, Department of Anatomy and Cell Biology, Department of Surgery, Department of Biochemistry, Department of Medical Technology | <u>Tuukkanen Juha</u> , Jämsä Timo, Neubauer Peter, Juvonen Tatu, Ruskoaho Heikki, <u>Larmas Markku</u> | 2 515 216 | COMBIO, NeoBio, FREE |
| University of Tampere | Institute for Regenerative Medicine (REGEA) | Ylikomi Timo, Hovatta Outi | 1 750 000 | COMBIO, FREE |
| University of Turku | Institute of Dentistry, Centre for Biomaterials, Department of Surgery | <u>Salonen Jukka</u> , Ylänen Heimo, <u>Vallittu Pekka</u> , <u>Närhi Timo</u> , <u>Kirveskari Pentti</u> , Jokinen Mika, <u>Yli-Urpo Antti</u> , Aro Hannu, Penttinen Risto | 8 141 339 | COMBIO, Drug 2000, POTRA, FREE |
| VTT Technical Research Centre of Finland | Biotechnology | Koskimies Salme, Autio Karin | 499 539 | ELITE |
| Åbo Akademi University (Turku) | Department of Chemistry | Rosenholm Jari, Hupa Mikko | 1 267 375 | COMBIO, FREE |
| Total | | | 17 120 643 | |

*) The numbers may also include projects with application areas additional to the dental ones.

Abbreviations:

COMBIO – Commercialisation of biomaterials

Drug 2000 – Biomedicine, drug development and pharmaceutical technology 2001–2006

ELITE – Innovation in Foods 2001–2004

FREE – Funding free from any specific research programme

iWell – Turning well-being technology into a success story 2000–2003

NCoE – National Centre of Excellence (Research in biomaterial technology)

NeoBio – Novel Biotechnology 2001–2005

POTRA – Polymers for building the future 2000–2003

Table IV. Research groups of Dentistry in Finland: The number of international publications of group members, and the corresponding research fields (IADR classification).

| University of Helsinki | Name of research group (number of members in the group) | n | IADR ¹⁾ (see Appendix Table II) |
|---------------------------------------|---|----|---|
| Ainamo Anja | Helsinki Aging Study (8) | 8 | 8 |
| Alaluusua Satu et al. | Developmental aberrations of teeth (24) | 78 | 3,6,12,16,17,23 |
| Hietanen Jarkko | Oral Pathology (11) | 38 | 2,9,10,15,23, |
| Kempainen Pentti | Neurovascular mechanisms of trigeminal pain and temporomandibular disorders (TMD) (10) | 9 | 12 |
| Könönen Mauno | BioDent Group (8) | 31 | 1,5,7,9,10,12 |
| Lindqvist Christian | Guided tissue regeneration and bioresorbable materials in maxillofacial surgery (10) | 27 | 15,16,18,21 |
| Meurman Jukka H. | Oral Health and General Diseases (12) | 30 | 2,8,10,14,15,16,17 |
| Murtomaa Heikki | Oral Public Health (9) | 30 | 14 |
| Peltola Jaakko | Oral Radiology (6) | 23 | 3,5,6,11,12,14,15, |
| Pussinen Pirkko | Periodontitis and cardiovascular risk (6) | 13 | 6,10,17 |
| Sorsa Timo | Proteolysis in Oral Diseases (17) | 87 | 2,6,9,10,15,17,18,20 |
| Tjäderhane Leo | Matrix Metalloproteinases in dental tissues (14) | 28 | 2,5,7,10,12,15,20 |
| Uitto Veli-Jukka | Periodontal Research Group (6) | 26 | 10,15,17 |
| Vehkalahti Miira | Oral health and oral health services (14) | 25 | 1,7,8,14 |
| University of Oulu | | | |
| Alvesalo Lassi | Kvantti (8) | 4 | 3 |
| Hausen Hannu | Caries management (6) | 22 | 1,2,18,22 |
| Lahti Satu | Psycho-social factors related to oral health (6) | 7 | 1 |
| Larmas Markku | Regulation of caries progression (8) | 14 | 2,3,11,13,20 |
| Larmas Markku | Practice-based research network in dentistry (9) | 14 | 5,6,14,15 |
| Knuutila Matti | Periodontology: Oral health behaviour (8+2) | 16 | 1,2,8,9,11,14,17,23 |
| Knuutila Matti, Syrjälä Anna-Maija | Periodontology: Miscellaneous (6+4) | 7 | 1,2,8,9,11,14,17,23 |
| Knuutila Matti, Tervonen Tellervo | Periodontology: Oral vs general health (7+4) | 33 | 1,2,8,9,10,11,14,17 |
| Oikarinen Kyösti | Research group of oral and maxillofacial surgery (6) | 53 | 9,12,15, 16,23 |
| Pirttiniemi Pertti | Oral development and orthodontics (15) | 12 | 3,22 |
| Raustia Aune | Oral rehabilitation (7) | 35 | 7,9,12,16,19 |
| Raustia Aune , Pirttiniemi Pertti | Temporomandibular disorders (TMD) (8) | 39 | 3,7,9,12,16,19 |
| Salo Tuula | Matrix metalloproteinases (MMPs) and extracellular matrix molecules (ECM) in oral diseases (43) | 73 | 4,5,7,10,11,15,17,20,23 |

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| University of Turku | | | |
| Alanen Pentti | Studies in epidemiology, risk assessment, organisation and health care economics in dentistry (8) | 32 | 1,2,3,7,12,15,23 |
| Forssell Heli, Jääskeläinen Satu | Trigeminal neuropathy group (7) | 17 | 1,12,16,22, |
| Happonen Risto-Pekka | Oral and Maxillofacial Surgery Research Group (17) | 32 | 1,5,15, 16 ,19, 23 |
| Heikinheimo Kristiina | Molecular pathology of head and neck tumours (4) | 9 | 3,15,18 |
| Honkala Eino | Dental Public Health (5) | 21 | 1,2,3,4,7,8 |
| Hurtta Helena | Aggressive periodontitis (3) | 0 | - |
| Karjalainen Sára | Pediatric Dentistry (4) | 7 | 1,2,6,14,15,21 |
| Le Bell Yrsa | Projects in Stomatognathic physiology (11) | 7 | 12 |
| Närhi Timo | Bioactive composites and implant coatings group (11) | 29 | 5,8, 9 ,10,11,19 |
| Pöllänen Marja | The function of junctional epithelium in periodontal tissue protection and destruction (1) | 2 | 17,18 |
| Syrjänen Stina | Human Papillomavirus Infections: Molecular Pathogenesis and Transmission (18) | 58 | 3,6, 10 , 15 ,18, 23 |
| Söderling Eva | Interactions with materials and microorganisms (7) | 6 | 1,2,5,18,21, |
| Söderling Eva | Effect of polyols and related substances on oral health (8) | 18 | 1,2,5,14,18,21 |
| Tammisalo Tapio | IMAGING (4) | 4 | 6,16 |
| Tenovuo Jorma | Oral defence mechanisms (8) | 34 | 1,2,6, 10 ,15,17,18,21 |
| Vallittu Pekka | FRC Research Group (28) | 92 | 5 ,19 |
| Varrela Juha | Effectiveness and efficacy of early orthodontic treatment (3) | 14 | 3,16 |
| Varrela Juha | Organization, outcome and costs of orthodontic treatment in Finland (5) | 6 | 1,2, 3 |
| Waltimo Tuomas, Kerosuo Eero | Control of endodontic infections (6) | 21 | 2,5,10,14,18 |
| Ylänen Heimo | Biomaterials Centre, BMC (16) | 18 | 18 |
| Institute of Biotechnology (BI)/ University of Helsinki | | | |
| Thesleff Irma | Molecular regulation on cranio-facial development (24) | 48 | 3 |
| National Public Health Institute (NPHI) | | | |
| Könönen Eija | Anaerobe Reference Laboratory (9) | 22 | 10 ,17 |

¹⁾ If the group has published > ten papers/research field in the period of 2001–2005, the number of the research field has been marked in bold.

F. SITE VISIT PROGRAMME – EVALUATION WEEK 24

Programme of the site visit week

| Date | Location | Time |
|-------------|--|----------------------------|
| Sun 10 June | Helsinki | 19.00–21.00 |
| Mon 11 June | Institute of Dentistry, University of Turku | 09.30–16.00 |
| Tue 12 June | Institute of Dentistry, University of Oulu | 11.00–16.30 |
| Wed 13 June | Institute of Dentistry, University of Helsinki National Public Health Institute (NPHI) Helsinki | 09.00–16.00 16.00–17.00 |
| Thu 14 June | Institute of Biotechnology, University of Helsinki Academy of Finland, Helsinki | 09.00–12.00 12.30–16.00 |

The Academy of Finland carried out an international evaluation of Finnish dental research in 2007. The evaluation covered the discipline nationwide with a view to assessing the strengths and weaknesses of Finnish dental research and to securing internationally high-standard research in Finland in the future. The evaluation was performed at the Institutes of Dentistry in Helsinki, Oulu and Turku and at two independent research institutes, or relative parts of them, that had received Academy funding for dental research or related projects.

This report presents the evaluation of Finnish dental/odontological research including research from certain other areas of medical sciences, natural sciences as well as technical sciences. The international evaluation panel finds the overall standard of science good, in some parts even excellent. The panel gives special recognitions but also identifies some focal problems. In Finland, dental research activities are dependent on rather few individuals, and in many cases based upon comparatively small research groups.



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