

Evaluation report

Evaluated point	Grade	Comments
Scientific impact of research	Good	<p>We had an opportunity to meet with staff from the Department of Health Technologies, School of IT, specifically the Centre for Biomedical Engineering (Prof Ivo Fridolin, Prof Kalju Meigas), the eMed Lab (Prof. Peeter Ross) and the Centre for Cardiovascular Medicine (Prof. Margus Viigimaa) and from School of Science, Department of Chemistry and Biotechnology: Division of Gene, Molecular Neurology research group, Metalloprotein group (Professor Tõnis Timmusk, Professor Peep Palumaa). We did not meet representatives from eNMR, the Department of Occupational Health and Ergonomics, the Bioelectrical Impedance group or the Sensor and Control Systems group, and there is little information in the submission on their activities. The comments below are therefore based on an incomplete evaluation of the whole group represented in this submission.</p> <p>Staff highlighted the existence of established collaborations between hospitals especially departments of cardiology and nephrology, and in some cases split positions, with the TTU. The neurobiology group housed its own animal facility ranging from flies to rodents. In general, groups were active in applied approaches to improve diagnostics and prognostics (e.g. non-invasive uraemic toxin detection; more user-friendly pulse wave detection) and doctor-patient communication (voice recognition in Estonian language). A wide range is covered in the TTU health area from basic research to more applied approaches with little apparent strategic direction to coordinate efforts. Thus, much of the work seems to be of high scientific quality with substantial impact in the field, but is quite diverse across different fields.</p> <p>Many publications appear in middle to low impact journals with a few notable exceptions. Drs Timmusk and Palumaa show consistent high impact publications (in collaboration with others), so there are clearly pockets of excellence in the area. Dr. Viigimaa has participated in multi-authored papers/guidelines with +2000 citations. It is, however, hard to evaluate the whole group in the absence of an opportunity to meet.</p> <p>Nevertheless, this clustered excellence seems not to be reflected in the bibliometrics presented in the submission. Research output per member of staff seems low, with a total of only 228 publications listed on the ISI Web of Science database in the period 2010-2015. This reflects an average annual output of about 43 papers: this translates to less than one paper per year per member of research staff.</p>

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		<p>Approximately 30% of these papers have never been cited even once, and citations are generally low. These data also appear to be at variance with the statement in the presentation by Prof Fridolin that the research output of the Centre of Biomedical Engineering alone was about 200 publications for the period 2009-2016.</p> <p>Scientific impact of research is considered good or very good, but appears not to be uniformly distributed across the diverse research areas.</p>
Sustainability and potential of research	Good	<p>Sustainability requires a high level of research productivity in relevant topics that is completed in a stable research environment embedded within a university that has teaching obligations and PhD studies supplemented with funding obtained from external competitive sources. The groups that we met were educating PhD students at high level with notable differences in the number of PhD students supervised at different groups. A small number of groups appeared to supervise most of the students.</p> <p>Infrastructure was impressive – we saw either new buildings or renovated older buildings. We did not have a chance to see the animal facilities. There was ample space and much up-to-date equipment in relevant biomedical basic research areas, including cell facilities, imaging etc. Department of Chemistry and Biotechnology had a second to none instruments equipped department that allowed most modern biochemical research to be conducted within the specific research areas regarding neurobiology and metal ion interactions.</p> <p>It was not clear to reviewers whether there was a strategic plan for harmonization and integration of activities to benefit from the potential synergies. The distribution of the members of the group across different Schools and Departments and different physical buildings may have some advantages but it perhaps also has some limitations. International standards are required but insisting on a fixed number of publications across research area and discipline appears rigid and not optimal in every case.</p> <p>It is not apparent how the work on the national healthcare databases aligns with the very substantial work of the National Institute for Health Development in this area. There appeared to be overlap and duplication of effort rather than the collaboration that should exist.</p> <p>There was ample evidence of a vibrant research culture in some of the laboratories that we saw, but this is not easily reconciled with some of the publication data cited above. There was limited evidence during the visit of international collaborations in the form of non-national representation in</p>

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		<p>the staff or student groups that we met. Such collaborations obviously exist, though, as in the work on bio-optical and bio-electric signals in Biomedical Engineering presented by Prof Fridolin.</p> <p>It is apparent that a substantial investment in infrastructure (including both buildings and laboratory equipment) has been made in recent years and a further investment in new professorial positions is in progress. The Vice-Rector seemed unconcerned about the decline in the student population from 15,000 to 11,000 and indeed seemed to anticipate a further decline to 9,000. The impact of this reduction on the University's funding position and on the viability of the existing infrastructure must surely be a cause for concern.</p> <p>The sustainability and potential of research is considered satisfactory and in some groups good or very good.</p>
Societal importance of research	Good	<p>No overall impression was given as to an explicit strategy to incorporate societal needs in the research efforts. Estonian national health registry is available but an impression was left that TTU researchers did not incorporate this facility in their activities. The research efforts strive to be within two growth areas: 1) ICT and 2) health technology, with neurobiology groups doing less applied and more basic research. It is clear that some of the research lines had emerged from hospital need for better IT infrastructure. No formal points of interaction or routine use of split positions were used as an instrument to facilitate exchange of ideas and research efforts that could bring in unmet societal needs. Nevertheless, several research areas have the potential for major societal impact. The research projects presented all had applied endpoints which were within reach by continued research. Examples were treatment for Alzheimer, diagnostics for arteriosclerosis/vascular aging, and voice recognitions equipment for medical professionals. Obviously, major breakthroughs in research area of neurobiology and nerve cell growth would benefit the society on a longer time scale. Patents and commercialization in form of products and spin-off companies were described. The submission says that "Research in biomedical engineering included development of non-invasive cost-effective robust tools for early detection of cerebral, cardiovascular and renal disorders in ageing population." Such a development would be remarkable, but it appears that this is work in progress rather than work completed. Professor Ross referred to several exciting developments in the e-medicine area, including analysis and development of digital decision support applications for personalized medicine, and online access by members of the public to their own medical data.</p>

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		Time constraints precluded the exploration of these areas. Societal importance of the research is considered good.
<p>Scientific basis in the field is sufficient to conduct doctoral studies. (This question should be answered only if: a) institution being evaluated is conducting doctoral studies and; b) The field being evaluated is proposed to grant positive evaluation. If these conditions are met then: a) If the level of scientific basis is sufficient for conducting doctoral studies in every structural unit being evaluated, then the answer should be „yes“; b) If the scientific basis is not sufficient in some structural units, then those units should be listed.)</p>		<p>We had a chance to meet a group of about 15 PhD students in absence of senior staff. The students we met were enthusiastic and seemed highly motivated to pursue careers in research. They appreciated the opportunity to study at the University. PhD students were generally satisfied with the environment and had a high degree of influence on their projects. Most students were recruited after having applied in open calls. PhD students stated that they were expected to steer the direction of their projects but they seemed not to be aware of any clear policy on the expectations relating to their performance and progression.</p> <p>We noted that each was required to have three published papers for submission of their thesis regardless of the specific subject area or nature of the project. Regular opportunities for presentation of research at internal meetings were available and all were expected to make presentations at national and international conferences. They indicated that financial support was readily available for this purpose. All PhD students we met were Estonian nationals, and greater recruitment from overseas would likely bring some benefits. There is clearly a strong research community of active graduate students. The new tenure track will further support this. The scientific base for conduct of doctoral studies was fulfilled for the research areas presented to us (see scientific impact of research). The infrastructures (equipment, laboratories and qualified supervisors) were present and satisfactory. The students expressed their satisfaction with the conditions too. To be praised is the open-minded culture that recognizes Department Chemistry and Biotechnology. All equipment was to be shared and rules were worked out on how to share it.</p> <p>In conclusion, there was a good to very good environment for doctoral studies.</p>

Summary assessment

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<p>Areas of special note as appropriate (Where necessary indicate sub-fields, assessment criteria, and/or structural units which, in the committee's opinion, were of a notably high level.)</p>		<p>As stated above the neurobiology cluster was at high level and other areas were also competitive.</p>
<p>Areas in need of improvement as appropriate (Where necessary indicate sub-fields of the field being evaluated, assessment criteria, and/or structural units which, in the committee's opinion, revealed significant shortcomings.)</p>		<ul style="list-style-type: none"> • A more focused strategy for interaction between health sector and TTU is needed. Establish formal contact points between hospitals and institute (e.g. how do young or newly hired researchers establish contact with relevant persons/patient categories needed for his/her research efforts?) • Definition of unmet needs in the health sector appeared to be random and no systematic approach to collaboration with other health professionals was noted. • More internationalization in PhD student recruitment. Use English as the daily language in the labs. • More focus on research productivity is warranted especially in light of the distinction between teachers/researchers and the very uneven distribution of productivity. • A more focused publication strategy is needed to ensure that papers reach their target audience. • More direct contact between students and researcher is encouraged.
<p>Assessment proposal to the Minister of Education and Research</p>	<p>To grant positive evaluation</p>	<p>Committee unanimously recommends positive evaluation.</p>

Feedback

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<p>Feedback for institution (This question should be answered only if the institution asked for feedback from the evaluation committee in the self-report (about up to three specific areas of R&D which it finds to be currently important, e.g., related to its development plan).)</p>	<p>To the forwarded question regarding the proportion of tenured/non-tenured staff it depends on the disciplines and type of work (e.g. if it is theoretical and experimental). In general there should be sufficient tenured staff to secure core business and succession planning. For groups engaged in experimental work, an appropriate ratio could be in the range of 1/10 to 1/6. Regarding realization of researchers' potential for creativity: If this means innovation and entrepreneurship we suggest that the present rules for ownership of patents are re-evaluated i.e. Inventor vs. university, and the proportion which the inventor owns. Further to facilitate the process, so the researcher does not stand alone with all the patenting aspects possibilities for assistance should be present. PhD students should join courses in entrepreneurship so they at least know the rules and possibilities for help.</p>
<p>Suggestions for unit, institution, state etc (As appropriate, committee can give additional feedback for the structural unit, the institution, or the State (please specify whom feedback is directed to) according to the directive assessment criteria for regular evaluation (article 7).</p>	<p>See above for further details.</p>