



# **Research Review**

**Faculty of Science and Engineering**

**University of Groningen  
2017**

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# 1. Introduction committee chair

This report presents the review and assessment of the research of six institutes and of the graduate school of the Faculty of Science and Engineering (FSE) of the University of Groningen. It was performed in accordance with the Standard Evaluation Protocol 2015 – 2021 (SEP), that dictates that research performance is to be scored on 3 main criteria: quality, societal relevance and viability towards the future. The review is based on the written information provided by the Faculty and the institutes (self-evaluation reports) and on the discussions that took place during the site visits in Groningen during the week of 11 – 16 June, 2017. The review committee consisted in total of 19 members, most of which participated in the review of two or more research institutes in which they had relevant scientific disciplinary expertise. Two members were from industry with the objective to contribute to the assessment of societal relevance.

The committee was very pleased with all relevant and informative documentation provided by the Faculty and the institutes in advance and also by the frank and open discussions that took place during the site visits with representatives of the Faculty, the six institutes and the graduate school. The programme was very well organized, the committee experienced great hospitality and obtained all relevant information necessary for making fair and objective judgements. Scores on all criteria varied from “very good” to “excellent”, which indicates that FSE overall represents very high quality research, that is very relevant to society and has great potential towards the future. It has been the intention of the committee that its report also contributes to further reflection in the Faculty and the various institutes on how to maintain this high international standard and further improve where possible.

I personally should like to thank all committee members for their commitment and dedication to the review process, in particular to those who stepped in as vice-chairs of the committee, and to the two secretaries for their excellent support.

Douwe D. Breimer  
Committee Chair



## 2. The review committee and the procedures

### 2.1. Scope of the review

The review committee has been asked to perform a review of the research of six institutes and of the graduate school of the Faculty of Science and Engineering (FSE) and of the institute KVI-CART at the University of Groningen. The review in this report includes the following research units:

- Van Swinderen Institute for Particle Physics and Gravity (VSI);
- Engineering and Technology institute Groningen (ENTEG);
- Zernike Institute for Advanced Materials (ZIAM);
- Stratingh Institute for Chemistry (Stratingh);
- Groningen Biomolecular Sciences and Biotechnology Institute (GBB);
- Groningen Institute for Evolutionary Life Sciences (GELIFES)

In accordance with the Standard Evaluation Protocol 2015-2021 (SEP) for research reviews in the Netherlands, the committee's tasks were to assess the quality, the relevance to society and the viability of the scientific research at the research unit as well as the strategic targets and the extent to which the unit is equipped to achieve these targets. Furthermore, a qualitative review of the PhD training programme (organised in the Graduate School of Science and Engineering, GSSE), research integrity policy and diversity was part of the committee's assignment.

### 2.2. Composition of the committee

For the review of the research of six institutes within the Faculty of Science and Engineering, the research institute KVI-CART and the graduate school (GSSE), the Faculty appointed a committee of 19 members in total. FSE appointed one chairman to take the lead in the review of all institutes to guarantee consistency. Due to unforeseen circumstances four vice chairs had to step in to replace the chairman during the site visit. In the list of committee members below, the institutes with an \* were chaired by the respective committee members/vice chairs.

For the review of each institute a sub-committee was appointed, consisting of committee members with relevant disciplinary expertise. Most committee members participated in the review of two or more research units, in order to create overlap and consistency in the review of the different institutes. In order to help review the institutes with respect to societal relevance, two committee members who work in industry were appointed and one of them participated as committee member in the review of each institute. The composition of the committee is given below, participation in the sub-committees is provided in brackets:

- Professor Douwe Breimer (chair), emeritus professor of Pharmacology, Leiden University; past rector magnificus of Leiden University (all institutes);
- Professor Gerard Meijer (vice chair), director of the Fritz-Haber Institute, Max-Planck-Society, Berlin, Germany (KVI-CART\*, VSI\*, ZIAM\*);
- Dr. Frank Schuurmans (vice chair), vice president research at ASML, Veldhoven, the Netherlands (KVI-CART, VSI, ENTEG\*, ZIAM);
- Professor Uwe Oelfke, professor at the Institute of Cancer Research, London, United Kingdom (KVI-CART, VSI);
- Professor Klaus Kirch, head of the Laboratory for Particle Physics, Paul Scherrer Institute, Villigen, Switzerland (KVI-CART, VSI);
- Professor Annabella Selloni, professor of Chemistry, Princeton University, USA (KVI-CART, VSI, ZIAM)
- Professor Matthias Wessling (vice-chair), head of Chemical Process Engineering chair, RWTH Aachen University, Germany (ENTEG, Stratingh\*, GSSE\*);
- Professor Dawn Tilbury, professor in the Mechanical Engineering Department, University of Michigan, USA (ENTEG, GSSE);
- Professor Anne Meyer, professor of Enzyme Technology and Biochemical Engineering, Technical University of Denmark, Denmark (ENTEG, GSSE);

- Professor Richard van de Sanden, Director of the Dutch Institute for Fundamental Energy Research DIFFER, the Netherlands (ENTEG, ZIAM, GSSE);
- Professor Andreas Hirsch, full professor of Organic Chemistry at the University of Erlangen-Nürnberg, Germany (ZIAM, GSSE, Stratingh);
- Professor Janine Cossy, professor in Organic Chemistry, Ecole Supérieure de Physique et Chimie Industrielles (ESPCI) ParisTech, Paris, France (GSSE, Stratingh);
- Professor Roderich Süßmuth, Rudolf-Wiechert professor in Biological Chemistry, Technical University Berlin, Germany (GSSE, Stratingh, GBB);
- Dr. Ir. Sjoukje Heimovaara, director Research and Breeding, Royal van Zanten, the Netherlands (Stratingh, GBB, GELIFES);
- Professor Ernst Bamberg, director of the department of Biophysical Chemistry, Max Planck Institute for Biophysics, Germany (Stratingh, GBB);
- Professor Wim van der Putten (vice chair), head of the Department Terrestrial Ecology, Netherlands Institute of Ecology (NIOO-KNAW), the Netherlands (GBB\*, GELIFES\*);
- Professor Lotte Soegaard-Andersen, director of the department of Ecophysiology, Max Planck Institute for Terrestrial Microbiology, Marburg, and professor for Microbiology at the Philipps-Universität Marburg, Germany (GBB, GELIFES);
- Professor Pat Monaghan, Regius professor of Zoology, University of Glasgow, Scotland (GELIFES);
- Professor Norbert Sachser, professor of Zoology, Department of Behavioural Biology, University of Münster, Germany (GELIFES).

The Curricula vitae of the committee members are included in Appendix 2. The committee was supported by dr. Meg Van Bogaert and Peter Hildering MSc, who acted as secretaries on behalf of QANU.

### **2.3. Independence**

All members of the committee signed a statement of independence to safeguard that they would assess the quality of the FSE institutes of the University Groningen in an unbiased and independent way. Any existing personal or professional relationships between committee members and the research unit(s) under review were reported and discussed in the first committee meeting. The committee concluded that there were no unacceptable relations or dependencies and that there was no specific risk in terms of bias or undue influence.

### **2.4. Documentation provided to the committee**

The committee had received the following documentation prior to the site visits:

- self-evaluation report of the unit under review;
- self-evaluation report at the level of the Faculty of Science and Engineering;
- appendices required by the Standard Evaluation Protocol (SEP);
- CWTS analysis;
- the Terms of Reference;
- the SEP 2015-2021;

### **2.5. Procedures followed by the committee**

The committee proceeded according to the SEP 2015-2021. Prior to the site visit, all committee members were requested to independently formulate a preliminary assessment concerning the unit(s) under review they were involved in, based on the written information that was provided. The final review is based not only on the documentation provided by the research unit(s), but also includes the information gathered during the interviews with management and representatives of the research unit(s). The first preparatory meeting by the committee took place on 11 June 2017, the interviews took place on 12-16 June 2017 (see the schedule in Appendix 3) in Groningen.

Preceding the interviews, committee members were briefed by QANU about research reviews according to the SEP 2015-2021 and were provided with information regarding specifics on Dutch

research (e.g. funding and position of PhD students). Also, each sub-committee discussed its preliminary findings and decided upon a number of comments and questions. The sub-committees also agreed upon procedural matters and aspects of the review. After the interviews the committee discussed its findings and comments in order to allow the chair to present the preliminary findings and to provide the secretary with argumentation to draft a first version of the review report. Prior to sending out the draft report to the committee members and FSE, the chairman met with the vice chairs after the site visit in order to achieve comparability of the findings of all subcommittees and to pursue a coherent report.

The draft report by sub-committees and secretaries was presented to the research unit concerned for factual corrections. In close consultation with the chair and other committee members, these reactions were reviewed prior to drafting the final report. The final report was presented to the Board of the University of Groningen, to the Dean of the Faculty of Science and Engineering, and to the management of the institutes.

## **2.6. Application of the SEP and scores**

The committee used the criteria and categories of the Standard Evaluation Protocol 2015-2021 (SEP). For more information see Appendix 1. The committee would like to make three remarks with respect to using the SEP scores that should be carefully taken into consideration when comparing the outcomes of this review with any other research review according to the SEP, in Groningen or elsewhere.

The chair, vice chairs and sub-committees agreed that by giving the score 1 (excellent), the sub-committee had to be unanimous that the major part of the work of the institute deserved the judgement: "one of the few leading groups worldwide" (SEP definition). Thereby the committee explicitly applied the scores as were intended in the current SEP. According to the committee a current *very good* (2) score should therefore be valued higher compared to the *very good* (4) score in the previous SEP, since the criteria for obtaining the score *excellent* (1) are more strict in the current protocol. The chair and vice-chairs met approximately one month after the site visit and calibrated the scores that were given to the institutes in order to obtain consistency.

Second, the committee was asked to provide full scores at the level of the institutes. In some situations the sub-committee would have preferred to give an intermediate score to more specifically score the quality, relevance or viability of the institute. The more detailed findings of the sub-committee therefore could not always be captured in the score, but should be deduced from the text.

Finally, within each institute a number of research groups are combined, each with its own quality, relevance and viability. The committee combined the work of all research groups into its findings and scores, also including the interaction between the research groups and the overarching findings at the institute level. This obviously led to an "average" score, which – again - cannot be compared with those of previous reviews without reading the qualitative comments in the text.

Category and meaning of the SEP scores: For each institute the conclusion includes the SEP score for research quality, relevance to society and viability. The meaning of SEP scores is excellent (1), very good (2), good (3) and unsatisfactory (4).



## 3. General Remarks at Faculty level

### 3.1. Introduction

The committee received the self-evaluation reports of the institutes and additional documentation prior to the site visit. Overall, the committee was very pleased with the quality of these self-evaluation reports. They were written in a concise manner, were very informative and served as an excellent base for the discussions during the site visit.

The information provided in the self-evaluation reports was verified, added to and discussed in the interviews during the site visit. The committee was impressed by the enthusiasm and vision it met in the interviews with many of the representatives of the institutes, both junior and senior. The level of self-criticism, sense of reality and views on future perspectives were refreshing and convinced the committee of a very positive overall atmosphere at the Faculty of Science and Engineering (FSE). This view was reinforced in the meetings with the Dean of the Faculty. These very informative daily meetings with the Dean ensured that all committee members had the opportunity to ask questions at a level surpassing the individual institutes, for example on budget allocations, strategic investments, career policy, collaborations between institutes etc. The Dean was well informed on the functioning and strategic questions of each of the different institutes and had a clear view on what type of authority and decisions are needed at the Faculty level versus those at the level of the individual institutes. The committee concluded that the Dean has a clear strategic vision on where FSE should go in the next period with a high, but not unrealistic ambition.

Finally, each evening after the formal interviews were finalized, committee members met with institute directors and other senior staff of the institutes. This way, the formal interviews were followed up by more informal interactions. The committee highly valued these informal meetings and on several occasions committee members gathered further clarifying information.

### 3.2. Strategy, mission and leadership at Faculty level

According to the committee the mission and strategy are well described in the self-evaluation report of FSE. This review focuses on the research activities within FSE, including the training of PhD students. The mission of the FSE is "to be an important international player in research and education" by

- "excelling in research and education in a broad range of disciplines in natural science with a vision to grow in engineering science;
- doing this with an international orientation;
- creating and pursuing new opportunities for research and education that arise between traditional disciplines;
- contributing to the solution of challenges of industry and society at large."

A number of strategies and policies have been put into place to pursue this mission, like excellence of individual scientists, excellence in large research programmes, excellent facilities and excellence in teaching. In addition, FSE has a strong international orientation, which is clear from the diversity in nationalities of staff members and by the fact that all master programmes and most bachelor programmes are provided in the English language and from 2018 all bachelor programmes will be taught in English. One particular aspect of internationalisation is the opening of a branch campus in Yantai (China), which will be discussed separately in chapter 3.5.

The committee noted that FSE has clear ambitions to further developing engineering science. The recent change in name of the Faculty, explicitly including Engineering, clearly displays this ambition. The committee would have expected more reflection of this ambition at Faculty level in terms of future opportunities and not only in the institutes that explicitly focus on engineering science. Although the Dean clearly supports and stimulates the ambitions of e.g. ENTEG, the committee feels that other institutes should more explicitly engage with the engineering ambition.



The committee recommends to more strongly emphasize and support the engineering science aspects of FSE in its policy.

In order to cross borders between disciplines, FSE stimulates research within the institutes to be multidisciplinary. Collaboration between institutes within FSE addresses four research themes, which run as a matrix through the organisation of the institutes. The four research themes are:

- Advanced Materials;
- Molecular Life and Health;
- Adaptive Life;
- Data Science and Systems Complexity.

Incentives to collaborate between institutes, beyond intrinsic motivation by individual scientists, are given by way of strategic seed funds by FSE. These are implemented - for example - by the financing of 40 PhD students in collaborative research projects across institute borders and also by the acquisition of new equipment. The Faculty Board and Executive Board of the university plan to invest over 25 M€ in the period 2015-2020 for interdisciplinary/inter-institute research. Overall, the committee applauds this approach and is convinced that the strategic vision of FSE is translated into sufficient incentives to collaborate between institutes. The next step is to clearly and carefully monitor the outcomes of these initiatives and pay continuous attention for new opportunities where collaboration between institutes will be required. In the review of the institutes the collaborative projects were not highly visible, or explicitly mentioned. When asked by the committee, examples were given, but higher priority is needed at the level of the institutes.

Finally, in the review of one of the institutes the value and role of a scientific advisory board was explicitly discussed. The committee learned that such a scientific advisory board is not mandatory at FSE. The committee recommends introducing such an advisory board for each institute; such a sounding board of experts with an outside view is considered to be very valuable. The size and position of a scientific advisory board should be dependent on the size of the institute. Nevertheless, even small institutes might strongly benefit from such a board.

### **3.3. Citation analysis**

FSE provided the committee with a citation analysis (by CWTS) at Faculty level, providing information on citation and impact of the publications of the institutes. The attention given to this analysis in the self-evaluation reports differed between institutes. All sub-committees took notice of this analysis and at some stage made use of it in its assessment, although not always explicitly. Overall the committee considered the report very informative, specifically the MNCS, the report in which the citations of the institutes are compared to the world-average in the respective discipline. At the same time, information on citations did not play a dominant role in the committee's overall judgements.

### **3.4. Societal relevance**

The societal relevance of each institute has been reviewed in the respective chapters of the institutes. Most topics in science and engineering research are highly relevant in themselves. However, the committees reviewed the societal relevance of the research of the institutes not only on the relevance of the research topics per se. More important is in what way the institutes pursue an active policy to engage with societal partners and actual research output that is considered to be relevant. Overall policy and strategy with respect to valorisation and outreach is organised at the level of FSE. Two topics were discussed with most institutes and a general review is provided in this chapter.

#### **Intellectual property**

Intellectual property protection and patent application are part of FSE's societal relevance strategy. In the self-evaluation reports limited information was provided with respect to Faculty policy on this topic, but at the request of the committee this was readily made available. The brochure *The*

*Value of Knowledge* is a useful guide of the UG for patenting and business development. From this document and from the information gathered during the site visit, the committee concludes that FSE seems to have a clear and active policy on dealing with patents, patent applications and collaborations with industry and other third parties. Professional support to do this effectively is provided at the university level.

During the review of a number of institutes, the committee discussed the way potential financial benefits of patents are distributed. Based on the responses, the committee concluded that there had been no clear distribution model clause in the past. However, in the recent past a new model was introduced, which assures that the inventors (individual scientists(s)), the institute, Faculty and university each get a specific percentage of the financial benefit. The committee thinks this could be a good incentive to stimulate the submission of patents.

#### Valorisation

In the self-evaluation report it is stated that collaborations with companies and governmental or non-governmental organizations are fostered. National policy (partly) boosted this development over the past period and led to – among others – a Committee Research Valorisation (CRV) that organizes matchmaking events with industry. By growing activities in engineering, FSE is also increasing contacts with industry. In 2016 the Groningen Engineering Center was opened to serve as a platform for interdisciplinary engineering research and education. As already mentioned, the focus on engineering was made more explicitly visible by changing the name of the Faculty in 2017 to include engineering.

The committee concluded that FSE is clearly and visibly realising its policy with respect to valorisation. For some institutes this policy and actual results were more explicit than for others, but overall the committee was very positive, both with respect to the policy itself as well as the execution of it.

### **3.5. China / Yantai**

In several interviews during the review the prospective China branch of the University of Groningen at Yantai was discussed. The sub-committees noted variation in enthusiasm between the different institutes about the Faculty's participation in this new endeavour. It was therefore on more than one occasion also discussed with the Dean. Although the activities in Yantai are not expected to start for another two years and a number of preconditions still have to be exactly defined and agreed upon, the committee experienced a clear vision of the Faculty board on the potential benefit as well as on the potential threats. The committee would like to shortly state its view on this topic in this part of the report and will refrain from providing detailed feedback in its review of the individual institutes.

In 2019 five science degree programmes are expected to start at the Yantai Branch of the University of Groningen. These five programmes make up about 80% of all UG programmes starting in Yantai in the first year of the initiative, implying that much weight is on the shoulders of FSE. An important consideration is the objective of FSE that the quality of teaching and research in Groningen should minimally stay at current level or further improve as the result of this endeavour. Therefore the condition has been agreed upon that only 15% of the courses at Yantai can be taught by current FSE staff; the remainder will be taught by new staff recruited by the Yantai Branch (which is a separate legal entity). Compensation for staff members who go to Yantai for a period between a month up to a year will be given at a factor of 2,5. With this financial arrangement, the University and Faculty plan to fully compensate the input of an institute and make it possible to appoint additional staff members at Groningen. The committee considers this degree of compensation as adequate, but is also aware of some potential pitfalls. For example, there is the risk that predominantly mid-career and senior staff members will spend time at Yantai. This will undoubtedly have impact on the balance between senior and junior staff within the FSE institutes. In some institutes the number of senior staff is already small relative to junior staff and



on a number of occasions it was stated that it is quite difficult to recruit high quality senior staff to Groningen.

Although discussions are still taking place and final decisions still have to be made, the Dean informed the committee that there will be clear and adequate conditions as well as arrangements with respect to the increased teaching load within the Faculty if staff members participate in teaching activities in Yantai. From what the committee understood from the Dean, nobody is obligated to take part in teaching at Yantai. Institutes should therefore not feel forced to participate if there is no benefit for the individual staff member or for the institute.

Furthermore, it was stated by the Dean that research should also be part of the Yantai Branch, which makes sense to the committee if it is supplementary to, rather than competitive with, the research in Groningen. Another positive aspect mentioned is an increase of reputation and visibility of the university with access to a new market of talented staff members and talented students.

In conclusion, the committee believes that FSE is planning and safeguarding the preconditions for its institutes in this endeavour seriously. Each institute as well as individual researchers can and should carefully weigh the benefits and risks before deciding to participate or not. It is strongly recommended that care is taken to ensure that the engagement in China is balanced, so the teaching load there does not become a drain on senior faculty at FSE. It is important that sufficient senior staff remain in Groningen to ensure sufficient high quality leadership capacity both for research and education. This could be achieved by new senior appointments as well as an expansion of tenure track staff in Groningen.

### **3.6. Funding structure**

In the self-evaluation reports funding is divided into three main categories, namely direct funding (first stream), competitive funding (second stream) and contract research (third stream). The amount of direct funding is based on teaching load in educational programmes and the number of graduated PhD students. Second stream funding is based on acquisition of research grants at national and international (ERC) level, while third stream funding is based on EU funding and contracts with, for example, industry. The percentage in direct funding (in 2016) varies between 35% and 62% depending on the institute.

The committee noted that some institutes focus more strongly on funding from third money stream (collaboration with industrial partners), while others focus more on the application of grants in the second money stream and on obtaining personal grants. The scientific director and board of each institute have a yearly meeting with the faculty board to discuss strategy, developments in staff and multi-year budget. The committee was provided with information on budget allocation of direct funding to the institutes, but it seems that there is no overarching strategy of the institutes on how to allocate this direct funding within the institutes. This seems sensible when taking the diversity of research topics into consideration as well as the different sources of funding. The committee did notice that providing seed money for new developments and collaborations was organized differently between the institutes. Specifically for institutes with a broad range of research topics, having limited strategic money to stimulate more coherence and collaboration may lead to lack of possibilities for renewal and/or may have an effect on the quality of the research output in the long term. Also, during the site visit it was mentioned on more than one occasion that it is difficult for mid-career research staff to obtain grants, in particular personal grants. For staff with a background in engineering and having worked in industry for some time, this seems to be even more difficult. FSE might consider this group specifically in distributing seed funding.

### **3.7. Human Resource: tenure track, postdoc and technical staff**

FSE has developed several policies and instruments with respect to human resource development. Institutes have a major influence in defining the profile for new (senior) staff members and the selection of the candidate. For the professorial positions, the Dean leads the selection procedure.

### **Tenure track system**

The FSE has a tenure-track system in place since 2002, in order to provide clear perspectives and well defined boundary conditions to young and talented researchers. There are clear criteria for candidates to be considered for such a position. When appointed, a 6-year contract is offered which is evaluated after 5 years. If the candidate fulfils the requirements, he or she is promoted to associate professor on a tenured position. After another 4-7 years the candidate will again be evaluated and in case of a positive judgment be promoted to full professor. During the review of all institutes, the subcommittees were very positive with respect to the interviews with the groups of tenure-trackers. Without exception the groups of tenure-trackers showed enthusiasm, positive dynamics and a clear vision with respect to the functioning and future of their institute as well as their own careers. It clearly shows the success of the tenure-track policy at FSE.

Setting up a new research line is one of the requirements for getting tenure. On the one hand this pushes the TT candidate to really show what he/she is capable of achieving. On the other hand it stimulates a rather individualized focus with potentially limited benefit for the institute as a whole. In one of the meetings with the Dean this discrepancy in requirements between excelling at an individual level and being of added value for the institute was discussed. The committee was pleased to learn that also FSE had become aware of this and is taking this into consideration in its new TT policy that is currently being developed. Indeed FSE should strive for a balance between pushing an individual to build his/her own group and career and the requirements of the institute, or Faculty as a whole.

The committee applauds the fact that the tenure track system also includes the option for young tenure track candidates to take academic leadership courses. It is considered very positive that career paths for tenure track positions are clearly outlined. One specific fellowship for tenure-track positions in Groningen is the Rosalind Franklin fellowship for excellent female researchers.

The career path and requirements for tenure trackers is very clear to the staff concerned; consideration is given to courses that are required like academic leadership and supervising PhD students. The subcommittees were positive about the fact that a tenure-tracker is expected to start his/her own research line and build a research group that is not primarily part of the research line of a full professor. This does put pressure on the tenure-tracker to be successful and develop an independent research career, but also allows for more visibility. As indicated before, the research line should fit well with the overall research strategy of the institute. FSE provides each tenure tracker with a PhD position and some additional funding to provide them with a good start.

The committee agrees that being able to write excellent grant applications should be part of the condition for tenure and all TT candidates are supported by senior faculty in writing and sharpening their grant applications. However, writing an excellent grant application does not guarantee the actual obtaining of a grant, because competition is tough. The committee was made aware of the limited opportunities for grant application at this point of the academic career, which seem to also differ between disciplines (and thus between institutes).

A final remark the committee wants to make is that the mentoring of a TT candidate after getting tenure should not be considered superfluous. This is dealt with differently between the institutes. Some consciously continue with a senior professor in a mentoring role, while in other institutes this is not part of the policy. The committee feels that TT candidates continue to require some mentoring even after obtaining tenure. Mentoring and professional development continue to be beneficial throughout a faculty member's career.

### **Post-doctoral fellows**

Funding policy in the Netherlands has resulted in a decreasing number of postdocs over the past decades. FSE states that postdoctoral fellows form an important part of the research staff. A distinct difference was observed in number of post-doc fellows between the institutes in FSE however. Some institutes indeed have a significant number of postdoctoral fellows, in some



institutes the number is rising while other institutes clearly have few post-doc fellows. The committee is valuing the policy of FSE that intends to increase number of postdocs, providing a continuum in career opportunities for young researchers. The committee did notice that postdocs, who are still in the qualifying stages of their career, might need more than just a supervisor. Moreover, they also require further training in for example integrity policy and supervision of undergraduate and graduate students.

With the growing community of postdoctoral fellows, FSE has also concluded that this group deserves more attention. FSE has introduced a postdoc platform and appointed two postdoc ambassadors. This is a promising start, but the committee wants to reiterate that also specific training and supervision should be provided to the postdoctoral fellows.

### **3.8. Number of staff and technical support staff**

It appears that the number of students in bachelor and master programmes in FSE has grown at a faster rate than that of the staff. Since the increase in direct funding as the result of increased student numbers always comes with a delay, this could be expected. Several of the degree programmes are currently growing and the increasing number of students will allow for further increase in faculty. The committee considers it to be important to attend to a good balance between junior, mid-career and senior staff.

According to the SWOT analysis the technical staff did not grow at the same speed as the tenure track researchers. Technical support staff is crucial to ensure efficient use of advanced equipment, and to train students and young researchers in how to use equipment. According to the Dean the decision for hiring additional technical support staff lies at the institute level. The committee recommends that need and allocation of technical staff across the faculty is more in depth investigated.

### **3.9. Housing/ facilities**

The sub-committees would have liked to be shown around the physical facilities, but understand that time was very limited during the site visit. The input that the committee received from the interviews and presentations provided a positive view on the facilities and research equipment.

The new Feringa building will provide new housing opportunities, but it now already appears that the space in this building will be too small to accommodate all staff. The committee was pleased to learn that alternative solutions are currently being discussed and encourages FSE to identify appropriate alternatives. The move to the Feringa building is an important opportunity for physical co-location of all institutes.

Currently, staff members of some institutes are scattered throughout one of the buildings and further growth of staff will lead to staff being located at a second building. With a bottom-up approach on collaboration between research units, this situation is far from ideal. Therefore, in the period up to moving to the Feringa building, it is important that physical (co-)location of (new) staff is carefully considered, with the aim of improving group cohesion being a primary factor.

### **3.10. Research integrity policy**

The University of Groningen complies with the Code of Conduct for Scientific Practice drawn up by the Association of Universities in the Netherlands (VSNU). The university has additional regulations for the protection of academic integrity. Research integrity is part of the yearly performance interviews of all staff members. FSE has a confidentiality officer for scientific integrity issues and a Steering Committee that advises the Faculty Board on this matter and on issues of data management.

During the review of all institutes the sub-committees discussed research integrity and data management. From those interviews it did become clear that FSE has a policy in place that institutes comply with. It was noticed that the degree of attention paid to integrity issues is at least

satisfactory in all institutes, but differences in attention given to this aspect were observed between the institutes. At the level of the PhD students this is organised at FSE (GSSE) level, which is important when taking into consideration the large and quickly growing community of international PhD students with different backgrounds in research culture. With respect to the group of post-doc researchers, no clear training and supervision strategy is in place. For this group the training and supervision is currently taken up at FSE level, which will include research integrity topics.

### **3.11. Diversity**

Diversity is considered to be an important aspect of academic good practice and the topic was discussed during the review of all institutes. With respect to nationality of the staff and cultural background, the committee met with a very diverse faculty. It became clear to the committee that FSE's policy on diversity is working well.

With respect to the balance male-female staff members, most institutes are clearly struggling to increase the number of female senior scientists. With the Rosalind Franklin fellowship, FSE has an impressive and world-wide acclaimed instrument to attract talented mid-career female scientists. However, at later stages of their career, up to the level of full professorship, it seems relatively difficult for several of the institutes to retain these female scientists at both junior and senior levels. This is most likely caused by a number of factors. A key issue may be that it is not sufficient to only attract female researchers in at junior level, but that at the same time females should be brought in at senior (full professor) level. The committee proposes that this is clearly an important issue that needs to be tackled, and that it should be considered in a broad, integral way. The committee also recommends FSE to carefully analyse why some institutes are more successful than others in attracting, and in holding on to, senior female staff.





## 4. Graduate School of Science and Engineering

### 4.1. Mission and management

The Graduate School of Science and Engineering (GSSE) was established in 2009 to host the PhD programme within the Faculty of Science and Engineering (FSE). The mission of GSSE is to organize high quality training and supervision for PhD candidates of FSE, thereby helping them to mature into knowledgeable, self-reliant and responsible researchers who can function well in various positions in academia, industry and society. Whereas the research institutes are the scientific home of over 900 PhD candidates, GSSE focuses on providing the administrative framework, establishing and enforcing transparent and uniform rules for training and quality assurance, setting up and maintaining a high-quality training environment as well as actively encouraging PhD student empowerment. In addition to the staff in GSSE, each institute in FSE has a PhD coordinator who is linked to GSSE.

The director of GSSE shows profound and convincing leadership and vision. She is the leader of the management team that coordinates all necessary processes professionally and together with the staff of GSSE they have set up a very convincing recruitment, teaching and training programme. Taking into consideration the limited resources and relative short existence of GSSE, the school is run very professionally with dedication and passion. It became clear to the committee that requirements and needs of PhD candidates are the focus of GSSE. Despite some minor comments by the committee, pointed out in this report, the overall conclusion is that GSSE is doing an outstanding job. This very positive impression was also supported by the interview with the PhD candidate delegation. The admission and registration procedure is straightforward, FSE has several ways to recruit PhD candidates, depending on the funding source. Initial concerns of committee members with respect to the quality of PhD candidates with foreign scholarships, specifically from the Chinese Scholarship Council (CSC), disappeared after it was informed on the procedure of recruitment.

Finally, the job opportunities for GSSE candidates finishing their PhD thesis seem to be very healthy for academic as well as industrial career developments. The committee considers the two-tier development line (industry and academia) to be very relevant, specifically to those in engineering research.

### 4.2. Training programme

Within the committee the position of PhD candidates as an employee rather than a student was discussed. In Groningen there seems to be a tendency towards the latter i.e. scholarship PhD candidates, which would imply a student status rather than an employee status. Depending on this position, the objective of training and supervision is different. The committee noticed that for the scholarship PhD candidates, training is mandatory (30 credits) while for others it is optional. To the committee it did not become clear why this difference exists and it considers it undesirable to have this distinction between groups of PhD candidates. Tailor-made training is to be commended for all PhD candidates and preconditions should be similar.

GSSE offers training on general research skills and soft skills, while it leaves decisions on the disciplinary training programme to the supervisor and PhD candidate. Each PhD candidate has a Training and Supervision Plan (TSP) in which both the research project and training programme is described, including a time plan. The supervisor is responsible for setting up the TSP in close consultation with the PhD candidate and progress is discussed during the annual R&D interviews. According to the committee the training programme is of high quality in terms of topics and objectives, not unnecessarily overloaded and it offers a variety of very useful soft skill activities.

Scholarship PhD candidates are obliged to take a total of 30 credits of mandatory training, of which two courses are fixed; the introductory event and the scientific integrity module. Another two courses are strongly recommended; *Introductory essay* and *Mastering your PhD*. Other training activities that are offered by GSSE are optional, participation in these courses can be freely chosen



by the candidate but also encouraged by the supervisor. For employed PhD candidates (as opposed to scholarly students) the 30 credits are recommended, but not mandatory as indicated before. The committee noticed an additional positive benefit of the courses, namely that several of the PhD students indicated that course participation also offered them a broader interdisciplinary workshop option within the FSE beyond their own research group environment.

Recently GSSE included in the TSE that PhD students have to draft a Research Data and Management Plan (RDMP) within six months after starting their PhD. Such a RDMP This is not new for most PhD candidates, international rules and regulations were already followed within FSE. The contract is merely a formalisation of what was already daily practice.

In addition to following training and courses, PhD candidates can acquire credits by attending conferences and participating in (external) summer schools. PhD candidates receive a budget to cover costs of their training and attending of conferences. The budget can be used according to personal planning of the candidates. The committee considers that in a broad Faculty like FSE it is good to have flexibility for PhD candidates on how to acquire the 30 credits. This flexibility does require co-responsibility for supervisors to actively be involved in the drafting of the programme and to guarantee that the activities chosen are indeed beneficial for the individual PhD candidate.

One major objective of GSSE is to put each candidate in charge of his/her own career development as soon as possible. For this an assertiveness training is provided as well as the mentoring course *mastering your PhD*. In the interviews it became clear that the GSSE administration is well prepared to handle all kinds of personal as well as career issues that are of importance for the functioning of PhD candidates. The supervision schemes are overall well balanced and clearly serve the purpose of supporting the PhD candidate both in social/personal as well as in scientific issues.

GSSE is not only training and supporting PhD candidates, but also has a number of support activities for PhD supervisors. For example, workshops on cultural differences, coaching, mediation and training on the recognition of looming burnout or depression. According to the committee it is important – specifically with the objective to improve time to completion of the PhD – that supervisors are well trained and supported.

Employed PhD candidates in GSSE are required to spend 10% of their time on teaching. Most often they are involved in tutorials or supervising laboratory practice. GSSE provides training and support to PhD candidates in order to develop their teaching skills. The committee considers this to be an important aspect of the training for PhD candidates, specifically for those who want to remain in academia.

### **4.3. Supervision**

The supervisor is in charge of the overall progress of the PhD candidate. Formal R&O (result and development) interviews in the first year are held after 6 months (comparing expectations) and 9 months (go/no-go decision). After a go-decision yearly R&O interviews are held in which the progress, training and supervision of the PhD candidate is discussed. The supervisor is responsible for drafting and signing the TSP with the PhD candidate and to verify in the R&O interview if progress is as expected and whether adjustments to the TSP are required. GSSE has a monitoring rather than a supervising role in this process and this seems a logical position.

During the site visit the committee had in depth discussions on the requirement and role of a second supervisor. It fully agrees that having two supervisors is beneficial to the PhD candidates and that each PhD candidate requires a different level of involvement of first and second supervisor. Interdisciplinary research projects often require co-supervision, while other projects and PhD candidates are well supported by one (daily) supervisor and a second supervisor in the background. Nevertheless, the committee recommends to evaluate the functioning and objective of dual supervision. GSSE rightly states that the PhD candidate should be in charge of his or her progress, but supervisors have the responsibility to provide proper supervision. With dual

supervision there is a risk of neither supervisors feeling fully responsible. Furthermore, dual supervision should optimally lead to synergy in the research project while it currently seems to be more part of a back-up plan.

The committee was impressed by the way GSSE is dealing with situations when PhD candidates indicate dissatisfaction with the supervision. There are a number of options for PhD candidates to talk in confidence about reasons why this is the case. They can approach their independent mentor from the *Master your PhD* training programme, who can give advice on steps they can take. Furthermore, at institute level, at GSSE level, at Faculty level and at university level there is a Trusted Person a PhD candidate can go to.

Overall, the committee is very positive on the facilitating role of GSSE in assuring candidates with optimal supervision and dealing with issues and problems that may occur.

#### **4.4. Time to completion**

The GSSE management is putting much effort to shorten the average duration of the PhD projects. Currently the duration is too long, in many cases even up to 6 years and longer. From the interviews during the site visit it became clear that within FSE more than one view exists on what should be aimed for and why. FSE has formulated the goal that 70% of the PhD candidates should receive their PhD within five years (now 45%). The committee understands that several factors can lead to prolonged duration of a PhD trajectory and delays cannot always be avoided. However, with a formal duration of employment or scholarship of four years, the target should also be that a significant percentage submitting their thesis should be within four years.

One objective of GSSE is to assist in shortening the tail of duration beyond five years. An action plan to improve this situation such as regular staff meetings and GSSE workshops for supervisors has been installed. Also there are various coaching schemes including "*Thesis Writing* and *Individual Coaching*" for PhD candidates in their fourth year. For PhD candidate who already suffer from a major delay, GSSE has introduced the "*Thesis Boot Camp*" in which the PhD candidates participate in intense and dedicated writing time over the course of three weekends. The committee is enthusiastic on these coaching schemes and the results of earlier boot camps are very promising. The committee is convinced that these will help PhD candidates to finalize their thesis.

The committee considers it of the utmost importance that PhD candidates start writing as soon as possible and are stimulated to do so. The final fourth year should be dedicated to a significant extent to the writing process rather than continuing experimental work in the lab. Preferably PhD candidates start even earlier in the process, already in their first year in preparing for example a table of contents of their thesis, as well as writing a summary of relevant literature and introduction to the thesis. The committee feels that in particular for PhD graduates who want to continue their career in engineering or in industry, time management and executing projects in time is an important feature that contributes to qualifying them fit for the job.

#### **4.5. Conclusion**

The committee recognizes the excellent work and achievements of GSSE over the past period. FSE is fortunate to have a graduate school in place that seems to work so well. GSSE seems specifically important for the large group of international PhD candidates, originating from different cultures and backgrounds. GSSE provides relevant courses, engages in training and in coaching and plays an important role in recruitment and – when needed – provides mediation.

It is clear that GSSE in recent years has been focusing strongly on a number of topics, for example shortening the duration of the PhD projects. Activities like the boot camp are considered to be excellent tools to help PhD candidates who are struggling to finish. The committee wishes to emphasize the importance of the writing process. The writing of the thesis is a hurdle for many PhD candidates and a frequent cause for delay. The sooner a PhD candidate starts to write, the more



likely it is that he or she graduates within reasonable time. GSSE can help in assuring that PhD candidates are stimulated not to work in the lab until they run out of time to finish their writing.

## 5. Review of the Van Swinderen Institute for particle physics and gravity (VSI)

### 5.1. The strategy and targets of the institute

The Van Swinderen Institute (VSI) focuses on fundamental, curiosity-driven research topics in particle physics and gravity. It was founded in 2014 from a merger of the former Centre for Theoretical Physics (CTN) and two groups originating from the Kernfysisch Versneller Instituut (KVI). The remaining groups at KVI were merged into KVI-CART.

#### Mission and strategy

The mission of VSI is to advance the understanding of the laws of nature at a fundamental level. The institute investigates nature's elementary constituents and fundamental forces over a wide range of natural conditions. VSI was founded to stimulate the collaboration between experimental and theoretical physics in Groningen. The institute has defined three research frontiers that guide its research:

- *High-energy frontier:* In this research line, the institute investigates high-energy scales to discover new physics beyond the standard model of elementary-particle physics. This includes searching for new particles with the Large Hadron Collider at CERN, and investigating the matter-antimatter asymmetry in the universe.
- *Cosmic frontier:* In this frontier, VSI investigates the physics of the Big Bang and the resulting quantum universe. It also tries to explain the fundamental nature of gravity, leading to new understanding into gravity as an emergent phenomenon, the black-hole information paradox and the nature of dark matter and dark energy.
- *Precision frontier:* This research line covers low-energy precision experiments on well-known particles to find minute deviations that might be the indication of new physics. This includes both the violation of parity in trapped ions, atoms and molecules, and the search for permanent electrical dipole moments in cold molecules.

The institute has thirteen staff members, 25 PhD students and 5 postdocs. During the site visit, the staff came across as an excellent team, with the common goal to explore the frontiers of physics beyond the standard model. The institute management has a clear view of what it wants to achieve and is working hard to achieve coherence between the research lines and to establish the institute in terms of program, funding and positioning.

The committee encountered many highly motivated and enthusiastic researchers, more specifically also a number of promising young researchers. The committee noticed that the institute currently has a relatively small number of postdocs compared to the number of PhD students. The institute could possibly benefit from a more balanced research team, where PhDs have the opportunity to learn from postdocs, and postdocs from each other.

#### Nikhef consortium

Through the activities of VSI, the University of Groningen contributes to the national Nikhef consortium. The university became a full and formal member of Nikhef in 2016 on the initiative of VSI. By becoming a member of Nikhef the institute is embedded in a major international research community on particle physics. The research staff has access to the Nikhef and CERN infrastructures and can contribute to large-scale, long-term projects such as the physics of the Higgs boson and the LHCb experiments on the physics of the Big Bang. Joining the Nikhef consortium appears to have been a wise decision, and has resulted in the adding of the search for a permanent electric dipole moment to the Nikhef portfolio. Nikhef connects the institute to the programme, funding and facilities of a large consortium, and provides solid, long-term embedding in a strong institutional research community.



## 5.2. Research quality

The committee became impressed by the institute's quality of research, especially considering the fact that VSI was set up only three years ago. The institute has a solid output (around 100 papers annually since 2014) and enjoys international visibility and recognition in its fields of research. VSI researchers are frequently invited to present their research at international conferences and colloquia (around 40 times annually since 2014).

VSI was founded to stimulate the collaboration between experimental and theoretical physics in Groningen. The committee concludes that this strategy is working well. It became impressed by the relevant and coherent research programme of the institute. Three previously separated research lines are starting to grow together and represent a well-formulated research programme on the frontiers of new physics.

Participation in Nikhef allows the VSI to connect to the wider programme, funding and facilities of a large consortium. The established links with Nikhef appear to have a very positive effect on visibility and recognition. The institute has attracted substantial long-term funding, mainly in the form of very competitive FOM programmes. This can be viewed as additional proof of the promise of VSI's research lines as seen by peers.

The committee was impressed by the promising young researchers that the institute attracted, and the new research lines that were launched. Several research projects have just started at VSI and success can only be judged in a few years. However, the committee feels that the choice and selection of projects are positioned in the top-league of fundamental questions and promises a high return if successful. This is true, for instance, for the measurement of the electric dipole moment of the electron. This in-house programme is also backed by participating in a collaboration with German institutions on a Xe-129 electric dipole moment measurement which is already very advanced and likely to deliver. Other projects like atomic parity violation or symmetry tests via specific LHCb data analyses are also very well placed. The institute avoids spreading their research lines too broad and thin, and provides a thematically focused research portfolio of the institute.

The link between the experimental projects and local theory, for example widely using EFT techniques, is considered to be important and a huge asset. This guarantees that the contributing members have overlapping and potentially synergistic interests while pursuing different projects. In terms of balance within the institute, the committee thinks that VSI does an excellent job in connecting theory and experiments. Particle physics in particular is well-connected to the experimental research. The interface between gravitational research and experiments could further be strengthened.

## 5.3. Relevance to society

The research topics of VSI are very fundamental and have no obvious societal and economic impact on the short term. The field mostly appeals to human curiosity and tries to understand the structure of nature at a fundamental level. However, in order to do so and to devise the most sensitive experiments, technological developments are pursued which can sometimes impact other fields of research and applications.

Given this fact, the committee sees that the institute is dedicated and motivated to do what it can to share its research outcomes with society. There are connections to industry in the development of instrumentation, for instance the development of a high-current, high-voltage amplifier with the company TREK HV, and cooperation with Tata Steel on using muons in tomography. The researchers at the institute address the public interest in their fundamental research in many outreach activities. They participate in popular scientific talks on national television, festivals, science cafes and primary and secondary education. The VSI also opens its doors in the annual National Science Weekend. In a surprising collaboration, VSI researchers even participated in a modern dance event with an artful visualization of cold molecules research in dance, sound and visuals.

The committee praises the VSI researchers for their dedication to share their enthusiasm for fundamental research with the general public.

#### **5.4. Viability**

The VSI is a young and relatively small institute, but due to successful acquisition of several long-running funding FOM programmes and participation in Nikhef projects, including the National Roadmap for Large-scale Research Facilities for the LHCb research line, the institute is largely covered in terms of funding for the next years. According to the committee the institute could be more successful in other funding schemes, especially European funds such as Horizon 2020 and the ERC programmes. The institute management is aware of this and is trying to improve their success rates by providing additional support for researchers applying for these funds. The committee thinks that the individuals and their projects certainly have the potential for success in ERC competitions and should well coordinate their efforts.

Due to the nature of its research, the institute is not connected to any of the Faculty's research themes and thus misses out on the additional funding opportunities this provides. The committee recommends the Faculty and the institute to reflect on whether a match could be made between VSI and some of the research themes. Also, the institute has to deal with the decrease in technical support caused by the detachment from the AGOR facilities. The Nikhef consortium partly compensates for the decrease in technical support, but it cannot completely replace the on-site technical support the AGOR facilities provided.

As a relative new institute, VSI is in a unique position of participating in several long-running funding programmes for the next five years. This provides the institute with the time to further integrate the various research lines into an even more coherent research programme and to further strengthen the interaction between theory and experiment. The institute management has a clear view of what it wants to achieve and is working hard to achieve greater coherence between the research lines and solidifying the institute in terms of programming, funding and positioning. The talented new generation of researchers the committee encountered will certainly be of great value to achieve this goal.

#### **5.5. Conclusions**

VSI is a young institute that can draw from a solid foundation of both experienced and young, talented researchers. The institute successfully developed its own identity and research lines within a short amount of time. It combined the various topics into a coherent research programme and has launched several very promising new research lines. The researchers at VSI are very successful in sharing their enthusiasm for fundamental research with the general public. With the membership of the Nikhef consortium and the long-term funding, VSI is very well equipped to further develop and solidify its research programme.

Research quality:	very good
Societal relevance:	very good
Viability:	very good





## 6. Review of the Engineering and Technology Institute Groningen (ENTEG)

### 6.1. The strategy and targets of the institute

The Engineering and Technology institute Groningen (ENTEG) was founded to develop, bundle and profile research carried out in relation to both the industrial engineering and management (IEM) and the chemical engineering (CE) degree programmes, with a research focus on chemical process technology and product technology. The committee observed a very strong and clear governance structure. It learned that the institute has limited tools to create incentives for a structural and organised way of collaboration within the institute. Nevertheless, the atmosphere the committee encountered in meeting with staff and PhD students was very positive with many bottom-up collaborations between research units within the institute.

The mission of the institute, doing excellent technology-driven scientific research in the field of design of products and processes, is broad. Hence the research activities and thus the strategic targets span over a very broad range of activities. The three research domains are clear, but imply that the research units (chairs) have to cover a very broad spectrum of subject areas. With the policy of tenure track staff focussing on building their own independent group and research profile, risk of fragmentation also increases. In addition the institute is considering to start a Mechanical Engineering programme in Groningen. Although growth of the institute over the past period is impressive, the committee wondered if with this many research areas the institute is spreading its resources too thin and recommends defining a set of prioritized focus areas or disciplines.

### 6.2. Research quality

The previous evaluation committee recommended that the chemical engineering units should increase in size. The Faculty has taken this seriously and even changed its name to include "engineering" into its title. FSE and ENTEG have focused on achieving significant and impressive growth over the past period. To the current committee it is clear that despite this growth, ENTEG is still relatively limited in size and at the same time has a very broad portfolio and diversity of research topics. The institute management realizes that for some of the activities (like chemical engineering) other universities hold full departments. Hence, the ambition of building a technology driven scientific research programme in engineering in its broadest sense carries the risk of covering too many research topics, each with too little critical mass. According to the self-evaluation report further expansion of the engineering scope of the whole Faculty will strengthen the institute. The committee understands this point of view, but it still wishes to point out that the risk of spreading its resources over a broad spectrum of research topics will not be resolved by further growth only. In the self-evaluation report the institute rightfully claims that it is time for consolidation for the institute to become sustainable. The committee strongly supports activities to prioritize and focus on certain research areas to for a unique ENTEG profile.

The overall conclusion of the committee is that the research in the period of evaluation is of very good quality. Some of the research staff are winning prestigious international awards and giving invited plenary talks at international conferences. The dynamics observed in the management team, programme leaders and group of tenure track staff was impressive. The team spirit, motivation and energy of the staff members is a very positive asset. From the self-evaluation report collaborations within the institute were not as clear as by the examples given during the site visit between staff from different research units, which were indeed more convincing. In addition to within-institute collaboration, the committee also recognized strong inter-institute cooperation collaborations with other institutes, like Stratingh, ESRIG, JBI and Zernike. Examples of interactions with institutes outside FSE and even outside the University of Groningen were also given.

From the CWTS analysis the overall MNCS score was impressive to the committee. The trend over the years showed somewhat of a decline towards recent years, which can be explained by the fact



that the expansion of staff with starting tenure track staff dilutes the score as their overall reputation is less developed. The committee is confident that the institute will be successful in increasing the impact of its publications in the upcoming period. The tradition of publishing in conference proceedings was also discussed, including the fact that these publications are not taken into consideration in the CWTS analysis. The committee was pleased to notice that according to common publishing routine, peer reviewed conference proceedings often are the first output of results and aim for a large audience, and subsequently are followed by a more extensive peer reviewed publication in an international journal.

The number of research staff has strongly increased over the past period. The SWOT analysis states that the increase of technical staff has lagged behind. During the site visit this threat was also expressed. Further growth of the institute should be followed by adequate growth in technical and laboratory support staff.

### **6.3. Relevance to society**

To the committee it became clear what ENTEG is aiming at with respect to societal relevance, like smart grids and bio renewable-based chemical engineering. The high level of collaboration with industry displays the societal relevance of the institute. ENTEG is focusing on research topics targeting (future) societal needs. For that it seeks collaboration with societal partners, which is evidenced by the fact that 30% of funding is provided by industrial partners. Also a number of patents have been registered. Furthermore, two start-up companies resulted from ENTEG and one is currently being setup. The work in systems and control by ENTEG is based in fundamental mathematics and grounded in engineering applications. This balance of theory and application ensures that the work has broad relevance.

ENTEG initiated a number of outreach activities to the general public, but according to the self-evaluation report the archiving of these activities could be done more structurally. A number of examples of outreach activities were provided, like contribution to a webinar and the IFUR robotic fish water-polo competition. The committee considers that by more strategically considering outreach activities, overall impact could be enhanced and more easily measured.

Although the ENTEG approach to societal relevance is not unique in the world and focuses strongly on local industry, it is clear to the committee that the institute makes a serious effort to achieve impact. The committee recommends that the institute should build in a "visualization" of publications with industrial collaborators. This is an important feature with respect to societal relevance and also counts at the level of international grant applications.

### **6.4. Viability**

ENTEG is an engineering science institute in a comprehensive university, the latter including a University Medical Centre as well as a Faculty of Social Sciences. To the committee this unique position for a Dutch engineering institute may in principle offer new opportunities to be exploited by ENTEG. Having the full support of FSE and turning from a growth into a consolidation phase, it is tempting to the committee to recommend that the ENTEG may target more collaboration with the medical field and/or social sciences to build upon this unique opportunity. However, at present, the committee does not recommend to span over more research areas. Rather, priority should be given to collaborations across domain areas within ENTEG e.g. in the form of ear-marked PhD or postdoc scholarships to build synergy between and across existing and successful research domains. Such direct synergy targets could also help to reduce afore mentioned fragmentation of the research portfolio within ENTEG. The committee should like to recommend to make room for fundamental research in engineering closely tied to applied research and to use "flagships" such as e.g. the Ocean Grazer to generate collaboration across ENTEG.

Overall the committee feels that ENTEG is well prepared for future challenges; ENTEG covers a wide scope of research expertise with relatively few, but ambitious and very competent staff, who continuously are looking for new research opportunities. The committee was impressed by the

drive and enthusiasm of the staff exhibiting a coherent team with an agile spirit. This is not self-evident to create nor to maintain in a financial situation where basic funding is limited, but ENTEG manages successfully to do so. Therefore, considering the high quality of research and staff, the committee feels that the future of the institute is potentially very bright. The risks and recommendations that the committee wishes to point out below have to be seen in this perspective.

Initiatives and collaborations within ENTEG are mainly the result of a bottom-up attitude. At this moment the committee considers this a strength. With the recent and foreseen additional growth of the institute, however, policy measures at the institute level are required to hold on to this strength. With all energy present in the institute individual researchers seem to have a strong appetite for more new topics and directions to explore. Developing a coherent strategic plan and setting directions for the entire institute is rather difficult in a bottom-up environment. The committee recommends that ENTEG develops a strategy towards the future based on fostering and further developing existing internal collaboration and to further stimulate coherence. Co-location of ENTEG groups would be highly advantageous when new buildings are ready.

The committee had an in-depth discussion on the participation of ENTEG in Yantai. The committee respects the positive attitude in the institute with respect to participating, but would like to point out that ENTEG is already stretching its resources. Although Yantai indeed may provide opportunities, there are also risks that - without the right strategy and precaution - might represent an extra burden on senior staff of the institute notwithstanding attractive financial compensation. Taking into consideration that ENTEG also wants to set up a new degree programme in Mechanical Engineering in Groningen and focuses on consolidated and coherent growth, the committee has some concerns with respect to the future if the institute does not carefully draft a strategy with clear process criteria as well as measurable quantitative and qualitative deliverables. In order to be able to maintain the high quality of research over the next review period, the committee recommends to prioritize all future activities in accordance with the strategic plan.

The committee fully concurs with the plans of the institute to become more visible as an engineering institute and to emphasize its unique profile in the environment of several science institutes and a comprehensive university. Exploring opportunities for joining 4TU is recommended as long as the motivation to do so stretches beyond merely profiling and also focuses on complementary content. Also, the Groningen Engineering Center as a hub is an important initiative, but again it should represent more than just branding "engineering". The committee recommends that FSE at faculty level provides more structural and explicit support with respect to the engineering ambition of the Faculty. Finally, the unique position of this ENTEG in a comprehensive university should also be better reflected in the future strategy of the institute. The committee feels that there is clear value in further bridging science, technology and engineering which may also lead to additional funding opportunities from within the university or from sources outside the university.

## **6.5. Conclusion**

The committee concludes that ENTEG has done very well over the past period resulting in high quality research. The committee was highly impressed by the dynamics and motivation it experienced between staff during the site visit. The breadth of research areas and high ambitions of the staff are current strengths, but should be carefully dealt with in order not to lose quality and scientific impact as the result of fragmentation. An adapted strategy is needed to achieve greater coherence in the research programme and also to foster and exploit its unique position in the Netherlands as an engineering institute in a comprehensive university.

Research quality:	very good
Relevance to society:	very good
Viability:	very good





## 7. Review of the ZERNIKE INSTITUTE FOR ADVANCED MATERIALS (ZIAM)

### 7.1 The strategy and targets of the institute

The Zernike Institute of Advanced Materials (ZIAM) is a research institute focusing on nanoscience and nanotechnology. Its mission is the design and scientific study of materials for functionality. It is a cross-disciplinary institute at the borders of physics, chemistry and biology, aiming to understand, control and exploit the material world at the microscopic level. The institute strongly believes in collaborative, multidisciplinary research. It pursues an open-lab culture with collaborations throughout the institute, ultimately leading to ground-breaking results and excellently trained junior researchers.

ZIAM is headed by the scientific director, who is strategically responsible for the chosen research lines, selection of personnel and the allocation of funds. For long-term research plans, annual budget and personnel selection, the director needs approval from the institute's board. The scientific director and the board are assisted by a coordinating office. The institute also has an International Advisory Board, that visits Groningen once every 1-2 years to advise the institute on research plans and directions for future exploratory fundamental research.

The current director of ZIAM was recently appointed after the previous director unexpectedly took another position outside the university. The current management took over in a turbulent time, with the excitement of a Nobel Prize within the Zernike/Stratingh Institute and the prospect of a huge private investment in the institute (see Viability). The committee recommends the management of ZIAM to thoroughly discuss such promising future perspectives and to frequently seek advice from colleagues inside and outside the institute to proceed through the current exciting times.

#### *Zernike Institute NRC*

Together with researchers from the Stratingh Institute for Chemistry and the Groningen Biomolecular Sciences and Biotechnology Institute (GBB), ZIAM forms the Zernike Institute National Research Centre (Zernike Institute NRC). This local collaboration holds the status of National Research Centre since 1999 and as a result has received substantial national funding. The Zernike Institute National Research Centre is one of the two remaining NRCs in the Netherlands. Funding for NRCs will be terminated as per 2021, with the scheme being incorporated into the NWO Gravitational Programme.

The Zernike Institute's research is structured in two overarching Focus Areas:

- *Focus Area 1: Biomolecular and bioinspired functionality* focuses on functional biomaterials, biophysical tools and biomedical applications. It combines elements from chemistry (synthesis, biocatalysis), bioengineering (protein/DNA engineering) and physics (optics, mechanics, biophysics, modelling)
- *Focus Area 2: Nanostructured materials for electromagnetic functionality* investigates organic photovoltaics, single molecules and monolayer materials, design and functionality of nanostructured materials, and emergent behaviour in complex materials. It combines physics (optics, energy, charge and spin transport, devices) and chemistry (inorganic/solid state synthesis, inorganic-organic hybrid materials).

All research groups in ZIAM are part of one or both focus areas. Each focus area has two leaders: one from ZIAM and one from GBB (Focus Area 1) or Stratingh (Focus Area 2). These focus area leaders have a strong role in defining the institute's overarching research agenda.



## **7.2. Research quality**

According to the committee, ZIAM operates at a very advanced level on various aspects of molecular materials sciences. Many projects at ZIAM are at the forefront of current worldwide research in the corresponding field. The research programme at ZIAM is both in depth disciplinary as well as interdisciplinary. The two main focus areas - materials with biomolecular and bioinspired functionality and nanostructured materials for electromagnetic functionality – provide a platform that promotes synergistic interactions of fundamental sciences like physics, chemistry and biology among themselves as well as with more applied disciplines like medicine and engineering.

The current staff of 32 principal investigators consists of chemists, physicists, material scientists and theoreticians, and is thematically balanced. According to the committee the interdisciplinary and comprehensive approach towards materials sciences in ZIAM has resulted in one of the very few truly multidisciplinary materials sciences research programmes world-wide. The multidisciplinary character of the research plays a key role in continuously stimulating the development of new approaches and true innovations. It offers unique opportunities to combine expertise across several disciplines and superseding the often existing barriers between classical fields. Within the same institute, new materials can be synthesized and characterized at the quantum mechanical, molecular and macroscopic level. This has led to successes such as the development of sustainable polymer-based materials, the demonstration of electronic spin transport in graphene, and the development of new multiferroics, i.e. magnetic insulators that respond to electric fields.

These contributions have received wide-spread international attention and are considered to be world leading. The scientific output achieved within the reporting period can be considered excellent. This is documented by a large number (approximately 160 per year) of highly visible and often highly cited publications in the best international journals, as well as by many marks of recognition by peers. Several papers by ZIAM researchers in for instance spintronics, multiferroics and organic solar cells are at the top of the list of the most cited in these fields. The 2010-2016 period included a Spinoza Award, two Vici grants, eight ERC grants and a large number of collaborative grants, and four senior staff members were elected as member of the Royal Netherlands Academy of Arts and Sciences.

The leading international role of ZIAM is further evident from the excellent reputation of its researchers, most of which are internationally well-known and highly respected. Numerous national and international collaborations have been developed, including strategic partnerships with for instance Seoul National University, Osaka University, Institut Teknologi Bandung, and the U4 Network (Göttingen, Uppsala, Ghent and Groningen). It is also part of the NanoLabNL consortium for open access infrastructure for R&D in nanotechnology. Additionally, the staff maintains about 250 individual, active collaborations for joint publications or grant applications.

In spite of the fact that there are many groups and subprojects, the committee feels that research at ZIAM is overall well-coordinated and coherent. Interaction between theory and experiment could further be strengthened since collaborative projects between theoretical and experimental groups do not seem very frequent. It appears that experimentalists often find theoretical collaborators outside ZIAM.

## **7.3. Relevance to society**

The main focus point of ZIAM, materials science, is judged by the committee as a very societally relevant field. The institute develops new materials that will be used in future applications. While mainly fundamental in character, a significant part of the research activity at ZIAM has excellent potential for technological applications such as solar cells, graphene technology, organic electronics and display technology, and biomedical applications such as drug delivery, medical implants and 3D-printed biomaterials.

To realize this potential, the institute actively seeks cooperation with leading companies such as IBM, BASF, ASML, Tata Steel, Fokker, Philips, NXP, SKF and Crucell to connect their fundamental research to potential technological innovations. Through the NanoLabNL consortium, ZIAM provides full-service access to their labs for commercial R&D in nanotechnology. In the period 2010 to 2016, the institute founded three spin-off companies to commercialize their research in graphene (HQGraphene), drug delivery (Nano-I-Drops) and antibiotics (AGILe Biotics), and filed for 15 patent applications.

The institute is also active in PR and outreach activities related to their research. A publication on 3D-printing of antimicrobial teeth was for instance widely covered by the media. The institute hosts open days for the general public and its researchers sometimes visit primary and secondary schools to talk about their research. However the committee thinks that the institute could do better in its approach towards society at large, as was also recommended in the previous assessment. The institute's outreach activities are ad hoc and are not part of a coherent strategy. The committee thinks that ZIAM does not fully realize its potential in sharing its research results with society at large. It recommends developing a PR strategy for the institute and to encourage its researchers to more structurally engage in outreach activities.

#### **7.4. Viability**

With the knowledge that the funding for the Zernike Institute NRC will be discontinued per 2021, the institute is fully exploring new opportunities for research funding. The most obvious opportunity is to apply for the NWO Gravitational Programme for continued funding of the Zernike Institute. This may require new, inter-institutional cooperation in order to fit the requirements for this funding scheme, which the institute is already working on. The institute is currently well-positioned in several research collaborations, including the collaboration that submitted the project Bits&Brains to the NWO Gravitational Programme.

The committee learned that an unexpected funding opportunity for the institute has very recently originated from a private donor who is willing to invest many millions into the institute's research on nanomaterials for brain-inspired computers. Full details could not be disclosed at the moment of the site visit, but it is clear that this represents a huge opportunity that will secure funding for the institute for many years. The committee points out that this funding will likely influence the research focus and structure of the institute and will therefore require a well thought through adapted future research strategy.

The committee was very impressed by the interviews with the senior programme leaders as well as with the junior professors and postdocs. The junior staff especially came across as very strong. From a diversity of backgrounds they were working enthusiastically on a wide range of relevant research topics. A major strength of ZIAM is the recruitment of young researchers and the establishment of a fruitful research environment that allows for successful career development. The committee noted that the strategic planning of ZIAM as well as the spirit of the programme leaders is sensitive and flexible enough to allow for new and promising research directions, including those that will be made possible by the extensive new funding as discussed in the previous paragraph.

The high quality of senior and young researchers and the excellent funding perspective of the institute gives the committee great confidence that the research in ZIAM will remain very strong in the future. The current funding situation is already very healthy and stable and will become even better in the near future. Altogether ZIAM is a highly visible and excellent research institute which is built on very solid scientific and efficient organizational grounds and therefore is excellently equipped for the future.

#### **7.5. Conclusion**

ZIAM is a world-leading institute in materials sciences. The broad and multidisciplinary approach of the institute delivers excellent research results and provides unique new research opportunities towards the future. Its research is at the forefront of developments in the field, which is based on



the excellence of its researchers. The committee wishes to especially praise the young generation: a diverse group of highly talented and highly motivated researchers working on very relevant and promising research topics. The committee sensed a great potential in many of them and expects them to be involved in major breakthroughs in the field in the future. The institute has many relevant and productive ties with industry, but could do better in PR and outreach. In terms of funding, ZIAM has excellent perspectives, which is not in the least caused by a very large private donation but also by its participation in a number of large and prominent research consortia.

Research quality:       excellent  
Societal relevance:     very good  
Viability:                excellent

## 8. Review of the Stratingh Institute for Chemistry

### 8.1. Organisation, strategy and targets of the institute

The Stratingh Institute for Chemistry (Stratingh) focuses on research in molecular and supramolecular chemistry, with overarching impact on biology and physics based on fundamental organic chemistry. It covers three research areas:

- **Chemistry of Life:** This area concentrates on a molecular approach to the study of biological phenomena and medically relevant problems, including the synthesis of complex natural products, the design and synthesis of small molecules to study and steer biochemical and cellular processes, and emerging properties like self-organisation and catalysis, including life itself.
- **Chemical Conversion:** This area investigates new synthesis and catalysis methods, including asymmetric catalysis and oxidation catalysis, designing artificial enzymes for new-to-nature reactions, the use of bio-based feedstocks and development of sustainable processes, and homogeneous catalysis methods using earth-abundant metals.
- **Chemistry of Materials:** This area covers various topics in nanoscience with a focus on advanced functional materials, such as molecular switches and motors, photovoltaics, functional polymers, molecular electronics, supramolecular materials, functional surfaces and artificial membrane components.

The Stratingh Institute is headed by the scientific director, supported by the board of the institute which acts as a sounding board for the director. The institute strives to have board representatives from all five research units within the institute. The director and the board are supported by the Stratingh office, which provides support at different levels. The full staff meets once every two months to discuss progress on the implementation of the institute's strategy on education, research and facilities, including the profile for new research positions and opportunities for new collaborations. During the interviews, the committee got a very positive impression of the institute's management. They presented a clear strategy on the future directions of research and composition of the research staff, aiming for excellent research.

### 8.2. Research quality

The Stratingh Institute for Chemistry belongs to the top chemistry institutes worldwide. The Nobel Prize in chemistry for Prof. Feringa in 2016 exemplifies this beautifully. The institute has a moderate size, yet it is very successful indeed. The researchers produce high-quality, internationally widely recognized output, are highly successful in competitive research funding and are regularly rewarded with prestigious awards and prizes.

The institute has selected three main research areas which are devoted to tackling future-challenging topics. The research lines are based on fundamental and basic research in organic chemistry, catalysis, molecular spectroscopy, electrochemistry and molecular electronics. According to the committee, this is a very modern approach to interdisciplinary research and definitely has helped to overcome the more old-fashioned departmental or mono-disciplinary structures. With these three research topics the most important and advanced research fields of organic chemistry are covered. From the publication record it becomes clearly visible that each of the research groups is covered by this multidisciplinary umbrella, and that a large number of Stratingh researchers cover more than one research field. The Stratingh researchers engage in efficient and productive collaborations among each other and with other groups inside and outside of Groningen.

The institute is performing excellent research in molecular and supramolecular chemistry. Below, the committee names a few of the institute's accomplishments and strengths. The work on drug discovery, stereoselective synthesis of biomarkers, on the functionalization of nanoparticles and in the field of DNA based catalysis is world class chemical biology. In the competitive and fast moving field of homogeneous catalysis, the institute convinces with contributions on the directed oxidation of C-H bonds with sustainable catalyst systems employing iron and manganese, and



enantioselective additions of Grignard type reagents. The institute is also strong in sustainable synthetic processes that can be used in industry, developing new advanced functionalized materials. The inventive approach towards rotary molecular motors is most impressive.

In terms of recognition by peers, several Stratingh researchers have received very prestigious grants and awards such several ERC grants at every level. In the past six years, there was not only the Nobel Prize 2016 for Prof. Feringa, but also two ERC Advanced Grants, 5 ERC Starting Grants, 12 VENI, VIDI and VICI grants and a NWO Gravitation Programme grant.

### **8.3. Relevance to society**

The committee became also impressed by the way the institute combines fundamental research with application oriented research. Molecular chemistry is very important for many societal challenges in sustainability and energy, and for advanced technologies. The Stratingh institute has many ties to society, for instance in the Chemical Building Blocks Consortium, photovoltaic installations and in the Bill and Melissa Gates Fund for developing new antibiotics and vaccines. The institute is involved in the Origins Centre, a network founded as a result of the National Science Agenda to investigate the emergence of life from self-replicating molecules on earth.

There are strong ties with industry on many levels. This is reflected by many grants and collaborations with external private parties. In catalysis, the institute works with companies such as Hexxion, DSM, Evonik, Catexel and Janssen Pharmaceuticals, and on spectroscopy with Avantes and ANDOR technology. In solar energy, it is involved in the Zonnewal Oostwold project, a large-scale hybrid sound wall on a 6 hectare area along the highway near the village of Oostwold.

The Stratingh Institute is active in several large consortia investigating societal relevant topics. These include the Advanced Research Center – Chemical Building Blocks Consortium (ARC-CBBC) with the universities in Utrecht and Eindhoven, aimed at developing new chemical building blocks for new sustainable processes, materials and products for a carbon-efficient economy of the future. Another example is the NWO Gravitational Programme on Functional Molecular Systems with the universities of Nijmegen and Eindhoven on molecular mechanisms, structures and chemical processes that lead to building living systems.

The researchers are passionate about education and outreach and are very actively engaged in many activities. Examples are presentations and visits to high schools and primary schools, public lectures and many media appearances related to the Nobel Prize 2016. The committee became impressed by the efforts and accomplishments of the institute's researchers to share their enthusiasm about their research with society at large.

### **8.4. Viability**

The institute is excellently equipped for the future. The committee has experienced a highly talented, strongly motivated team of researchers with a strong team spirit. The researchers in the institute were and will certainly be able to remain very competitive in future research funding applications from different sources. The outstanding quality and the strong international reputation of the Stratingh Institute is perfectly reflected in the funding situation. The institute enjoys an excellent financial status due to the very high success rate for national grants as well as for ERC grants. Also the industrial funding is very substantial. All research staff has shown that it is able to successfully attract funding, both personal and in collaborations in consortia and with industry.

The management is already preparing the younger generation for the retirement of two senior, world renowned researchers in 2020. The younger generation is being coached by senior researchers, also in leadership in science. The committee is convinced that, even after the retirement of the institute's two most prominent researchers, the institute will continue to be a world-leading institute in chemistry. During the past years an excellent publication output is observed from almost every group in the institute. It has a number of scientifically extremely capable senior researchers which have an impressive publication record in both quantity and

quality. The junior researchers also gave a highly motivated impression during the interviews. The tenure track system seems to work very well for the institute and for the individual researchers. Because of the institute's strong international reputation and visibility, it is able to attract very talented junior researchers from the best universities elsewhere who have ample opportunity to develop into excellent researchers at the Stratingh Institute. Like other institutes at FSE, the Stratingh Institute clearly shows that the recruitment and career development of young and very talented junior scientists works very well. The committee considers this as one of the greatest strengths of the Stratingh Institute that may serve as a role model for other European institutes.

### **8.5. Conclusion**

The Stratingh institute is an excellent, world-leading institute at all levels. It consists of very strong researchers who are internationally leading experts in their fields and are recognized with many prestigious grants and awards. The institute successfully combines fundamental and applied research, and successfully transfers its research results to society through both cooperation with industry and engaging in outreach activities. The prominent senior research staff is grooming a very talented generation of young and mid-career researchers that is fully ready to take over the necessary future leadership roles at the institute. The committee was deeply impressed with the overall performance of the institute, and judges that the institute deserves the highest scores possible.

Research quality:	excellent
Societal relevance:	excellent
Viability:	excellent





## 9. Review of the Groningen Biomolecular Sciences and Biotechnology Institute (GBB)

### 9.1. The strategy and targets of the institute

The Groningen Biomolecular sciences and Biotechnology institute (GBB) is dedicated to research and teaching in biomolecular sciences, hosting the sub-disciplines biochemistry, bioinformatics, biophysical chemistry, cell biology, chemical biology, enzymology, genetics, microbiology and systems biology. Focus within the institute lies on curiosity-driven science, with application outlets into (industrial) biotechnology and biomedicine. GBB centres around two focal areas, *Molecular Mechanisms of Biological Processes* and *Physiology and Systems Biology*. Together they establish the foundation for the engineering of complex molecular and cellular systems.

From the well written self-evaluation report and the in-depth discussions during the site visit, the committee concluded that GBB is currently expanding its research focus. More specifically, GBB aims at expansion of target systems, from archaea, bacteria and lower eukaryotes (microbiology focus) towards also using mammalian cells and higher eukaryotes, and strengthening research on molecular mechanisms. Any expansion in research areas, which in this case is more an add-on than an actual shift in research focus, usually coincides with both opportunities and challenges. This also was observed by the committee with respect to GBB. A significant part of the site visit was used by the committee to get a clear understanding of the future plans, strategy and developments that have already started to take place.

### 9.2. Research quality

GBB operates at the interface between fundamental sciences and biotechnology, whereby GBB's primary focus is on microbiology. The expertise spans from genetics to molecular mechanisms to physiology of microbes (bacteria, yeast). The strength of the institute is the successful identification of and investigation on the function of a large number of membrane proteins with the specialization on a variety of transporters. The mechanism of function of these proteins is elucidated with biochemical and biophysical methods.

Over the years GBB has managed to build up an excellent research environment in molecular microbiology and membrane proteins. It was clear to the committee that several research groups enjoy an excellent international reputation. The committee acknowledges that within the chosen research areas GBB contains some of the most influential research groups in the world. Particular highlights in the past review period included very successful research to better understand the Sec system, bet-hedging strategies, flux-based regulation of microbial metabolism, molecular crowding and transporters. The scientific impact of the work was also considered to be of high international standards; the understanding of cell functioning has a strong impact on fundamental science as well as on how this improved understanding of function translates into more practical applications. As demonstrated by several publications different research groups interact and collaborate in a very fruitful way. Also impressive to the committee was the smooth transition from basic molecular studies of biomedical relevant proteins to the drug discovery. A further highlight is the new project "synthetical cells". Here, the extremely high competence on reconstitution methods may have been the key for success. Ongoing studies in collaborations inside and outside the Netherlands have produced very promising results in the extremely competitive areas of research of GBB.

The publication strategy shifted from a predominant focus on numbers of publications to more focus on high quality and high impact. This strategy is supported by the committee and appears to be working quite well. The publication record is outstanding, demonstrating that in its fields of research GBB produces world class science. Published highlights for example are EM and crystallography studies together with the functional analysis of the ABC transporters, the protein transport machines, membrane protein insertion, the development and application of new computer techniques.



The committee was pleased to see that the excellent quality of research was not restricted to the senior staff, but extends to the recruited younger researchers who evidently have already been doing excellent work. This implies an inspiring ability of GBB to attract high-quality young staff. The young investigators have brought in new promising projects as high resolution EM techniques and research on new mammalian proteins with biomedical relevance. During the interviews junior staff informed the committee that indeed the very high quality and strong international reputation of the research groups in GBB were the dominant motivational reason to come to Groningen. The high quality of research is also reflected in the very successful application in competitive funding schemes, including an impressive amount of twelve Marie-Curie training projects.

The committee was impressed by the performance of the younger staff members during the interviews; all seem to have a clear and similar vision on the future direction of the institute. In general the senior staff also seemed to be in agreement on expansion plans, however, less consensus on a clear vision and strategy was observed among this group. A challenge for future recruitment, which will be elaborated upon in the viability paragraph, is to carefully consider the current strengths within the institute to make sure that they are maintained when adding new directions.

### **9.3. Relevance to society**

GBB clearly has very good connections to industry, reflected by the amount of contract funding acquired. The collaboration with industrial partners seems excellent, and it became clear to the committee that the institute is strongly focussing on valorisation. The committee considers the balance with respect to collaborative activities with industry and curiosity driven research to be good at this moment. GBB should guard this balance, since increased collaboration with industry could lead to reduced focus on curiosity driven research.

GBB was involved in quite a number of approved patent applications, which is impressive. Less clear to the committee was what the benefits from these patents are in terms of revenues in euros, or otherwise. The committee considers it to be important that a granted patent leads to practical application and ultimately results in financial benefits.

From the interview with the tenure trackers, the committee learned that there is more variety and efforts in outreach activities than could be deduced from the self-evaluation report. It remained unclear, however, whether a clear and coherent strategy with respect to outreach and valorisation is in place. It is therefore recommended that the institute develops an outreach strategy for its staff that should entail more than merely stimulating participation in outreach activities. This strategy should also focus on greater visibility and coherency of the outreach activities.

During the site visit the societal relevance with respect to the education of prospective teachers was also discussed. Most PhD graduates are getting a job in industry or academia. A number of PhD graduates from GBB continue their career in teaching in higher professional education (hogeschole), which is adding to the societal relevance of the institute. It was mentioned by staff from GBB that the training of high school biology teachers in a master programme at the UG is somewhat outside the scope of the institute, since these students usually opt for a more general educational programme in biology. The staff of GBB stated that increasing the knowledge and understanding of high school teachers in microbiology would - on the long term - be beneficial for the discipline as a whole and the institute more specifically. The committee agrees with this and stimulates the institute to come up with plans on how to achieve more impact on the training of high school biology teachers.

### **9.4. Viability**

GBB is scientifically broadening its scope; the institute plans to transfer the comprehensive expertise in molecular biology, protein chemistry and biotechnology to include higher eukaryotic systems. However, during the site visit the exact direction in which GBB plans to go did not become entirely clear and the committee observed different views on this topic. GBB plans to keep

focussing its research on structural biology (microbiology), which is in line with the successful work done in the past, while the intention seems to be that more research on mammalian cells and higher eukaryotes will be added to the research portfolio of the institute. Adding new directions is supported by the committee and although several ideas were considered to be very interesting, they should clearly add value to and be coherent with the current excellent research. The committee feels that the excellent competence on microbial systems of the current staff justifies a movement towards higher eukaryotes as a logical step towards the work on artificial cells. However, a clear vision on which changes are desirable, has been made dependent on which new staff members will be appointed. In itself, such approach to choose for the best candidates is very well defensible, but makes it difficult to assess to what extent the institute is capable to deal with the future as it is not known what the implications are for the current plans of GBB.

From the site visit the committee concluded that GBB is working on a general plan and towards a potential point at the horizon. But GBB appeared still in the middle of discussing the specific direction and the strategy on how to get there. To the committee, it remained unclear whether the new direction will include a focus on neurobiology, immunology and/or another topic. This has to be decided in the near future, because it will also determine the research competence of prospective staff members to be hired (or the new hires may change the new direction). The challenge for GBB seems deciding which road to take and formulating a long term joined vision and strategy that is supported by the entire institute, including the new staff members still to be appointed. The committee considers this latter aspect to be very important, since it observed some differences in opinion towards future plans between junior and mid-career, and some senior staff members.

The committee agreed with the institute management that the upcoming retirement of quite a number of senior staff members should definitely be seen as an opportunity to further shape and implement new research directions as add-on's to the current excellent quality of the research. The hiring of new staff has been very successful in the past period and the committee foresees that this may also be the case in the future. Of course new staff will be very important for the future direction of the institute and selection should therefore be in accordance with the future vision and strategy.

The committee wishes to express some caution with respect to the initiation of new plans towards higher eukaryotes. The committee is of the opinion that GBB has an excellent track record in work on lower eukaryotes and that this excellence should provide the solid basis for future directions. Again, this requires a well thought-through future research vision and strategy and may also require a reorientation of the collaboration with partners within the FSE and the University Medical Centre.

## **9.5. Conclusion**

The quality of the research over the past period has been excellent. Specifically with respect to the work on lower eukaryotes, GBB is one of the leading research institutes in the world. Valorisation of research in terms of connections to industry is strong, evidenced by the large percentage of contract funding. Still, relevance to society could be further enhanced by encouraging junior and senior staff members to develop and carry out clear and well-supported outreach plans.

With respect to the future, there is overall consensus with respect to the direction to include higher eukaryotes, though this requires more clarity and specificity. It is clear that GBB is on very solid scientific ground doing excellent work and now it seems entering a transition phase. Upcoming retirements provide opportunities as well as uncertainties. The committee recommends that in the near future the institute develops a clear vision and strategy that is broadly supported. Once GBB succeeds in defining and implementing where they want to go and how to get there, the viability will become excellent.



Research quality: excellent  
Relevance to society: very good  
Viability: very good

## 10. Review of the Groningen Institute for Evolutionary Life Sciences (GELIFES)

### 10.1. Organisation, strategy and targets of the institute

The Groningen Institute for Evolutionary Life Sciences (GELIFES) focuses on biological adaptation. This covers both the short-term, physiological, neurobiological and behavioural responses of individuals to their local conditions, and the long-term eco-evolutionary response of populations, communities and ecosystems to challenges imposed by their environment.

GELIFES was founded in 2015 from a merger between the Centre for Behavioural Neuroscience (CBN) and the Centre for Ecological and Evolutionary Studies (CEES). The vision behind this merger was to integrate research on the short-term and long-term processes of adaptation, and combine these expertise to realize new insights in adaptive life. This strategy aims to develop the new and ambitious focus area Adaptive Life of the Faculty, and to further improve the international visibility and impact of the institute. The initiative is supported financially through the Faculty theme Adaptive Life over the course of five years.

To improve integration of the two former institutes, the new institute GELIFES took several organizational measures. The researchers are no longer organized into research groups, but each researcher forms his/her own independent research line with a specified budget. Research staff meets each other in six new, integrative and non-hierarchical expertise groups for peer support:

- Behavioural & Physiological Ecology;
- Conservation Ecology;
- Evolutionary Genetics, Development & Behaviour;
- Genomic Research in Ecology & Evolution in Nature;
- Neurobiology;
- Theoretical Research in Evolutionary Life Sciences.

To increase applied funding and societal impact, GELIFES established two competence centres (Brain and Behaviour and Sustainable Landscape) across the expertise groups. The competence centres provide support for acquiring funding from external sources and valorisation opportunities. The institute used the additional Adaptive Life Faculty funding to realize 24 PhD positions in integrative projects. Also, all new tenure track positions in the institute are filled with research programmes that strengthen the integrative research programme.

In the self-evaluation and the interviews with the committee, the management presented a clear and well considered vision for the institute. There was genuine and impressive enthusiasm for the new structure at all levels in the institute. The decisions taken by the management to improve further integration of the former institutes were considered innovative and encouraging, and the formation of the expertise groups and special topics have energised overall research, while at the same time providing a 'home' for all researchers. New collaborations have been established, sparked by the integrative topics. According to the committee, the management of the institute has taken very effective measures to achieve true integration between the two former institutes.

The composition of the research staff at GELIFES is predominantly male, especially in the senior positions. The institute is very well aware of this gender issue and is searching for ways to improve gender balance. The board is well aware that even advertisement texts may already be selective and tries to open up for female candidates. However, already the fact that the senior staff is mostly male might be a barrier for female candidates. Appointment of strong senior female staff will be an important step in changing this. The gender balance cannot only be changed bottom up, but needs to be improved at all staff levels at the same time. Additionally, the institute should continue to work on the pipe line of (female) junior researchers and keep them in the system.



## 10.2. Research quality

The committee was very impressed by the visionary approach of GELIFES, and praised the successful combining of two fields that are traditionally studied by two separate scientific communities. Based on a cross-linked scientific approach GELIFES aims at a comprehensive understanding of adaptation across different levels of biological organization, integrating research into mechanistic, ecological and evolutionary processes. This ranges from genes to organisms to communities and ecosystems. Internationally only few institutes in the life sciences have a comparable integrative profile to GELIFES. Some researchers belong to the few most influential scientists in their particular fields.

Over the last few years, GELIFES and its predecessors have conducted very good, internationally recognised research. This is reflected by a constantly high number of publications in high – some even in the highest – impact journals. Some of the articles are ground-breaking, belonging to the top 1% of a particular field. Many programme leaders of GELIFES are very well recognized by the international scientific community and take leading roles in scientific societies. They are frequently invited to keynote lectures at international conferences and they organize important conferences themselves.

The committee believes that institute has the potential in the coming years to fully realizing its vision and strategy and achieve the highest rating in all categories. It has already made very significant research contributions that show that it is on the right track to achieve internationally recognized excellence, but the current time span is simply too short to see this already happening. According to the committee, the institute has the potential to develop into a world-leading institute in biological adaption when the institute's vision and strategy are implemented and work out as planned for the coming years.

## 10.3. Societal relevance

The institute makes an excellent contribution to society. GELIFES has many collaborations and partnerships with societal partners and with industry, who have taken part in many projects in diverse areas such as plant research, light and agriculture. Topics in which the institute cooperates with industrial and societal partners include human chronobiology (Philips), pharmaceuticals (Roche, Eli Lilly, Novartis, Pfizer), dementia (RIVM), metabolism and aging (Nutricia, Danone), insect genetics (Amusca, Koppert), ecology (Friesland Campina, Rabobank), nature conservation (Natuurmonumenten, Staatsbosbeheer, Rijkswaterstaat, Birdlife Netherlands, WWF Netherlands, and several local organizations such as the Wadden Academy, the provinces of Groningen and Friesland, It Fryske Gea, and Seal Rehabilitation Center Pieterburen. The work of the institute clearly influences public policy-making, for instance on nature conservation in the Waddenzee and Oostvaardersplassen. For the future, the research line in evolutionary medicine is very promising for new applications.

The committee was particularly impressed by the excellent collaborations of the institute and the role it plays in regional, national and international policy on nature conservation and ecology. According to the committee, GELIFES is connected to society and societally relevant topics on many levels. The researchers are very active in outreach, including media appearances, public lectures, social media and educational programmes at schools. The institute actively seeks media attention, resulting in frequent coverage of GELIFES's research in the media. Outreach is appreciated and valued by GELIFES, and researchers are stimulated to participate. Outreach activities are part of the formal tenure track evaluation and are annually discussed in performance interviews. The committee praises this dedication to outreach and PR, and the way it is integrated in the institute.

## 10.4. Viability

GELIFES is still relatively young and is in the process of establishing itself, both in terms of organization and in terms of research programming. The institute has a huge potential and the committee observed very positive energy among the research staff. The institute is well aware of

its own strengths and weaknesses. The institute will have to work hard to bring the various research lines together, especially where overlap in research topics with other groups is less obvious, such as neurobiology. The integrative topics and new tenure track positions are very good tools to achieve this. The committee recommends to use the upcoming retirements in the next 5-10 years to further integrate the research lines.

The current level of direct funding is nearly 60% of the total budget, which is high compared to the other FSE institutes. As mentioned before, to realize its vision and strategy, GELIFES will need an increased level of external funding, specifically more competitive funding to realize its vision. An important achievement in this respect is the prestigious Spinoza Prize received by Theunis Piersma for his work at GELIFES and NWO-institute NIOZ, of which the major part landed in Groningen. However, in general the number of grant applications by GELIFES researchers is generally too low. For instance, in the past six years the institute acquired eleven personal grants in the NWO VENI, VIDI, VICI scheme, and one in the ERC.

GELIFES is already on the right track by setting up a support group of Talent Development, which assists researchers in applying for external funding. Also the institute's large number of societal and industrial partners may well offer opportunities in more joint applications for funding, or even in direct funding by third parties. GELIFES was generously extra supported by the Faculty with over 10.4 M€ over five years through the Adaptive Life faculty theme. The committee considers this a well-placed investment. The 24 appointed PhD students appear very well placed by using them to enhance internal cross-discipline collaboration. The results will show in the coming years. The challenge for the institute is to be proactive in generating additional funds to replace this starting subsidy on the longer term.

In the interviews, the housing situation of the institute was mentioned several times. The distribution of staff across two wings of the building seems to hamper integration and communication. The committee thinks that this concern should be addressed to help further integration of the two former institutes. This does not necessarily need restructuring of the building. Redistributing the institute members throughout the existing two wings could have a positive influence on the integration of the two parts of the institute.

The committee considered the viability in relation to the recent merger. If plans work out as envisaged, GELIFES is clearly on its way to excellence, but the timing of the present review simply does not allow that qualification yet.

### **10.5. Conclusion**

The GELIFES institute is in the middle of executing a very ambitious vision and strategy to develop an integrated research programme to study both short-term and long-term aspects of biological adaptation. The committee considers this very positive and thereby fully supports the goals of the institute. The staff have clearly been energised by the new structure and their enthusiasm was very impressive. New links have already been formed. The staff at all levels feel well supported and the institute is well led. and the institute aims to develop into a world leader and this seemed feasible to the committee. During the next few years it will become clear whether the institute will realize its ambitions and develop into a world-leading institute in biological adaptation. To further support this, the institute should aim to acquire more external funding to supplement the direct funding provided by the faculty, and acquire more personal research grants as that will stimulate own research lines of young researchers. The institute makes an excellent contribution to society, with many collaborations with industry and society and a very visible track record in ecology and nature conservation. Finally, the institute should work on improving its gender balance and PhD completion rates.

Research quality:	very good
Societal relevance:	excellent
Viability:	very good





# Appendices





## Appendix 1: Explanation of the SEP criteria and categories

There are three criteria that have to be assessed.

Research quality:

- Level of excellence in the international field;
- Quality and Scientific relevance of research;
- Contribution to body of scientific knowledge;
- Academic reputation;
- Scale of the unit's research results (scientific publications, instruments and infrastructure developed and other contributions).

Relevance to society:

- quality, scale and relevance of contributions targeting specific economic, social or cultural target groups;
- advisory reports for policy;
- contributions to public debates.

Viability:

- the strategy that the research unit intends to pursue in the years ahead and the extent to which it is capable of meeting its targets in research and society during this period;
- the governance and leadership skills of the research unit's management.

The point is to assess contributions in areas that the research unit has itself designated as target areas.

Category	Meaning	Research quality	Relevance to society	Viability
1	World leading/excellent	The unit has been shown to be one of the most influential research groups in the world in its particular field.	The unit makes an outstanding contribution to society	The unit is excellently equipped for the future
2	Very good	The unit conducts very good, internationally recognised research	The unit makes a very good contribution to society	The unit is very well equipped for the future
3	Good	The unit conducts good research	The unit makes a good contribution to society	The unit makes responsible strategic decisions and is therefore well equipped for the future
4	Unsatisfactory	The unit does not achieve satisfactory results in its field	The unit does not make a satisfactory contribution to society	The unit is not adequately equipped for the future





## Appendix 2: Curricula vitae of the committee members

**Professor D.D. (Douwe) Breimer (chair)** is emeritus professor of Pharmacology at Leiden University and was both rector magnificus and president of the Executive Board of Leiden University. His research focus was on pharmacokinetics, pharmacodynamics and drug metabolism. Breimer co-authored over 500 scientific papers and supervised more than 50 Ph.D. students. Breimer holds honorary doctorates from Ghent University, Uppsala University(1992), Semmelweis University (Budapest), the University of Navarra (Pamplona), Hoshi University (Tokyo), the University of London and the Université de Montréal.

**Professor G.J.M. (Gerard) Meijer (vice chair)** is director of the Fritz Haber Institute (FHI) of the Max Planck Society in Berlin. Meijer obtained his Physics degree and his PhD in Physics at the University of Nijmegen. He became professor in experimental physics at the University of Nijmegen in 1995. Between 2000 and 2003 he was Director of the FOM institute for Plasmaphysics in Nieuwegein after which he became director of FHI in Berlin. Between 2012 and 2016 he was President of the Executive Board of Radboud University Nijmegen after which he returned to FHI in Berlin.

**Dr. F. (Frank) Schuurmans (vice chair)** is vice president research at ASML. Schuurmans received his PhD in Physics from the University of Amsterdam. He worked as senior scientist at Philips before working at FEI Company in 2007. In 2011 Schuurmans started at ASML.

**Professor M. (Matthias) Wessling (vice chair)** heads the Chair of Chemical Product and Process Engineering at RWTH Aachen University and he holds an Alexander von Humboldt Professorship. He is Editor of the Journal of Membrane Science. After studying chemical engineering in Dortmund and Cincinnati, he did his PhD in Twente/NL. He was Senior Research Scientist at Membrane Technology and Research Inc., Menlo Park, CA and head of the Department of Separation Processes at Akzo Nobel. From 2000 to 2010, he was Chair of Membrane Science and Technology at the University of Twente.

**Professor W. (Wim) van der Putten (vice chair)** is Head of the Department of terrestrial Ecology at the Netherlands Institute of Ecology (NIOO-KNAW). He graduated at Wageningen University where he also obtained his PhD. From 1988 onwards he was appointed as postdoc at the Institute of ecology at Heteren where he became senior scientist in 1994 and acted as interim head in 1997. In 2000 he became head of the department Multitrophic Interactions at NIOO-KNAW. In 2003 he was appointed extraordinary professor in Functional Biodiversity at Wageningen University.

**Professor K.S. (Klaus) Kirch** has been Associate Professor of Experimental Particle Physics at ETH Zurich's Institute of Particle Physics and simultaneously Head of the Laboratory of Particle Physics at the Paul Scherrer Institute (PSI) since 2009. He is Full Professor since 2014. Kirch studied mathematics and physics at the Albertus Magnus University of Cologne. He worked at PSI and ETH Zurich, completing a doctorate in 1997. In 1999 he moved to Los Alamos National Laboratory, USA, as a postdoctoral fellow. In 2001 he returned to the PSI, where he worked as a scientist specialising in fundamental particle physics with neutrons and collaborating on the development of the UCN source.

**Professor U. (Uwe) Oelfke** is Deputy Head of the Division of Radiotherapy and Imaging, Head of the Joint Department of Physics at the Institute of Cancer Research in London and he leads the Radiotherapy Physics modelling research group. Oelfke gained his PHD at the University of Hanover in 1990, after which he moved to TRIUMF, Canada's national laboratory for particle and nuclear physics. In 1997 he returned to Germany to join the German Cancer Research Center (DKFZ) in Heidelberg, he became group leader in 2001 and received a professorship in 2004. By combining his expertise in nuclear and medical physics, Oelfke is working to improve planning and delivery of radiotherapy.



**Professor A. (Annabella) Selloni Annabella Selloni** is David B. Jones Professor of Chemistry at the Department of Chemistry of Princeton University since 2008. She is a Fellow of the European Academy of Sciences (2016) and the American Physical Society (2008), and has been named an APS Outstanding Referee (2012). Professor Selloni received her Ph.D. from the Swiss Federal Institute of Technology (Lausanne, Switzerland) in 1979. After a postdoc at the IBM- T.J. Watson research centre in Yorktown Heights, she held positions at the University "La Sapienza" (Roma, Italy), at the International School for Advanced Studies (Trieste, Italy), and at the University of Geneva (Switzerland), before joining Princeton University in 1999.

**Professor R. (Richard) van de Sanden** Richard van de Sanden (1964) holds an MSc (1987) and PhD in applied physics from Eindhoven University of Technology University (1991). In 2000, he was appointed as a full-time professor at the Eindhoven University of Technology. In 2011 he became the director of the Dutch Institute for Fundamental Research, an institute governed by the Dutch Science Organization NWO and which focuses on fundamental research for Fusion energy and Solar Fuels. Since 2013 he is a member of the Netherlands Royal Academy of Arts and Sciences (KNAW).

**Professor A.S. (Anne) Meyer** is full professor and Head of Enzyme Technology and Biochemical Engineering at the Technical University of Denmark.

**Professor D. (Dawn) Tilbury** is professor in the Mechanical Engineering department at the University of Michigan. Tilbury has an undergraduate degree in Electrical Engineering and did her MS and PhD at the University of California. Tilbury's research interests lie in in the area of control systems, and she is a member of the Robotics Group and the Controls Group in the College of Engineering. Tilbury was director of the Ground Robotics Research Center on reliability of autonomous ground vehicles and Deputy Director of the Automotive Research Center (ARC) from 2011-2013.

**Professor A. (Andreas) Hirsch** is full professor and Chair of the Organic Chemistry group at University of Erlangen-Nürnberg. He is coordinator of the Graduate School Molecular Science (GSMS), the Interdisciplinary Center for Molecular Materials (ICMM) and the Collaborative Research Center "Synthetic Carbon Allotropes" (SFB 953) in Erlangen. He is on the Board of Directors of the Cluster of Excellence "Engineering of Advanced Materials" (EAM) in Erlangen and the Central Institute for Materials and Processes (ZMP) in Fürth.

**Professor J. (Janine) Cossy** is professor at the Laboratoire de chimie organique at ESPCI in Paris. She earned a doctorate in chemistry at the University of Reims, and then undertook a post-doctoral fellowship at the University of Wisconsin. Appointed as a professor at ESPCI ParisTech in 1990, her work focuses on the total synthesis of natural biologically-active products like anticancer agents, antibiotics, anti-inflammatories or products acting on the central nervous system. She has also conducted research on free-radical reactions and photochemical reactions. Cossy has been a consultant for Rhône-Poulenc, Rhodia and L Oréal and co-founded the startup Acanthe Biotech and CDP Innovation.

**Professor R. (Roderich) Süßmuth** is Rudolf-Wiechert-Professor in Biological Chemistry at the Technical University of Berlin. He received his PhD and did his habilitation at the University of Tübingen. The Süßmuth group currently employs more than 30 scientists from various disciplines, e.g. chemistry, biology and biochemistry. The group has a long tradition to solve scientific questions emerging at the interface of chemistry and biology and consists of two departments: I) biochemistry and II) organic chemistry.

**Dr. S. (Sjoukje) Heimovaara** is director of Research and Breeding at Royal van Zanten. She studied Plant Breeding at Wageningen University and received her PhD at Leiden University. At Royal van Zanten she is responsible for development and innovation. Heimovaara had prior positions at ABIN and TNO.

**Professor E. (Ernst) Bamberg** is Professor of Biophysical Chemistry at University of Frankfurt and Director of the Department of Biophysical Chemistry of the Max Planck Institute für Biophysik in Frankfurt. Bamberg has been a Member of Scientific Advisory Board at GenSight Biologics SA since April 17, 2012. He is the inventor of the optogenetics approach and has been at the fore front of this technology since its discovery.

**Professor L. (Lotte) Søgaard-Andersen** is director of the department of Ecophysiology, Max Planck Institute for Terrestrial Microbiology, Marburg and professor for Microbiology at the Philipps University Marburg. Søgaard-Andersen obtained her MSc, MD and PhD at the University of Odense, Denmark, where she also was assistant professor. She was visiting scientist at Stanford University after which she went to the University of Southern Denmark where she first was associate professor and in 2002 became full professor. Since 2004 she is Director and Head of the Department of Ecophysiology at the MPI in Marburg. She focuses her research on how bacteria adapt and differentiate at the molecular and cellular level in response to changes in the environment.

**Professor P. (Pat) Monaghan** is holder of the Regius Chair of Zoology at the University of Glasgow, and was previously Professor of Animal Ecology from 1997 to 2012. She obtained her PhD from the University of Durham, UK. Her research interests lie in physiological, behavioural and population ecology, with particular emphasis on the responses of individuals to changing environmental conditions and how early life conditions can affect ageing trajectories later in life. Her work is highly interdisciplinary, and spans many biological levels from molecular through to population biology. She became a Fellow of the Royal Society of Edinburgh in 1997.

**Professor N. (Norbert) Sachser** is professor for Zoology and head of the Department of Behavioural Biology at the University of Münster, Germany. Sachser studied biology, chemistry and sociology at the University of Bielefeld, Germany. He received his PHD thesis in 1984 at the Department of Behavioural Biology and became postdoc and assistant professor at the Department of Animal Physiology at the University of Bayreuth, Germany. He accepted a call for a professorship in zoology/behavioural biology from Münster University in 1993.





## Appendix 3: Programme of the site visit

Sunday 11 June 2017

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14:30	16:00	Preparatory meeting chair and secretaries
16:00	17:00	Instruction committee members
17:00	19:00	Preparation of KVI-CART and VSI
19:00	20:30	Dinner (committee members only)

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Monday 12 June 2017

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09:00	09:30	Meeting with Dean
09:30	12:30	Interviews KVI-CART: 09:30 - 10:15 Management 10:15 - 11:15 programme leaders 11:15 - 11:30 break 11:30 - 12:00 tenure track and junior professors 12:00 - 12:30 postdocs
12:30	13:30	Lunch
13:30	16:30	Interviews VSI: 13:30 - 14:15 Management 14:15 - 15:15 programme leaders 15:15 - 15:30 break 15:30 - 16:00 tenure track and junior professors 16:00 - 16:30 postdocs
16:30	17:45	Evaluation KVI-CART
17:45	19:00	Evaluation VSI
18:00	19:00	Instruction new committee members
19:00	20:00	drinks and meeting with institute directors (KVI-CART, VSI)
20:00	21:30	dinner (committee members only)
21:30	23:00	Meeting with Rector Magnificus

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Tuesday 13 June 2017

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08:30      09:00      Meeting with Dean

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09:00      10:00      Preparation of interviews ENTEG

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10:00      13:00      Interviews ENTEG  
10:00 - 10:45 Management  
10:45 - 11:45 programme leaders  
11:45 - 12:00 break  
12:00 - 12:30 tenure track and junior professors  
12:30 - 13:00 postdocs

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13:00      14:00      Lunch

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14:00      15:00      Evaluation ENTEG

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14:00      15:00      Instruction new committee members

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15:00      16:00      Preparation ZIAM

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16:00      19:00      Interviews ZIAM  
16:00 - 16:45 Management  
16:45 - 17:45 programme leaders  
17:45 - 18:00 break  
18:00 - 18:30 tenure track and junior professors  
18:30 - 19:00

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19:00      20:00      Drinks and meeting with institute directors (ENTEg, ZIAM)

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20:00      21:30      Dinner (committee members only)

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Wednesday 14 June 2017

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09:00	09:30	Meeting with Dean
09:30	11:00	Evaluation ZIAM
10:00	11:00	Instruction new committee members
11:00	11:45	Presentation preliminary findings KVI-CART, VSI, ENTEG, ZIAM
11:45	12:30	Preparation GSSE
12:30	13:15	Lunch
13:15	15:45	Interviews GSSE 13:15 - 13:45 Management 13:45 - 14:30 PhD candidates 14:30 - 14:45 break 14:45 - 15:15 supervisors 15:15 - 15:30 director
15:30	17:00	Evaluation GSSE
16:00	17:00	Instruction new committee members
17:00	18:30	Preparation Stratingh Institute
18:30	19:30	Drinks and meeting with institute directors (GSSE, Stratingh)
19:30	21:00	Dinner (committee members only)

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Thursday 15 June 2017

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09:00	09:30	Meeting with dean
09:30	12:30	Interviews Stratingh Institute 9:30 - 10:15 Management 10:15 - 11:15 programme leaders 11:15 - 11:30 break 11:30 - 12:00 tenure track and junior professors
12:00	12:30	Lunch
12:30	13:15	Evaluation Stratingh Institute
13:30	14:00	Presentation preliminary findings GSSE, Stratingh
13:30	14:30	Instruction new committee members
14:30	15:30	Preparation GBB
15:30	18:30	Interviews GBB 15:30 - 16:15 Management 16:15 - 17:15 programme leaders 17:15 - 17:30 break 17:30 - 18:00 tenure track and junior professors 18:00 - 18:30 postdocs
18:30	19:30	Drinks and meeting with institute directors (GBB and GELIFES)
19:30	21:00	Dinner (committee members only)

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Friday 16 June

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09:00	09:30	Meeting with dean
09:30	11:00	Evaluation GBB
09:30	11:00	Instruction new committee members
11:00	12:00	Preparation GELIFES
12:00	13:00	Lunch
13:00	16:00	Interviews GELIFES 13:00 - 13:45 Management 13:45 - 14:45 Programme leaders 14:45 - 15:00 Break 15:00 - 15:30 Tenure track and junior professors 15:30 - 16:00 postdocs
16:00	17:00	Evaluation GELIFES
17:00	17:30	Presentation preliminary findings GBB, GELIFES

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## Appendix 4: Quantitative data

Research staff: Research staff in headcounts (#) and research input in full time equivalent (fte).  
The fte numbers equal the following research time:

- Tenured staff: 40%
- Tenure-track: 65%
- Postdocs: 90%
- PhD students: 85%

### VSI

	2010		2011		2012		2013		2014		2015		2016	
	#	fte												
<b>Tenured staff</b>	11	4.9	11	4.9	11	5.2	11	5.2	10	4.4	11	4.1	11	4.7
<b>Post docs</b>	7	6.3	9	8.1	9	8.1	8	7.2	8	7.2	7	3.9	4	3.6
<b>PhD students</b>	21	-	27	-	31	-	31	-	31	-	34	-	35	-
<b>Support staff</b>	2	-	2	-	2	-	2	-	2	-	2	-	2	-
<b>Visiting fellows</b>	0	-	0	-	0	-	0	-	1	-	3	-	4	-

### ENTEG

	2010		2011		2012		2013		2014		2015		2016	
	#	fte	#	fte	#	fte								
<b>Tenured staff</b>	10	4.1	12	4.1	11	4.6	15	5.7	17	7.0	19	7.3	18	6.2
<b>Post docs</b>	4	1.3	10	3.1	10	5.3	15	7.1	20	10.2	25	12.5	25	11.6
<b>PhD students</b>	40	-	47	-	54	-	59	-	71	-	71	-	81	-
<b>Support staff</b>	7	-	7	-	7	-	8	-	7	-	8	-	9	-
<b>Visiting fellows</b>	6	-	7	-	5	-	6	-	12	-	11	-	12	-

### ZIAM

	2010		2011		2012		2013		2014		2015		2016	
	#	fte												
<b>Tenured staff</b>	29	11	30	11	27	12	30	12	32	13	32	13	31	13
<b>Post docs</b>	53	31	60	36	59	38	50	35	53	30	49	23	42	25
<b>PhD students</b>	140	-	141	-	149	-	162	-	172	-	165	-	167	-
<b>Support staff</b>	24	-	25	-	22	-	24	-	23	-	22	-	20	-

### Stratingh

	2010		2011		2012		2013		2014		2015		2016	
	#	fte												
<b>Tenured staff</b>	11	4.7	11	5.2	12	5.4	14	6.1	15	6	15	5.9	15	6.2
<b>Post docs</b>	25	13.9	17	12.5	15	11.6	21	13.7	29	22.8	30	17.1	27	14.7
<b>PhD students</b>	65	-	73	-	93	-	92	-	95	-	98	-	97	-
<b>Support staff</b>	9	-	9	-	7	-	8	-	9	-	10	-	9	-
<b>Visiting fellows</b>	15	-	17	-	16	-	12	-	13	-	17	-	23	-

### GBB

	2010		2011		2012		2013		2014		2015		2016	
	#	fte												
<b>Tenured staff</b>	28	8.7	27	9.0	27	8.8	24	8.2	27	8.2	26	8.3	25	8.3
<b>Post docs</b>	57	51.3	60	54.0	65	58.8	64	57.6	67	60.3	53	47.7	53	47.4
<b>PhD students</b>	111	-	101	-	108	-	107	-	117	-	118	-	119	-
<b>Support staff</b>	16	-	16	-	16	-	17	-	17	-	20	-	22	-
<b>Visiting fellows</b>	3	-	2	-	2	-	1	-	3	-	1	-	2	-

### GELIFES

	2010		2011		2012		2013		2014		2015		2016	
	#	fte												



<b>Tenured staff</b>	37	14.7	37	15.1	36	14.8	37	14.3	37	14.8	38	15.4	37	15.5
<b>Post docs</b>	34	22.4	35	23.4	39	21.3	38	20.9	42	23.1	46	21.8	46	22.8
<b>PhD students</b>	123	-	128	-	125	-	124	-	136	-	141	-	147	-
<b>Support staff</b>	27	-	31	-	30	-	31	-	31	-	32	-	31	-
<b>Visiting fellows</b>	1	-	3	-	4	-	9	-	17	-	23	-	22	-

## Funding

### VSI

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Direct funding</b>	k€ 1.254 43%	k€ 1.248 39%	k€ 1.198 38%	k€ 1.334 45%	k€ 1.530 50%	k€ 1.598 56%	k€ 1.513 55%
<b>Research grants</b>	k€ 1.680 57%	k€ 1.974 61%	k€ 1.969 62%	k€ 1.658 55%	k€ 1.519 50%	k€ 1.281 44%	k€ 1.237 45%
<b>Costs</b>							
<b>Personnel costs</b>	k€ 1.816 62%	k€ 2.226 69%	k€ 2.362 75%	k€ 2.416 81%	k€ 2.595 85%	k€ 2.503 87%	k€ 2.356 86%
<b>Other costs</b>	k€ 1.118 38%	k€ 996 31%	k€ 805 25%	k€ 576 19%	k€ 454 15%	k€ 376 13%	k€ 394 14%

### ENTEG

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Direct funding</b>	k€ 1.586 52%	k€ 1.442 45%	k€ 1.988 45%	k€ 2.232 47%	k€ 2.900 53%	k€ 3.349 58%	k€ 3.853 61%
<b>Research grants</b>	k€ 747 24%	k€ 837 26%	k€ 901 20%	k€ 939 20%	k€ 708 18%	k€ 704 12%	k€ 763 12%
<b>Contract research</b>	k€ 727 23%	k€ 927 29%	k€ 1.513 35%	k€ 1.544 33%	k€ 1.631 30%	k€ 1.769 30%	k€ 1.722 27%
<b>Costs</b>							
<b>Personnel costs</b>	k€ 1.990 65%	k€ 2.154 67%	k€ 3.001 68%	k€ 3.364 71%	k€ 4.014 73%	k€ 4.499 77%	k€ 4.888 77%
<b>Other costs</b>	k€ 1.071 35%	k€ 1.053 33%	k€ 1.399 32%	k€ 1.352 29%	k€ 1.465 27%	k€ 1.323 23%	k€ 1.449 23%

### ZIAM

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Direct funding</b>	k€ 8.431 50%	k€ 7.993 45%	k€ 8.913 48%	k€ 8.438 50%	k€ 9.586 57%	k€ 9.979 63%	k€11.103 62%
<b>Research grants</b>	k€ 4.957 30%	k€ 5.201 30%	k€ 6.288 34%	k€ 5.706 34%	k€ 4.757 28%	k€ 4.424 28%	k€ 5.250 29%
<b>Contract research</b>	k€ 3.268 20%	k€ 4.451 25%	k€ 3.403 19%	k€ 2.866 16%	k€ 2.488 15%	k€ 1.631 10%	k€ 1.665 9%
<b>Costs</b>							
<b>Personnel costs</b>	k€10.011 60%	k€10.536 60%	k€11.426 61%	k€11.295 66%	k€11.240 67%	k€10.615 66%	k€10.713 59%
<b>Other costs</b>	k€ 6.644 40%	k€ 7.110 40%	k€ 7.177 39%	k€ 5.714 34%	k€ 5.592 33%	k€ 5.420 34%	k€ 7.305 41%

### Stratingh

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Direct funding</b>	k€ 3.267 59%	k€ 3.254 45%	k€ 3.570 47%	k€ 3.454 43%	k€ 3.133 37%	k€ 3.459 42%	k€ 3.589 43%
<b>Research grants</b>	k€ 1.689 31%	k€ 3.172 44%	k€ 2.846 37%	k€ 3.574 44%	k€ 3.969 46%	k€ 3962 48%	k€ 4.100 49%
<b>Contract research</b>	k€ 563 10%	k€ 744 10%	k€ 1.143 16%	k€ 1.069 13%	k€ 1.453 17%	k€ 896 10%	k€ 703 8%
<b>Costs</b>							
<b>Personnel costs</b>	k€ 3.569 65%	k€ 4.154 58%	k€ 4.863 64%	k€ 5.225 65%	k€ 6.052 71%	k€ 6.013 72%	k€ 5.824 69%
<b>Other costs</b>	k€ 1.950 35%	k€ 3.016 42%	k€ 2.696 36%	k€ 2.706 33%	k€ 2.504 29%	k€ 2.304 28%	k€ 2.568 31%

### GBB

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
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<b>Direct funding</b>	k€ 7.736 45%	k€ 6.746 41%	k€ 6.430 34%	k€ 6.868 41%	k€ 6.770 40%	k€ 7.270 38%	k€ 6.786 35%
<b>Research grants</b>	k€ 6.114 36%	k€ 5.466 33%	k€ 6.383 33%	k€ 4.696 28%	k€ 3.802 23%	k€ 3.613 19%	k€ 4.817 25%
<b>Contract research</b>	k€ 3.199 19%	k€ 4.183 25%	k€ 6.347 33%	k€ 5.261 31%	k€ 6.315 37%	k€ 8.256 43%	k€ 7.667 39%
<b>Costs</b>							
<b>Personnel costs</b>	k€11.443 67%	k€10.956 67%	k€11.145 58%	k€11.943 71%	k€11.674 69%	k€12.251 64%	k€12.853 67%
<b>Other costs</b>	k€ 5606 33%	k€ 5.438 33%	k€ 8.015 42%	k€ 4.883 29%	k€ 5.211 31%	k€ 6.909 36%	k€ 6.446 33%

## GELIFES

<b>Funding</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
<b>Direct funding</b>	k€ 7.445 61%	k€ 7.399 64%	k€ 7.184 56%	k€ 7.612 63%	k€ 7.328 59%	k€7.601 55%	k€ 7.698 58%
<b>Research grants</b>	k€ 2.912 24%	k€ 2.668 23%	k€ 3.632 29%	k€ 2.777 23%	k€ 2.904 23%	k€ 4.382 32%	k€ 3.610 27%
<b>Contract research</b>	k€ 1.876 15%	k€ 1.547 13%	k€ 1.925 15%	k€ 1.705 14%	k€ 2.168 18%	k€ 1.874 13%	k€ 1.987 15%
<b>Costs</b>							
<b>Personnel costs</b>	k€ 8.686 71%	k€ 8.296 71%	k€ 8.811 69%	k€ 9.206 76%	k€ 9.560 77%	k€ 9.876 71%	k€10.419 78%
<b>Other costs</b>	k€ 3.559 29%	k€ 3.318 29%	k€ 3.930 31%	k€ 2.888 24%	k€ 2.842 23%	k€ 3.981 29%	k€ 2.876 22%

## Publications

### VSI

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	57	53	66	49	110	100	60
<b>Non-refereed articles</b>	1	2	1	1			
<b>Books</b>	1		1			1	
<b>PhD theses</b>	2	1	3	4	3	4	10
<b>Conference contributions</b>	8	13	10	9	4	3	2
<b>Posters</b>	5	5		11	1	9	1
<b>Working paper</b>	1	1			2	7	1
<b>Total publications</b>	75	75	81	74	120	124	74

### ENTEG

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	34	36	43	52	72	68	93
<b>Conference proceedings</b>	19	18	29	33	37	37	45
<b>Books</b>		1				2	1
<b>Book chapters</b>	3	6	2	6	1	4	7
<b>PhD theses</b>	5	5	4	11	11	12	7
<b>Patent applications</b>	2	2	1	3	3	2	1
<b>Total publications</b>	63	68	79	105	124	125	154

### ZIAM

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	151	160	163	166	198	162	194
<b>Non-refereed articles</b>	17	16	13	7	15		1
<b>Book chapters</b>	13	7	5	8	2	2	1
<b>PhD theses</b>	18	23	27	23	24	23	34
<b>Conference proceedings</b>	12	8	2	3	2	5	1
<b>Patents</b>	3	3	3	3	1	1	1
<b>Total publications</b>	214	217	213	210	242	193	232

### Stratingh

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	117	98	93	120	109	116	99
<b>Books (edited)</b>	1	2					1
<b>Book chapters</b>	9	1	7	2	6	3	1
<b>PhD theses</b>	8	12	9	13	11	16	18
<b>Patents</b>	1		2		1		
<b>Total publications</b>	136	113	111	135	127	135	119

### GBB

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	206	214	193	197	157	182	159
<b>Books &amp; book chapters</b>	3	9	9	6	5	3	5
<b>PhD theses</b>	36	28	28	12	23	27	29
<b>Patents</b>	4	3	2	3	7	5	1
<b>Total publications</b>	249	254	232	218	192	217	194

### GELIFES

	2010	2011	2012	2013	2014	2015	2016
<b>Refereed articles</b>	253	269	272	252	261	264	262
<b>Non-refereed articles</b>	11	11	9	9	10	5	4
<b>Books</b>	1	2	1	2	5	4	2
<b>Book chapters</b>	19	11	28	8	8	15	10
<b>PhD theses</b>	30	21	26	30	21	23	20
<b>Others</b>				1	1	2	7
<b>Total publications</b>	304	314	336	302	306	313	305

