Graduate School VLAG

- Food Technology, Agro-Biotechnology, Nutrition & Health Sciences -

Assessment report

FINAL

EXTERNAL PEER REVIEW
2009 - 2014

June 2015

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Preface

This report summarises the findings of the External Peer Review of the VLAG Graduate School at the Universities of Wageningen and Maastricht which was carried out between 15 and 18 June 2015. In addition to discussions with colleagues from both universities, the review process benefitted greatly from the extensive preparation undertaken by VLAG and by the provision of detailed statistics and other information in a standardised and digestible format. The review took into consideration changes in structures and staffing since the last review in 2009 and our report includes an analysis of the Graduate School as a whole as well as of the individual chair groups (Wageningen) and research lines (Maastricht) within VLAG.

The Review Committee appreciates the professional assistance provided by the VLAG Management Team and, in particular, by the two academic secretaries Drs. Frans van der Akker and Dr Roelinka Broekhuizen who helped to turn the outcomes of our discussions into coherent text and who, over a very busy 4 days, ensured that we kept to time! Special thanks go to Vesna Prsic, MSc who organised everything very thoughtfully and efficiently. We also thank the Wageningen UR, Maastricht University and VLAG administration and the VLAG faculty, staff and PhD candidates for their contributions in making the review an interesting, informative and rewarding process.

Finally special appreciation goes to the members of the review committee for their cheerful commitment, high levels of professionalism, sheer hard work and wise counsel.

June, 2015

Prof. Dietrich Knorr
Chairman, External Peer Review Committee VLAG
Prof. John Mathers
Chairman, External Peer Review Committee NUTRIM

1 Executive Summary

Graduate School

- The committee unanimously finds that the mission, management, financial resources and viability of the Graduate School are sound and sufficient. The mission of VLAG is clear, timely and clearly in line with Wageningen UR (WUR) mission.
- The research environment of VLAG is regarded as very positive; PhD candidates and members of VLAG associated institutes expressed their satisfaction with the management of each PhD study program, research environment, and facilities.
- VLAG has a genuine "corporate identity" for PhD candidates; the PhD training and education program is regarded to be of high quality.
- Very positive is the high engagement and pro-activity of the PhD candidates at Wageningen University (WU) and NUTRIM.

In general, the VLAG Graduate School clearly provides a sound basis for both academic and industrial careers.

Wageningen University

- The committee was impressed by the overall excellence of VLAG and realises that there is variation among groups with respect to size and history. We feel that the VLAG research groups are in an optimal position to realise the creation of synergy across the food chain.
  Important is that there is excellent connection with industry and research institutes; this in not only important for societal relevance (which is major), but also contributes to the environment for the PhD candidates.
- The last six years have harboured major changes in the management and structure of multiple groups, introducing both a risk and an opportunity for the groups and the community as a whole.
- Succession planning needs to attract the best globally available, while new facilities and equipment will give a new incentive.
- Many groups are faced with increased number of undergraduates. While this demonstrates the success of the university and the disciplines involved, it also raises the question how to balance research and teaching. This is an issue that would merit attention in the coming period.
- We do feel that VLAG faculty may develop stronger involvement in international organizations and at international events.
- Food companies are shifting their focus eastwards. WUR needs to adapt to this by building new relationships and be even more innovative to remain at the cutting edge.
- The new assessment criterion *relevance to society* was presented well. During the assessment interesting differences in focus among the chair groups were demonstrated. Some chair groups performed true benchmarking with peer groups beyond the bibliometric benchmarking, which was quite helpful. Further improvement of benchmarking with international peer groups would be beneficial.
- The VLAG seed money grant instrument is regarded to be an effective instrument to trigger research collaboration and support the submission of research proposals.
- While the groups on average show very good performance, there is much synergy to be gained in an intensified interaction between research groups:
  - Sharing of capital-intensive equipment leads to new inter- and intra- groups/university relations.
  - The committee was pleased to see the first actual research results of this strategy with a link between research and sustainable applications.
  - Possible nuclei of collaboration are on:
    - Nano/Microscale technologies
    - Research into the transition towards more sustainable food proteins.

- Interaction between food science and nutrition science.
- Understanding the relations between process conditions, food structure and (technical and nutritional) functions

NUTRIM

- The focus of NUTRIM on prevention helps to make the overall theme of *Healthy Living* a reality.
- NUTRIM is in a strong position to create synergy with other groups across MUMC+.
- NUTRIM forms a bridge between clinical and more basic research. The integration of clinicians and basic scientists within multidisciplinary research lines is impressive.
- The committee was impressed by the overall excellence, but identified that there is variation between groups.
- Balanced depth vs. breadth (focus).
- There is excellent connection with industry and research institutes enabling major contribution to society.
- Infrastructure investments e.g. the Interfaculty institute M4I will facilitate innovative leading-edge research programmes.
- Changes in management and structure of research lines are both a risk and an opportunity.
- Recruitment strategy needs to attract the best globally available.

General

- Research integrity is well embedded in program and culture at both universities.
- It needs to be addressed whether the organisation of VLAG is still in line with the changing funding landscape of the national priorities / top sectors.
- Recognising excellence in creativity/innovation/engineering is suggested.
- Fostering intergroup collaboration, optimizing synergies and minimizing redundancy is seen as future strength.

1.1 Statement

As a result of the performed review the committee states that

- ☑ The Graduate School VLAG provides a well-organized, coherent and productive research environment for the PhD programme.
- ☑ The Graduate School offers a sound and institutionalised programme in which PhD candidates are trained to become independent researchers.
- ☑ The Graduate School functions as an independent organisational unit with its own budgetary and managerial responsibility, with the universities involved providing a level of financing for a period of at least six years that can be described as sufficient in view of the research school's planned capacity.

2 Introduction

2.1 The evaluation

All publicly funded university research in the Netherlands is evaluated at regular intervals in compliance with a national Standard Evaluation Protocol (SEP 2015-2021), as agreed by the Association of Universities in the Netherlands (VSNU), the Netherlands Organisation for Scientific Research (NWO) and the Royal Netherlands Academy of Arts and Sciences (KNAW). The evaluation process, which is applied at the research unit level, consists of a systematic external peer review conducted every six years and a three-year interim review, often based on an internal self-reflection, focused on what is achieved since the last external peer review.

The primary aim of SEP assessments is to reveal and confirm *the quality* and the *relevance of the research to society* and to improve these where necessary.

In addition, SEP assessments also serve specific aims, depending on the target group involved:

- The first target group consists of researchers and those who head research groups. They need to know how the quality of research, societal relevance and their unit's strategy will be assessed, and how these aspects can be improved.
- The second target group consists of the boards of the institutions, who wish to track the impact of their research policy.
- Government wants to know the outcomes of such assessments in connection with the institutions' accountability for expenditure and its own efforts to support an outstanding research system.
- Finally, society and the private sector are interested in the assessments because they seek to solve a variety of problems using the advanced knowledge that research delivers.

Moreover these reviews at Wageningen University include another objective. It requests a formal recognition of the activities of its Graduate Schools now -since 2015- the ECOS-KNAW (The Research School Accreditation Committee) that was responsible for accrediting the Graduate Schools in the Netherlands, has ceased to exist. The SEP includes a terms of reference for the reflection on the PhD programme of the Graduate School, but for the formal recognition of its Graduate Schools Wageningen University requests to indicate whether the Graduate School complies with the following conditions:

1. The Graduate School provides a well-organized, coherent and productive research environment for the PhD programme
2. The Graduate School offers a sound and institutionalised programme in which PhD candidates are trained to become independent researchers
3. The Graduate School functions as an independent organisational unit with its own budgetary and managerial responsibility, with the university or universities involved providing a level of financing for a period of at least six years that can be described as sufficient in view of the research school's planned capacity

These conditions comply with the previous ECOS-criteria as well with the special conditions set by Sodola, the Dutch network of accredited research/graduate schools in all fields of academic research.

In early 2015 the European University Association (EUA) was invited by Wageningen University to conduct an evaluation of the generic elements of its doctoral education, with the aim of determining whether:

1. The intended learning outcomes of the Wageningen PhD programme meet international standards.
2. The Wageningen PhD programme has the structure and processes in place for PhD candidates to attain these learning outcomes.

Therefore results of this evaluation contribute to the current review, which focuses on the quality of the Graduate School specific elements of the PhD training programme (appropriate research environment, course programme, day-to-day PhD supervision, etc.).

This External Peer Review deals with the performance of the Graduate School and in particular the position of its research groups within the (inter)national science and PhD education arena (retrospective) and identifies ways for further improvement (prospective).

The Dean of the Faculty of Health, Medicine and Life Sciences (FHML, Maastricht University) sent an additional request to the NUTRIM Review Committee for an external evaluation of research of NUTRIM. Along with a quantitative and qualitative assessment on each of the three SEP criteria, three additional questions were formulated:

1. Based on the goal of the NUTRIM School to be a linking pin between fundamental and clinical research and to cover the entire research continuum from fundamental to applied research, did NUTRIM and its research lines achieved this goal in the past 6 years and to what extent?
2. NUTRIM research will play a key role in the profiling of the Maastricht UMC because of the central position of the innovation theme 'Food and Metabolism'. What would be the best way to maximize the contribution of NUTRIM to the defined profiles and specialties of the Maastricht UMC?
3. What is the added value of the participation of the School NUTRIM in the Graduate School VLAG in terms of collaboration and synergy for the four NUTRIM research lines and for the School NUTRIM as a whole?

2.2 The assessment procedure

The evaluation procedures followed by the Review Committee were those set out in the NWO/VSNU/KNAW "Standard Evaluation Protocol 2015-2021 for public research organisations". This protocol entails two main characteristics:

- *Two levels of assessment*: The assessment takes place at two levels of the research organisation, i.e. the level of the Graduate School and the level of research units;
- *Three main criteria*: The research units are assessed on the three assessment criteria, i.e. research quality, relevance to society, and viability.

The Review Committee was requested to report its findings on the research units in line with the three main criteria. With respect to the evaluation of VLAG as a whole the findings should be reported in descriptive terms. For the assessment of the research units, the results of the assessment should be given both in scores as well as in descriptive terms. In the text, the most important considerations of the committee should be clarified, while the conclusion should be summarized in a single discrete score according to a four point scale (annex 1). An excerpt of the Standard Evaluation Protocol was provided as a tool supporting this assessment. The three criteria should always be reviewed in relation to the group's mission, especially if this mission restricts the group to operate only for / in a national scientific community.

The assessment was based on and supported by three main components of evidence:

- self-assessment reports detailing the operation, management, research activities, outputs, and SWOT analysis of the Graduate School, and its research units; these self-assessment reports were written as prescribed in the national Standard Evaluation Protocol;
- internet-references of the selected papers and dissertations from each research unit to allow the Review Committee to examine in detail examples of published work;
- discussions with boards, PhD council, postdocs, academic staff and research managers about the information provided.

The site visit was undertaken during the period 15 June - 18 June, 2015 and consisted of a number of components, which can be summarised as follows (annex 2):

- a plenary introduction to Wageningen University and the VLAG Graduate School by the Rector Magnificus of Wageningen University and the scientific director of VLAG;
- NUTRIM Review Committee introduction with the Dean of FHML at Maastricht University (UM), the scientific director and PhD programme coordinator of NUTRIM;
- sub-committee sessions with all individual chair groups and research lines (leaders and key staff);

- a meeting with the PhD councils at both universities
- a Wageningen meeting with the director general of the Agrotechnology and Food Sciences Group involved and representatives of the VLAG International Advisory Board and VLAG Management Team.
- a final plenary debriefing meeting with the scientific directors of VLAG and NUTRIM, representatives of the chair groups, Dean of Sciences, and the Rector of Wageningen University

The Review Committee comprised 13 peer members and two secretaries (annex 3). The final report with the conclusions and recommendations was formulated according to the formats that have been provided to the Review Committee. The draft report was presented to the director of VLAG to redress any (factual) errors.

The Review Committee was impressed by the thorough and excellent preparation and execution of the review documents. The chair of the Review Committee acknowledges the sound preparation (meeting with the International Advisory Board, phone and skype contacts prior to the meeting), the new format for the site visit (representation of the research units to be interviewed), and attention to the relevance to society in the new evaluation protocol.
The welcome by the Rector and the Deans, introduction by the director of VLAG, the terms of reference and bibliographic data, and the subsequent lively discussion with the university faculty, provided very helpful information for the Review Committee.
Overall the Review Committee felt welcome and regarded important as was evident by presence of the Rector and the availability of the President of the WUR Executive Board.

2.3 Results of the assessment

This report summarises the findings, conclusions and recommendations of an international peer review of the VLAG Graduate School undertaken in June 2015. The peer review covered the period between 2009 and 2014.
The assessment of VLAG and its chair groups (WU) and research lines (UM) was based on and weighted according to the rationale explained in annex 1. This means that the performance of the groups was benchmarked against the performances of other groups in the global arena of comparable disciplines. The conclusions, as presented in chapters 4 and 5 of this report, follow the structure and the criteria which are formulated in the Terms of Reference (annex 1). Chapter 4 gives an impression of the performance of the Graduate School VLAG and Chapters 5 and 6 elaborate on the performances of its individual research groups, at both WU and UM.

2.4 Quality of the information

The Review Committee was impressed by the quality of the information provided. In particular, the bibliometric data provided in each University in a standardised format was of great value in assessing the scientific quality of each of the research groups. The self-assessment reports were well structured and sufficiently detailed. The SWOT analyses that were included proved to be very valuable, were an accurate reflection of all of the positive and negative attributes of each group and were a helpful point of departure for discussions with research groups.
The presentations during the site visit were well organised and informative and the Review Committee appreciated the uniform approach that had been recommended by VLAG management. The committee met with representatives of the various stages of the career path (PhD candidates, postdocs, and staff members), which helped to provide a comprehensive view of the whole Graduate School. The meetings with the representatives of the research institutes, the Dean, the Rector and the President of the WUR and with the Dean and senior colleagues at the Maastricht University completed this view and were much appreciated.

The total program made it possible for the Review Committee to achieve a full and fair impression of the qualities, strengths and weaknesses of the VLAG Graduate School.

3 Structure, organisation and mission of VLAG

3.1 Introduction

The Graduate School Advanced Studies in Food Technology, Agro-Biotechnology, Nutrition & Health Sciences (Dutch acronym VLAG) is a collaborative research and PhD training organisation. Participants in VLAG are staff, postdocs and PhD candidates from Wageningen University, from the local Graduate School NUTRIM at Maastricht University, and from five major institutes for applied research in The Netherlands. Focus of the collaboration is the PhD programme that is embedded in a coherent and productive research environment that aims to perform academic research of the highest quality. The chair groups / research lines that participate in this review are presented in the table below.

Table 3.1

Wageningen University – Chair groups Department Agro-Technology & Food Sciences	
Cluster Food Sciences:	
- Food Chemistry	Prof. H. Gruppen
- Food Microbiology	Prof. M.H. Zwietering
- Food Process Engineering	Prof. R.M. Boom
- Food Quality and Design	Prof. V. Fogliano
- Physics and Physical Chemistry of Foods	Prof. E. van der Linden
Cluster Bio-based Sciences:	
- Biobased Chemistry & Technology	Prof. J.H. Bitter
- Bioprocess Engineering	Prof. R.H. Wijffels
Cluster Bio-molecular Sciences:	
- *Biochemistry*	*Prof. S. de Vries*
- *Biophysics*	*Prof. H. van Amerongen*[1]
- BioNanoTechnology	Prof. A.H. Velders
- Microbiology	Prof. W.M. de Vos
- Organic Chemistry	Prof. H. Zuilhof
- Physical Chemistry and Soft Matter	Prof. J. van der Gucht
- Systems & Synthetic Biology	Prof. V.A.P. Martins Dos Santos
Cluster Nutrition Sciences:	
- Nutrition & Health	Prof. F.J. Kok
- Nutrition & Epidemiology	Prof. P. van 't Veer
- Nutrition, Metabolism & Genomics	Prof. A.H. Kersten
- Nutrition & Pharmacology	Prof. R. Witkamp
- Sensory Science and Eating Behaviour	Prof. C. de Graaf
- Toxicology	Prof. I.M.C.M. Rietjens
Maastricht University - Faculty of Health, Medicine & Life Sciences **NUTRIM - School for Nutrition and Translational Research in Metabolism**	
Research Line 1: Metabolic syndrome	Prof. R.P. Mensink
- Programme 1: Energy balance and obesity	
- Programme 2: Diabetes and cardiovascular disease risk	
Research Line 2: Gut-liver homeostasis	Prof. A.A.M. Masclee
- Programme 1: Gut-liver metabolism	
- Programme 2: Intestinal integrity and defence	
Research Line 3: Chronic inflammatory disease and wasting	Prof. L. van Loon
- Programme 1: Host-defence mechanisms, inflammation, and metabolic networks	
- Programme 2: Skeletal muscle weakness and body composition in ageing and disease	
Research Line 4: Gene-environment interactions	Prof. F.J. van Schoten
Departments: Anatomy & Embryology, Bioinformatics, Clinical Chemistry, Genetics and Cell Biology, Health Promotion, Human Biology, Imaging, Internal Medicine, Medical Microbiology, Movement Sciences, Ophthalmology, Paediatrics, Plastic Surgery, Respiratory Medicine, Surgery (incl. Plastic Surgery), Toxicology	

[1] These two groups in italics participate in the peer review of the Graduate School Experimental Plant Sciences

Currently the total number of scientific staff and postdocs that participates within VLAG is approximately 410, consisting of 150 scientific staff and 80 postdoctoral researchers from WU, and 83 scientific staff and 36 postdoctoral researchers from UM, and approximately 60 scientific staff from the five participating research institutes. In total 530 PhDs are currently being trained in VLAG (415-WU; 115-UM).

3.2 Mission of the Graduate School

VLAG forms a high-class academic community in research and post-graduate education in the areas of Food Technology, Agro-biotechnology, Nutrition, and Health Sciences. The Graduate School provides a platform for high-quality post-graduate education and professional development of young researchers, and for research collaboration within and across these areas.
VLAG operates based on the vision that our society needs high quality scientists able to perform excellent science for impact. The mission is to help young researchers develop their careers and to promote research collaboration within and across Food Technology, Agro-Biotechnology, Nutrition, and Health Sciences.
Implementation of the mission is realised through three main objectives:

- To enable and manage excellent interdisciplinary research
- To educate junior scientists and mentor postdocs
- To facilitate sharing of knowledge and expertise both within VLAG and by collaboration with other universities, research institutions, and networks.

In order to meet these objectives VLAG operates along several lines of activity, namely:

- Research: VLAG bears responsibility for monitoring the quality of research of the member groups, and strives to improve the quality of research by initiating and facilitating cross-disciplinary, translational research in its domains.
- Education: A major part of the mission of VLAG is to ensure quality in research and scientific development of young scientists and to provide an environment that stimulates their further development, deepens scientific understanding, and stimulates the development of a broad society oriented perspective.
- Knowledge and expertise sharing: Being a broad, multidisciplinary Graduate School, VLAG actively stimulates collaboration between different disciplines and groups, first of all within VLAG, and also with peers outside VLAG.

3.3 Management and organisation

Figure 1 represents the matrix structure of VLAG combining four science areas and five research themes within VLAG. The 4 science areas (horizontal bars in Figure 1) are identical to the 4 clusters within the Agrotechnology and Food Sciences Department at WU, thus providing visibility of the participating disciplines. NUTRIM research is embedded in the VLAG research theme ‘Nutrition, Metabolism & Health’. The thematic structure is the basis for the interconnectivity between various scientific disciplines.

The 5 VLAG research themes (vertical bars in Figure 1) are distinctive in their focus and orientation. The groups active within the *Sustainable Food & Biobased Production* and *Product & Ingredient Structuring and Functionality* themes work on food and non-food products for better health, better products and materials, and improved sustainability, and have a more practice oriented approach. The groups active in the *Food Safety & Integrity* and *Nutrition, Metabolism and Health* themes are oriented more towards human physiology and its interaction with foods and food components; on cellular, individual and population levels. The groups that work within the *Biomolecular Interactions* theme are more fundamentally oriented and lay the foundation for the other groups; but their work is often directly relevant to food, nutrition, and non-food applications.

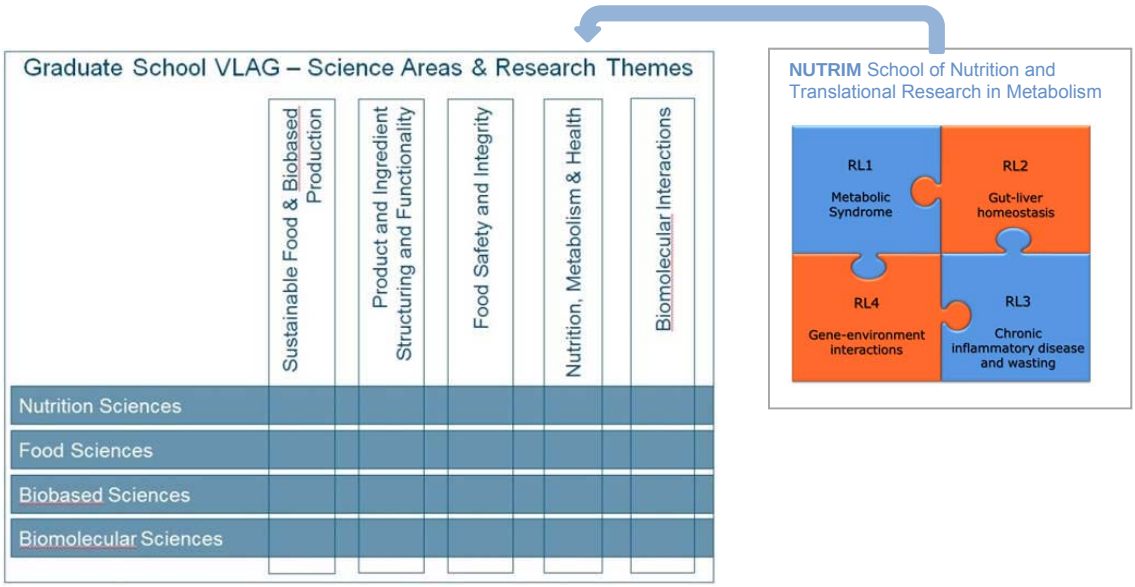

Figure 1 - VLAG Science Areas and Research Themes matrix.

The research units from two universities, combined with the five research institutes that are member of VLAG, cover the whole range from fundamental sciences to practice oriented research, and with this realise societal impact through better sustainability, nutrition, and health in our modern society.

The formal decision-making authority is the VLAG Board. The Scientific Director and the VLAG Management Team (MT) are providing guidance to the day-to-day operations of the Graduate School. With four advisory bodies - representing the PhD candidates, the participating research groups, the institutes, and the international scientific community - an adequate governance structure is in place.

Table 3.2

Providing Advice	Decision making	Execution
International Advisory Board VLAG Contact Persons VLAG PhD Council External peers	VLAG Board VLAG Management Team	Scientific Director Managing Director Programme Coordinator Education Coordinators

The *Scientific Director* is engaged in VLAG management two days per week and is assisted by a *Managing Director* and a *Programme Coordinator*. The NUTRIM Management Team consists of the Scientific Director, the Managing Director and the four Research Line Leaders. The MT meets monthly. The Scientific Director of NUTRIM has the full and integral responsibility for the school and reports to the Dean of FHML, and is also member of the VLAG MT.

The *VLAG Board* is the decision making authority. This includes nominating the Scientific Director and approving the long-term strategy and planning. The *VLAG Management Team* monitors implementation of the research and education strategy, including the allocation of the Wageningen University funds to PhD/ postdoctoral projects. Allocation of NUTRIM core funding for inter-institutional projects is decided by the Scientific Director of NUTRIM. The *International Advisory Board* (IAB) provides advice on strategic issues concerning the direction and quality of the research and educational programme, and helps to identify opportunities for academic and professional alliances. The IAB also performs mid-term reviews of VLAG and additionally for NUTRIM as a local Graduate School, as requested by the Board of the Faculty of Health Medicine and Life Sciences (Maastricht University). The *VLAG Contact Persons* form an informal platform formed by representatives from all participating research groups and institutes. The Contact Persons advise on all activities, and help to disseminate information to and from the participating groups and institutions. The *VLAG PhD council* deals with issues related to the position of the PhD candidates. The chairperson of the PhD council participates in the meetings of VLAG Board and VLAG Contact Persons. The NUTRIM PhD council consists of representative PhD candidates of the different research lines supported by the PhD coordinator and a member of the NUTRIM Office. One of the PhD candidates chairs this committee.

The committee was impressed by the positive trend on the major performance indicators such as number of scientific staff, number of PhD candidates and relative impact.

During the period under review the number of all staff categories at WU has increased steadily. Scientific (tenured) staff increased by 4% per year, PhD candidates by 7%, and the number of postdocs grew considerably by 12% per year on average. Over the same 6 year period the staff associated with VLAG at WU grew in total by 37%.

The Graduate School VLAG produced on average 886 peer reviewed articles in journals covered by Web of Science per year between 2008 and 2013. The number of publications produced by the scientific community within VLAG has grown from 741 in 2008 to more than 980 in 2012 and 2013, and their impact has grown as well. The relative impact of these publications is 2.23, which is more than twice the world average, and can be categorised as 'very high relative impact'. The impact is reflected by the fact that on average 27% of the publications belong to the top 10% most cited publications.

4 Performance of the Graduate School VLAG

4.1 The identity of the institute and the mission statement

The Review Committee assessed a significant amount of written information during the review and conducted interviews with all chair groups at Wageningen and all research lines at Maastricht as well as with a small selection of PhD candidates and research institute representatives. In general, it was felt that VLAG had a strong identity amongst the staff and PhD candidates at Wageningen and there was good staff engagement with its mission and good correspondence between its research themes and those of the individual chair groups / research lines. The research environment of VLAG is regarded as very positive.

In Maastricht, the PhD candidates recognised, and benefitted from, the introductory VLAG PhD week and other VLAG training courses. Those PhD candidates with projects bridging the two universities had a stronger affinity with the VLAG than those whose projects were Maastricht-based only and for whom the NUTRIM identity appeared more immediately relevant. Academic staff at Maastricht valued VLAG highly and aimed to use it to enhance collaborations with Wageningen.

PhDs and members of VLAG associated institutes expressed their satisfaction with research environment and facilities. This environment was also demonstrated by the "corporate identity" shown by PhD candidates as well as in the discussion with the institutes.

Mission statement of the Graduate School VLAG:
"The mission of the Graduate School VLAG is to develop the careers of young researchers and to promote research collaboration in Food Technology, Agro-Biotechnology, Nutrition and Health Sciences area."

Mission statement of NUTRIM (Maastricht University):
NUTRIM promotes translational research into chronic metabolic and inflammatory disorders with a high societal burden that will contribute to personalized lifestyle and medicine approaches. In its PhD programme NUTRIM aims to meet the demand for scientists who are acquainted with novel fundamental research concepts and are equipped to optimize the translation from science to the clinic and to public health.

The above VLAG and NUTRIM mission statements are broad enough to allow all stakeholders to adhere to their principles. The Review Committee realises that these have been refined continuously over recent years, but are of the view that they are now in an excellent state and ones with which all stakeholders can identify.

Of course, the internal structure is different at the two universities but the Committee considers that there is no need for uniformity as the main virtues of having a joint Graduate School, namely, ensuring excellence in its research, increasing the education and training opportunities for PhD candidates at both universities, and promoting inter-university joint research is, in general, being met.

4.2 Management and Leadership

VLAG represents a unique academic community in The Netherlands in research and doctoral education in the areas of food technology, agro-biotechnology, nutrition and health. It now involves Wageningen University and Maastricht University with intensive research collaborations with several Dutch research institutes.
Chair groups / research lines are at the centre of VLAG's activities. The VLAG Management Team has a limited role, particularly since most of the operational funding of the research groups comes from the respective universities or outside sources. The Review Committee finds it commendable therefore that the management of VLAG does add significant value to the graduate program by stimulating strategic research, promoting interdisciplinary work, funding selected PhD/ postdoctoral projects, and promoting and funding specific courses and international scientific exchanges.

It was apparent to the Review Committee that major stakeholders of VLAG (e.g. chair groups, researchers, and PhD candidates) were satisfied with the performance of the management and the leadership provided by the program during the review period.

NUTRIM has a clearly defined management structure. The NUTRIM Management Team which consists of the Scientific Director, the Managing Director and the Leaders of the 4 Research Lines, meets monthly, and appears to be highly effective in defining and implementing its research strategy. The Scientific Director of NUTRIM reports to the Dean of the Faculty of Health, Medicine and Life Sciences (FHML) and is also a member of the VLAG MT. This ensures that NUTRIM is responsive to strategic and structural changes within Maastricht University Medical Centre (MUMC+) and that it is well-placed to exploit research and training opportunities between the Universities of Wageningen and Maastricht.

4.3 Strategy and Policy

The strategy of VLAG Wageningen to build on a strong relationship with research institutes via participation and collaboration has led to a successful sharing of knowledge and expertise.
The collaboration with industry through the top institutes (TIFN, ISPT, DPI and Wetsus) has established long-term collaborative programmes which are now superseded by a similar structure in the top sectors. This successful policy offers both career prospects to the PhD candidates and is a pillar to make the link to society and valorisation.
The committee was impressed by the VLAG open calls that have clearly initiated truly new collaborative research, stimulate synergies, and support starting tenure track candidates/professors.

VLAG finances early stage development of large project proposals to be funded by the national science foundation. This instrument is a successful way to support the creation of project proposals.

The VLAG current portfolio of courses, for all four scientific domains (food technology, nutrition science, biomolecular sciences and biobased technology) is regarded as a an extensive and comprehensive curriculum of postgraduate courses

The structure of VLAG with the 5 research themes, and the five research institutes creates a rather complex governance and organisation, however it is clearly successful in connecting all groups.

Research within NUTRIM is implemented through 4 research lines (RLs) which consist of integrated, multi-disciplinary teams including both clinical and basic scientists. These teams have a very clear orientation towards research which aims to make significant contributions to the university's Healthy Living goal. NUTRIM is a dynamic organisation which is responding very positively to new challenges and to new opportunities (e.g. the recent development of the very impressive and newly-established Multimodal Molecular Imaging Institute (Interfaculty institute M4I) and the potential to link with the Faculty of Psychology and Neuroscience) which provides confidence that NUTRIM will continue to drive innovative research within MUMC+. The current RLs include 1. The Metabolic Syndrome, 2. Gut-liver homeostasis, 3. Chronic inflammatory disease and wasting, and 4. Gene-environment interactions. Since the 2009 review, RL4 underwent substantial change and is developing a new research strategy. In addition, RL2 is undergoing changes to exploit new opportunities following the recent appointment of a new clinical leader. The RLs are relatively large providing critical mass to

address their objectives, to bid competitively for national and international funding, to exploit opportunities for collaboration across VLAG and elsewhere and to deliver the wider aims of MUMC+.

The Review Committee strongly endorses the general strategic aims of NUTRIM within VLAG and recommends that existing links between research groups based in Maastricht and Wageningen should be strengthened. Whilst there are a small number of good examples of shared PhD candidates between Maastricht and Wageningen, with notable exceptions, opportunities to develop larger scale, more extensive collaborations between the two universities have not been realised. In part this appears to be because both parties are insufficiently aware of what the other can offer and this could be addressed by initiating more joint activities e.g. a joint NUTRIM/ Wageningen Research Day and by provision of seed-corn funding for innovative collaborations. In addition to these bottom-up approaches, Wageningen University and MUMC+ may wish to explore opportunities for strategic alliances which would enhance their international competitiveness.

4.4 PhD candidates

A number of PhD candidates and the VLAG PhD council were included in the meetings with the Review Committee. There was a general acceptance that their experience at VLAG Wageningen was a very positive one with sufficient checks, balances and supports in place. A meeting with PhD candidates (and post docs) within VLAG Maastricht demonstrated the success of the Graduate School in attracting excellent young researchers and in nurturing their training and development. The PhD councils within both universities are highly active and have developed and implemented web-based resources to help support (new) PhD candidates. There may be opportunities to enhance the PhD candidates experience within VLAG as a whole by sharing best practice in this area and through the development of new approaches e.g. using social media and other digital technologies to encourage interactions between PhD candidates based at Wageningen and those in Maastricht.

The current PhD council at WU has 14 out of 22 chair groups now actively involved. Better advertising of the PhD council towards all groups can make the impact even higher.

In addition to their advanced training in research project specific skills, we found that the VLAG training enhanced the candidates' opportunities to acquire and to practice a wide range of transferrable skills which are exemplars of good practice and which could be better communicated to prospective PhD candidates and other stakeholders. For example, most PhD candidates supervise on average ca 5/6 masters students over the course of their PhD training. Such Masters student supervision is good management experience which can help prepare PhD graduates for a position in industry as well as for academic careers. The coordination of the multiple tasks in parallel during the PhD trajectory helps to develop competencies that are rare and valuable. With respect to career development: more courses on basic sciences and business, and a voluntary course on educational skills and management skills would be appreciated by the PhD council at Wageningen.

An active link including sharing of best practices or merger between the two PhD councils is recommended.

The self-responsibility and self-organising characteristics of the PhD councils at both universities strengthen their impact. The members of the PhD councils and other PhD candidates that the Review Committee met were highly engaged and, in particular, we were impressed by their initiative in organising and raising funding for PhD research tours overseas, information booklets/ website for new PhDs and the creation of an equipment inventory.

The level of flexibility for PhDs and the possibilities to move around in the Dutch or international research environment is impressive.

In summary, the Graduate School provides a well-organised, coherent, and productive research environment for the PhD programme in which PhD candidates are trained to become independent researchers and to develop a wide range of additional, high level skills relevant for both industry and academia which are likely to be of enduring value as the PhD graduates develop their careers.

4.5 Research staff

The overall quality of the scientific performance of the research staff is seen as impressive by the Review Committee. Several individual scientists are competing at top international levels within their respective fields. The Committee noted that there is an ongoing assessment of the scientific performance of both individual scientists and the research groups. The Committee supports this strategy and recommends its continuation.

The Committee notes some career development challenges. Due to the limited number of tenured positions becoming available, the competition for these is generally tough. However, both universities operate tenure track processes through which promising academic staff can develop their careers with the possibility of eventual promotion to a Personal Chair, subject to performance.

At the same time many post doc positions are filled from the in-house PhD programmes. Later in the career stronger performance criteria are in place, often linked to the annual performance and development talks and the tenured track system. This assessment is to be based on the achievements and esteem of the individual in house as well as in the broader setting. The Review Committee recommends that the outcome of the annual performance and development talks is included in career planning for the individual staff member.

The Review Committee stresses the importance of a clear international perspective and outlook in the research performed by staff and this criterion was generally fulfilled. In contrast with the PhD training programmes which are well described, the essential training and development of staff was not made clear to the Committee in the written documentation provided. Nor was there any evidence of how the outcomes of such training and development procedures were used in management decisions either at the higher managerial level or within the research lines and individual chair groups.

The Review Committee recognizes that while some research groups are formulating necessary succession plans for tenured staff members, the existence of an overall staff plan for VLAG was not apparent to the committee members. Small groups are especially vulnerable to the loss of key personnel and therefore ad hoc succession plans always need to be in mind.

The Review Committee especially noted that both universities should develop recruitment strategies which aim to attract the best staff and students from the global market.

4.6 Resources, funding, and facilities

The management and organizational structure of VLAG is seen as flat and efficient. The resources are in a range typical for such a large graduate program on a European scale. The Review Committee supports the management's philosophy of devoting a significant portion of its budget to supporting the research mission through funding of some PhDs in annual or biannual open competitions, with the remainder applied to incentivising staff to deliver additional discipline education programmes. While the PhD funding through this central function represents only a small percentage of the total research funding, its use in promoting new interdisciplinary initiatives is supported by the reviewers. In this respect, NUTRIM's decision to extend its Graduate Programme from its own resources to attract additional high quality PhD candidates looks promising.

By most international standards, the facilities at Wageningen are excellent. The co-location within a new building (from autumn 2015) of researchers from the Division of Human Nutrition offers important advantages in improved management of, and access to, shared facilities and research platforms. In addition, it may help to focus a critical mass of researchers on addressing shared research objectives.

An investment grant (in 2009) awarded by the Maastricht University Board to NUTRIM as a Centre of Excellence has enabled them to create new positions to strengthen their integrative biology approach and to coach new talent. More broadly, initiatives by MUMC+, other knowledge institutes, the Province of Limburg and private companies have considerable potential to strengthen NUTRIM. These include linkage between the Chemelot Campus and the Maastricht Health Campus and the recent establishment of the interfaculty institute M4I molecular imaging facility.

4.7 Academic reputation

VLAG Wageningen:
The average number of PhD dissertations per FTE and the number of peer reviewed publications as well as their impact indicate that output and the subsequent academic reputation of VLAG can be generally ranked as internationally competitive with several research areas reaching world class levels. There is evidence of some variance in reputation within VLAG which seems to be linked to the state of development of a chair group, its size and the chair's leadership qualities. However, VLAG overall has a significant international reputation and this is matched by that of most of its chair groups and research lines, with the overall rating of VLAG, if scored as a single unit, being high. In addition, the existence of a sizable number of endowed chairs within VLAG can also be regarded as another indicator for its high academic reputation.

The record concerning additional activities such as patents, industry contracts, (inter)national project participation and coordination, editorial activities, involvement in national and international boards and conferences, invitation for presentations or written contributions as well as attraction of international students provides good evidence of the individual engagement of VLAG tenured staff. Consistent enhancement of the academic reputation of VLAG personnel and its associated institutions can be linked to the rigorous review and supervision of PhD projects, the requirement to obtain a research plan as well as completing 30 ECTS of courses during the four year contract period, and the norm of four peer reviewed publications per PhD thesis. The systematic and periodic assessment of scientific merits of VLAG scientific staff, the periodic bibliometric analysis of VLAG publications and finally the PhD candidate's training and supervision plan all contribute to the impressive academic reputation of the VLAG Graduate School.

VLAG NUTRIM, Maastricht:
NUTRIM has a strong international academic reputation as indicated by the high citation indices and other bibliometric analyses. Over the review period, NUTRIM has published approximately 450 papers/ year with an overall relative impact of 2.11 which is categorised as "very high relative impact". Clinical Medicine is the dominant research field for all 4 research lines, and in this research field their Relative Impact (RI; range 1.90 – 2.76) is higher than for their publications as a whole. In the relevant "special topics" ranking by Thompson Reuters Science Watch, 3 NUTRIM senior scientists (Professors Saris, Wouters and Schols) were ranked in the top 20.

4.8 Scientific and social relevance

VLAG, through its origins in both Wageningen and Maastricht, has always had societal and scientific relevance high on its list of priorities. As a university, Wageningen evolved from an agricultural college through the Wageningen "Landbouw Hogeschool" to today's university with practical and societal relevance as its priority. This is exemplified in the mission of Wageningen UR which is "*To explore the potential of nature to improve the quality of life*". Historically, it has seen the application of a solid set of fundamental scientific disciplines to agriculture production and processing problems. This foundation, together with the more recent integration of a series of research institutes into the university structure, has transformed it into the most successful applied research and technology transfer organization in The Netherlands. These developments ensure that the university's high societal relevance is matched with its major scientific relevance. In further developing these dual objectives, the continued and essential input of the basic physical and biological sciences must not be overlooked. That VLAG in Wageningen maintains a range of basic sciences amongst its disciplinary mix is an indicator of this continuing scientific relevance, one which can be demonstrated through its excellent bibliometric data and, in particular, through its significant number of researchers with papers in both the top 10% and 1% most cited authors lists.

Since its establishment in 1976, Maastricht University has been innovative in many ways including in the teaching approach implemented within its Medical School that differs from that used by other Dutch Medical Schools. It continues to innovate in its strategy for health delivery and in the research which underpins that strategy. The focus on Healthy Living within a teaching hospital distinguishes it from all other Medical Schools in The Netherlands and, very likely, most internationally. The shift away from management of disease towards prevention provides a unique opportunity for NUTRIM researchers interested in nutrition, physical activity and health to play a central role in research across

MUMC+. NUTRIM is now positioned as an “innovation platform” within MUMC+ with linkages to all four disease orientated profiles (cardiovascular diseases, respiratory diseases, cancer and neurodegenerative diseases) across the Medical School. To reflect these changes and to emphasise its expertise and focus, NUTRIM has been re-labelled as the Maastricht School of Nutrition and Translational Research in Metabolism. As such, within VLAG, it offers strong complementary expertise with the Wageningen activities in the food and nutrition sectors. NUTRIM is strengthening it research capabilities in the food and nutrition areas at the same time as the Division of Human Nutrition in Wageningen is developing its research strategy and capabilities in areas of clinical nutrition. To avoid unnecessary overlap and to maximise collaboration for mutual benefit, there would be advantages in both institutions considering opportunities for strategic alliances which align relevant aspects of their research strategies.

NUTRIM’s work in physiology, metabolism and human nutrition is highly relevant, and is applied to major public health problems in developing and developed countries, and has an excellent track record in undertaking intervention studies with outputs that have directly influenced public policy. Consequently, NUTRIM enhances not only the overall scientific goals of VLAG but also contributes significantly to its societal relevance.

4.9 Prospects and expectations for the Graduate School

- In summary, it is clear that the VLAG is doing an excellent job in managing, stimulating and supporting PhD level training and research across the two constituent universities. However, the external environment in which the VLAG operates is changing fast with pressures on funding, changes in societal demands and aspirations and a refocusing towards the east by many of the relevant industries. This will mean that in the medium and longer-term VLAG will need to be responsive to altered funding priorities and mechanisms to ensure that the organisation remains aligned to the changing landscape of national priorities/ top tectors.
- Engage with food and other relevant companies to understand their shift in focus eastwards and to respond to altered training needs for PhD graduates.
- Build new relationships within and between groups and universities to optimise synergies, to drive innovation, to ensure that the research teams remain at the cutting edge and to minimise research redundancy.
- Recognising excellence in the fields of creativity, innovation and engineering is important for the university. This type of excellence helps to create a true innovation climate, and this is essential to stay at the cutting edge.

4.10 NUTRIM specific questions

The Review Committee thought that much of the research done by NUTRIM was world class and among the best reviewed within VLAG. As context for the committee’s responses, it is important to recognise that the Review Committee has addressed these questions through the lens of the VLAG External Review, using the information provided by NUTRIM as part of that review and on the basis of our meetings with colleagues from the four research lines within NUTRIM. Whilst the overview information on the organisation and strategy of Maastricht provided by NUTRIM, as it pertained to the VLAG review, was very helpful, the Review Committee did not have the opportunity for discussions with other key senior colleagues, particularly those in leadership roles within the Specialities and Profiles, who would have been able to help to evaluate the wider contribution made by NUTRIM to the goals of MUMC+.

- Question 1: Regarding the MUMC+ goal that NUTRIM should be a linking pin between fundamental and clinical research, the Review Committee was impressed by the extent to which NUTRIM has integrated clinicians and basic scientists within highly effective, multi-disciplinary teams. These teams have a very clear orientation towards research which aims to make significant contributions to the university’s Healthy Living goal. As is reported in more

detail in the VLAG assessments of the individual research lines, the Review Committee found that, over the past 6 years, NUTRIM researchers have undertaken very high quality research that covered the spectrum from fundamental to applied research. Research performance is uneven among the research lines and some will benefit from greater focus and renewal of their research strategy. NUTRIM is a dynamic organisation which is responding very positively to new challenges and to new opportunities (e.g. the recent development of the very impressive interfaculty institute M4I facility and the potential to link with the Faculty of Psychology and Neuroscience) which provides confidence that NUTRIM will continue to be a key linking pin for MUMC+.

- Question 2: The Review Committee has learned that NUTRIM makes strong contributions to at least three of the profiles (cardiovascular disease, respiratory disease and cancer) and has potential to make contributions to the fourth (neuro intervention). With its focus on Food and Metabolism, NUTRIM brings novel insights to conventional clinical disciplines and provides linkage and synergy across disciplines. To maximise the potential contribution of NUTRIM to the existing Profiles and Specialities, MUMC+ may consider:
    i) Further integration of relevant researchers and research groups within NUTRIM to provide critical mass in key areas.
    ii) Incentives for innovative collaborations between NUTRIM and Profiles and Specialities aimed particularly at establishing longer-term partnerships with the potential to undertake riskier, more challenging, but more ground-breaking, research.
    iii) Mechanisms to ensure that NUTRIM and their collaborators maximise the potential which MUMC+ investments such as the Interfaculty institute M4I facility offer in enabling Maastricht researchers to extend their existing research excellence to achieve world-leading positions. In particular, this may facilitate rising stars within NUTRIM and MUMC+ to bid successfully for ERC and other prestigious research funding. It may also help NUTRIM and MUMC+ to attract more high quality applicants from the global research market for academic posts in Maastricht.
- Question 3: It appears that Maastricht University/ NUTRIM is using VLAG primarily as a vehicle for education of PhD candidates. VLAG offers high quality, relevant training courses and oversight structures which enhance the research training offered within the MUMC+. Issues such as economies of scale and access to a wider range of expertise are likely to make it unattractive for MUMC+ to attempt to establish an independent Graduate School. There are a small number of good examples of shared PhD candidates between Maastricht and Wageningen but, with notable exceptions, the reviewing committee felt that opportunities to develop larger scale, more extensive collaborations between the two universities have not been realised. In part this appears to be because both parties are insufficiently aware of what the other can offer and this could be addressed by initiating more joint activities e.g. a joint NUTRIM/ Wageningen Research Day and by provision of seed-corn funding for innovative collaborations. In addition to these bottom up approaches, MUMC+ may wish to explore opportunities for strategic alliances between MUMC+/NUTRIM and relevant groups within Wageningen. Such alliances could be particularly valuable if MUMC+ and the Limburg region pursue their idea for an Agro-Food facility in the north of the region.

5 Reports on individual Chair Groups / Research Lines

The Review Committee consisted of 13 experts in various areas relevant to the VLAG disciplines. Subcommittees of 3 – 4 experts were assembled for each of the chair groups / research lines to be evaluated. Each of the experts participated in 5 – 6 evaluations. The composition of the expert teams varied throughout the evaluation process to ensure that the evaluation standards were as uniform as possible.

Process of evaluation of single chair groups and research lines
Each evaluating subcommittee consisted of a Chair, a Rapporteur, and 1-3 members. Before the interview, each of these experts formed a preliminary opinion of the group to be evaluated, based on the materials supplied by the chair groups / research lines. The meetings with the groups were opened with a brief summary of activities during the evaluation period, followed by a discussion about core activities of the group, scientific highlights, publications and impact, staffing, financing, relations to and with VLAG and other research groups, problems experienced during the evaluation period and future perspectives of the group. Available positions for tenured staff, changes expected in the next 5 to 10 years of significance for the viability of the group were also discussed.

Following the interview, the subcommittee discussed the information provided in the absence of the group, to establish a provisional set of scores for the three criteria Research quality; Relevance to society; and Viability, as well as the reasoning behind each of the scores. The Rapporteur formulated the text which was discussed by the subcommittee and modified as deemed necessary resulting in the final subcommittee report on the group.

It was almost always possible to draw clear conclusions and assign scores for each of the three criteria, based on the documents and interview with each of the groups. In one case the group had been active for only a short recent part of the evaluation period, it was therefore decided not to score the research quality and relevance to society, and this is indicated in Table 5.1.

Results of evaluation of the complete set of VLAG chair groups and research lines
The individual chair group / research line reports were discussed in several plenary meetings of the entire committee to finalize the text and scores and to insure that the general evaluation procedures were comparable across all of VLAG.

Table 5.1 Summary of the scores for Research Quality, Relevance to Society, and Viability for the VLAG research groups

VLAG Wageningen Chair Groups				
		Research Quality	**Relevance to Society**	**Viability**
Cluster Food Sciences				
1	Food Chemistry	1	1	1
2	Food Microbiology	2	2	2
3	Food Process Engineering	1	1	1
4	Food Quality & Design	3	2	2
5	Physics & Physical Chemistry of Foods	2	1	3
Cluster Bio-molecular Sciences				
6	Biobased Chemistry & Technology	2	2	2
7	Bioprocess Engineering BPE	2	2	3
Cluster Bio-based Sciences				
8	BioNano Technology	ns	ns	2
9	Microbiology	1	1	1
10	Organic Chemistry	1	1	1
11	Physical Chemistry & Soft Matter	1	1	1
12	Systems & Synthetic Biology	2	2	1
Cluster Nutrition Sciences				
13	Nutrition & Health	1	1	2
14	Nutrition & Epidemiology	1	1	2
15	Nutrition, Metabolism & Genomics	1	1	1
16	Nutrition & Pharmacology	2	2	3
17	Sensory Sci. & Eating Behaviour	2	1	3
18	Toxicology	1	1	1
NUTRIM Maastricht Research Lines				
1	Research Line 1: Metabolic syndrome	1	1	1
2	Research Line 2: Gut-liver homeostasis	2	1	2
3	Research Line 3: Chronic inflammatory disease and wasting	1	1	2
4	Research Line 4: Gene-environment interactions	2	2	3

Wageningen Research Units

5.1 Food Chemistry

Leader research group: **Prof. H. Gruppen**
Research input tenured staff: **FTE 2.1**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
There is a very clear vision and description of activities of the chair group. There has been an ongoing evolution of research activities over the period of the review, with a very focused view of their research on analytical chemistry, mechanistic understanding of interactions, and structure-function relationships. There is a clear choice to perform mechanistic and hypothesis-driven research, applying state of the art analytical tools to quantify and study functionality of specific food components (carbohydrates, proteins, phytonutrients), if necessary in complex mixtures, and in a well-defined set of applications (reactivity/functionality, processing/digestion, biochemical modification). The food components selected were based on similarities in equipment needed (e.g. no attention to lipids). This is a relevant choice to optimize equipment use and maintain state-of-the-art with respect to analytical methodologies.
The research group follows a wise publication strategy. Bibliometric indicators are strong and have improved further since the last review in 2009. The group focuses on state of the art analytical methodologies, and the strategy to keep a strong analytical infrastructure base is wise. The number of grants (e.g. NWO) increased steadily in the last 6 years, as well as the total number of publications in peer-reviewed journals. The average relative impact within Agricultural Sciences is 2.14 with 50% of the publications aimed at this category. The group also aims to ensure that PhD completion times are within 4 years.
The group made a comparative analysis with six peer laboratories in Europe and defined how they can be original and/or complementary within their research field. Determination of functionality will only be done in house when a standard assay (defined in collaboration with an experienced partner) is available.

Relevance to society
The work in the group has a high relevance for society. The industrial relevance is highlighted by working with industrial scientists, hiring academic staff with an industrial background, and by performing research projects in collaboration with industry. There is also a strong international outlook. The chair group invests a considerable amount of effort in working with primary schools in a number of schemes – these appear to have a high impact and they represent an effective science outreach strategy. Particular attention is given to research oriented teaching. Although the focus is primarily analytical, the group has two patents and provides analytical services for other research groups and industry. There are strong levels of EU and industry funding. The chair group is very successful in preparing graduates for employment in industry.

Viability
There appears to be considerable thought given to strategic development and future research direction (and recruitment to support new developments). This chair group has made strategic choices and these decisions have been justified based on the current success of the research programme. A suitable strategy has been described to obtain the required funding from research grants and contract research. The focus on analytical approaches (and the dependence on very expensive equipment) is possibly a risk, but a good strategy is given on how to secure both the budgets and the personnel (technicians) needed to operate the machines.

Other remarks
Another threat is the increasing numbers of students leading to higher teaching loads for the department. The group has made a strategic decision to employ a lecturer whose role is largely to teach in the BSc courses thereby reducing the teaching load for the research staff members. Importantly (and essentially) this lecturer is kept up to date with developments in the research area by the scientists within the chair group.

Recommendations

The use of a lecturer devoted to teaching in the research group is an approach that could also be an interesting strategy to reduce the teaching load in other research groups within VLAG. It was suggested that a proper career development structure for such individuals whose role is primarily a teaching one, should be established in the University. Regarding the VLAG courses given under the coordination of the Food Chemistry group, it would be of interest to organise a course on phytonutrients, since the latter is one of the selected core nutrients in the research at the department. Finally, working out a better visibility and strategy for collaboration between the individual research lines would be useful.

5.2 Food Microbiology

Leader research group: **Prof. M.H. Zwietering**
Research input tenured staff: **FTE 1.9**

Score		
	Research quality	**2**
	Relevance to society	**2**
	Viability	**2**

Research quality
The group on Food Microbiology produces high quality research with a very good output. The group is internationally recognized with a good mix of very well established leaders and younger faculty members. The group has developed a unique niche by integrating the domain of Food Microbiology 'from molecule to management'. Strong teamwork and internal collaborations within the chair group are noted. The research work on food fermentation is related to both western as well as non-western societies. Some regionally preferred partners in the South have been identified (mainly in Africa), although the strategy determining the regions in which to work is mainly set by external policies (e.g. WOTRO funding).
Some of the bibliometric indicators are found to be lower than the VLAG average. Relatively few publications are found in interdisciplinary journals. Somewhat strangely, non-Food Microbiology groups moving into the field of Food Microbiology was perceived as a threat.
Although no formal strategy exists to attract partners for EU-projects, complementarity and reputation are seen as important drivers in the selection of EU-consortia. In response to the previous assessment (2009) the group now obtained two EU-funded projects, which is still quite modest for such a well-recognised Food Microbiology group. In view of the workload there are no ambitions to play a coordinating role (project leader) in EU projects, nor does there appear to be any inclination to apply for ERC grants. In recently submitted EU-projects, the group acts as work package leader.
The University management needs to approve the addition of new staff members to the team. A specific policy for post-doc positions may be useful, since relatively brief stays (2 year) for post-docs are quite short which makes it difficult to assure a stable transfer of experience. For PhD candidates specific courses are available through the VLAG Graduate School. The number of PhD candidates (9.9 FTE in 2014) in comparison to senior and post-doc staff (4.6 FTE in 2014) is perceived as being rather low.

Relevance to society
The research, by its very nature, is clearly highly relevant to society. The group is very well integrated into the 'Food Safety' ecosystem of The Netherlands and Europe and plays internationally significant and influential roles in various agencies (e.g. in ILSI-EFSA, ICMSF, FAO/WHO and Codex working groups, and national policy work). These activities were well highlighted in the self-assessment report. The group gives regular interviews to the media and is consulted by national advisory bodies, although in the report less examples were given of outreach activities to the public and other non-expert stakeholders. There are also strong collaborations with the food industry. The research work for developing countries (e.g. on fermentation) has proven to be very useful and relevant for (local) societies.
The group focuses more on precompetitive research work with no evidence for patents/licences in the current review period. In the future patenting may be possible for specific topics (e.g. fermentation). For bilateral funding with industrial companies, procedures for patenting (e.g. publications on hold for predefined period) are available.

Viability
International peer groups in the field of food microbiology have been identified.
While some description of the future strategy for the group is outlined, this refers mostly (and very briefly) to funding and scientific disciplines. There is no reference to the methodology employed for future planning. It may be beneficial to have some more formal structure on strategic planning, especially for future activities. The group has no plans to undertake research on viruses and molds, but has plans to work on these topics in strategic co-operations. There are no NWO funded projects, and a relatively large proportion of projects are financed by one single source (TIFN); this poses a risk which, it must be said, has been recognised by the chair group. A further threat that was highlighted was the increasing numbers of students, which raises the burden on existing personnel with research

tasks. The reduction in funded FTEs over the recent number of years has been noted and this may also pose a threat to the future research output.

Other remarks

In order to maintain the quality of work, the group indicates the need for less bureaucracy, supply of good support and facilities from the university, and the freedom to decide how to use basic funding.

Recommendations

The group may benefit from introducing a more formal structure on strategic planning for future activities. The policy towards external (EU) and Dutch NWO funding needs further attention. The group could show a greater ambition to publish more of their output in higher impact journals.

5.3 Food Process Engineering

Leader research group: **Prof. R. M. Boom**
Research input tenured staff: **FTE 2.24**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
The chair group of Food Process Engineering consists of 25-30 PhD candidates (typical average number of PhD candidates), 4 postdocs, 4 technical staff, 4 assistant professors, and 1 personal, 1 endowed and 1 full professor with complementary skills. In addition to staff, the group significantly invested in equipment in recent years and is very well equipped. The group is organized into 4 research themes. Under the strong and visionary leadership of Prof. Boom, the group has re-defined Food Process Engineering research to a modern research discipline that encompasses new technology principles, e.g. micro- and nanoscale engineering, as well as thermodynamic and sustainability based approaches. The group has set a clear strategy, 4 theme teams collaborate very well, and funding has increased since the last review despite Prof. Boom's heavy administrative duties. The group has extensive collaborations within and outside VLAG and WU. To cope with the trend of food industrial shift to Asia, the group has established collaborations with several Asian universities, such as Nanyang Technological University in Singapore and the University of Tsukuba in Japan.

The group's strategy of combining fundamental study with practical application leads to new process principles, new processes and new methods (e.g. to structure protein products and within protein separation technology). The research is conducted within an excellent infrastructure that gives PhD candidates access to newly acquired state-of-the-art equipment. The group publishes in both engineering and more fundamental journals, leading to high score in citation and comparable impact indices to their direct peers. The group is highly productive with 50 publications in 2014. As a process engineering group, the impact of the group is also coming from its innovative technological developments (see below).

Relevance to society
Almost all research has been done together with industries or other societal partners. Almost every PhD candidate works sometime within industry or partner, or is based at industry. The group trains highly qualified students with excellent employability. The group adopts an active patent policy, preferably together with industry. Several products on the market employ their technologies, including Friesche Vlag cappuccino foam, dairy ingredient production, and fish feed industry, truly indicating the strong impact of the work done by this group. The group's work has attracted media attention nationally and internationally. There is an impressive list of interviews.

Viability
The group has a strong national and international position. The vision of the group for the next 5-10 years is to intensify relations among 4 research themes and to consolidate and extend the group. The group has defined a strategic plan together with all other groups within the Food Science Cluster for collective investment efforts as one unit, which is a very important step to unite all 5 groups into one unit and to take advantage of critical masses in these groups. The strategies for future funding are to (a) set research agenda for top sectors, EU, WU, and several others; (b) network with industries and institutes and remain core partners in public-private partnership; (c) continue with attention to the National Science Foundation and EU and other funding sources. Crowdfunding from the Peas Foundation to promote plant-based protein sources is a new type of interaction and is very interesting. The group also lays out a comprehensive plan for graduate education.

Other remarks
There are three observations from this review:

- Three areas (i.e. nano/micro, protein structure and chain structure-function) can be considered to form a center of excellence.

- The work of this group indicates that excellence is coming not just from high-impact publications, but also from innovative engineering approaches and strong impacts on technologies.
- The university needs to establish a mechanism (e.g. financial incentive) to support bridging the gap between food and nutrition.

Recommendations

The group has been demonstrating the excellence of their work and has laid out a clear strategy with emphasis in sustainability for a successful future. It is suggested that the university develops a mechanism in order to promote collaborations between food and nutrition.

5.4 Food Quality & Design

Leader research group: **Prof. V. Fogliano**
Research input tenured staff: **FTE 3.99**

Score		
	Research quality	**3**
	Relevance to society	**2**
	Viability	**2**

Research quality
The group's original raison d'etre was presented as integrating the approaches of the "disciplinary" food cluster groups, providing bridges to other areas and provide a chain view. As noted already in the 2009 review, there is a problem with the breadth of the approach. The focus of the individual project areas is widely disparate, and it is unclear if all the individual project or research areas within FQD are able to maintain sufficient expertise and how they decide whether the internal expertise is sufficient. We note that breadth was further increased in the review period by taking up the subjects of insect based food and design of "healthy" foods.

While there are individual excellent researchers, senior and junior, the productivity per researcher of the large group as a whole is lower than most other food groups. The bibliometric results are very good but might be positively skewed by multi-authored review type papers. We do not see as yet evidence of a prominent role of the chair group in any specific research field, or in an integrative field such as e.g. whole chain management, or in taking up coordination of EU projects.

We are of course aware that the group is heavily involved in teaching, that the leader position was vacant for a length of time and that the new leader has yet hardly had time to influence the group's culture.

Relevance to society
The former group leader was prominently featured in nationwide media and the group is present in YouTube with "food enlightment" clips.
The group accepts significant numbers of PhD candidates from developing countries, some with their own funding, and has a fairly rigorous admission procedure. The graduates than form a basis for a collaborative network, but the development does not seem to be based on strategic considerations but to be based on individuals. Preferential partners to collaborate with should be based on expertise and the amount of impact to be expected. The recent focus on China catalysed by the presence of a Chinese dairy company in Wageningen is laudable.

Viability
We have not seen convincing evidence of any systematic internal collaboration or internal deep knowledge transfer which highlights the vision in relation to the integrative research approach of the group to develop scientific knowledge on food design (and quality management). It will be important to identify some fundamental research questions that can underpin the group's broad research mission and make it more concrete. There would seem to be a good opportunity to capitalize on the excellent achievements of the new chair, otherwise the group's difficulties in securing funding from companies, EU or national agencies might continue.
Given the antecedents of the chair and the importance of dairy industry in the Netherlands, we find it for example surprising that the dairy group, the only one in Wageningen, is not more prominent in fundraising in the chair group.

Recommendations
It is questionable whether the original, very desirable goal of integrating different disciplines is achievable within a chair group - it should probably be handled in a wider context. Within the food cluster, there appears to be awareness of the need, and recent initiatives (Food production dynamics, Food consumption and digestion dynamics) bear witness to this. However the integration needs to be extended also beyond the boundaries of the existing clusters, most clearly across the food - nutrition

boundary. Virtual structures such as "centres of excellence" could be devised for important topics, e.g. for proteins or the complete food chain.
The FQD itself should focus on a few areas in which its staff has a track record of excellent research (as reflected e.g. in H index commensurate with time as independent researcher). There seems to be ample opportunity to focus staff groups into fewer areas to reach critical mass. The research areas selected should have some common underpinning motivating why they should be a part of one chair group, be it in underlying theory, methodology or raw material to support a clear unifying vision under the new chair.

The large developing country network could be exploited more effectively e.g. by creating food alumni events for all chair groups' alumni.

5.5 Physics & Physical Chemistry of Foods

Leader research group: **Prof. E. van der Linden**
Research input tenured staff: **FTE 1.52**

Score		
	Research quality	**2**
	Relevance to society	**1**
	Viability	**3**

Research quality
The research potential and the level of innovative ideas are high, but the potential has not been fully translated into a high research output. The number of publications is low, although the RI of 1.68 is above world average.

A coherent strategy, emphasizing four fundamental research lines as presented is considered a promising base for future progress:
Molecular assembly; Building blocks and mixtures; Soft-interface dominated materials; Micro-mechanics and sensory.
These four fundamental research lines represent a reformulation of the group's vision to exhibit the ambitions and focus areas clearly.

It is however crucial for the quality of the research that the fundamental research lines are executed efficiently, i.e. in high profile publications as well as balanced by means of research staff for coherence. It will be relevant to target more fundamental grant calls, e.g. grants from NWO to support the fundamental aspects of this research.

At the same time it is important to maintain the integration with genuine food products to also set this group's research aside from strong peers in the field.

Relevance to society
The decision of the group to engage in book writing relating to culinary aspects, also within "molecular gastronomy", is positive in relation to outreach and societal engagement. The collaboration with alternative external partners such as hotel schools via molecular gastronomy is a good way to translate into society. It was noted that the interaction with hotel schools and chefs is moreover considered a two-way traffic in the sense that it inspires the group to solve new problems, new research, and in turn generate new knowledge. 8 patents that appear to have been adopted by commercial partners already is also a manifest of the societal relevance of the work.

Viability
The research strategy is clearly articulated to be based on the 4 research lines mentioned above. The group is appropriately organized, but execution of ideas and the solving of new fundamental problems should be reflected in more research grants, and in more PhD projects in VLAG.

The panel has noticed the note 2 regarding the research grants in Table 2.2 in the self-assessment report, but the total funds for research grants and contract research still seems low, especially considering the significance of the new findings within meso-structural design, the high visibility of the group via molecular gastronomy activities, and the food physics subject in itself.

There seem to be good opportunities for stronger interaction with other food groups (of the Food Sciences Cluster) and with ETH and to efficiently integrate the research lines with applications. The existing collaboration with ETH is appreciated as long as the arrangement with Dr Leonard Sagis at ETH leads to translation of the theoretical learnings back to food systems for Wageningen.

The group is appropriately organised and is well fit to support the identified research lines. The idea of embarking into the physics of food materials degradation and understand oral processing better is novel, but it is unclear how the science will be planned in relation to solving fundamental research problems. It will be important to link the fundamental questions (research lines) to this research and to build on the intellectual potential present in the group to achieve research excellence. The subject

area of oral processing also invites to collaboration with the Cluster of Nutrition Sciences, notably the group of Sensory Science and Eating Behaviour.

Recommendation

It is urgently important to fill the new tenure track position in complex systems to further underline physics theory interfacing with food systems/physical chemistry of foods (generic) to support the integration of the research lines in the group.

5.6 Biobased Chemistry & Technology

Leader research group: **Prof. J. H. Bitter**
Research input tenured staff: **FTE 2.22**

Score		
	Research quality	**2**
	Relevance to society	**2**
	Viability	**2**

Research quality
The decision to initiate a chair in this field is applauded and the combination of chemical catalysis with modelling is both unique and promising. This new group is in need of a couple of flagship projects that capitalize on and integrate the background of the chair in heterogeneous catalysis and the existing expertise in the former groups in modelling, process engineering and homogeneous catalysis. It is not yet clear that such a project has been embarked upon. The main focus appears to be on non-noble-metal heterogeneous catalysis, but the new, fundamental approach was not really made clear.

The new chair's publication record prior to leading this group was impressive, and thus it is highly likely that at some point the new group will be on track, providing he can integrate the resources available to him.

Quality of the research is growing but still it must be improved. The group should identify relevant targets, define the fundamental scientific questions to be pursued more clearly, and plan the strategy to achieve it. To achieve their objective of combining chemical catalysis with modelling for biobased chemistry, the research group must integrate their fields of expertise in closer way. Otherwise there is a risk that they are performing diffuse research with no high impact.

Relevance to society
Shift to a biobased economy is clearly important and highly relevant to society. While the chair appears to spend some efforts with outreach activities in speeches to trade groups, etc., these appear to be happening at a fairly low level, and there is important work to be done in raising public awareness. No publications for the general public have appeared since the new organization of the chair in 2013.

Number of patents is good but not excellent. The same for social dissemination and promotion of PhD candidates.

Viability
The chair, who arrived in 2013, has the challenge to unite two former groups and topics to produce something new that is greater than the sum of the parts. It is not clear that this has been achieved yet. The expressed wish of the chair (who comes from the fossil fuel catalysis world) to bring the biobased and oil based approaches together is extremely interesting, but its realization has not yet been demonstrated. The group is encouraged to try to gain European projects with a clear target to ensure their recognition and viability.

A cause of concern is the approach to hiring an academic in the Biorefinery area, which appears to involve rather less of a comprehensive, worldwide search for excellence than would be expected.

Other remarks
Graduate students appear well supervised, with whole-group meetings weekly, subgroup meetings biweekly, and frequent 1:1 meetings with supervisors.
Teaching appears to be more focussed than before, with new course offerings in biorefinery, biobased products, and sustainability analysis.

Recommendations

- Greater integration of the former groups is needed, in order to produce something more valuable than the sum of its parts. This can be achieved via visible, flagship projects involving new fundamental approaches.
- To more clearly outline some clear fundamental research questions that will be addressed and which at the same time can spur the synergy and generate recognition for the group.
- The tremendous potential for applying the chair's background in fossil-based heterogeneous catalysis to biobased systems should be realized.
- Public outreach should be increased, and should take advantage of the chair's considerable charm and charisma!
- The search for the biorefinery academic should be conducted on a more professional, worldwide basis.
- Ensure that synergy between the two tracks chemical catalysis and modelling is really underlined in the staff recruitment.

5.7 Bioprocess Engineering

Leader research group: **Prof. R. H. Wijffels**
Research input tenured staff: **FTE 4.1**

Score		
	Research quality	**2**
	Relevance to society	**2**
	Viability	**3**

Research quality
Since 2009 the group has doubled its output of scientific articles, increased the RI from 1.13 to 2.1 (in 2013) and achieved an almost triple increase in %T10 to 31% and %T1 of 4% in 2013. This increase in scientific output and quality is a positive response to the comments raised in the 2009 review. The majority of the publications, and the key publications are within the field of microalgae biotechnology and microalgae production.

The overarching research ambition of the group lies at the interface between reactor engineering and cell metabolism (metabolic engineering); the goal is to combine these two fields to solve problems in relation to improving yields in bio- processing: “Engineering efficient bioprocesses for high quality products”. The strategy covers processes accomplished by microalgae, microbes (yeast and bacteria), and mammalian cells (incl. sponges) by combining classical reactor engineering and “omics”; in addition, there is a desire to focus on a *Monascus ruber* strain as a new platform organism. In practice the research thus covers a lot of different systems. There is an imbalance in the research, because the group has reached excellence and ample funding in microalgal biotechnology, whereas the critical mass is very low in microbial technology and in mammalian cell technology. Mammalian cell technology moreover has a defined target towards production of pharmaceuticals, which is a different product category than that targeted in the microalgal and partly the microbial processes. Hence, the microalgal biotechnology reaches score 1, whereas the other two pillars are scoring lower.

Relevance to society
The algal biotechnology research is highly relevant to the broad society, and a structured plan is in place for dissemination of algal biotechnology to the wider public, a primary example being the design challenge for production of microalgae. The algae program is a good example to generate public awareness of new processes for the bioeconomy. Another aspect is that patenting is also carefully considered (but patents could increase), especially in the algae biotechnology area. So relevance to society is high, for the algal biotechnology part, and the group is aware of the importance of societal impact of the algal research also via the AlgaePARC exposure. The societal relevance of microbial technology, mammalian cell technology, and the focus on the bioprocessing aspects (as opposed to on the specific products) is also highly relevant to society, since new manufacturing technologies for pharmaceuticals and biochemical may develop. The exposure of the broad field of Bioprocess Engineering as a whole to the public could benefit from having a broader public dissemination strategy for bioprocesses to display the significance of bioprocesses that goes beyond algal biotechnology.

Viability
Within the field of microalgae the group has been very successful in European projects and in obtaining contracts with companies (e.g. AlgaePARC). The group clearly has a leading role in algal biotechnology. This success provides a strong base for the group to be at the front of this future-directed research area for several years to come. The algae biotechnology pillar itself provides important research questions related to bioreactor engineering, metabolic processes, as well as downstream processing of algae.

There may be strength in having all three pillars, algae, microbes, and mammalian cells cultivation as a base for bioreactor engineering diversity and for building examples for combining reactor engineering and metabolic engineering, as well as for teaching. However, each system holds significant complexity and the systems are too different and each too large research areas in themselves to allow research excellence within all three in one chair group. At the review meeting it became evident that the bioprocessing problems currently addressed within microbial biotechnology in the group do not align with the bioprocessing research issues of microalgae bioprocesses. Hence, the structuring of the group in three pillars, algae, microbes, and pharmaceutical biotechnology (the latter

with mammalian cells cultivation), holds the risk that very different bioprocessing research problems are pursued in each pillar, and in turn that the high potential for synergies to support the goal of doing generic research at the interface between reactor engineering and cell metabolism (metabolic engineering) is not fulfilled. Hence, the focus on bioprocesses and the bioprocess technology field is a relevant and future-directed research field, but the current pillar structure of the group holds a risk that the opportunities for harvesting synergies across the different types of processes are not fully capitalized on.

At the review meeting it became clear that it is the vision of the chair to maintain a concerted focus for the BPE chair group on *engineering of efficient bioprocesses* with the many different bioprocesses as research objects as opposed to splitting the chair group to e.g. exclusively underpin the strong Microalgae Biotechnology which could be an option.
To support this vision of a concerted, general bioprocessing focus we recommend to *restructure* the group to target the generic bioprocessing technology questions, i.e. cell biotechnology, reactor design, downstream processing, rather than (the current) structuring around different types of cell technologies. A restructuring across the different types of cell technologies will more clearly allow synergies between the three types of biosystems to be identified and harvested. A significant window of opportunity exists for identifying showcase problems that are solved efficiently by combining bioprocess engineering approaches and metabolic engineering across the different types of bioprocesses in the group (biotechnology, cultivation, downstream processing). Collaboration with engineering groups specializing in separation technology is an option to support fundamental research development in this area in the group. Hence, the score 3 for viability does not reflect that the chair group is scientifically weak and certainly not that the bioprocess engineering field is not important or viable, but mainly reflects that the broad goal for bioprocesses seems easier to reach via a restructuring of the group emphasising engineering disciplines across the different cell systems, rather than the current structure along the different types of cell systems.

Recommendations

It is recommended to clearly define new metabolic engineering targets for microbial biotechnology that align better with microalgae biotechnology; a similar recommendation seems apparent for the mammalian cell cultivation (currently under pharmaceutical biotechnology). There seems to be good opportunities for using the pharmaceutical expertise in the group to create new fundamental bioprocessing research questions that can interface directly with the strong microalgae research. By re-structuring to reflect bioengineering technologies, i.e. innovative reactor design, metabolic engineering, downstream processing, the group will have a stronger base for identifying the synergies between bioreactor engineering and metabolic engineering. It is recommended to focus on these opportunities by more clearly targeting transverse research elements across the pillars.
Downstream processing is an integral part of all bioprocesses, but it is recommended to seek collaboration with other groups for downstream processing research.

5.8 BioNanoTechnology

Leader research group: **Prof. A.H. Velders**
Research input tenured staff: **FTE 0.4**

Score		
	Research quality	**-**
	Relevance to society	**-**
	Viability	**2**

Chair has only existed since April 2012, thus only viability has been scored.

Research quality
The chair has a tremendous range and breadth of activities. These range from cyclodextrin-based multivalent linkers for extraction of antibiotic resistant bacteria from hospital waste streams, to miniaturized, multinuclear NMR probes. The research basis lies in both chemistry (cyclodextrins, nanoparticles) and instrumentation (NMR, optical spectroscopy, and microfluidics). His publication record is good, and his national (Leiden) and international (La Mancha) networking exemplary.

Relevance to society
Great potential for societal relevance with medical tracers, wastewater treatment approaches, and biosensors.

The chair has taken charge of the University's NMR facilities.

Exploiting social media to promote group.

Viability
The chair's capabilities in inorganic chemistry, in NMR, in multivalent, selective binding, etc. are of tremendous potential utility to many groups in VLAG, including those in the Food Sciences Cluster. It is up to the chair himself, however, to acquaint his colleagues with the potential utility of his activities for their own research.

Unfortunately the group finds itself in a surprisingly precarious financial situation, despite making great efforts in teaching. The reason appears to be the built-in time-lag in returning funds to the groups involved in teaching.

The tenure-track position available in the group will be advertised internationally.

Other remarks
Closer ties to the Food Sciences Cluster should be established, in order to integrate this interesting group into its surroundings. There is a clear need for many of the capabilities of this group within other groups, but the chair needs to open the eyes of his food colleagues to the importance and potential of his field.

Recommendations
The current financial system of delayed rewards (i.e. remuneration for teaching and PhD graduations) for starting groups severely punishes such new groups. To support this important field, the group should at the very least be given an initial financial float to launch the activities, and ideally a start-up package.

This is an inspiring, newly created appointment, and the university needs to continue the momentum by supporting the group at a serious financial level.

The group's and chair's focus is clearly in inorganic chemistry, and this might be a more appropriate name for the group, and consistent with the names of the organic chemistry and physical chemistry groups.

5.9 Micr*o*biology

Leader research group: **Prof. W. M. de Vos**
Research input tenured staff: **FTE 3.65**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
The group has an outstanding reputation and has produced an impressive number of scientific papers of excellent quality. The group is highly productive, achieving the highest metrics of all the WU chair groups. The general scientific objectives are: to discover fundamental aspects of selected microbe-based model systems at ecological, cellular and molecular levels and to apply the obtained insights to improving the quality of life. These activities are manifested in the mission: "science to impact". The activities are directed by a chair and three group leaders, each one of whom has an extraordinary output. They attract an impressive level of funding. The integration of education and research is excellent. The various subgroups are devoted to particular aspects of the very broad research field but they collaborate extensively with one another. As such, the internal coherence of the programme is excellent. This strong integration of the various activities is, to a large part, due to the inspiring leadership of the programme leader.

Relevance to society
This chair group makes a major effort to communicate the value and relevance of their activities in education and research to society; this is highly commendable. These efforts are assisted by the scope and breadth of research which is highly relevant and connected to societal needs. For example, the results of the research in the areas of faecal transplantation to treat metabolic syndrome and in human gene therapy are of tremendous interest to the public. Considering the large number of patents and spin-outs generated during the evaluation period the use of research products by societal groups such as industry is also visible. General communication media (national TV, radio and newspapers) have been used extensively to disseminate several research results to the general public.
There is a tremendous diversity of funding sources, including many EU contracts, and there are also many collaborations with industry. The excellent employment statistics of the PhD graduates also attests to the overall relevance of the chair group's research activities.

Viability
Plans for future development are well thought out and success in attracting contracts supports the notion of strong viability. The group has an impressive number of national and international contacts with other research groups at universities and with industry. The viability of these contacts is clearly manifested in the formulation of the plans for the future. The chosen research targets are very relevant for the field and hold strong promise for the future.

The decision not to invest in expensive high-throughput equipment, but to contract out this analysis when required, allows access to up to date technology on an ongoing basis.

The panel was also impressed with the very considered approach employed by the chair group for staff recruitment, career development strategies for existing staff and with the ongoing process employed by the group for strategic planning.

Other remarks
Within the reporting period this group has not only stabilized its top position in this internationally most competitive area but they have actually advanced further. The reviewers are pleased to note that although they have achieved the highest rating possible, as they did in the last review in 2009, the group was able to further improve its publication record, its overall impact and its already excellent reputation. The group deserves all the support that it needs to maintain its position as true world leaders in their research areas.

5.10 Organic Chemistry

Leader research group: **Prof. H. Zuilhof**
Research input tenured staff: **FTE: 2.8**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
High-quality research published in very good chemistry journals. Very prolific and highly awarded chair with excellent citation rate. Nice mixture of synthetic work on surfaces and state-of-the-art surface-analytical studies and technique development. Focus on surface organic chemistry with biological relevance makes the group unusual and attractive to others, inside and outside WU. Interesting in-house development of mass spectrometric approach that proves useful in characterizing their novel surface chemistries. Novel surface-functionalization chemistries have been developed that have great utility.

Relevance to society
Patents, spinoffs and industrial collaborations, as well as medically relevant products such as approaches to dealing with cholera toxin, or biosensors. Good contributions to teaching at all levels, but surprisingly, lower than anticipated numbers of PhDs.

Viability
Hiring procedure for next position (surface-based analytical) is exemplary and truly international. Significant amount of group time spent on organic chemistry education, but this is inevitable. Group age distribution more-or-less bimodal, which will present opportunities for hiring in near term. Sustainable research strategy.

Other remarks
Highly successful spin-off culture in the group, based on group IP. Very successful history of PhD study trips that provide useful opportunities to PhD candidates to present, as well as opening doors to international collaborations. Entrepreneurial spirit of PhD candidates encouraged in funding such trips! PhD candidate supervision/discussion seems to be multilevel and frequent.

Recommendations
Continue successful path!

5.11 Physical Chemistry & Soft Matter

Leader research group: **Prof. J. van der Gucht**
Research input tenured staff: **FTE 2.85**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
The Laboratory of Physical Chemistry and Soft Matter (PCC), formerly the Laboratory of Physical Chemistry and Colloid Science until January 2015, has been led by Prof. J. van der Gucht since 2013. The aims of PCC comprise understanding how macroscopic properties of systems or materials follow from the chemical nature of matter. The PCC consists of 8 scientific staff members with complementary skills and is organized into three theme areas: (a) self-assembly, proteins, colloids and polymers, (b) modelling and measurements of forces and (c) physical properties: mechanics and rheology. The group performs solid fundamental sciences systematically with applications in mind through collaborations with industries.

At Wageningen, the group collaborates with and well integrates their research with a number of chair groups within and outside VLAG; particularly strong collaborations are in place with food and biobased research groups. The group also provides experimental and modelling facilities to other groups.

At the national and international levels, 1/3 of papers involve international author teams. The group plays an active role in the Dutch and EU Soft Matter networks. The group publishes a number of high-impact papers, such as Nature Nanotech, Nature Materials, Nature Physics, Nature Comm., PNAS, Angew and PRL.

Relevance to society
The group has strong partnership with major industries (e.g., L'Oreal, P&G, BASF, AKZO, DSM, Philips, and Shell) through consulting, collaborative projects and a special chair (Unilever). The group is also actively engaged in several outreach activities. Applied projects almost always are in collaboration with industries or applied research groups at WU. Patents are transferred to partners.

The group trains highly qualified students with excellent employability. For PhD candidates, they are able to discuss projects at group meetings or sub-group meetings for specific topics and to have frequent meetings with supervisors. PhD candidates attend at least one international conference every year.

Viability
The group has young staff members with balanced expertise. In addition to the new chair in 2013, three new tenure track staff members and 2 young technicians have been added in recent years. The group builds on a high international reputation, excellent experimental and modelling facilities with strong technical support staff, and broad and dynamic research portfolio. The group has been successful in obtaining external funding. The strategy for future funding is to target NWO, industries (top sector) and EU. The group will continue to attract excellent graduate students and postdocs. The overall goal is to remain a key player in the international field of soft matter.

As a new chair, Prof. Van der Gucht has been implementing several different strategies: (a) to have more high-impact publications, recruit more postdocs, and have more high-risk projects; (b) to become flatter in the group structure while it was more hierarchical before; (c) to move into complex systems and materials, bridging the gap from small scale to large and to add new capabilities like synthesis, all of which are attractive to industry.

Other remarks
Currently, the group has 50% Dutch students and 50% from abroad. Staff members are mainly Dutch.

The group teaches basic chemistry (1000 students). While people in the group recognize the importance of teaching and are satisfied with their teaching situation overall, but heavy teaching loads come between September and December and have impacts on their normal research activities.

Recommendations

The group is excellent in all three criteria. The PI has been implementing new strategies to maintain the tradition of excellence of the group and bring the group into exciting directions. It would be nice if the university could spread out teaching over the year and if the group could increase the diversity of research staff.

5.12 Systems & Synthetic Biology

Leader research group: **Prof. V.A.P. Martins dos Santos**
Research input tenured staff: **FTE: 1.1**

Score		
	Research quality	**2**
	Relevance to society	**2**
	Viability	**1**

Research quality
Considering that this chair group was founded in 2010 with just three staff (and it may in fact be too early to judge the quality of the research using criteria employed for the other chair groups), the quality of the research output is very impressive with a number of key publications in very high impact journals.

The group has already achieved a high level of visibility and is successfully implementing many projects. A notable achievement is the securing and successful initiation of 8 EU projects. The newly founded Centre of Systems Biology is a most important cornerstone for important collaborations with other research groups in Wageningen and the Netherlands.

A major bottleneck for this group is the integration of new researchers which have been funded through recently acquired research grants and the University should continue to extend support to achieve and enhance further collaboration and integration.

Relevance to society
Research areas developed by the chair group have clear societal relevance (in the areas of human medicine and disease and in the production of fine chemicals). The group has many valuable industry links and has already generated quite a number of patents and staff members have been involved in the establishment of two spin-out companies.

Although the self-assessment report did not provide comprehensive details regarding the extent of its outreach and dissemination activities to the public and other stakeholders, this was addressed to a major degree in the presentation at the site visit where a strong vision for societal engagement was outlined.

Considering that the group is still at a relatively early stage of evolution there is indeed further scope for developing a strong outreach programme and for participation in national/ international committees/ advisory boards.

The group has been very successful in securing funding from national agencies, from industry and in particular from the EU. The ambition to compete for ERC funding is noted and endorsed.

Viability
The research themes are of high significance and hold strong promise for the future. As such, there is no doubt that the group is now very well positioned to continue its development and to operate at the forefront of the field. It would be desirable to further strengthen the integration of the group into the research programmes of the other research teams. Appropriate actions could be concerted research programmes funded by the Centre of Systems Biology or NWO. Such activities should also be linked to other groups in the Netherlands active in the field. Ambitious plans regarding staff recruitment (including the tenure track portfolio), collaborations and industry engagement were clearly outlined indicating that the group has developed a strong strategy to ensure a viable and relevant future. The chair group is well positioned to take up the considerable opportunities offered by the incorporation of Synthetic Biology as a major development area in its new strategic plan.

Recommendations
This chair group should receive continued support from the University to ensure high level integration of its research activities within the University environment and externally.

5.13 Nutrition & Health

Leader research group: **Prof. F.J. Kok**
Research input tenured staff: **FTE: 3.4**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**2**

The Division of Human Nutrition has an impressive track record of leadership and productivity in the field of human nutrition research. However, the retirement of Professor Kok, who has led the Division for many years, and Professor Van't Veer's move into a new role within the University mean that this is a critical moment in the evolution of the Division of Human Nutrition. In addition, the very recent appointment of 2 new chairs (Professors Feskens and Kampman) and the co-location of nutrition researchers in a new building offer opportunities to re-visit both the Division's overall strategy and the structures and processes which will help to deliver that strategy and to ensure that the Division maintains its leading position. Issues which the Division as a whole may wish to consider include:

- What are the Division's unique strengths and opportunities and how can these be harnessed to develop a focussed research strategy?
- With the shift in funding towards more applied areas, how will the Division maintain/ improve its scientific excellence?
- What is the Division's overall strategy with respect to Clinical Nutrition which is emerging as components of 3 of the current research groups?
- Are the current 5 chair groups within the Division the optimal structure for the next 5 – 10 years? Are there opportunities for consolidation to create critical mass and/ or for new groups to stimulate innovation?
- What is the Division's communication strategy? For example, would there be advantages in the new MOOC in Nutrition being managed at Division level?
- How will the Division compete with "new entrants" to research in human nutrition who, in some cases, appear to be producing more of the high profile, innovative publications?

Research quality
This group has an extensive remit covering international maternal and child nutrition, nutrition and ageing, clinical nutrition and nutritional, physical activity and sports.

The bibliometric analysis shows that the group has been performing at a high level. The average of 55 papers per year is high as is the RI of 2.22 across the period 2008-13. 4% of papers were published in the top 1% of outputs in this research field with 31% in the top 10%.

In addition to the core facilities and functions described by the Division, it is clear that the groups also share common endeavours in establishing cohort studies. The strategy of establishing a new study (EetMeetWeet, or Eat, Measure, Know) which fills a very specific niche is sensible given the extensive investment in very large cohorts elsewhere which are either open access or with which it is possible to develop collaborations.

The group has considerable strengths in dietary assessment but is seemingly aware of the challenges of defining their scientific contribution in terms of ability to undertake exposure measurement rather than a central interest in the questions being addressed. It would be important that the group defines itself in terms of the scientific questions it wishes to address rather than its measurement capability.

The group's expertise is principally in nutritional physiology which allows connectivity to both basic and more applied areas of science. The translation through to prevention is largely towards individual approaches to prevention which may be delivered in a clinical or quasi-clinical setting.

Relevance to society
The group is doing research that is societally relevant and is clearly positioned by its participation in external groupings such as governmental advisory boards to facilitate the translation of their research.

The group's leadership in international nutrition is an important aspect of their work and societal relevance.

Viability

The retirement of Professor Kok and the move of Professor Van 't Veer are clearly major events for the Nutrition and Health and the Nutrition and Epidemiology groups. In preparing a new way forward with Professors Feskens and Kampman, it will be important to consider whether the historical distinctions between these two programmes is ideal in order to execute their forward strategy. Whilst it is clear that the Division aspires to operate as an entity which is more than the sum of its parts, it will be important to ensure that any sub-divisions are rational and facilitate the production of excellent science. It is not surprising that this strategic thinking has not yet been done as both appointees have only recently taken up their chairs, however, it would be important to review the sub-divisions in the overall Division of Human Nutrition at an early stage.

The group highlighted the high teaching load of some of its staff members, who may, as a consequence, have less scientific productivity than they would like. It would be important to pursue a strategy of managing the teaching load and finding new and more efficient ways to provide education whilst preserving time and energy for research. Alongside this need for protection of time for research, the group needs to be incentivised to become more focussed so as to maximise the impact of what can be delivered in that research time.

In the past, the number and quality of the research outputs has been good but perhaps there has been a limited number of particular research highlights. Moving forward, the group may want to rethink its strategy to aspire to fewer, more high-profile outputs.

5.14 Nutrition & Epidemiology

Leader research group: **Prof. P. van `t Veer**
Research input tenured staff: **FTE: 3.3**

Score		
	Research quality:	**1**
	Relevance to society:	**1**
	Viability:	**2**

The Division of Human Nutrition has an impressive track record of leadership and productivity in the field of human nutrition research. However, the retirement of Professor Kok, who has led the Division for many years, and Professor Van't Veer's move into a new role within the University mean that this is a critical moment in the evolution of the Division of Human Nutrition. In addition, the very recent appointment of 2 new chairs (Professors Feskens and Kampman) and the co-location of nutrition researchers in a new building offer opportunities to re-visit both the Division's overall strategy and the structures and processes which will help to deliver that strategy and to ensure that the Division maintains its leading position. Issues which the Division as a whole may wish to consider include:

- What are the Division's unique strengths and opportunities and how can these be harnessed to develop a focussed research strategy?
- With the shift in funding towards more applied areas, how will the Division maintain/ improve its scientific excellence?
- What is the Division's overall strategy with respect to Clinical Nutrition which is emerging as components of 3 of the current research groups?
- Are the current 5 chair groups within the Division the optimal structure for the next 5 – 10 years? Are there opportunities for consolidation to create critical mass and/ or for new Groups to stimulate innovation?
- What is the Division's communication strategy? For example, would there be advantages in the new MOOC in Nutrition being managed at Division level?
- How will the Division compete with "new entrants" to research in human nutrition who, in some cases, appear to be producing more of the high profile, innovative publications?

Research quality
The group is nationally and internationally recognized for its expertise in nutritional epidemiology of diabetes, blood pressure, cardiovascular disease, cancer, as well as its expertise and practical experience in dietary exposure assessment. It proposes research lines with the common aim to generate reliable evidence on diet as related to non-communicable diseases by means of observational and interventional studies. Classic analytical epidemiology methods (RCTs, cohorts, case control) are used while new assessment instruments are developed.
The research group has slightly increased in size since the 2009 assessment. In 2014 it included 8 members of the scientific staff and 25 PhD candidates. Between 2009 and 2014, 575 refereed articles were published and 37 PhD theses were defended. The publication RI was high (2.55) and improved since the 2009 assessment; 30% of the group's publications appeared in the 10% most cited articles, and 5% in the most cited 1%.

Relevance to society
This line of research is of obvious relevance in a number of highly prevalent non-communicable diet-related conditions. In addition, the groups has contributed over the years to the training of a large number of competent young researchers who pursue their careers in domains that serve the general public, policy communities and education.

Viability
This group is already well established. However, the SWOT analysis highlights a number of difficulties that will have to generate original answers. For example, the tools used in nutritional epidemiology are likely to evolve rapidly in the years to come. Novel tools such as apps, sensors, wearables will progressively change to nature and scope of dietary intake data. This will require much reactivity and adaptability. In addition, the recent changes in funding policy, both from governmental and private

sources, putting more emphasis on applied research, creates a challenge aggravated by competition in the field of human nutrition.
The issue of how this group develops in the future alongside the Nutrition & Health group is discussed in our review of the latter.

Recommendations
The group is doing excellent work and should be encouraged to remain focused on those research areas where they are internationally competitive. Some proposed new developments might deserve particular caution. The novel line of research aiming to develop research on specific nutritional needs in diseases states (and potentially to propose dietary recommendations) is an ambitious project that might prove extremely difficult to carry out. The extreme heterogeneity of aetiologies, treatments, and prognosis in diseases states makes the establishment of dietary needs even more difficult than it is in a healthy population. The development and use of adequate biomarkers and other objective indicators should remain a priority.

5.15 Nutrition, Metabolism & Genomics

Leader research group: **Prof. A.H. Kersten**
Research input tenured staff: **FTE: 1.8**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

The Division of Human Nutrition has an impressive track record of leadership and productivity in the field of human nutrition research. However, the retirement of Professor Kok, who has led the Division for many years, and Professor Van't Veer's move into a new role within the University mean that this is a critical moment in the evolution of the Division of Human Nutrition. In addition, the very recent appointment of 2 new chairs (Professors Feskens and Kampman) and the co-location of nutrition researchers in a new building offer opportunities to re-visit both the Division's overall strategy and the structures and processes which will help to deliver that strategy and to ensure that the Division maintains its leading position. Issues which the Division as a whole may wish to consider include:

- What are the Division's unique strengths and opportunities and how can these be harnessed to develop a focussed research strategy?
- With the shift in funding towards more applied areas, how will the Division maintain/ improve its scientific excellence?
- What is the Division's overall strategy with respect to Clinical Nutrition which is emerging as components of 3 of the current research groups?
- Are the current 5 chair groups within the Division the optimal structure for the next 5 – 10 years? Are there opportunities for consolidation to create critical mass and/ or for new groups to stimulate innovation?
- What is the Division's communication strategy? For example, would there be advantages in the new MOOC in Nutrition being managed at Division level?
- How will the Division compete with "new entrants" to research in human nutrition who, in some cases, appear to be producing more of the high profile, innovative publications?

Research quality
This group has managed the transition following the departure of Prof. Muller really well and has clearly created a coherent and innovative strategy based around molecular nutrition research. The group is publishing well as lead or last author, but is also playing a contributory role in papers that are getting into top ranked journals. The group clearly has the ambition to lead papers that achieve an equivalent impact. The group has a well-defined approach which it applies to 5 key areas; molecular regulation of lipid metabolism, mechanism and functional relevance of immune-metabolism, nutritional regulation of metabolic health, epigenetics effects of early life nutrition on ageing and nutritional systems biology of the intestine.

The bibliometric analysis shows that the group has been performing at a very high level. The volume of papers is reasonable with around 25 papers published per year. The RI of 2.60 across the period 2008-13 is high with some evidence of an increase over time. 7% of papers were published in the top 1% of outputs in this research field with 40% in the top 10%.

Relevance to society
The group is conducting work that is of societal relevance and is clearly working extremely hard to be active contributors to improving public understanding of science. Whilst their efforts in initiatives such as the MOOC are laudable, the demands of science communication are inexhaustible.

Viability
As indicated above, the group may wish to reflect on how they will maintain focus and perhaps reduce the number of topic areas across which they are working. This is especially important since in their self-assessment "limited critical mass" is listed as one of its potential weaknesses.

Moving forward the group is unlikely (as in the past) to be able to define its niche by virtue of access to technology platforms. Being aware of this and positioning the group to be expert at analysis and interpretation of data is a sensible strategy.

The group is coherent, young and ambitious and has excellent leadership. Ideally, in this formative phase, it needs to be supported in having protected time and institutional support to prepare fellowship applications.

Recommendations

The review committee were encouraged by the group's strategic decisions about what it was not going to do but some consideration of whether it is possible to sustain excellent productivity across the 5 areas would be warranted.

Since the demands of science communication are inexhaustible, the group and the division will need to carefully consider its strategy for communication and make an active decision about the resources and time that they wish to allocate to this endeavour.

5.16 Nutrition & Pharmacology

Leader research group: **Prof. R. Witkamp**
Research input tenured staff: **FTE: 0.7**

Scores	**Research Quality:**	**2**
	Relevance to society	**2**
	Viability	**3**

The Division of Human Nutrition has an impressive track record of leadership and productivity in the field of human nutrition research. However, the retirement of Professor Kok, who has led the Division for many years, and Professor Van't Veer's move into a new role within the University mean that this is a critical moment in the evolution of the Division of Human Nutrition. In addition, the very recent appointment of 2 new chairs (Professors Feskens and Kampman) and the co-location of nutrition researchers in a new building offer opportunities to re-visit both the Division's overall strategy and the structures and processes which will help to deliver that strategy and to ensure that the Division maintains its leading position. Issues which the Division as a whole may wish to consider include:

- What are the Division's unique strengths and opportunities and how can these be harnessed to develop a focussed research strategy?
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- Are the current 5 chair groups within the Division the optimal structure for the next 5 – 10 years? Are there opportunities for consolidation to create critical mass and/ or for new groups to stimulate innovation?
- What is the Division's communication strategy? For example, would there be advantages in the new MOOC in Nutrition being managed at Division level?
- How will the Division compete with "new entrants" to research in human nutrition who, in some cases, appear to be producing more of the high profile, innovative publications?

Research Quality
The group was established as a new chair in 2006. Its research activities started in 2007. The group was initially embedded in the Nutrition, Metabolism and Genomics chair and was evaluated in 2009 as a part of this chair. This is the first assessment of the group as a separate research entity. In 2014 this small group only consisted of 0.7 FTE of scientific staff and 1.1 FTE of post-docs.
Three research programmes are currently developed by the group, at the interface between nutrition and pharmacology: 1. Effects and kinetics of endocannabinoids and related fatty acid amines; 2. Metabolism during disease, particularly focused on muscle wasting, cachexia and anorexia in cancer patients; and 3. Effect of polypharmacy on nutrient status in elderly people. The first line of research led to the finding that DHEA, an important dietary n-3 PUFA, can be metabolized to its N-acylethanolamine conjugate, which has structural and functional overlap with endocannabinoids, and probably acts as an endogenous anti-inflammatory mediator. The group has published 55 refereed articles between 2009 and 2014, 33% of which falling in the 10% most cited publications, but none in the top 1%. The overall RI is 2.13 for the same period.
The research strategy appears overly ambitious. The group is still small and much remains to be done in order to establish it as a leader in any of the relevant scientific domains. In future years, more publications and PhD theses should contribute to reinforcing the group's core expertise and reputation.

Relevance to Society
The research programmes are clinically oriented with a clear potential relevance to major societal issues (metabolism in disease states, the emerging and still under-recognized problem of multi-medication in the elderly). The polypharmacy research is of obvious relevance for clinicians. The group reaches out to the public by engaging in public lectures, discussion forums, and appearing in national and international media.

Viability
This very small group engages in lines of research that require major expertise in many scientific fields, with complementary research to be undertaken in animal models and human patients. Given the small size of the group, it is difficult to see how such expertise could be achieved and maintained at a sufficient level to support all three research programmes. The group intends to “grow through collaborations”. It does have a fine network of collaborations both within WU and with national and international partners. The group is part of consortia that compete for major research grants and have an on-going collaboration with Danone in the field of anorexia/cachexia. The SWOT analysis highlights that the group has a unique profile and has started to get international recognition. However the tenured staff is still quite limited and collaborations cannot alone support the viability of a research group. Getting sufficient sustained funding for the three lines of research is likely to remain a challenge.

Recommendations
The group’s viability would benefit from a reconsideration of its future strategy within an overall renewed Division of Human Nutrition. In particular, the three current research programmes with limited overlap might prove unsustainable for this small group.

5.17 Sensory Science. & Eating Behaviour

Leader research group: **Prof. C. de Graaf**
Research input tenured staff: **FTE: 1.9**

Score		
	Research quality	**2**
	Relevance to society	**1**
	Viability	**3**

The Division of Human Nutrition has an impressive track record of leadership and productivity in the field of human nutrition research. However, the retirement of Professor Kok, who has led the Division for many years, and Professor Van't Veer's move into a new role within the University mean that this is a critical moment in the evolution of the Division of Human Nutrition. In addition, the very recent appointment of 2 new chairs (Professors Feskens and Kampman) and the co-location of nutrition researchers in a new building offer opportunities to re-visit both the Division's overall strategy and the structures and processes which will help to deliver that strategy and to ensure that the Division maintains its leading position. Issues which the Division as a whole may wish to consider include:

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- What is the Division's communication strategy? For example, would there be advantages in the new MOOC in Nutrition being managed at Division level?
- How will the Division compete with "new entrants" to research in human nutrition who, in some cases, appear to be producing more of the high profile, innovative publications?

Research quality
The programme leader is an internationally-recognised leader in his research field who publishes well cited papers in higher impact nutrition journals e.g. *American Journal of Clinical Nutrition* and who has collaborations with excellent research teams internationally.

The bibliometric analysis shows that the group has been publishing approximately 25 refereed articles per year and that their RI was 1.92 across the period 2008-13 which is an above average world impact. 2% of papers were published in the top 1% of outputs in their research fields with 25% in the top 10%. Most of their outputs were in the research fields of Agricultural Sciences (where they performed very well: RI = 2.31) and in Neuroscience & Behaviour (where their performance was less impressive: RI = 1.30).

This relatively new research group (formed on 1 January 2009) aims to understand the psychobiological mechanisms underlying eating behaviour and has operationalised this as 3 research lines:

1. Food structure – food oral processing- dynamic sensory perception and preferences;
2. The impact of sensory and metabolic signals on eating behaviour;
3. The peripheral physiology and neurobiology of reward and satiety.

It is difficult to see how such a young research group with only 1.9 FTE scientific staff can sustain competitiveness across all 3 research lines. In addition, because of their ability to address the "real world" problems of today, they will be an attractive research collaborator/ contractor for more applied research which could be at the cost of more long-term, fundamental and innovative research. The programme leader recognises this tension and aims to achieve an appropriate balance between the more basic science (which might be funded by the NWO or others) and more applied research funded by industry.

Relevance to society
The group is doing research that is clearly of considerable societal relevance and which could benefit multiple stakeholders including the public, policy makers and industry. They have been instrumental in the establishment of the Dutch Smell and Taste Centre through collaboration with the Alliance Nutrition – Gelderse Vallei which is recognised by health insurers.

Viability
This is still a relatively young research group which, if it is to become world class, will need to further refine its research strategy – please see comments under Research Quality above. For example, we think that it will be difficult for them to achieve their ambitions in the area of Clinical Nutrition and to become "…one of the top centres in Europe/ world with respect to taste and smell disorders" whilst at the same time focussing on achieving "…critical mass in the area of the role of cephalic phase responses in food choice and intake". NB Please see generic comments on the Division of Human Nutrition about overall strategy and, specifically, the Division's strategy for Clinical Nutrition research. Access to a 3T MRI provides an opportunity to study gut events/ digestion in real time but, given the research lead established by other international teams, it will be important that the group identifies research topics/ approaches which will enable them to be internationally competitive.

In response to the tough funding landscape in The Netherlands (and across the EU), the programme leader has been active in developing research links and in exploring funding opportunities overseas, notably in Singapore. This could be a significant advantage but the challenge will be to ensure that any projects/ programmes fit within the research focus of the group.

5.18 Toxicology

Leader research group: **Prof. I.M.C.M. Rietjens**
Research input tenured staff: **FTE 1.49**

Score		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
Central in the mission of Toxicology is to perform and deliver high quality research and education in Food and Environmental Toxicology. For a small group, this unit is generating excellent research and are world leading in some areas of toxicology. There is a strong focus on risk assessment, on which the individual research lines converge. A highlight is the integration of in vitro toxicity data and kinetic models with reversed physiologically based kinetic modelling aimed at reducing the need for animal studies. The research is conducted within an excellent analytical infrastructure. The group publishes in the best toxicology journals and generates science that is moving the discipline along and informs regulatory authorities and government departments. Professor Rietjens is very influential in European and World toxicology. The quality of the science is evidenced by awards (e.g. SOT Award for the Best Published Paper Advancing the Science of Risk Assessment) and invitations of membership to influential bodies. Because the group is small an important part of their strategy is to have strong national and international research collaborations. Funding strategies are very good. The appointment of 2 young tenure track assistant Professors increases the group's dynamic development options (epigenetics, stem cells, environmental toxicology). PhD training in this group is exemplary and includes both VLAG Educational Certificate courses and courses enabling professional registration as European Toxicologists.

Relevance to society
Much of what the group does has direct relevance to society, underpinning the safe use of chemicals. This is exemplified by the extensive advisory activity of Professor Rietjens at regulatory and government bodies in the Netherlands, the EU and on International Expert Panels. The links with highly influential commissions (e.g. at EU-level) are strong. The training and output of PhDs is excellent and provides a resource that is rapidly diminishing globally but still enjoys a strong market demand, hence giving the excellent employment statistics. There is a proactive strategy to communicate and disseminate knowledge on toxicology to the public. The group has excellent relationships with industry and the media, and is involved in local interactions at consumer level (broad public, high school children) as well. The group is also preparing a MOOC (massive open online course) in food safety in collaboration with the group of food microbiology. The objective is to attract more students of food safety to the VLAG Graduate School in Wageningen.

Viability
The group is at the forefront of scientific contributions to the development of new methods for human and environmental risk and safety assessment. The research themes are relevant and timely and going forward offer significant potential e.g. on novel nuclear receptor and kinase technology. There is a clear vision for future funding, with attention to EU projects (Horizon 2020) and intentions to obtain an ERC advanced grant. At present the group is comparatively small, but the recent appointment of younger tenure track researchers will certainly improve viability. The international profile of Prof Rietjens is outstanding and it is anticipated that she will be carrying the flag for this group for the immediate future until the younger members of the team develop their careers. The strategy of attracting endowed chairs to the group is a good solution for developing strong links with industry and funders, and improving the profile of the unit. The contribution of Endowed chairs to developing research lines and supervision of PhD students gives added value. One problem noted is that it is difficult to attract and retain post-docs trained in toxicology due to their appeal to potential employers.

Other remarks
Members of the review panel noted that further improvement of modelling metabolism and detoxication kinetics, especially addressing the issues of inter-subject variability, is likely to be challenging.

Recommendations

In view of the small size of the department, it will be important to have a clear succession plan to prepare and support young Assistant Professors for advancement. It is also recommended that increased synergistic interaction of Toxicology with other groups in the Graduate School VLAG would be beneficial.

6 NUTRIM Maastricht Research Lines

6.1 NUTRIM Research Line 1: "The Metabolic Syndrome"

Research Line Leaders: **Prof. R.P. Mensink and Prof. P. Schrauwen**
Research input tenured staff: **FTE 7.9**

Score:		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**1**

Research quality
The research activity of NUTRIM Research Line1 (RL1) includes two research programmes: 1. Energy balance and obesity, and 2. Diabetes and cardiovascular disease risk. Programme 1 addresses intervention strategies for long-term maintenance of energy balance and food intake. The second programme aims to identify or characterize how nutrition, physical activity, environmental factors and clinical interventions can beneficially affect molecular, metabolic and functional effects. The group is equipped with a state-of-the-art metabolic ward in which twenty rooms were recently realized conforming to the latest quality standards regarding safety, climate and research infrastructure. The emphasis is on the axis molecular biology -physiology- function and health. Basic research is completed by clinical structures, for example in the context of bariatric surgery (exploration of physiological changes associated with novel bariatric procedures).

The research staff in 2014 consisted of 110 persons including 23 tenured professors and 46 PhD candidates (7.9 FTE tenured staff and 11 FTE post-docs). These numbers have been relatively stable over the previous years. The staff is mainly based at the Departments of Human Biology, Health Promotion, Human Movement Sciences, Surgery, Radiology, and Internal Medicine, ensuring impressive complementary expertise.

This group has an already well established international reputation and is considered one of the leading units in many aspects of nutritional research. The group has established many collaborations with prestigious partners within the Netherlands and on the international scale. It has attracted major funding from public (the EU in particular) and private (about half of its funding) sources.

The scientific output in terms of publications and citation is outstanding. About 200 refereed articles are published every year, of which 25 % are within the top 10% most cited publications in their field, and 3% are within the top 1%. The overall relative impact over the years 2008-2013 is 1.97.

Relevance to society
Understanding the aetiology of metabolic disorders is of clear societal relevance. The metabolic syndrome is a major public health problem contributing to Type 2 diabetes and cardiovascular disease. The treatment and prevention of obesity is one of the main research areas of the RL1. Members of the RL1 are involved in committees and organisations that provide advice on the role of nutrition and exercise in the prevention and treatment of obesity, such as the Health Council of the Netherlands.

Viability
Members of the RL1 are leading international experts in physiology and metabolism. The publication record is strong and the number of papers appearing in prestigious high impact journals is increasing. Significant funding has been obtained and maintained over the years. A large part of the research is embedded in various Top Institutes and RL1 has been very successful in obtaining grants.

The SWOT analysis highlights the difficulty in recruiting excellent researchers from outside the Maastricht area, a problem that is further complicated by the necessity to undertake intervention studies in Dutch speaking participants. Although the SWOT analysis also mentions the decrease in financial support by both governments and industry, this RL1 appears sufficiently established to compete for major sources of support.

Recommendations
The strong emphasis on physiology, a field in which the research line is excellent, should be emphasized more when describing the aims and activities of the group, certainly in its mission

statement and perhaps even in its title. Although a lot of excellent research is devoted to the Metabolic Syndrome, the group's exceptional accomplishments are in physiological research, which should be highlighted.
The RL1 is aware of the need to maintain focus and is dealing with the need to develop new competencies by a strategic approach to collaboration.

6.2 NUTRIM Research Line 2: "Gut liver homeostasis"

Research Line Leaders: **Prof. A.A.M. Masclee and Prof. S. Olde Damink**
Research input tenured staff: **FTE 7.3**

Score:		
	Research quality	**2**
	Relevance to society	**1**
	Viability	**2**

Research quality
The research line has conducted a broad scope of research on gastrointestinal and hepatic disease using a wide range of molecular, cellular, physiological and epidemiological approaches. The 5 key publications selected to show the top outputs of the group illustrate the diversity of scientific approach. The group is highly clinically orientated and aspires to increase the translational nature of their work still further.

The bibliometric analysis shows that the group has been performing at a high level. The average of around 150 papers per year is high and the RI of 2.00 across the period 2008-13 is good. 3% of papers were published in the top 1% of outputs in this research field with 27% in the top 10%. The previous review of VLAG in 2009 indicated "a need for more high-impact papers", whilst noting that it may be difficult in this field. This need remains.

The 2009 review also highlighted that "the researchers have chosen a bottom up approach, allowing projects from individual researchers… The strategy and organisation of this research line, however, remained unclear". It was unclear to the review committee in 2015 whether there had been a change in the degree to which the group has an explicit strategy.

Relevance to society
The topics being investigated by this research line are important to society but the strategy for translation could be clearer. It would be helpful to be able to articulate how the different aspects of the research will be translated into clinical or public health action. Whilst the group clearly makes a contribution to education, the RL2 did not demonstrate a clearly co-ordinated or strategic approach.

Viability
The recent appointment of Prof. Olde Damink creates an opportunity to reconsider the overall strategy for this research line and will be important to identify clear future opportunities. In addition to preserving the important investments that have been made in the past (such as the establishment of IBD cohorts) the RL2 also needs to have a strategy to realise the potential of that past investment. In their SWOT analysis, the list of opportunities is extensive and diverse and some prioritisation and increased focus would be justified.

A further argument in favour of focus is the strong clinical interface of this research line which means that many of its contributors have a heavy clinical workload.

6.3 NUTRIM Research Line 3: "Chronic inflammatory disease & wasting"

Research Line Leaders: **Prof. LJ.C. van Loon and Prof. J.P. Kooman**
Research input tenured staff: **FTE 8.9**

Score:		
	Research quality	**1**
	Relevance to society	**1**
	Viability	**2**

Research quality
This is a strong and productive research line which has a clearly defined research strategy. The group studies the determinants and pathways involved in inflammation in chronic disease and the systematic manifestations and metabolic alterations in ageing and chronic disease. The approach of studying chronic organ diseases as a model of accelerated ageing is logical when those disorders are of moderate severity. The results of these investigations may therefore be relevant to the topic of healthy ageing. The study of systemic issues such as cachexia associated with more severe disease such as cancer or severe COPD is highly important for those clinical conditions, but the relevance of these pathophysiological mechanisms to healthy ageing is less clear cut.

The group has a strong connection between basic and clinical science.

The bibliometric analysis shows that the group has been performing at a very high level. The average of 155 papers per year is high (~20 per FTE per year) and the RI of 2.55 across the period 2008-13 shows the impact of the work that has been published. Importantly, 6% of papers were published in the top 1% of outputs in this research field with 32% in the top 10%.

Relevance to society
The societal relevance of the work in this research line is framed in terms of the importance of NCDs such as T2D and COPD. These are, of course, major public health issues which are of huge relevance to society. The link between the work of the research line to these broad statements of societal relevance is less clear. The research line's view that personalised prevention or treatment is the route by which its results will be translated into clinical or public health benefit remains to be proven. Whilst there may be opportunities for personalising prevention, there is a current lack of interventions to preserve or enhance muscle mass, for example, that have been tested on broad groups of individuals or patients, so the prospect of stratifying groups still further seems a distant goal.

Viability
The group itself note a lack of success in obtaining major personal grants at the junior and mid-career level. This is a generic issue within VLAG that needs to be addressed by identifying opportunities to free potential applicants up from other responsibilities to allow focused preparation time and additional support structures within the Institution to maximise the probability of success. The group also notes the limited number of tenured staff positions. The response to deal with this by increasing the size of the group to ensure critical mass among the core support groups is logical in the short term but may create a long term issue of sustainability. As with other groups, the maintenance of research focus is an important concern. RL3's proposal to broaden their remit to include bone may be an opportunity, but the group should consider whether such a broadening will reduce focus and dilute attention. The aspirations of the group with respect to systems biology with the aim that "future research should focus on understanding how NCDs such as CVD, cancer, CKD, chronic respiratory disease and T2D cluster at the genetic, molecular and mechanistic level" is extremely ambitious and may deflect from the more focused objectives of this group as currently stated.

The group has extensive collaborations within NUTRIM and elsewhere within Maastricht and also with external groups including those within VLAG at Wageningen. A number of key synergies were identified with Wageningen some of which had been exploited in TIFN. However, greater awareness of interests and expertise of different groups would increase the opportunities for identifying potential synergies.

6.4 NUTRIM Research Line 4: "Gene-Environment Interactions"

Research Line Leaders: **Prof. F.J. van Schooten and Prof. M. Zeegers**
Research input tenured staff: **FTE 5.8**

Score:		
	Research quality	**2**
	Relevance to society	**2**
	Viability	**3**

Research quality
The research line Gene-environment interactions use integrated, interdisciplinary and systems approaches to examine environment and diet on health and disease. The quality of this grouping is internationally recognised and competitive but not internationally leading. The loss of the toxicogenomics group in 2011 had a significant effect on staffing and funding, which although stable, have not returned to pre-2011 levels. The group have an international profile in their respective fields and a sustained publishing record with articles in leading discipline journals. At present, the research activity of the group is excessively broad and lacks convincing cohesion. The current emphasis on omics methodology is vulnerable to the rapid pace of technology development, especially in view of the attempt to support multiple omics platforms, and is unlikely to achieve cutting edge visibility in each of these areas. There are several research threads that put the group in a potentially world-leading area, specifically the analysis of volatile breath metabolites, obesity and adipocyte stress and genetic epidemiology, but to improve, the group should review their strategic direction and develop a clear focus that exploits their research strengths.

The bibliometric analysis shows that the group has been performing well. Importantly, 3% of papers were published in the top 1% of outputs in this research field with 23% in the top 10%. The average of about 80 papers per year (~15 per FTE per year) and the RI of 1.77 across the period 2008-13 supports this analysis.

Relevance to society
Contributions to teaching are significant (~50% FTE) and are delivered at all levels. Much of the work, including the significant strengths of the group, have direct relevance to society. The focus on personalised healthcare has the potential to increasingly contribute to society relevance, provided the work is effectively translated. For example, work on the breath analysis has potential for clinical applications. Members of the group contribute to key health associated committees in both the Netherlands and the EU.

Viability
The transfer of the toxicogenomics group from RL4 had high impact in terms of loss of staff and funding. Staffing and funding levels have now stabilised, but going forward it will be important to shape a very focussed strategic vision to move the RL to a sustainable critical mass. The RL members' increased teaching contribution to improve financial stability is not sustainable in the medium-long term, because of the adverse impact on research excellence.

Recommendations
For growth and long term viability, we recommend that the RL4 strategy should be reviewed to ensure that the research strands are coherent, mutually supportive and most importantly contribute to a focussed research strategy.

7 Annex 1 Criteria and scores of national protocol SEP

Criterion 1: Research quality
The committee assesses the quality of the chair group's research and the contribution that research makes to the body of scientific knowledge. The committee also assesses the scale of the chair group's research results (scientific publications, instruments and infrastructure developed by the group, and other contributions to science). The following elements are to be considered in assessing this criterion:

- scientific quality
- productivity to the scientific community (in relation to the volume of the tenured scientific staff)
- the academic reputation of the group
- the strategy to provide the output at the highest relevant level possible

Criterion 2: Relevance to society
The committee assesses the quality, scale and relevance of contributions targeting specific economic, social, or cultural target groups, of advisory reports for policy, of contributions to public debates, and so on. The point is to assess contributions in areas that the chair group has itself designated as target areas. The following elements are to be considered in assessing this criterion:

- a narrative in which the group demonstrates its relevance for society
- research products for societal target groups such as
  - professional publications and outreach to the general public
  - other research output to society
- use of research products by societal groups such as
  - patents, licences, training courses
  - projects in cooperation with societal partners (European Union, Top-sectors, international funds)
  - contract research (including consultancies), also co-publications and use of facilities
  - present jobs of alumni
- demonstrable marks of recognition by societal groups such as demonstrated by
  - advisory reports for the government
  - media exposure as presentations on radio / TV, invited opinion articles etc.
  - membership societal advisory boards

Criterion 3: Viability
The committee assesses the strategy that the chair group 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. It also considers the governance and leadership skills of the chair group's management. The following elements are to be considered in assessing this criterion:

- leadership of the chair
- (scientific) visibility and recognition
- research vision and strength of the research lines
- innovative strength
- strategic choices and decisions
- composition of the group (expertise, people)
- acquisition capacity

The meaning of the scores for the three main assessment criteria:

Score	Meaning	Research quality	Relevance to society	Viability
1	Excellent / world leading	One of the few most influential research groups in the world in its particular field	An outstanding contribution to society	Excellently equipped for the future
2	Very good	Very good, internationally recognized research	A very good contribution to society	Very well equipped for the future
3	Good	Good research	Makes a good contribution to society	Makes responsible strategic decisions and is therefore well equipped for the future
4	Unsatisfactory	Does not achieve satisfactory results in its field	Does not make a satisfactory contribution to society	Not adequately equipped for the future

8 Annex 2 Programme Site visit VLAG Peer Review June 15 – 18

8.1 Monday, 15th June

Time				
10.30	**Welcome** by *Prof. Arthur Mol*, Rector Wageningen University			
10:45	**Introduction to Graduate School VLAG** by *Prof. Remko Boom*, Scientific Director of VLAG			
11:15	**External Peer Review - Terms of Reference** by *Wil Meulepas* (Corporate ER&I, Wageningen UR)			
11:30	**Bibliometric Analysis** by *Dr Ellen Fest* (Wageningen UR Library)			
11:45	**Starting on common ground** by *Prof. Dietrich Knorr (PRC Committee Chairman)*			
12:15	**Committee's working programme, Roles within sub-committees, Pre-scores & final scores, Reporting (**Internal meeting Review Committee)			
12.30	LUNCH			
Time	*Parallel sessions - Wageningen*			
13.15	WU Site visit I: **Bioprocess Engineering** Sub-committee: *Prof. Fernández* *Prof. Meyer* *Prof. Reuss* *Prof. Knorr **	WU Site visit II: **Nutrition & Health** Sub-committee: *Prof. Bellisle* *Prof. Mathers* *Prof. Wareham*	WU Site visit III: **Food Microbiology** Sub-committee: *Prof. Van Camp* *Prof. Dejmek* *Prof. Fitzgerald*	WU Site visit IV: **Organic Chemistry** Sub-committee: *Prof. Gooderham* *Prof. Jiang* *Prof. Spencer*
14.30	WU Site visit V: **Biobased Chemistry & Technology** Sub-committee: *Prof. Fernández* *Prof. Meyer* *Prof. Spencer* *Prof. Jiang*	WU Site visit VI: **Nutrition & Epidemiology** Sub-committee: *Prof. Bellisle* *Prof. Mathers* *Prof. Wareham*	WU Site visit VII: **Microbiology** Sub-committee: *Prof. Fitzgerald* *Prof. Reuss* *Prof. Gooderham*	WU Site visit VIII: **Food Quality & Design** Sub-committee: *Prof. Van Camp* *Prof. Dejmek* *Prof. Knorr **
15.45	***Discussion of findings / Working out the reports***		TRIP TO MAASTRICHT - NUTRIM Review Committee: *Prof. Bellisle, Prof. Gooderham,* *Prof. Mathers, Prof. Wareham* *Dr Roelinka Broekhuizen (secr.)* Graduate School VLAG: *Dr Fre Pepping*	
18.00	Informal Dinner at Hotel restaurant		**NUTRIM General Introduction** **Dinner**	
19.30	Hotel: Discussion of findings / Working out the reports			

8.2 Tuesday, 16th June

<table>
<tr><td>Time</td><td colspan="2">Parallel sessions - Wageningen</td><td>Site visit Maastricht</td></tr>
<tr><td>08.45</td><td>WU Site visit IX:
Physics & Physical Chemistry of Foods

Sub-committee:
Prof. Petr Dejmek
Prof. Dietrich Knorr*
Prof. Anne Meyer
Prof. Shaoyi Jiang</td><td>WU Site visit X:
Systems & Synthetic Biology

Sub-committee:
Prof. F. G. Acién Fernández
Prof. Gerald F. Fitzgerald
Prof. Matthias Reuss</td><td rowspan="3">Site visit: NUTRIM – Research Line 1

Site visit: NUTRIM – Research Line 2

Site visit: NUTRIM – Research Line 3

Review Committee:

Prof. France Bellisle
Prof. Nigel Gooderham
Prof. John Mathers
Prof. Nick Wareham

Secretary:
Dr Roelinka Broekhuizen</td></tr>
<tr><td>10.00</td><td>WU Site visit XI:
Physical Chemistry & Soft Matter

Sub-committee:
Prof. Petr Dejmek
Prof. Shaoyi Jiang
Prof. Nicholas Spencer
Prof. John van Camp</td><td>Discussion of findings / Working out the reports</td></tr>
<tr><td>11.15</td><td>WU Site visit XII:
Food Chemistry

Sub-committee:
Prof. John van Camp
Prof. Petr Dejmek
Prof. Anne Meyer
Prof. Gerald F. Fitzgerald</td><td>Discussion of findings / Working out the reports</td></tr>
<tr><td>12.30</td><td colspan="2">LUNCH</td><td>LUNCH in Maastricht / Meeting NUTRIM PhD council</td></tr>
<tr><td>13.30</td><td colspan="2">Meeting with VLAG PhD council (9 Review Committee members)</td><td>Site visit: NUTRIM – Research Line 4</td></tr>
<tr><td>15:00</td><td colspan="2">Discussion of findings / Working out the reports</td><td>TRIP TO WAGENINGEN - Departure at 15.15</td></tr>
<tr><td>17.15</td><td colspan="2">Wageningen: Transport to hotel</td><td>17.30 Arrival at the hotel in Wageningen</td></tr>
<tr><td>18.00</td><td colspan="3">Plenary half-time debriefing (all Review Committee members)</td></tr>
<tr><td>18.30</td><td colspan="3">DINNER at Restaurant Belmonte - Hotel ‘de Wageningsche Berg’</td></tr>
</table>

8.3 Wednesday, 17th June

Time	*Parallel sessions*	*Parallel sessions*	*Parallel sessions*
08.45	Site visit XIII: **Nutrition, Metabolism & Genomics** Sub-committee: *Prof. Nigel Gooderham* *Prof. John Mathers* *Prof. Nick Wareham*	Site visit XIV: **Food Process Engineering** Sub-committee: *Prof. Petr Dejmek* *Prof. Dietrich Knorr ** *Prof. Anne Meyer* *Prof. Shaoyi Jiang*	**Discussion of findings / Working out the reports**
10.00	Site visit XV: **Nutrition & Pharmacology** Sub-committee: *Prof. France Bellisle* *Prof. John Mathers* *Prof. Nick Wareham*	Site visit XVI: **Toxicology** Sub-committee: *Prof. John van Camp* *Prof. Nigel Gooderham* *Prof. Anne Meyer* *Prof. Matthias Reuss*	**Discussion of findings / Working out the reports**
11.15	Site visit XVII: **Sensory Sci. & Eating Behaviour** Sub-committee: *Prof. France Bellisle* *Prof. John Mathers* *Prof. Nick Wareham*	Site visit XVIII **BioNano Technology** Sub-committee: *Prof. Nigel Gooderham* *Prof. Shaoyi Jiang* *Prof. Nicholas Spencer* *Prof. Dietrich Knorr **	**Discussion of findings / Working out the reports**
12.30	LUNCH		
13.30	**Graduate School VLAG – Review**		
16.00	**Meeting with the representatives of the research institutes participating in VLAG: FBR, NIZO, RIKILT, RIVM, TNO**		
Evening	Informal dinner		

8.4 Thursday, 18th June

Time	**Full Committee**
09.00	**Finalising reports**
11.30	**Consultation meeting** with the representatives of the VLAG Management Team and VLAG International Advisory Board Prof. Raoul Bino (director of AFSG), Prof. Johan van Arendonk (Dean of Sciences
12.30	LUNCH
13.30 - 15.00	**Presentation of the preliminary findings and advice by the Peer Review Committee** Debriefing to representatives of VLAG research groups (WU), VLAG International Advisory Board Prof. Raoul Bino (director of AFSG), Prof. Johan van Arendonk (Dean of Sciences, WU)
	Finalising reports

9 Annex 3 Bio-sketches of the Committee members

Prof. Dr D. (Dietrich) Knorr
Technische Universität Berlin, Germany

Dietrich is Professor Emeritus of Technische Universität Berlin.
He received an engineering degree and a PhD in Food and Fermentation Technology from the University of Agriculture in Vienna. He was research associate at the Department of Food Technology in Vienna, Austria, and visiting scientist at the Western Regional Research Centre of the US Department of Agriculture, Berkeley, USA; the Department of Food Science Cornell University, Ithaca, USA; and of Reading University, Reading, UK. From 1978 until 1987, he was Associate Professor, Full Professor and Acting Chair at the Department of Food Science at the University of Delaware, Newark, USA, where he kept a position as Research Professor. From 1987 to 2012 Professor Knorr was Full Professor and Department Head at the Department of Food Biotechnology and Food Process Engineering, Technische Universität Berlin, Germany. He also holds an Adjunct Professorship at Cornell University.
In August 2014 Dietrich was elected as President Elect of the International Union of Food Science and Technology. He is President of the European Federation of Food Science and Technology, member of the Governing Council, International Union of Food Science and Technology and Member of the International Academy of Food Science and Technology.

Prof. Dr N. (Nicolas) D. Spencer
ETH, Zürich

Nicholas is professor for Surface Science and Technology at the ETH Zürich.
He studied at the University of Cambridge, where he obtained a Bachelor's degree in Chemistry and earned his Ph.D. in the area of Surface Chemistry in 1980. Following this he worked as a postdoctoral fellow at the University of California, Berkeley. From 1982 to 1993 he was employed at the Research Division of W. R. Grace and Co. in Columbia, Maryland, working in the areas of catalyst research, high-temperature superconductors. Since August 1993 he has been Professor for Surface Science and Technology at the ETHZ, and from 1996 to 1998 and 2002 to 2006 he served as Chair and Head of the Department of Materials. He is currently the President of the ETH Zurich Research Commission. Besides he is founding co-editor-in-chief of the journal Tribology Letters, a Fellow of the Royal Society of Chemistry, and a Member of the Swiss Academy of Engineering Sciences.
The principal areas of his research are surface functionalization and characterization, with a particular emphasis on their application in tribology and implant materials. Over the last few years, he has been working intensively in the area of surface-chemical and surface-morphology gradients, polymer brushes, new lubricant additives, and ionic liquids.

Prof. Dr G. (Gerald) Fitzgerald
University of Cork, UK

Gerald is Professor of Food Microbiology and Head of the School of Microbiology at University College Cork. Besides he is Deputy Director of the Alimentary Pharmabiotic Centre.
Having graduated as Ph.D. in Microbiology he conducted his research spanning fundamental and applied aspects of the industrially important Lactic Acid Bacteria used in the production of fermented foods and probiotics. He has published approximately 250 peer reviewed papers, is co-inventor on eight patents and has directed or co-directed over 60 PhD theses.
He served as Interim Director of the industry-led Food for Health Ireland (FHI) research centre from its foundation until August 2009. Currently he also holds a position as Deputy Director of the Alimentary Pharmabiotic Centre (APC) since its foundation in 2003. This SFI-funded centre (with industry partners also contributing) is focused on understanding the role of intestinal microbiota in human health and disease and it includes approximately 160 research scientists.
He was awarded a DSc by the National University of Ireland in 2006 for his published work. Recently he was recently selected for a Leadership Award under the University Staff recognition Awards Programme 2012. He has been working extensively with the Food Industry throughout his career.

Dr F. (France) Bellisle
Institut National de la Recherche Agronomique (INRA), Paris, France

France is Research Director at the Institut National de la Recherche Agronomique (INRA).
Having obtained her Bachelor and Master Degree in experimental psychology, she worked at the College de France in Paris where she obtained both a Doctorate Degree (1980) and a State Doctorate Degree (1984) from the University of Paris. From 1982 until 2010, she worked in French National Research Institutes (CNRS, INRA). She developed original research in the field of human ingestive behaviours. Her research interests covered all types of determinants of food and fluid intake in human consumers, including psychological, sensory and metabolic factors as well as environmental influences. She has published over 200 articles (original data and reviews) in international peer-reviewed journals and contributed to several books. She was a deputy editor of the British Journal of Nutrition for six years and participates in editorial boards of many French and international scientific journals. Since retiring from the INRA in 2010, she continues her scientific activities (research and student monitoring) with the Nutritional Epidemiology unit of the University of Paris 13.

Prof. Dr F. (Francisco) Gabriel Acién Fernández
University of Almería, Spain

Francisco Gabriel is Professor Chemical Engineering at the University of Almería.
After having obtained his Ph.D. at the University of Almería in 1996, He became Assistant Professor at the Department of Chemical Engineering of the University of Almería up to 2012 and Full Professor at the same department from 2012 onwards. Het contributed as professor in various Master studies at the Universities of Seville, Malaga, and the International University of Andalucía. He has published ten books related on teaching activities in addition to research in teaching.
Research lines include the treatment of waste biomass and the biotechnology of microalgae. On this last field he has participated in 10 European projects in addition to 30 national projects and contracts with companies. He published over 90 peer reviewed papers in international journals and 12 book chapters, and in addition developed 8 patents extended at international level. He is member of International Society for Applied Phycology and Latino American Society for Algal and Environmental Biotechnology, and editor of Algal Research and RELABIAA journals. He also collaborates with international projects as DeserBioenergy in Chile (Budget 8 M€) and CONACYT in Mexico (Budget 3 M€) aimed to develop processes for the production of biofuels from microalgae in especial locations.

Prof. Dr M. (Matthias) Reuss
University of Stuttgart, Germany

Matthias is Emeritus Professor of Biochemical Engineering at the University of Stuttgart. After having obtained Ph.D. (Dr.-Ing.) in Chemical Engineering from the Technical University of Berlin in 1970 he was Research Assistant in the Department of Biotechnology at the GBF Braunschweig until 1976. In 1977 he became Professor of Biochemical Engineering at the Technical University of Berlin. From 1988 until his retirement in 2009 he was Professor of Biochemical Engineering and Director of the Institute of Biochemical Engineering at University Stuttgart. Besides he was Director of the Centre Systems Biology at University Stuttgart form 2006 to 2013 and NGI Distinguished Visiting Scientist from 2010 to 2013 at the Kluyver Centre Delft and NICSB Amsterdam. His research interests include the fields of systems biology, metabolic engineering, synthetic biology, 4D-spatial distribution of signal transduction processes, bioreactor modeling, enzyme technology, and drug metabolism in hepatocytes.
He was Fellow of the International Institute of Biotechnology, received the Research award of the State of Baden-Wuerttemberg in 1992 and became Doctor *honoris causa* at the TU Delft in The Netherlands in 2006.

Prof. Dr A. (Anne) S. Meyer
Technical University of Denmark

Anne is Professor at the Department of Chemical and Biochemical Engineering (DTU Chemical Engineering).

Her research interests span a variety of food related subjects as enzyme technology in food and biorefinery processes, prebiotic carbohydrates, dietary fibers, enzyme engineering, functional food ingredients and biorefinery products. She has managed several large projects with Industry and was Co-Leader in FOOD-Denmark PhD School from 2005 to 2008.
She has published a wide variety of peer reviewed articles (h index 40) and holds 4 patent applications. She is member of three editorial Boards: J. Agric. Food Chem. (ACS), New Biotechnology (EBF); Biocat. & Agricult. Biotechnology.
She also has supervised and guided several PhD students to a successful graduation.

Prof. Dr S. (Shaoyi) Jiang
University of Washington, Seattle USA

Shaoyi is Boeing-Roundhill Professor of Chemical Engineering and Adjunct Professor of Bioengineering at the University of Washington.
He received his Ph.D. degree in chemical engineering from Cornell University in 1993. Subsequently followed his research career as a postdoctoral fellow at the University of California, Berkeley until 1994 and as a Research Fellow at Caltech until 1996, both in chemistry, until he acquired a position at the University of Washington, Seattle.
He is a senior editor for Langmuir, a fellow of American Institute of Chemical Engineers (AIChE), a fellow of the American Institute for Medical and Biological Engineering (AIMBE) and a member of the Washington State Academy of Sciences. His research focuses on biomolecular interfaces, biomaterials, and biosensors, particularly molecular understanding, design and development of zwitterionic-based functional materials for biomedical and engineering applications.

Prof. Dr N. (Nigel) J. Gooderham
Imperial college of London, UK

Nigel is Professor of Molecular Toxicology at Imperial College London.
His current research interests include mechanisms of chemical carcinogenesis and toxicity, the role of MiRNAs in chemical carcinogenesis and toxicity and the genetic toxicity of food-derived chemicals and oligonucleotides. He has been actively involved in toxicology education at Imperial College London and externally, contributing primarily to postgraduate programmes. He has served on the UK Government's Advisory Committee on Mutagenicity, is a member of the MRC ITTP Steering Committee and funding panel and previously the NC3Rs Research Funding Assessment Panel. He is a member of the UK's MHRA Panel of Assessors, is the Editor in Chief of Toxicology Research and has served on the Editorial Boards of Mutagenesis, Toxicology, the Journal of Applied Toxicology and the Cancer Handbook. Nigel is a Fellow of the Royal Society of Chemistry and the British Toxicology Society and a member of the Society of Toxicology, the Biochemical Society, and the United Kingdom Environmental Mutagenicity Society. He has held numerous offices within the British Toxicology Society (BTS) including Chairman of the BTS Scientific Committee and is currently a member of the BTS executive. He also holds the posts of Visiting Professor at the University of Malaysia, Terangganu, Malaysia and the Kwame Nkrumah University of Science and Technology, Kumasi, Ghana.

Prof. Dr J. (John) Van Camp
Ghent University, Belgium

John is bio-engineer and nutritionist at the department of Food safety and Food Quality of the Faculty of Bio-Science Engineering, Ghent University, where he is associated to the research group "Food Chemistry and Human Nutrition (nutriFOODchem)".
He is responsible for education, research and services concerning nutritional value of foods and food products, and the relationship between nutrition and health of humans. His research activities are related to bio-active proteins and peptides, micronutrients (vitamins, phenolics, trace elements) and nutrition epidemiology. He coordinates a research team of 2 post-docs and 10 PhD students. He is author/co-author of 15 book chapters and 145 articles in international journals with referee system (A1). He is a member of the High Health Council in Belgium, member of the advisory commission "Food Science and Nutrition" of IFS (International Foundation for Science), member of the board and treasurer of the Belgian Nutrition Society (BNS), and one of the editors for the journal "Food

Chemistry". Since October 2011, he is the chair of the educational committee of the Dutch Ba and Ma programs "Bio-Science Engineering" at the Faculty of Bio-Science Engineering, University of Ghent.

Prof. Dr J. (John) Mathers
Newcastle University, UK

John is Professor of Human Nutrition and Director of the Human Nutrition Research Centre in the Institute of Cellular Medicine in Newcastle University, UK.
He undertook academic training in the Universities of Newcastle, Cambridge and Edinburgh. His major research interests are in understanding the role of diet in the aetiology and prevention of common complex diseases and in the modulation of ageing. His work includes studies from the molecular and cellular levels to large-scale human intervention trials. He directs the LiveWell Programme which is developing and piloting pragmatic behavioural interventions to facilitate healthy ageing. This research is also informing the development of lifestyle-based interventions to promote healthy musculoskeletal ageing through the Centre for Integrated Research on Musculoskeletal Ageing (CIMA). His current research includes the EU-funded Food4Me project in which he is leading a Proof of Principle study of the effectiveness of personalised nutrition approaches for effecting change in eating patterns.
John is a past President of the Nutrition Society and serves on several national committees including the BBSRC's Bioscience for Health Strategy Panel and the Food Standards Agency's Advisory Committee on Novel Foods and Processes.

Prof. Dr P. (Petr) Dejmek
Lund University, Sweden

Petr is Professor Emeritus at the Department of Food Technology, Lund University.
He graduated as process engineer from the Technical University in Aachen Germany and earned his PhD in food engineering at the Lund University. After having been stationed as researcher for ten years with Alfa Laval companies in Sweden and Denmark, he returned to Lund University to eventually holding a research chair as Professor of Dairy Technology, Full Professor of Food Engineering and Head of the Department. As a visiting professor he worked at Tokyo University, ENSIA Massy, Japanese National Food Research Institute, University of Wisconsin and University of California Davis. He was one of the editors of the International Dairy Journal for 10 years. He is the author of over 100 publications on varying topics of food technology and engineering and the founder of two spin-off companies.

Prof. Dr N. (Nick) Wareham
University of Cambridge, UK

Nick is the Director of the MRC Epidemiology Unit, Co-Director of the Institute of Metabolic Science, Honorary Consultant at Addenbrooke's Hospital and Professor of Epidemiology at the University of Cambridge, England. He studied Medicine at St Thomas' Hospital Medical School and Epidemiology at both the London School of Hygiene and Tropical Medicine and Cambridge University, England. After research fellowships at Harvard and Cambridge University, he took up the Directorship of the MRC Epidemiology Unit when it was founded in 2003. His principal research interests are in understanding the aetiology of type 2 diabetes and in developing strategies for prevention and early detection. These preventive approaches include individual and societal level interventions and he is the Director of the UKCRC Centre for Diet and Activity Research (CEDAR).

Drs. F. (Frans) van den Akker (secretary WU)

Dr R. (Roelinka) Broekhuizen (secretary UM)