RESEARCH REVIEW

VAN 'T HOFF INSTITUTE FOR MOLECULAR SCIENCES

2017-2022

UNIVERSITY OF AMSTERDAM

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Preface

The Van 't Hoff Institute for Molecular Sciences (HIMS) is a research institute at the Faculty of Science of the University of Amsterdam. HIMS is a chemistry institute focused on four research themes: Analytical Chemistry, Computational Chemistry, Molecular Photonics, and Synthesis & Catalysis. During the site visit, the peer review committee had intensive discussions with the HIMS management team, and representatives of all four research themes. In addition, meetings with representative of the PhD community, mid-career personnel, the technical and administrative staff and the DEI team were organized. All meetings took place in a very open, constructive atmosphere in which the short and long-term ambitions of the institute but also concerns of the employees were discussed. HIMS has built a great community, people feel generally happy, well supported. This is an excellent basis to achieve the mission of HIMS to be recognized as international top institute in Chemistry. The peer review committee has identified several key areas which need continuous attention to achieve this goal, mainly clear strategic choices on selected research topics such as AI in Sustainable Chemistry, stronger focus on gender balance and diversity and a clear long-term policy on the maintenance and renewal of the key research infrastructure.

Hubertus Irth, chair of the committee

1. Introduction

1.1 Aim of the assessment

All publicly funded university research in the Netherlands is evaluated at regular intervals in compliance with a national strategy evaluation protocol (SEP 2021-2027), as agreed by the Universities of the Netherlands (UNL), the Netherlands Organization 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 an external peer review conducted every six years.

The committee is requested to assess the quality of research conducted by the Van 't Hoff Institute for Molecular Sciences (HIMS) and its four research themes:

- Analytical Chemistry
- Computational Chemistry
- Molecular Photonics
- Synthesis & Catalysis

as well as to offer recommendations to improve the quality of research and the strategy of HIMS.

This report describes the findings, conclusions, and recommendations of this external assessment of the research of HIMS.

1.2 The committee

The Board of the UvA appointed the following members of the committee:

- Prof. dr. Hubertus Irth, Universiteit Leiden, Leiden Academic Centre for Drug Research (chair)
- Prof. dr. Christophe Coperet, ETH Zürich, Department of Chemistry and Applied Biosciences
- Prof. dr. Joanna Wencel-Delord, University of Würzburg, Germany
- Prof. dr. Johan Hofkens, KU Leuven, Department of Chemistry
- Prof. dr. Jennifer van Eyk, Cedars-Sinai Medical Center, Los Angeles
- Prof. dr. Mark Tuckerman, New York University, Department of Chemistry
- Jacqueline Vaessen, Chair Topsector Chemie
- Dian Schrauwen, PhD candidate Radboud Universiteit, Institute for Molecules and Materials

The university board appointed Annemarie Venemans of De Onderzoekerij as the committee secretary. All committee members signed a declaration form stating no conflict of interest and ensuring impartiality and confidentiality.

1.3 Procedures followed by the committee

Before the site visit, the committee reviewed detailed documentation comprising the self-assessment report of the institute including appendices.

The committee proceeded according to the Strategy Evaluation Protocol (SEP) 2021-2027. The assessment was based on the documentation provided by HIMS and the interviews with their management, selections of senior and junior researchers, and PhD candidate representatives. The interviews took place on November 13 and 14, 2023 (see Appendix A).

The committee discussed its assessment at its final session during the site visit. The committee chair had a coordinating role in the writing procedure and delegated the writing of sections to members of the committee. The committee members commented by email on the draft report. The draft version was then presented to the institute for factual corrections and comments. Subsequently, the text was finalized and presented to the Board of the university.

2. Assessment of the research of HIMS

2.1 Management, organization and strategy

Research organization

Van 't Hoff Institute for Molecular Sciences (HIMS) is one of the eight research institutes affiliated with the Faculty of Science (FNWI). The research of HIMS is organized in four disciplinary themes (Analytical Sciences, Computational Sciences, Molecular Photonics and Synthesis & Catalysis). The management of the institute is governed by the Management Team (MT) consisting of four senior staff members representing the four research themes and one member of the younger and female staff. One of the four senior staff members is the director, who chairs the MT and is accountable to the dean of FNWI. The committee has the impression that this organizational structure works in a rather harmonious way. The MT works as a collegial management team with a proper representation of the interests of the four themes. Decisions are taken by collegial discussion and finding a common agreement, rather than (anonymous) voting.

The committee understands the choice to divide the institute in manageable research themes. It wants to note that the term 'theme' for these subunits is somewhat confusing since these themes operate essentially like a classic substructure in a strong departmental organization. The research themes are currently more siloed than synergistic, and groups within each theme operate as independent groups, as typically happens in a department. It is important for the HIMS management team to decide if functioning like a department is the goal or if they envision a closer connection between the themes would redound to the benefit of the Institute.

Currently, there is a risk of less horizontal communication and strategic collaborations with other themes. The committee noted that collaboration between themes seems to be initiated mainly via bottom-up approaches, e.g., direct contacts between PhD candidates, postdocs or assistant professors. This is, of course, a very positive development and the basis for all strategic collaborations. The committee, however, is of the opinion that a more explicit vision, focus, and strategy on an Institute level are required, and choices about interdisciplinary research need to be made (see also paragraph 2.4). The implementation of a strong strategic vision will require a substantial change in management philosophy. More clear vision of the strategy of HIMS should also help organizing issues concerning equipment, maintenance and renewal.

Mission and strategy

The objective of HIMS is to generate and share knowledge needed to address existing and future scientific and societal challenges, with emphasis on molecular chemistry. The knowledge and expertise of HIMS is expanded and utilized by engaging in collaborative research efforts of importance for society and industry. HIMS has identified Chemistry of Complex Systems and Materials, Chemistry for Sustainability and Chemistry of Biomolecular Systems as strategic research areas. These research areas are chosen in such a way that essentially every HIMS scientist should feel a strong connection to at least one of these areas.

The committee is of the opinion that the implementation of these research areas needs a significant improvement if HIMS wants to establish itself as a global leader in academic Chemistry.The committee feels that HIMS is especially competitive in *Chemistry for Sustainability* with an ambition to become a

leader particularly when combined with Computational Sciences/Artificial Intelligence (see also paragraph 2.4). The other two research areas are most certainly of high quality but in the committee's opinion lack the overall critical mass of the Sustainability area. Yet both *Chemistry of Complex Systems* and *Chemistry of Biomolecular Systems* are vital to the overall programme. The committee believes that the HIMS MT should proactively undertake the responsibility of making decisive and strategic choices in consultation with the HIMS staff. These choices involve determining whether uniform support should be allocated to all research areas or if a particular domain is to be designated as the distinctive focal point for HIMS. The committee is of the opinion that this is the key mandate of the MT to go forward and make active decisions.

Financing

Based on numbers listed in the self-evaluation report the committee noted that HIMS is funded for about 40% by the university and 60% by grants and contracts. In the period 2017-2022 the total funding was stable with minor fluctuations, that is, the direct funding increased slightly, research grants decreased somewhat, and contract research became more important. Acquiring 60% of the total funding from external sources is an excellent achievement. Many of the external grant programmes are based on public-private partnerships, which the committee considers a very positive development. In general, the committee believes that the different funding streams are well-balanced. There is no strong dependence on a single source of external income, a very positive situation which most likely creates a very beneficial long-term stability for HIMS.

All representatives of the research themes expressed their worries regarding the long-term funding of critical research and teaching infrastructure. Funding of large-scale instruments via NWO is highly competitive and will most likely not be the sole solution of this problem. The committee recommends that the HIMS Management together with Innovation Exchange Amsterdam (IXA) actively investigates other grant acquisition opportunities that allow the inclusion of instrument funding. Collaborative efforts between different themes should help in determining and applying for special grants dedicated to the large instruments. Many infrastructure-based grants require significant matching from the applicant. The committee understood from the HIMS management that they investigate the possibility to establish a research fund for instrument investments based on the financial reserves of the institute/faculty. Using at least part of this funds for matching purposes might leverage the impact of such as research fund significantly.

HIMS is in the lead of the Research Priority Area (RPA) Sustainable Chemistry of the University of Amsterdam. The funds associated with this RPA are structural which clearly helps the long-term funding of HIMS. Regarding external funding, the participation in public private partnerships (PPPs) will remain crucial. The committee believes that all four research themes are well equipped to participate in PPPs. It is also worthwhile to mention that many PPP programmes have a very low threshold especially for junior scientific staff to participate and thereby establish an important track record for their future career.

2.2 Research quality

There is unequivocal evidence of the very high quality of research conducted at HIMS. This is demonstrated by the significant number of publications in esteemed journals, substantial grant income,

accolades received by individual staff members, and the citation data provided in the self-evaluation report.

The suggested quality assessment aspects skew toward considering both quality and impact although the committee is aware that it is possible to publish a high-quality paper in an area that does not have a large audience. Given this, one needs to look at metrics like impact factors and average number of citations per paper, both of which are reported. It is noteworthy that the final weighted citation impact is 1.5 times the world average, and the raw average citations per paper is around 20. In future reports, it would be more useful to see the citation distribution, perhaps even broken down by research area to evaluate where improvements are needed.

The academic stature of HIMS researchers is further demonstrated by awarded grants, awards, prizes, and honorary appointments. The relatively large percentage of the external income to the HIMS budget is a strong indirect indicator of the overall quality of HIMS. Individual and network-grants are immensely competitive and often reflect the quality and track record of the participating researcher. It seems that at HIMS there is currently a bias towards network grants whereas the number of individual grants is somewhat stagnating. The committee has not performed an in-depth analysis on this topic. The competitiveness in the application for individual grants, both in The Netherlands and Europe, is extremely high. Researchers understandably follow the funding opportunities that might have the highest chance of success. HIMS does not have a specific policy to favour individual grants above network grants, we therefore do not see a big issue in this area.

2.3 Societal relevance

HIMS aims to educate and groom excellent young researchers performing PhD research at the institute. HIMS staff also passionately contributes to the education of bachelor and master students within, as well as, outside the chemistry domain. Together with the VU Amsterdam, HIMS maintains a broad BSc program in chemistry, and specialized MSc tracks in Molecular Sciences, and Analytical Sciences. The most important contribution of HIMS to society is therefore delivering highly competent and responsible young scientists, who will help science and society prosper.

The institute has a large number of industry contracts and eight part-time full professors from industry, university, national research organizations and charity. Moreover, it participates actively in initiatives from the Ministry of Economic affairs to strengthen the innovation potential and competitive position of Dutch industry, specifically Technological Top Institutes and Topconsortia for Knowledge and Innovation.

There are many areas to illustrate societal impact. A key area for HIMS in the committee's opinion is the initiation spin-off companies. HIMS has a strong profile in fundamental research leading to innovations that can be further developed by external partners but especially by start-up companies involving senior and especially junior researchers. Examples of successful spinouts are InCatT, Plantics, Susphos, Sparks904, and Open Kitchen Labs. During the site visit the committee got a presentation on a new spin out SanGui and the molecular heaters will be spun out soon.

Establishing a spin-off company appears to be an extremely time-consuming task. The committee commends the demonstrator lab, where researchers can receive advice and support on all aspects of the idea-to-market process. Additionally, IXA aids in developing a valorization strategy. The committee appreciates the fact that a number of these spin-off companies are created by female assistant professors. The committee recommends that HIMS also support researchers within the institute in setting up a spin-off company, for instance, by sharing best practices and mentorship. The committee

recommends including valorization/spin-out activities as important element in the assessment of internal promotions.

HIMS only applies for patents in case their actual usage by either own staff or third parties is expected. Currently HIMS has 4 approved patents available for licensing based on their research. The committee understood that it is the aim is to file one patent per year for the coming six years. As the last patent was filed in 2016 that seems to be an ambitious goal. There seems to be limited centralized support for patent applications, with the financial burden of application and maintenance relying on external funding. The committee recommends that HIMS should take a more active role in this with central financial support for patents to ensure long-term viability and impact.

The committee appreciates the impact HIMS has in areas such as art and forensic sciences. It considers these examples as excellent showcases how a fundamental discipline like Chemistry can build strong links to societal topics with a very high visibility for the public. In this way, HIMS demonstrates that the societal impact is not limited to commercial/economic impact but also extends to areas such cultural heritage and law enforcement.

The committee was very pleased that the University of Amsterdam has actively addressed the topic of research collaborations with fossile industry companies. HIMS is represented in a committee that judges potential projects according to criteria established by the university. A key advice is that projects need to be focused on sustainability. The committee is convinced that in this way HIMS scientists get a very clear guidance in how to constructively engage with fossile industry companies.

Furthermore, HIMS is actively engaged in outreach activities such as promoting events at primary and secondary schools, lectures and media coverage. Together with Amsterdam Chemistry Network HIMS organizes ACID (Amsterdam Chemistry Innovation Day) the annual event that informs on the most recent chemical innovations and future trends in the field.

2.4 Viability

During the site visit, the committee engaged in discussions on the strategy of the institute to address its weaknesses and possible threats, and to optimally make use of their considerable strengths and opportunities. The issues most prominently impacting the institute's viability and the institute's strategy are discussed below. In general, the committee believes that the viability of HIMS is outstanding. The committee's main concern is that HIMS should have the ambition to become one of the international academic leaders in the field of Sustainable Chemistry, particularly in combination with AI.

Cross-theme strategy

The committee indeed noted that the research themes are impactful areas on their own but believes that HIMS can strongly benefit by creating one or two overarching research areas that fully integrate the potential of the individual themes.

In the committee's opinion, HIMS has the potential to become a world-leading institute in AI-based Sustainable Chemistry. While all other themes will benefit from a strong interaction with AI in all its flavors, the biggest impact is in the committee's opinion to be expected in the interaction with the Sustainable Chemistry area. When it comes to topics such as accelerating materials discovery, optimizing chemical processes, designing safer chemicals or chemistry and health, HIMS has all the research elements in-house to be at the forefront of academic and industrial developments in this key area for society. Moreover, HIMS is embedded in a local knowledge ecosystem at Amsterdam Science Park and in Amsterdam in general that provides highly complementary knowledge to achieve this goal.

During the site visit, the committee came across many developments and initiatives that support the integration of knowledge areas that are essential for AI-based sustainable chemistry. Yet, the committee believes that the scientific world is only at the beginning of this transformational development. For HIMS to be in the lead rather than following the initiatives of others, the HIMS MT together with the PIs will need to make important decisions in this regard. As mentioned earlier, the MT should feel a strong mandate to make strategic choices that will not please every scientist in HIMS.

The committee recommends allocating a substantial financial budget to investments in the cross-theme research topic AI-based sustainable chemistry. This includes infrastructure investment but especially also new staff positions that are linked to the overarching topic rather than an individual themes. The committee understands that reallocation from the existing (primary) budget of HIMS for this purpose will require a structural consensus between the HIMS PIs. HIMS has already established strategy meetings where topics such as overarching themes are discussed with the entire scientific staff. The committee believes that a long-term strategic plan is required that formalizes the vision of the institute.

While the committee advocates for a robust emphasis on the cross-theme research topic of AI-based sustainable chemistry, it is important to emphasize that it does not intend to diminish the significance of the other research themes. Parts of Chemistry of Complex Systems and Materials such as catalysis can potentially be integrated into the AI-based sustainable chemistry area. Other topics such as Chemistry & Art or Chemistry & Forensic Sciences deserve continued attention. While not on the same scope as Sustainability, these topics are very important for the visibility of HIMS when it comes to societal impact. The topic Chemistry of Biomolecular Systems has essentially the same strategic potential as AI-based sustainable chemistry, but the committee feels that there is less critical mass available at HIMS to autonomously play a similar leading role. This area can probably best leverage in collaboration with colleagues at other FWNI institutes, VU Amsterdam or the different NWO and KNAW research institutes located at Amsterdam Science Park.

Infrastructure

In order to be successful, HIMS needs to have state-of-the-art instrumentation/facilities. As mentioned in the self-evaluation report, these facilities are theme-specific while overarching facilities are mainly centered around routines services in e.g. NMR. The self-evaluation report shows that the theme-specific facilities are vulnerable and not easy to fund from the budget of research projects. HIMS therefore supports the themes in updating their infrastructure by providing financial support for necessary repairs and upgrades. However, from the interviews, it became apparent that many instrumentation/facilities need replacement or must be upgraded.

The management indicated that funds could potentially be allocated from reserves, with a preference for facilities that are most frequently used. The committee views this investment in facilities positively but recommends that HIMS refrain from focusing solely on equipment that is most used. It is important to invest in equipment that aligns with the core strategy the institute intends to pursue. Also, collaboration between themes might help to get equipment funded. A plan for obtaining the needed upgrade should come with a longer-term collective plan for equipment renewal.

2.5 Working environment and personnel policies

Gender balance

The committee finds that the institute has a serious problem when it comes to gender diversity. Specifically, the institute lacks female professors, an omission that is very difficult to explain after many years of structural investments e.g, in the two sector plans in which HIMS participates. During the interview, the management team indicated that they are making significant efforts to address this issue, but hiring a female professor externally is nearly impossible. Therefore, they intend to focus on promoting internal staff members. A bottleneck in this regard is the interpretation of promotion rules within the faculty, which the management team considers to be open to multiple interpretations. The committee believes that there is no time to lose to resolve this topic. It considers the lack of senior female scientific staff as a strategic problem and inappropriate message towards the female students that must be fixed as soon as possible to prevent female staff from moving to other positions outside HIMS. As for PhD candidates, postdocs, and assistant professors the gender balance is good and has significantly improved over the past six years.

The committee recommends that the institute engage in a dialogue with the faculty regarding the interpretation of the rules for internal promotions, emphasizing the need for flexibility. Additionally, the committee advises against waiting for internal promotions and suggests actively searching externally for a female professor, because it is crucial that there will be an improvement in gender diversity in the short term. With the reputation of the institute, HIMS should be able to attract high-profile (international) senior researchers. The committee believes that more flexibility in the monetary and non-monetary compensation for high-profile researchers is necessary.

Sisters in Science is an excellent example of breaking the common stereotypes around chemists and scientists, by telling the public about chemistry in their daily lives. They received the NWO Diversity Initiative Award for their work.

Open science and research data management

The committee acknowledges the ambition of establishing the Open Science policy of HIMS. It confirms that HIMS is well aligned with internal and external policies concerning Open Science. The main worries are centred around the non-homogenous approach and data management policies that are in place, and particularly the practical implementation of electronic lab journals.

As stated in the self-evaluation report, HIMS is actively developing a research data management (RDM) plan in agreement with policy that is currently being formulated by the faculty and university. Currently, there is no uniform RDM plan in place. In the research themes, the committee found various forms of (temporary) RDM practices. The panel acknowledges these RDM practices positively and understands that different projects may require different forms of RDM. However, the committee advises HIMS to share best practices and to strive for greater uniformity in data management practices across the institute.

Academic culture

The self-evaluation report state that HIMS has an open atmosphere in which researchers, support staff, and students can work safely and be part of the research community. The interviews held by the committee with both young and more senior staff fully confirmed this picture. The committee perceived

HIMS as a strong community. As far as the committee could see there is also a lot of appreciation for the HIMS leadership, i.e., the management team and the scientific director.

HIMS members value the 'welcome pack' they receive upon starting. It contains a wealth of information about both the institute and the group where they will be working. The PhD council plays an important role in the onboarding of new PhD candidates.

The institute aims to have a diverse and inclusive organization that is an attractive place for diverse talent and promote a dynamic atmosphere throughout the institute. In 2020, HIMS established a Diversity Team, which is committed to a working environment where everyone is treated with dignity and respect. One of the main actions of the Diversity Team has been the distribution of a diversity survey, the results of which are currently being analysed. The committee was very impressed with the work of this team and encourages the management team to act on the results of the survey. The committee is of the opinion that the Diversity Team deserves an autonomous position within HIMS, allowing the team to actively promote the values of diversity, equity, and inclusion within HIMS. The Diversity Team should receive an adequate budget form the MT to be spend at their own discretion. The committee believes that the current grassroots-based Diversity Team is a major asset for HIMS to achieve its overall strategy.

Teaching load

The committee conducted discussions with the research themes regarding their teaching load. Most of the staff members indicated overall satisfaction with their teaching load, although it was difficult to accurately quantifying their precise load. In addition, the discussions revealed variations in teaching workload among the research themes, with the "Analytical Chemistry" theme appearing to have a higher teaching load than the other research themes.

The management explained that they track the teaching workload of each staff member through the DVM programme ("docentvergoedingenmodel") and strive for an equitable distribution of the workload (amongst both the permanent staff and the PhD candidates). The committee recommends that HIMS provide greater transparency to the staff members on this matter.

HR-policies

The faculty is working on guidelines for the implementation of the 'Recognition and Rewards' (R&R) plan as formulated by the university. However, according to the institute, there are currently limited financial means to support the R&R goals. The committee believes that this delay and corresponding lack of clarity may weaken staff morale. It advises HIMS not to adopt a passive stance but to actively engage in the implementation of the faculty's R&R plan. Establishment of clear guidelines e.g. for internal promotions could be a first step. While these guidelines are typically well established for research performance, the committee strongly believe that attention should also be given in the recognition of activities that are centred around teaching and impact. For every staff member it should be possible to excel in at least one of these areas, but not necessarily in all of them at the same time. Recognizing and rewarding teaching and impact talents is in the committee's opinion as important as rewarding research performance.

2.6 PhD programme

As stated in the self-evaluation report, HIMS aims to train their PhD candidates to become "independent scientific researchers with suitable skills for careers within science as well as outside the academic world". The discussion with the PhD candidates strongly revealed this independence, since the candidates themselves seemed to be the leaders and initiators of many collaborations between the themes and with their colleagues. An example is the HIMS Symposium that was initiated by the PhD candidates to improve the knowledge and awareness of the research topics of the different themes.

Starting PhD candidates were happy to receive a welcome package yet felt the need to convert the 40 pages information document in a new HIMS website. This idea originated from the PhD council and shows the high degree of self-organization and proactive behaviour of the PhD candidates at the institute. The PhD council even strives to organize onboarding events for new PhDs to improve on the welcome that is already in place.

Cohesion between the PhD candidates is promoted mainly by the joint general PhD courses that PhD candidates have to follow at the start of their project. These courses, focussed on managing their project and providing solutions or pointers for when supervision is not going well, were appreciated. For the more knowledge focused courses, the PhDs expressed that information on the possible (not obligatory) courses and summer/winter schools is not available to all PhDs. Often information is passed on from PhDs that previously did a Masters or Bachelor at the UvA or senior PhD candidates and an overview is lacking.

In addition, the PhDs are not aware of any guidelines on when a PhD project is completed. They mention the informal requirement of four publications, but because of the very different research done in the separate themes, this requirement is not necessarily realistic for all themes. PhDs on one hand appreciate the grey area of finishing requirements, because it gives some flexibility, yet on the other hand they would like to see some theme specific guidelines. In cases where supervisor and PhD do not agree on when a project is finished this will prevent unnecessary conflict or delay. In addition, PhD candidates will profit from the security of knowing where their project will go and when it is nearing completion.

The PhDs did express the concern that if these guidelines will be solely based on the number of publications successful graduation from a research project that did not immediately take off smoothly might become unnecessarily hard. Especially, since research never really proceeds as planned and sometimes results of important but failed experiments are not publishable. The committee recommends having a critical look at the current guidelines and to consider alternative possibilities.

The PhD candidates were happy with the balance between research, training and teaching. Although teaching hours appear to not always be distributed evenly across the PhDs, they did not recognize a teaching load that could hamper their research. In addition, the PhDs are given the right to refuse teaching when they have already met their requirements. Yet, transparency of guidelines and regulations should be improved here as well, to ensure and maintain equal division of the teaching load. The same holds for the four-eye principle of promotor and co-promotor that some PhDs are unaware of. It would be important for PhD candidates to realize this principle, since it should give them the assurance that they are not fully dependent on their promotor.

The mini defence that is organized approximately half-way through the PhD is strongly appreciated and the PhD can decide whether this is open to others outside of the committee themselves, which is valuable since some PhD candidates like to have friends and colleagues present, while others do not. The flexibility of the time frame in which this mini defence is organized (one year) is also of great benefit as it allows the PhDs to ensure that they have a publication to defend.

In general, the PhD candidates perceive the atmosphere at HIMS as very open, pleasant and supportive. In the case of problems, they often discuss directly with their supervisor or the administrative support team if they have administrative issues. For problems they cannot discuss in the group the PhDs are aware of the confidential advisor.

When it comes to their careers after the graduation some PhDs are already offered jobs before they have finished, and in general, the time between graduation and a new position is short and the transition is smooth. Regarding their career plans the PhD candidates really appreciated the "Launch your career" course that consists of individual sessions as well as sessions in a small group. To some of them this was the most valuable course they had in their training programme. Clearly, PhDs also benefit from the network of their supervisors and supervisors actively coach their students towards their future career.

As such, HIMS is very successful in training excellent, independent, and proactive young researchers in an open and supportive environment that leads to a smooth transition to a future career, both inside and outside of academia. The committee recommends that HIMS maintains its current highly successful PhD programme with ample freedom and support for the PhD candidates, yet with the addition of some clearer guidelines and communication regarding the requirements for graduation and especially the four-eye principle.

2.7 Final conclusions and recommendations

The committee holds the research quality in HIMS in high regard. Nonetheless, from an external perspective, the committee has identified several potential avenues for further advancement and enhancement. The most important ones are summarized below. The committee hopes that these recommendations will help HIMS expand upon and consolidate its recent gains.

The committee recommends:

- To develop more explicit vision, focus, and strategy on an institute level with respect to collaboration between themes, research areas, and interdisciplinary research;
- To further investigate grant acquisition opportunities that allow the inclusion of instrument funding, thereby not focusing solely on equipment that is most used;
- To further support researchers within the institute in setting up spin-off companies, for instance, by sharing best practices and by external coaching;
- To take a more active role in the patent position with central financial support for patents to ensure long-term viability and impact;
- To allocate a substantial financial budget for investments in the cross-themed research topic of AI-based sustainable chemistry;
- To increase gender balance on the senior scientific staff level by actively searching, internally or externally, for female professors;
- To clearly inform the faculty members about the expectations regarding promotions;
- To engage in a dialogue with the faculty regarding the interpretation of the rules for internal promotions, emphasizing the need for flexibility;
- To share best practices and to strive for greater uniformity in data management practices across the Institute;
- To give the Diversity Team an autonomous position within HIMS, including an adequate budget. This will ensure that diversity is given greater prominence on the agenda;

- To provide greater transparency to the staff members on the distribution of the teaching load;
- To actively engage in the implementation of the faculty's R&R plan;
- To be more transparent with respect to guidelines for PhD candidates, for example teaching and training requirements, supervision by the four-eye-principle and guidelines for finishing a PhD;
- To maintain active support of the PhD candidates and council to ensure their proactive and independent functioning as a homogeneous group.

3. Assessment of the Research themes

3.1 Research theme 1: Analytical Chemistry

3.1.1 Aim and strategy

The Analytical Chemistry (AC) group is composed of strong interconnected PIs who have driven their science based on analytical chemistry principals and then apply them to address important aspect of human experience. The mission statement of the AC theme plays an important role in the HIMS institute, by combining complex measurement science, innovative research, and education. The AC theme strives to meet this mission by developing innovative analytical technologies, applying these technologies to important needs in society and industry and integrate key parts of the analytical portfolio in a high-quality quality teaching programme.

The AC theme did provide a general strategy to achieve their mission including establish new collaboration while strengthening the existing relations within HIMS and industrial partners in key areas of separation science, detectors (i.e., mass spectrometry) and data science which will impact both their theme but also others across the institute. Importantly they will strive to maintain the exceptional MSc track for new chemistry students while supporting the national honors programme: ATLAS. A key component for the success of the master's programme is to ensure the ability to expose students to high-end technologies and approach which means having support for equipment and staff. Maintaining the strength of the master's programme is fundamental to the success of all areas of HIMS.

3.1.2 Research quality

Overall, the theme focus is on high-quality research and outcomes for societal relevance through broad topics including material science, environmental toxicity, health profiling, forensics and art sciences. The common thread of the group is to share high-end equipment and the needed expertise. The theme is moving toward integration of AI and machine learning and this, if successful, will be an important aspect of common shared methodology and an opportunity to further expand impact with the other three themes and the broader scientific world.

3.1.3 Societal relevance

The core topics of the theme with a focus on human life sciences, environment toxicology, forensics and art all have the potential of a strong societal visibility. There are many examples of how these research topics find their way in outreach activities such as TV programmes or dedicated publications. Undoubtedly, the strongest societal impact is related to the successful joint MSc programme with the VU. In addition, the Centre for Analytical Sciences Amsterdam (CASA) provides a large number of well-trained analytical graduates for the Dutch society and industry. CASA has played this role consistently for many years, and its societal relevance cannot be overstated.

3.1.4 Viability

The AC theme carries out PI-driven research and theme interactions are centered around analytical chemistry approaches and the need to share equipment. The science at the individual theme level is outstanding and focuses on a number of important areas. All PIs require new instrumentation, including a high-resolution mass spectrometer (MS). The PIs are to be congratulated for the hard work they have done to build up the current instrumentation infrastructure, but there is an urgent need to acquire a state-of-the-art high-end MS instrument. This instrument (including a yearly service contract) is essential for the AC theme and the other themes. Without it, there is considerable and unacceptable risk to this theme and across HIMS. This should be the highest priority as it is the largest threat to their science, their internal and external collaborations and very importantly, to their educational programme.

A potential strength of the AC theme is a move towards application of artificial intelligence (AI) and machine learning (ML) within the analytical chemistry theme, where they have already made considerable progress. As HIMS adopts more AI and ML methods and expands resources in this direction that AC theme needs to actively participate in HIMS wide initiatives. In the meantime, the theme needs to generate large data sets (another reason for the high-end MS), and to be adopt digitalization of their data.

The theme needs to develop an active plan for the recruitment or retention of the talent, including both scientific and technical support staff. Having a strong and detailed execution plan will be helpful and should include a detailed plan for support of technical staff hiring or updating expertise. This plan should also include process to transfer novel finding/method to establish start-up companies or interact more with Industry.

Finally, in the committee's opinion, it is crucial for the AC theme to actively participate in the research programme AI in Sustainable Chemistry that is on the strategic agenda of HIMS. The committee believes that the AC theme has the potential to be a strong partner in this area. At the present stage, the achievements of the AC theme do not have maximum visibility while many methodologies currently developed might be considered 'dual use' in the positive sense: similar applications of novel methodologies of the AC theme might be possible, e.g., in the biomedical and sustainable chemistry areas. The committee strongly believes that it is essential for the AC theme to play an active role in shaping AI for Sustainable Chemistry.

3.1.5 Recommendations

The committee recommends:

- To develop an active plan for hiring over the next few years into upcoming areas of AC (e.g., AI) to ensure that the strategic mission can continue;
- To obtain high-end high-resolution instruments (e.g., MS) and provide a framework of service /collaborations to cover costs of staff and service contracts and to use this instrument to expand internal collaborations. This should be supported by HIMS and university leadership.
- To formulate a long-term road map for the future instrumentation required over the next 5 years to ensure success;
- To develop a means to ensure that PIs research time is protected by i) reducing the teaching load if needed, ii) expanding the number of staff within AC and iii) including other scientists from the one of the other research themes;
- To collaborate with other themes within HIMS who have successful programmes around start-ups. This could be an initiative that is run by the managementteam;

- Moving towards AI and ML, to handle issues of digital data especially from instrumentation and to ensure that FAIR practices are adopted;
- To continuously train the technical support staff, especially in the area of data acquisition in combination with AI/ML. Including the technical staff in collaboration with AI/ML researchers is essential.

3.2 Research theme 2: Computational Chemistry

3.2.1 Aim and strategy

The Computational Chemistry (CC) theme is uniquely poised among the four principal research themes to collaborate with the other three themes. This is particularly true considering their expertise and the increasing interest in using artificial intelligence (AI)-driven chemistry across all topics covered in the four themes of HIMS; however, CC is, by no means, limited to AI-driven chemistry. The CC theme is home to expertise in advanced molecular simulation techniques such as rare-event sampling, first-principles molecular dynamics, and quantum chemistry, with applications in electrochemistry, biomolecular systems, soft matter, and materials. The self-evaluation report demonstrates that the CC theme already has a large number of joint publications with the other research themes. The CC theme is also known for innovative algorithm and methodology development, and they make their codes available to the community. Going forward, the CC theme clearly seeks to be a leader in AI-driven chemistry, in general, and AI for sustainable materials and molecular design, in particular. While the CC theme will continue to push the boundaries of fundamental research in theoretical chemistry, they aim to explore and lead emergent application areas such as quantum computing and sustainable chemistry. They will also initiate exploration into target areas of therapeutic peptide design, self-organizing matter, and nonequilibrium dynamics.

The CC theme members have identified several challenges that could impede their strategy, including a low number of Ph.D. students/staff power and limited funding to keep up with rapid developments in topics such as AI, leading to poor continuity between projects and difficulty adhering to FAIR data practices. As more themes in HIMS begin to leverage AI and machine learning (ML) in their research projects, the demand for computational resources will grow. Any growth in computational resources beyond the current available 2,000 cores will also require an increase in power supplies. HIMS should seek to maximize energy efficiency as they grow their high-performance computing resources. Finally, improving support for grant writing and software development and maintenance, and reducing the administrative burden will help ensure that the CC theme can meet the high demands of training students in the broad range of topics, including chemistry, physics, mathematics, and computer science (including ML), required within the group and HIMS.

3.2.2 Research Quality

The CC theme has international visibility and a reputation for work that advances and pushes the boundaries of computational chemistry. Researchers in this group have, for example, pioneered methods for the sampling of rare event processes in materials and biomolecular systems and have leveraged ML to identify precise mechanisms and low-dimensional manifolds on which these processes ultimately occur. This theme has also extended the power of first-principles molecular dynamics to the realms of electrochemistry and catalysis, which are central to topics such as clean energy and the circular economy and to the central aims of HIMS. The CC theme has established collaborations across various institutes at the UvA (IBED, IoP, IvI, SILS, and KdV) and with international universities and industries in computational and AI-related research activities. In future applications, the panel expects this theme to become leaders in the application of ML techniques to generate predictive, reactive models that will replace the expensive electronic structure calculations that underly these first-principles dynamics calculations.

3.2.3 Societal Relevance

Members of the CC theme have forged collaborations with industrial partners working on societally relevant problems, including therapeutics and biotechnology, climate mitigation and carbon capture, quantum science, and analytics for medical applications. Such partnerships should be encouraged and supported by HIMS, with an aim toward adding additional partnerships, while still maintaining a firm commitment to fundamental science. Support for these partnerships will need to include both human and computational resources. Challenges that could impact relevance, as identified in the SWOT analysis table, include lack of funding to expand the CC theme faculty and lack of student support.

3.2.4 Viability

The viability of the CC theme will depend on a number of factors including financial support for students, infrastructure, and diversity hires (currently, only 2 out the 9 regular staff members are women). Members of the CC theme will need to be able to divide their time between fundamental innovations and leveraging these innovations in application studies and industrial partnerships. Students in the CC theme receive training and become qualified for diverse career paths that can range from academic or industrial research to science management positions, and work in non-science positions such as data science, scientific consulting, software development, and finance. Preparing students for these diverse possibilities is a critical component of the mission of the CC theme. Finally, by placing an emphasis on AI-driven molecular science, the CC theme can position itself and the other research groups in HIMS as a leader in this rapidly emerging area. This strategy will provide new avenues for seeking joint funding opportunities, for strengthening connections with related departments, e.g., Computer Science and Mathematics, for establishing new industrial partnerships and avenues for participation in start-ups and could serve as a recruiting tool to increase the number of PhD candidates and postdocs in the CC theme, possibly including student jointly supervised between the CC theme and other themes in HIMS.

3.2.5 Recommendations

The committee recommends:

- To devise a plan to leverage AI and machine learning to position the CC theme and HIMS as leaders AI-driven chemistry;
- To strengthen ongoing collaborations in AI with UvA (Computer Sciences and Mathematics)
- To help develop an institute-wide vision and strategy for infrastructure and HR in AI and Data-Driven Chemistry;
- To identify and apply for joint funding opportunities with other groups in HIMS that have an AI-driven chemistry and/or data-science component. Seek additional participation in industrial partnerships and start-ups;
- To create a broad student and postdoc recruitment strategy based on fundamental developments within the CC theme as well as joint projects with other HIMS groups and with other UvA Institutes. The plan could also include students from mathematics, computer/data science, physics, and related areas of engineering with an interest in chemical problems.

3.3 Research theme 3: Molecular Photonics

3.3.1 Aim and strategy

The mission of the Molecular Photonics (MP) theme revolves around harnessing the power of light for chemical applications. In an era where sustainable and efficient technologies are imperative, the utilization of light in chemistry emerges as a ground-breaking avenue. Light, with its dual particle/ wave nature, presents an intriguing platform to manipulate and catalyse chemical reactions.

The relevance of the MP theme's mission lies in its potential to revolutionize various fields. By employing light as a tool, it is possible to design novel materials and processes that not only enhance the efficiency of chemical reactions but also contribute to environmentally friendly practices. The ability to precisely control chemical transformations through light opens avenues for cleaner and more sustainable industrial processes.

Moreover, the ambitions of the MP theme align with the broader scientific goal of understanding and manipulating matter at the molecular level. This microscopic perspective allows for unprecedented control and customization of chemical processes, paving the way for the development of advanced materials, pharmaceuticals, and energy solutions.

An additional strength lies in the theme's focus on utilizing light to study molecular processes. This is achieved through the development of cutting-edge spectroscopy tools that go beyond the current state-of-the-art. By delving into advanced spectroscopic techniques, the group enhances its capacity to unravel the intricacies of molecular interactions, providing valuable insights into chemical phenomena.

In short, the mission of the MP theme is highly relevant in the contemporary scientific landscape, as it embodies the fusion of light and chemistry to address pressing challenges.

3.3.2 Research quality

The 20th century was the era of electronics, resulting in disruptive technological developments in fields as diverse as computation and telecom. It has become clear over the past decade that light will be the source of power and thus 'photonics' is the technology of the 21st century. Photonic materials can be used in telecommunication, solar cells, catalysis, bio-imaging and when used in a smart way, get more efficient or new applications for our everyday life. Indeed, photonics offers several advantages such as reduced energy consumption, higher data bandwidth and switching speed, highly sensitive and direct identification of molecules. At the root of these developments lies innovative materials science and molecules, especially nanomaterials and molecular assemblies.

From the above and when looking at research done and planned in MP, it is clear that MP deals with a timely and relevant research line to which they have contributed significantly. The research is strongly instrumentation driven: a key enabler for the identification of interesting photonic materials and molecules are the advanced spectroscopic techniques implemented and realized by the MP theme. The theme is recognized as leading worldwide in both developing and applying new spectroscopic techniques. This creates a unique position to interact with other HIMS themes and beyond. Laser lab, for example, is a successful initiative. The scientific relevance is beyond doubt and testified for by a strong publication track record, international recognition of PIs through keynote/invited lectures etc.

Attracting and retaining talent at all levels is an issue. During the interview it was brought up that Astronomy uses a unique matchmaking process in this context and has way less than 20% PhDs

dropping out. Others could learn from that. The new course 'lights on matter' could help to better prepare students, but it will take a while before the effect materializes.

3.3.3 Societal relevance

With a robust foundation in fundamental knowledge, the theme has progressively engaged in projects directly linked to socially impactful applications. This involvement extends to medically oriented initiatives, encompassing the development of innovative approaches for medical diagnostics, photodynamic therapy, photopharmacology, and skin protection against UV radiation. These ventures typically unfold through collaborations that directly involve medical hospitals and industry partners.

Global food security stands out as one of the most pressing challenges. As an active participant in a large European consortium, the theme is contributing to the development of 'molecular heaters.' When applied as a foliar spray, these molecular heaters aim to enhance crop production, enabling agriculture and horticulture at lower temperatures and higher altitudes. Field trials proved successful; scaling up and preparing for spin out are the next steps to be taken.

Furthermore, the MP theme recognizes the significance of spectroscopic techniques as a fundamental tool for analyzing art objects. A notable illustration is the recent examination of Rembrandt's masterpiece, The Night Watch. One of the primary objectives of such Science for Art projects is to gain insights into the degradation processes affecting artistic creations. The presence of a professor of Molecular Spectroscopy in the theme contributes to the visibility of the MP theme to the outside world.

These multifaceted endeavors, together with first efforts in valorization through spinning off research, underscore the theme's commitment to applying scientific expertise to address diverse societal challenges. The increasing number of patents with possibility of spin-off companies, will further accelerate valorization of knowledge developed within MP.

3.3.4 Viability

In the aims for the future the theme explains research lines and strategies for the next six years. The focus on instrument-driven research will be maintained. Furthermore, the renewed interest in more classical photochemistry, a traditional strength of the theme, in new fields like electro-photocatalysis and flow chemistry will be explored/exploited. Importantly, these new fields form a breeding ground to foster more intense collaborations with all other groups in HIMS. Complex macroscopic physical chemical phenomena will be studied from a molecular/nanoscale perspective. Based on unique instrumentation analytical applications will be developed with relevance for the medical sector and industrial actors focused on sustainability.

A comprehensive but adequate SWOT analysis was presented and in the strategy for the next period, measures to tackle identified weaknesses and threats, as well as opportunities, are presented by means of six listed short-terms targets. However, an overarching strategy how these targets will address the weaknesses and opportunities on a longer research horizon is missing.

3.3.5 Recommendations

- To create more awareness of this theme in HIMS and outside by branding the name Molecular Photonics. This branding might help to generate more traction in funding schemes aimed at instrumentation upgrading and maintenance and in larger programmes;

- To devise a policy plan on how the group can replace and maintain critical infrastructure by tapping in external and internal funding;
- To define longer-term goals that are currently still generic and underdeveloped. The refocused aim of MP allows for easy alignment with the three priority themes of HIMS: chemistry of complex systems and materials, chemistry of biomolecular systems and chemistry for sustainability. An MP compassing research line would help visibility and allow the group to be stage-setting for future research programmes;
- To develop a strategy to align AI and data management with other groups within HIMS and to foster new collaborations, going beyond the (successful) ad hoc approach that is followed currently.

3.4 Research theme 4: Synthesis & Catalysis

3.4.1 Aim and strategy

The aim and strategy of Synthesis & Catalysis (SC) is to be the national and international leader in sustainable organic chemistry. To reach this goal, the SC theme is composed of several groups focusing on main topics such as molecular and heterogeneous catalysis, electrochemistry, circular chemistry, synthetic methods developments and materials. Each of these subgroups has their own research meetings and, biweekly, the whole theme meets for scientific discussion. The exact subdivision of the SC theme remains a bit unclear to this committee, but it seems that these subgroups operate mainly independently.

Each of the subgroups has its own research strategy and future plans, but the SC theme would greatly benefit from a more general future research plan. The committee encourages the SC theme's current aim to regroup in the Amsterdam Center for Electrochemistry (AMCEL) and support Electrochemistry as a uniting research focus. Diverse complementary competence and expertise of the members of SC are the basement for reaching such a challenging goal. SC members participate in the RPA in Sustainable Chemistry that provides additional financial support to develop collaborative projects and enforce cutting-edge research. The theme members aim to play a strong role in this RPA and strongly implement their vision in the RPA's aims. In that way the SC theme is very successful in maintaining a leading position in their research field.

In the RPA in Sustainable Chemistry, the SC theme will also be a part of the AMCEL, which has the mission to develop green and electrical energy-based chemistry for the future. The SC theme is also strongly involved in other national initiatives towards greener chemistry. These collaborative projects (supported by RPA fundings) are one of the strategies to enhance more diverse research projects. In addition, SC strives to translate their research in Sustainable Chemistry to concrete applications via numerous industrial collaborations and the creation of several spin-offs. SC also formulated the ambition to establish close collaboration with AI group and become a leader in this topic, but this remains to be implemented and fully organized.

3.4.2 Research quality

The quality and impact of the research of the SC theme is very high and several members of the theme are internationally renowned specialists in their domain (vide supra, sustainable and supra molecular chemistries, organic and organometallic chemistries, homogeneous and heterogenous catalysis, flow chemistry…). The research quality is reflected by numerous secured national grants and impressive number of publications in high-ranking well-regarded international journals. This has not yet translated into larger grants and strong leading position in national or EU grants. The research impact of the SC theme could be better highlighted in the document and through various communication channels, with an impact going beyond this of individual groups and clearly showing the greater strategy. Considering the quality of the various groups, identifying common challenges and opportunities would clearly be an asset for the future development of this theme. The creation of several spin-offs is certainly to be highlighted.

3.4.3 Societal relevance

Research at SC is of very strong societal relevance as it aims to provide innovative solutions towards challenges we are facing today, the energy and feedstock transition and the de-fossilization of society.

Research focusing on electrification and valorization of the chemical feedstock are obviously also very important for the society, however more detailed information about these topics was not given in the self-evaluation report, or during the site visit, but would be worth to elaborate on. Societal relevance is illustrated by the participation of the SC theme in the National Growth Funds (Groenvermogen Hydrogen, Biobased Circular and Future Carbon). SC presents well-balanced research between fundamental knowledge and applied science, creating possibilities for a rapid development of concrete applications and transfer of the knowledge towards industry. In the past years the SC theme has been very successful in establishing startups based on their research. Most recent spin-off company is Nano Hybrids, based on a novel technology for solvent-free synthesis of nanoparticles.

3.4.4 Viability

Research conducted by the SC theme has a very high international standing, with clearly identified ambitions to answer the key societal challenge of this age. The SC theme is a relatively comprehensive research theme, that allows SC to bring together chemists showing complementary research competences. The SC theme is mainly financed by grants obtained by the PIs individually and the RPA funds. Therefore, constant efforts towards securing finances of SC are capital, and SC should actively pursue larger EU grants or industrial collaborations. Several collaborations between the PIs of SC and other research themes exist, but the committee recommends more and more strategic collaborations within the theme and within HIMS, itself. SC also plans to establish close collaboration within the field of AI with the other HIMS themes. Such collaborative research will certainly further increase the viability of SC and open totally new perspectives/opportunities. The PIs within the SC theme seem to operate mainly as individual research groups with *ad hoc* collaborations, yet their long-term strategic vision and the cohesion of the HIMS institute could benefit from long-term collaboration. Major threats are foreseen regarding the maintenance and the consolidation of the infrastructures (from instruments to personnel), and the integration of more specific data management plans (from ELN and data-storage compliant with FAIR data, to data-driven science).

3.4.5 Recommendations

The committee recommends:

- To actively seek diversified funding sources, including larger EU grants and industrial collaborations, to complement the current reliance on grants obtained by individual PIs and RPA funds;
- To foster more strategic collaborations internally with the goal particularly to enhance AI in sustainability, both within the theme and within the broader HIMS institute, moving beyond ad hoc collaborations to enhance the long-term vision and cohesion of the institute.
- To enhance the visibility of its research impact by emphasizing common challenges and opportunities across various groups and strategically communicating its achievements beyond individual projects.
- To establish a more defined structure, encouraging a cohesive approach by developing a comprehensive research plan that integrates the diverse subgroups' strategies and future plans, emphasizing the uniting focus on Electrochemistry within the AMCEL.

Appendix A - Programme of the site visit

November 12	
16.00 – 16.30	Welcome committee with directorate HIMS
16.30 – 18.30	Preparatory meeting panel
19.00	Dinner committee

November 13	
08:30 – 09:00	Arrival of the members at Amsterdam Science Park
09.00 – 09.15	Welcome committee with dean
09.15 – 10.15	Discussion with HIMS MT
10.15 – 10.45	Evaluation/break panel
10.45– 11:45	Interview Analytical Chemistry
11:45– 12.15	Evaluation committee
12.15 – 13.15	Lunch
13.15 – 14.15	Interview Computational Chemistry
14.15 – 14.45	Evaluation/break panel
14.45 – 15.30	Interview PhD council
15.30 – 15.45	Evaluation/break panel
15.45 – 16.30	Interview Tenure trackers
16.30 – 16.45	Evaluation/break panel
16.45 – 18.00	Lab tour
19.00	Dinner committee

November 14	
09.00 – 09.30	Panel preparation day 2
09.30 – 10.30	Interview Molecular Photonics
10.30 – 11.00	Evaluation/break panel
11.00 – 12.00	Interview Synthesis and Catalysis
12.00 – 12.15	Evaluation committee
12.15 – 13.15	Lunch
13.15 – 13.45	Supporting staff
13:45 – 14:30	Diversity team
14:30 – 14:45	Review + preparation next interview
14.45 – 15.30	Interview remaining questions with management
15.30 – 16.45	Internal meeting committee – review, writing, preparation preliminary findings
17:00 – 17.30	Presentation preliminary findings
17:30	Drinks

Appendix B - Quantitative data

B.1 HIMS - Research staff in FTE

	2017	2018	2019	2020	2021	2022
Scientific staff						
Assistant professor	8.0	5.0	5.0	11.0	11.0	11.0
Associate professor	10.6	10.8	10.8	9.2	8.0	8.0
Full professor	12.4	12.6	12.6	13.4	12.4	11.4
Postdocs	23.4	13.8	13.8	23.4	16.3	20.2
PhD candidates	63.0	66.3	66.3	63.0	62.0	71.0
Total fte research staff	117.4	108.5	108.5	120.0	109.7	121.6
Support staff	23.8	22.4	22.4	24.6	25.7	24.1
Total staff	141.2	130.9	130.9	144.6	135.4	145.8

B.2 HIMS - Funding (in fte) and expenditure (in M€)

	2017	2018	2019	2020	2021	2022
Funding						
Direct funding	37.3	31.1	37.7	40.8	37.1	41.7
Research grants	51.6	56.2	59.7	53.6	41.7	43.8
Contract research	28.5	21.4	18.4	25.6	30.8	36.1
Total funding	117.4	108.7	115.8	119.9	109.7	121.6
Expenditure						
Personnel	8.573	8.231	8.506	9.644	9.642	9.582
Other costs	7.933	7.640	7.742	7.559	7.422	8.551
Total expenditure	**16.506**	**15.871**	**16.248**	**17.203**	**17.064**	**18.133**

B.3 HIMS – PhD enrollment and success PhD candidates

	M	F	≤ 4 yr	≤ 5 yr	≤6 yr	≤7 yr	Graduated	Not yet finished	Discontinued
2014	6	7	1	8	2	-	11	-	2
2015	19	4	3	14	3	1	21	1	1
2016	18	13	1	22	3	2	28	1	2
2017	13	11	-	12	5	-	17	3	4
2018	12	15	2	8	-	-	10	15	2