Assessment report

EXTERNAL PEER REVIEW

2018 - 2023

January 2025

Preface

This report summarises the findings of the external Review Committee of GROW - Research Institute for Oncology and Reproduction at the Faculty of Health Medicine and Life Sciences (FHML), Maastricht University. The review/site visit was carried out on November 5th and 6th 2024. This review was carried out in light of the SEP evaluation according to the Strategy Evaluation Protocol 2021-2027.

In addition to discussions with colleagues from GROW and FHML, the review process benefited greatly from the preparation undertaken by GROW and from the provision of information in a standardised and digestible format. The Review Committee appreciates the professional assistance provided by the whole GROW team. We also thank Maastricht University, FHML and GROW administration, staff and PhD candidates for their contributions in making the review an interesting, informative and rewarding process.

January, 2025

Assessment of the GROW Research Institute for Oncology and Reproduction

Content

1. Introduction to the Institute

GROW, the Research Institute for Oncology and Reproduction, is one of seven research institutes of the Faculty of Health, Medicine and Life Sciences (FHML) of Maastricht University. At the Maastricht campus, GROW connects researchers at Maastricht University, MUMC+ and the Maastro clinic. GROW is part of managed clinical networks, including the EOCI-accredited OncoZON network for oncological care. Research within GROW is aligned with research at the eight affiliated hospitals in the region.

The current evaluation concerns the period 2018-2023. At the start of this review period, GROW had a change of management and government, with the appointment in 2018 of Prof. dr. M. van Engeland as its director and the assignment of new program leaders as part of the GROW management team (MT) in 2020. Besides scientific director Prof. M. van Engeland and managing director J. Doomen, the management team (MT) of GROW currently consists of GROW program leaders (2 for each program), 4 PhD coordinators and 2 specific advisors (one on Artificial Intelligence (AI) and one for talent recruitment). The MT meets on a monthly basis. Twice a year the GROW MT meets with the GROW council to align with the various department representatives. An external scientific advisory board (SAB) is consulted annually for strategic input. The GROW office is headed by the GROW managing director, and includes various support staff for financial support, legal support, funding support, HR support, office managers and a financial controller. Directors of each research institute meet with the Dean prof. A. Schols and vice-Deans prof. S. Kremers and prof. M. Oude Egbrink from FHML.

After the reporting period, in 2024, the name of GROW changed from ‘school’ to ‘research institute’, and in the self-evaluation and this report, ‘GROW research institute’ is used.

2. Aims and strategy

The mission/vision of GROW involves the following topics:

1) Improving cancer prevention,
2) Developing accurate cancer diagnostics,
3) To improve survival rates of patients with cancer, with a focus on preserving quality of life and functional abilities.
4) Contribute to a healthy reproduction life cycle, including conception, pregnancy, and long-term health for women and children.

Research addressing each of these missions is organized in corresponding research programs that focus on each of these topics;

- Program P1 focuses on 'Prevention of Cancer',
- Program P2 focuses on 'Basic and Translational Cancer Research',
- Program P3 focuses on 'Innovative Cancer Diagnostics and Therapy',
- Program P4 focuses on 'Reproduction and Perinatal Medicine'.

To achieve this mission, GROW has defined a number of strategic aims, which align with the activities of GROW:

- Address clinical needs in oncology and reproductive medicine
- Stimulate local, regional, national, and international collaborations
- Be an attractive partner for the research community, society, and policymakers
- Create an inspiring, inclusive, educational, and safe research community
- To educate young scientists

3. Qualitative Evaluation

The GROW written report (Self-evaluation 2018-2023 part A / Self-evaluation 2018-2023 part B1 oncology / Self-evaluation 2018-2023 part B2 Reproduction) and the site visit on November 4th/5th 2024 provided a platform for discussions around institute aims, organizational aspects, strategic choices, operational aspects and career development. The committee gained an in-depth insight into GROW, which was facilitated by a well-prepared site visit, with open and constructive discussions with early, mid-career and senior scientists, interviews with MUMC+ and FHML leadership, a visit to a MERLN research group collaborating with GROW scientists (the MERLN laboratory room 5.213), discussion with support staff and researchers at affiliated hospitals (live and online). Furthermore, a session was organized where posters of the different research groups were presented. The open attitude, the constructive discussions and willingness to share key insights of the GROW organization allowed for a meaningful evaluation by the committee and made the committee feel very privileged.

The GROW institute incorporates two 'branches': Oncological research and Reproduction/Perinatal Medicine research, and these two divisions have provided separate self-evaluation reports. In addition, the output of each of the programs is provided as a narrative summary, in line with the guidelines of the SEP. Examples of publications are provided, which align to the focus area of each program.

A. Research quality

In its evaluation of GROW, the committee encountered an open and dynamic research environment, committed to the many aspects of oncological and reproductive research. The vision and activities of GROW involve the integration of the continuum of fundamental, translational and clinical research. GROW promotes collaboration, and throughout all interactions of GROW researchers, the overall approach echoed 'team science'. In speaking to the different groups of interviewees, an image emerged of a leadership that promotes social cohesion, and transparency, with researchers working for and with each other. The committee talked at length with the different levels of researchers (senior, mid-career, PhD candidates) as well as management and support staff about how collaboration is promoted and how cross-fertilization of research efforts is achieved. These interviews, along with the poster session and the lab tour underlined the very innovative work that is being done at GROW.

The majority of research performed within GROW is characterized by a clinical/translational focus, although also fundamental research is done. This focus on clinical/translational research is especially prominent for the research performed outside the academic hospital by regional partners.

During the period under review, the research output was sizable, and a steady increase in the number of publications was seen. The impact of publications has been measured by Category Normalized Citation Index (CNCI), and the percentile in the subject area. The CNCI is benchmarked against the world average. Perhaps a more useful comparison would be a benchmark against Dutch Universities, as they operate in the same education and funding landscape. Another consideration would be to use Field-weighted Citation Impact (FWCI), which

is a very similar but more commonly used metric by Dutch universities and would allow for better comparison.

The GROW CNCI analysis was based on output of 2014-2021, since the CNCI for the last two years of the reporting period (2021-2023) cannot be assessed yet. The self-evaluation reports that the CNCI ranges consistently around 2 (page 56 of part A, figures 12/13), which is well above the world average. Of note, the data representation in figure 12 is not entirely clear. The boxplots appear to indicate median CNCI values of approximately 1; whereas the red line consistently ranges around 2. The meaning of the red lines is not explained in the text or legend.

The top ten highly cited papers from GROW attracted very high numbers of citations. The committee noted that these papers mostly contained guideline and standardization articles, on which GROW researchers contributed, but were not *per se* first, senior or corresponding authors. Participation in these highly cited papers clearly shows that GROW researchers are recognized for their expertise in their field. Yet, to measure the impact of GROW research activities, it would also be insightful to also indicate the highly cited research papers on which GROW authors are listed as key first or senior authors. The committee feels that sufficient high-quality papers have emerged from GROW-initiated studies to be able to highlight GROW research better.

Concerning the financial level, many research grants were acquired by GROW researchers. The total funding level has increased by approximately 10% over the period 2018-2023. Funding comes from a variety of sources, including charity funds (e.g. the Dutch Cancer Society), contract research, governmental agencies (e.g. ZonMW), and European funding (e.g. EU H2020). Although the current reporting period indicates an increase in personal grants compared to the previous reporting period (SEP report 2018), the number of competitive personal grants from (inter)national personal funding schemes (ERC, NWO Veni/Vidi/Vici) is somewhat limited, with 1x NWO Veni, 2x NWO Vidi, 1x NWO Aspasia and 1 ERC CoS grant in the current reporting period.

Especially for the researchers at non-academic partner hospitals, a major financial source appears to be contract research, including clinical validations. Although the committee obtained limited insight into the details of the financial resources, the already substantial relative contribution of this type of funding appears to increase further over time, which may impact the academic signature of GROW, as is also discussed in the viability chapter (paragraph 3 C).

Based on the reported research publications by GROW, presentations at the poster session and the tour through the MERLN lab, the committee observed high-quality research with clear thematic approaches, and innovative technologies.

B. Societal relevance

Topics of the research programs align well with societally relevant issues. Measuring societal impact is challenging, and no broadly accepted metrics are defined. GROW has used online media attention for research output, and articles being mentioned in policy documents.

Most research output gained online attention (6551 out of 8107 articles). A more direct analysis of impact concerns output being mentioned in policy documents. The most impactful papers using this metric involve clinical studies and toxicology studies. In addition, PlumX analysis was used to search for research output that was used in medical guidelines. shows that >50% of GROW research output scores in the top 1% world-wide, which illustrates the societal impact of the work. Finally, an ‘area-based connectedness (ABC)’ analysis was performed to analyse the

link between research output and societal issues. This innovative ABC analysis clearly illustrates the strong impact of GROW research on clinical guidelines.

Six case studies have been highlighted (section 5.3), that illustrate thematic research efforts (e.g. 'cancer and pregnancy') and organizational efforts to facilitate research (e.g. rare disease expertise centres and relation with affiliation professors). Without exception, these case studies show vision, adhere to the GROW mission/vision and address topics with high societal relevance.

Many GROW researchers are active in (inter)national committees, including memberships of national funding organizations (e.g. KWF scientific board, ZonMW, NVRO) and clinical registries (e.g. PALGA). This is a recognition of their contribution and impact on the field, and again underscores impact. Yet, efforts could be made to increase participation in committees of funding agencies, and increasingly make use of the knowledge of committee members, which may positively affect grant success.

During the interviews and poster sessions on site, the committee observed that the researchers were proud of their achievements and study results, but were less guided in strategies to communicate their results back to the larger community. Boosting the communication strategy of GROW could improve the outreach to society and ultimately impact of the acquired results. Increased involvement of patient organisations during the startup and implementation of the results may be beneficial.

C. Viability

Four different research programs are formed, three of which are focussed on oncological research, one is focussed on reproduction and perinatology research. Each research program is headed by two program leaders. The themes of these programs are logical and delineate thematically distinct topics in oncology, and fit the focus areas of the GROW researchers. The program leaders have a balanced male/female ratio, and have a smart tiling system, where every three years one senior program leader is replaced by a more junior program leader. The group of program leaders has been transformed into a diverse group of mid-career scientists; a smart decision to give relatively young researchers management roles, and create broad involvement in the research organization and create a new cohort of leaders. This appears to lead to a lot of energy and even more collaboration. Program leaders now are selected from tenured staff at the Assistant/Associate Professor level, providing upcoming researchers an opportunity to obtain experience in leadership and administrative tasks, which is an important asset in maintaining a viable research institute.

From the self-report, it is incompletely clear if the programs have structural meetings to unite their participating researchers. Also, it is unclear how programs interact with each other (e.g. joint meetings) to translate research findings. An annual research day is organized, to which all participating researchers, and thus all programs participate. Joint research meetings within programs and regular institute meetings appear an important tool to keep the GROW research community connected.

The viability of GROW will also depend on its ability to differentiate itself and contribute in a meaningful way in a competitive national and international research environment. The 'team science' attitude, contribution to clinical trials and clinical guidelines, the translational efforts

between clinical and preclinical researchers all positively contribute to the viability of GROW. The committee also observed that the new management team and the appointment of the next generation of leaders as program leaders strongly supports the viability of the research institute. The committee strongly encourages GROW to even better demonstrate the impact work at GROW has both nationally and internationally through a more active and agile communication strategy (see also section 3 B and 'recommendations')

The staff size appears to be adequate, with a healthy ratio of staff size versus PhD candidates. The committee also observed a healthy staff build-up of full professors (n=19), associate professors (n=16), assistant professors (n=20) and researcher staff (n=41). Many assistant professors (18 of 20) have permanent positions, which appears to be a high ratio when compared to other institutions. Of note, during the course of the reporting period, the number of PhD candidates increased substantially, whereas the number of staff members remained relatively constant. This unequal growth may lead to increased demand of supervisors, which may negatively affect its quality.

An important asset of the GROW research community is the high number of collaborations with partners in affiliated hospitals in the region. This is reflected by the vast growth of external vs internal PhD candidates. Although the registration of external/internal PhD candidates also reflects financial streams rather than physical location (i.e. 312 PhD candidates are externally funded vs 89 (22%) internally), a large proportion of PhD candidates appears to work outside of the Maastricht campus (171 located outside Maastricht; 243 located at Maastricht). Strong ties with affiliated hospitals have clear benefits; patient accrual in clinical trials can be expanded, clinical training can be combined with PhD trajectories, and in a changing health care system in the Netherlands, collaboration with regional partners is essential to maintain research into key clinical indications. GROW with its regional partners appears very well set up to sustain and perhaps expand its research activities in the future, which will help in securing its viability, and can be a leading example for how other academic hospitals can arrange research with regional partners.

Conversely, with substantial (and increasing) research efforts at affiliate hospitals - which are mainly clinical in nature - GROW may expect a shift in the balance between clinical, translational and fundamental research, with especially fundamental research having less critical mass. A possible consequence is that a substantial fraction of GROW will facilitate external organizations to perform clinical research, with less autonomy to define its own strategic agenda. Although the committee does not value one type of research over another *per se*, the academic profile of GROW may change over time, and the committee advises GROW to consider if this adheres to its goals and suggests evaluating the balance between these different types of research, and to take measures to restore this balance if needed.

A key aspect of GROW is that it combines research in oncology and reproduction/perinatology. As observed during previous audits, the committee noticed a separation between the two subgroups. The committee discussed this topic with junior, mid-career and senior researchers. For some researchers, no clear added benefit was expressed of a joint Oncology/Reproduction institute, but also no negative impact was expressed. Especially with the junior researchers, substantial enthusiasm about the funding scheme to connect Oncology with Reproduction (the 'Bridge the Gap' program) was observed.

When the topic of a joint research institute was discussed with leadership of various organizational units, the current set-up appeared to be a good option, and rather than putting

energy in lobbying for a reorganization, the committee felt a need for investing energy in research focus. For the leadership of the clinical oncology centre MCCC, the benefits of a shared research institute were less obvious, although this logically fits with their focus on clinical activities in the oncology area.

One of the strategic plans of GROW for the coming six years is to stimulate joint research activities between the divisions of oncology and reproduction/perinatology. The committee realizes that funding levels for such initiatives are under pressure, but wants to emphasize the importance of investing in this area. Nevertheless, such initiatives push for new research focus areas, while a focus on maintaining the well-performing existing research lines is also needed – some of which currently are challenged by shortage of staff, research support and financial means. Also, some stakeholders will be better served with these efforts (fundamental and translational researchers) than others (MCCC).

As for the strategic outlook: GROW has indicated a number of focus areas for future investigation, including Artificial intelligence (AI) and the microbiome. AI appears a logical choice, with GROW already having an AI advisor and ongoing research using AI technology. The microbiome is an expanding and competitive field, and the committee was not convinced that investing in the microbiome would effectively build on currently present expertise or support the building of bridges between oncology and reproduction/perinatology. Other topics for investment may be more logical, especially if they build on current local expertise (see also recommendations).

Combined, GROW is a viable research institute, with a healthy academic staff build-up, with challenges and opportunities regarding Oncology/Reproduction integration, connecting the internal/external research staff. All these topics are clearly on the radar of the GROW management team.

4. Additional areas of evaluation

A. Open Science

The percentage of open access publications (gold and hybrid) has increased from 45,2% in 2018 to 67,6% in 2023. When 'green' open access is included, these percentages increase to 77,5% in 2023. Although a large part of the GROW output is openly available, and the increase over time is substantial, still approximately 20% of publications are not openly accessible. Of note, a steady decrease in the use of green open access is observed over the reporting period, with a marked drop to ~10% in 2023. Using green open access options along with the availability of university portals, only little extra effort is needed to increase the percentage of open access publishing. An awareness campaign with practical support rather than financial means could increase these percentages.

B. PhD policy and Training

The committee has seen a well-organized research infrastructure for PhD candidate supervision and monitoring, which forms the basis for doing solid research in a safe environment. This includes the multiple levels of PhD candidates monitoring and evaluation, including the online 'PhD TRACK' system. In addition, independent PhD coordinators have regular meetings with PhD candidates, and a buddy system is set up, as well as a PhD council.

The committee was pleased with the active involvement of PhD coordinators, who proactively engage in establishing meetings with PhD candidates to offer advice during their trajectory, not only at the academic scientific level but about well-being of the PhD candidate. Concerning the well-being and safety of PhD candidates, GROW has set-up multiple tools, for example PhD coordinators and confidential advisors that PhD candidates can contact regarding supervision issues. In addition to the PhD training and supervision plan, the committee recognized that PhD candidates are educated through mandatory courses on crucial aspects of research. An annual science day is organized, which PhD candidates are encouraged to attend, and which facilitates PhD candidates to meet their peers, learn to present to a broad research audience, and establish network connections with other researchers within GROW.

When interviewing PhD candidates, the committee received positive feedback on the usefulness of the training and supervision plan, periodical meetings with the supervision team as well as the PhD coordinators. The available mentoring tools (e.g. PhD coordinators) are technically available to all PhD candidates, both internal and external. However, although the interviewed external PhD candidate was aware of the PhD TRACK system, the awareness of available courses/events organized by GROW was less when compared to internal PhD candidates. A recommendation in this regard would be to increase communication and outreach to external PhD candidates to achieve a higher participation in PhD training and monitoring activities.

The interviewed PhD candidates were very positive about available courses, both the optional and the mandatory courses. It was mentioned that career orientation activities for final year PhD candidates could be extended. Additionally, interviewed PhD candidates expressed enthusiasm about the annual science day and the general efforts of GROW to connect researchers. Of note,

due to the smaller number of the reproduction/perinatology PhD candidates, these PhD candidates expressed more limited networking opportunities at GROW activities.

Regarding the PhD council of GROW, the committee met a motivated group of researchers, actively organizing activities for PhD candidates. All PhD council members felt encouraged to interact with GROW management, and express their ideas and concerns, illustrating a safe and solid environment to further improve on the quality of the PhD program. A discussion point for future consideration is to explore if and how PhD council participants can be involved in strategic decision-making within the GROW institute.

C. Academic Culture

Throughout the evaluation, the committee has identified how crucial academic culture is for GROW at the different levels of organizations. There is a strong adherence and education dedicated to the code of conduct for research integrity. In particular, the committee observed that education regarding scientific integrity is present across new employees (upon signing up the contract at HR) and also PhD candidates. In the case of PhD candidates, GROW provides scientific integrity education at different stages of the PhD trajectory, where PhDs are educated in various mandatory Scientific Integrity courses. Additionally, PhD candidates are required to sign up/adhere to the code of conduct. The FHML/MUMC+ Platform for Scientific Integrity (PSI) has developed tools and roadmaps for further improving education and awareness regarding scientific integrity. In addition to valuing education, FHML/UM also possesses confidentiality advisors, available for all types of employees when engaged in any kind of situation regarding scientific integrity. Altogether, the committee finds GROW to excel in monitoring, educating and raising awareness regarding scientific integrity, ensuring the adherence of employees to the code of conduct of scientific integrity.

GROW has deployed several activities to reach out to all stakeholders. One example the committee appreciated was the so-called ‘GROW-on-tour’, where the GROW-management visits departments and other relevant stakeholders, introducing themselves, and asking about their needs. This activity started within Maastricht and is still ongoing, and included external locations. The interviewees showed enthusiasm about these activities, and the committee strongly supports GROW-on-tour.

Several support activities appear to be better available to researchers in Maastricht, whereas a sizable group of PhD candidates is working at affiliate hospitals. An example is that PhD candidates within Maastricht automatically have a meeting with a PhD coordinator, whereas this appears optional for external PhD candidates. This apparent two-track policy, although understandable from a practical point of view, may lead to differential levels of support, engagement, PhD candidate monitoring and research quality.

Two aspects that have also been mentioned elsewhere in this report are intimately linked to academic culture; grant acquisition and communication. Whereas the quality of the research is high, the committee in some of the interviews observed some hesitance or lenience towards external communication of research accomplishments or striving for (personal) grants. To address this, the committee observed multiple activities; GROW management has monthly meetings between a funding advisor on available funding opportunities and identifying suitable candidates. The high quality of research observed justified these efforts, and will likely further improve on obtaining EU and individual grants.

Another important pillar of academic culture is diversity and social safety. In this regard, the UM social safety team has provided a lecture regarding social safety and inappropriate behaviour. However, how GROW is involved as a driver of diversity and inclusion is not obvious at the moment. It could be initiated at the UM level rather than at the individual research institute. Given the growing importance of diversity, social safety and inclusion in the scientific community, it is recommended that GROW takes this opportunity to raise awareness and educate their employees in diversity. As a recommendation, GROW could consider organizing Diversity Rounds (informative sessions for PhD candidates, mid-career researchers and PIs) similar to those performed annually regarding scientific integrity. Additionally, GROW could implement or develop a Diversity and Inclusion workshop/session mandatory for new employees, PhD and non-PhDs. Nonetheless, the diversity at the program leader and management team was very balanced, both concerning gender and age.

Taken together, the committee witnessed a vibrant academic community, with ample attention to PhD training and programs that warrant scientific integrity. Points of attention include a more structural approach to diversity management and creating a more agile attitude towards (personal) grant acquisition and communication.

D. Human resource policy

Concerning career development for PhD candidates, several initiatives are organized by GROW (as also mentioned in section 4B); There are four PhD coordinators who have regular meetings with the internal PhD candidates. External PhD candidates can participate on request, which appears to be increasingly stimulated. Alumni cafes are organized, where alumni discuss their career path. In addition, a buddy system for PhD candidates is available, in which junior and more senior PhD candidates are connected (it was not clear to the committee if this system is also available for external PhD candidates). Grant information is distributed by email and support from a grant officer is available. When asked about possible improvements, the PhD candidates suggested that GROW could increasingly facilitate collaboration between departments.

As there are many external PhD candidates, the question arises how they are connected to GROW. Although external PhD candidates are invited to all GROW activities, the committee got the impression that participation was limited. To address this, personal invitations are sent out to increase their participation. Furthermore, external PhD candidates can use the online PhD TRACK support, which is easily available and appreciated by the external candidates. As said, a meeting with a PhD coordinator happens only on request for external PhD candidates. The external PhD candidate interviewed by the committee did not see this difference as problematic, as he received additional support from his own hospital. He also needed less help with career building, as he was already offered a job after obtaining his PhD. So although this was not considered problematic by the external PhD candidate, the committee applauds efforts to increase the participation of external PhD candidates in these monitoring and training activities.

Post-docs will discuss future options with their supervisor, rather than with independent advisors. For this group no clear tracks are available, and support and training are limited. Currently no special post-doc mentoring program is available, which the committee sees as an area that deserves more attention. A pilot will start next year, supported by GROW. Senior scientists underscored that the support for post-docs should be improved, as they are needed for continuity. The committee agrees, as this group of young scientists constitutes the next

generation in GROW, and gives the advice to increase the support for this group to help them become future group leaders.

Also, for the post-doc mid-career group no external coach/mentor appears to be available; this group indicated that they would appreciate more support from GROW when it came to developing their careers. Mid-career researchers expressed a need for more clarity from UM/GROW on what is expected from them, and on how to proceed with a career. It seemed unclear to them what the promotion regulations entailed, and how these regulations relate to other research institutes. Also, the division of roles of department versus GROW in this context was not always clear.

A common topic of discussion was the notion that providing education takes (too) much time. In addition, it appeared to GROW researchers that teaching was only recognized for promotion to associate professors if given at Maastricht University, not at other organizational units, such as European schools. As the committee observed that GROW members sometimes have difficulties in securing time for research grant writing, differentiation between researchers could be helpful.

GROW has a talent scout, which is a new position. This scout knows all local MSc students and helps them choose a master project. There is no scouting by GROW for external candidates at a broader level, this is done by the departments. This is something that might be reconsidered in order to attract ambitious and talented scientists from elsewhere to come to Maastricht.

In conclusion, GROW has clearly invested in creating a close research community. Very visible activities such as 'GROW-on-tour' are recognized and appreciated by the researchers. This reflects the commitment of the new GROW MT. As also mentioned in section 4B, GROW has implemented various levels of PhD candidate training and monitoring. An online system is in place (PhD TRACK), independent and confidential advisors monitor progress, and a buddy system ensures that new PhD candidates can benefit from the experience of senior PhD candidates.

E. Research infrastructure

The GROW institute MT is well-supported by administrative, legal and support staff. Concerning the research infrastructure, the committee noticed a locally concentrated campus in Maastricht, with the various research locations within walking distance (Faculty of Health, Medicine and Life Sciences (FHML), MUMC+, Maastro clinic, laboratories). The close vicinity makes it easy to find and interact with colleagues and with facilities such as the GROW offices. As far as the committee could judge, the facilities were good, with proper housing and sufficient personal space. As part of a lab tour, the committee made a short site visit of one of the laboratories (the MERLN laboratory room 5.213). This visit provided a good impression of the technical facilities available to GROW. The laboratory was relatively new, and offered all facilities needed for top-class research. However, the number of people working in the labs is growing, and space is limited. It is important to create a proper and safe working environment for laboratory personnel, with the possibility to locate noise generating equipment, such as -80 freezers, in a separate location. Future plans are that all labs are to be renovated one by one, giving an excellent opportunity to create an even better working environment.

The offices of GROW and its scientific director are on the same floor as those of other institutes, which facilitates the collaboration between institutes. The committee was pleased to note that

not only scientists but also support staff such as technicians feel connected to GROW and are part of GROW. All of them are invited for the annual GROW science day. Of note, the support staff (i.e. analytical support staff) was less inclined to represent their professional group during management meetings. According to them the usefulness of participating is limited for technicians, but there is no need felt from the side of technicians to increase contact.

5. Qualitative Evaluation Oncology

A. Research Quality

The oncology research division within GROW has defined three key focus areas, each addressed in a separate research program:

- Prevention (P1)
- Basic and Translational Cancer Biology (P2)
- Innovative Cancer Diagnostics and Therapy (P3)

Combined, these three programmes comprehensively span the entire oncological research spectrum, from fundamental research to patient-centred clinical studies, including epidemiological research. Although the design of these three oncological research programs is not unique for the oncology research at GROW, it is a logical classification, and GROW makes it recognizable through unique research activities. Each programme is led by two programme leaders, with leadership overlapping rotating every three years to ensure sustainable knowledge exchange and maintain fresh perspectives. The oncology programs incorporate leading research groups across multiple subfields, including:

- P1: Epidemiology, toxicogenomics
- P2: Precision medicine, radiotherapy, translational immunology, obstetrics and gynaecology, pathology
- P3: Dermatology, gastroenterology and hepatology, oral and maxillofacial surgery, internal medicine, otorhinolaryngology, head and neck surgery, pulmonology, radiology and nuclear medicine, surgery and reconstructive surgery

Together, these groups produced 3,878 refereed articles during the review period (2018–2023), with steady growth over the years. When compared to global benchmarks, the metrics indicate above-average performance of the oncology division. The impact scores of the Oncology division within GROW reflect those of the entire GROW institute.

In the self-evaluation, the contribution of each of the programs to the GROW goals are exemplified by research output. The prevention program (P1) has a clear and successful focus on development and implementation of methodology and relevant model systems. Also, a strong aspect of this program involves cohort analysis and molecular pathological epidemiology, with extensive research output. The Basic and Translational Cancer biology program (P2), again developed innovative model systems, identified biomarkers to guide diagnosis and treatment decisions. Other successful research focus areas, include tumour microenvironment, hypoxia and metabolism. Finally, AI and radiomics are recognizable elements of this program. The Innovative Cancer Diagnostics and Therapy program (P3) has a more translational focus, involving successful studies on immune-tumour interactions, innovative immunotherapy-radiotherapy combination treatment studies and AI application in clinical settings. A strong aspect of these programs is that topics addressed in the fundamental program (P2) align well with studies in the translational/clinical studies in P3.

Analogous to the entire GROW institute, the number of PhD candidates in the Oncology division grew significantly over the reporting period, while the research staff remained similar in size at FHML and even a decrease in MUMC+ staff, pointing at increased supervision demand on staff.

The standing of GROW oncology researchers within their peer communities is evident from their roles as board members, society presidents, and journal editors, as well as the awards and recognitions they have received. GROW funding showed an increase of approximately 10% over the reporting period. Multiple large grants were obtained by GROW oncology researchers from a diverse range of fundings bodies, including KWF and EU. Of note, NWO Veni, Vidi and Aspasia personal grants were obtained.

The GROW leadership recognizes the growing role of data science and AI in accelerating biomarker discovery, drug development, image analysis, and clinical trial design. While the clinical data science group plays a key role, it covers only a portion of this broad domain. In its strategic outlook, GROW has indicated AI is an area to invest in. The planned AI training programme for scientists may contribute, but it is unclear if this will be sufficient in addressing this goal, and recruitment of additional AI-focused principal investigators may be needed.

B. Societal relevance

Research at the oncology division of GROW addresses topics that are clearly relevant for society. A prime example hereof is GROW's focus not only on better diagnosis and treatment, but also on 'preservation of function' and 'quality of life'. Such a focus adheres to the growing population of cancer survivors, who must deal with the adverse effects of cancer and cancer treatment.

In their societal relevance analysis using the ABC methodology, again clinical guidelines appear as most connected to GROW research output. The result of this analysis aligns well with the many GROW oncology researchers who are part of guideline committees.

Illustrative case studies of the impact of GROW oncology research include the Netherlands Cohort Study, which has been successfully used for pathological epidemiology studies on the role of diet on cancer risk. A second case study highlights computational and experimental models to uncover the effects of radiation on healthy tissue and tumour tissues.

An important sign of the efforts of GROW to make impact is the recognition of MUMC+/MCCC/GROW as an accredited Comprehensive Cancer Center by the OECI. This highest levels of accreditation within OECI requires integration of care and research, and illustrates how critical steps are taken to increase impact for patients. In addition, MUMC+/MCCC/GROW along with regional partners who together form OncoZON are the first European accredited Comprehensive Cancer Network. This is a unique accomplishment which establishes MUMC+/MCCC/GROW as a frontrunner in organizing regional cancer care at the highest level, and provides unique opportunities to boost research programs.

C. Viability

GROW Oncology has a productive research program with clear societal impact. Their regional networking efforts provide unique new opportunities to consolidate impactful research and have a very positive impact on the viability of GROW.

In addition to the overall comments on viability of the GROW institute (see section 3C), the committee has some additional points to consider. A potential tread to viability is difficulty in recruiting talented staff. The number of PhD students increases, whereas the staff size is stable (FHML) or decreased (MUMC+). Considerations to address may include protected research time for staff with extensive clinical and educational duties and tenure-track positions.

In the future strategic plans of GROW, artificial intelligence (AI) and generative models are indicated as an area for investment. Currently, GROW already includes a strong research group focussing on AI (Clinical Data Science, prof. A. Dekker) and an AI advisor across the domains. An envisioned growing role of AI is also acknowledged by GROW at several locations in the self-evaluation report. In the self-assessment, GROW indicates plans to initiate an AI training programme for GROW scientists, with 'all departments in GROW equipped with necessary AI tools and knowledge'. The evaluation committee underscores the GROW vision that AI will likely have a transformative impact on research. However, to adequately implement AI in GROW, the mentioned training program may not be sufficient, as AI development typically requires specific skill sets. While the Clinical Data Science group produces an extensive amount of high-quality AI research, this research is predominantly translational/clinical in nature, while GROW also hosts many basic scientists. A suggestion is to consider recruiting a specific PI with AI expertise who can bridge basic science and AI. Such PI(s) can work in close collaboration with basic or clinical scientists, ultimately requiring and resulting in more specific AI leadership.

6. Qualitative Evaluation Reproduction and Perinatal Medicine

A. Research Quality

Within the Reproduction and Perinatal Medicine Division, three research topics are defined, which together are addressed in one research program (P4):

1) The healthy embryo and reproductive failure
2) Mother and child health
3) Women's Health

These three topics combined represent the 'life cycle' approach, to which all relevant Reproduction and Perinatal Medicine research topics can be logically included. At GROW Reproduction, there are several internationally recognized research groups, including those related to preimplantation genetic testing (PGT), rare metabolic diseases in children, and ethics. Other innovative research programs, that are very promising but perhaps less known, include the delivery room for sheep to study placental complication within the Department of Paediatrics. In general, the committee observed multiple research activities of high quality, divided over many topics, which together constitute a comprehensive research program.

GROW reproduction produced 1,140 refereed articles during the review period (2018–2023). When compared to global benchmarks, the metrics indicate above-average performance of the reproduction/perinatology division. The impact scores of the reproduction/perinatology division within GROW reflect those of the entire GROW institute.

In the self-evaluation, the contribution of the Reproduction and Perinatal Medicine program (P4) to the GROW goals are exemplified by research output of its three research lines.

The 'healthy embryo and reproductive failure' research topic involves multi-omics analysis of relevant developmental stages and relevant tissues, improving preimplantation genetic testing (PGT) and in vitro fertilization (IVT) protocols, along with ethical evaluation. In addition, highly innovative synthetic embryo research is performed, with clear opportunities for genetic and chemical screening to identify novel therapeutic strategies. The 'mother and child health' topic studies the impact of chronic disorders and lifestyle factors on the health of mothers and children. Highly innovative experimental models are successfully developed, which allow for testing interventions. These experimental studies align with clinical cohort analysis for risk assessment, aid evaluation, and the development of decision tools. In the 'Women's health' topic, multiple benign pathologies of the female reproductive system are studied. These three research topics appear very synergistic, and have cross connections concerning development of experimental models and genetic approaches.

Similar to the entire GROW institute, the number of PhD candidates in the Reproduction/Perinatology Division increased significantly over the reporting period, while the research staff remained similar in size, both at FHML and at the MUMC+. This shifting between staff and PhD candidates increases supervision burden, especially when also teaching load and clinical duties are considerable.

The standing of GROW Reproduction researchers is evident from their many roles as board members, society presidents, and journal editors, as well as the awards and recognitions they have received. GROW Reproduction funding remained relatively stable in the period 2018-2022, with a substantial increase of approximately 50% in 2023. Multiple large grants were obtained by GROW Reproduction researchers, with notably large grants from ZonMW and EU. The committee got the impression that the success rate of (personal) grant applications is not quite high and that especially clinical scientists lacked sufficient time for conducting research.

B. Societal relevance

Similar to the entire GROW institute, the impact of GROW Reproduction is mostly on clinical guidelines. In line with this notion, GROW Reproduction researchers have contributed to national and international guidelines.

Two case studies are described that illustrate the societal impact of GROW Reproduction. Firstly, a study on preterm birth is highlighted, which affects a large number of births in the Netherlands, and can lead to life-long adverse effects. In this study, innovative experimental models are used to study neuronal developmental consequences of pre-term births. Secondly, The EXPECT study analyses foetal growth abnormalities, and successfully resulted in implementation of risk assessment models. This research is conducted in close collaboration with regional partners and is a prime example of research with clear relevance for society.

The above-mentioned case study underscores the unique opportunity for GROW reproduction to utilize its unique regional position, with its demographic challenges regarding reproductive and perinatal health. Together with the other research institutes, stakeholders in reproductive and perinatal health and municipalities, efforts could be made to further improve the reproductive and perinatal health in the region and implement preventive strategies.

C. Viability

GROW Reproduction has a clearly defined research topics with impactful results. In addition to the overall comments on viability of the GROW institute (see section 3D), the following points were observed by the committee:

As discussed also elsewhere in this report, positioning of Reproduction along with Oncology within GROW to the committee initially appeared as an ‘arranged marriage’. However, in discussing the position of Reproduction as a program within GROW, the committee got the impression that the reproduction group was content with how GROW is currently organised. The efforts of GROW to promote integration of research activities of Reproduction and Oncology were positively evaluated by interviewees and the evaluation committee.

Reproduction and women’s and children’s health research is distributed over several research institutes, in particular GROW and MERLN, with a strong and successful collaboration between these two institutes. A clear example involves research into the development of stem cell-derived models for human blastocyst and peri-implantation development (synthetic embryos) to perform large-scale screening in microfabricated cell culture systems, including microfluidics maternal tissue models. A shared research focus and overlap was also observed between GROW

and GRiP, which according to the interviewees constitutes an important collaboration, mostly based on shared technical and methodological aspects. Whereas GROW forms a research Institute, GriP is a research platform, with its own board and meeting structure. The distribution of reproduction/perinatology research over multiple organizational units appeared somewhat complex. A more focussed organization of GROW Reproduction research may lead to better visibility and more optimal use of financial means and support.

The leadership of GROW research programs involves 2 program leaders per program. This is a logical approach. The consequence of this system for the Reproduction and Perinatal Medicine research program is that 2 out of the 3 research topics are covered by program leaders. For Reproduction this could lead to inadequate representation of one of the research topics, it could be considered for this program to have 3 program leaders (like what was done during 2021-2023).

A considerably threat to viability involves continuity of staff, as also mentioned in the SWOT analysis. Timely identification and positioning of successors for retiring PIs is important to sustain established and productive research lines. The committee advises to recruit (clinical) researchers with dedicated research time, and support them in applications for (personal) grants and start-up grants.

The many and diverse research topics within the reproduction and perinatal health program combined with the limited number of staff creates a need to focus. Rather than expanding research topics - which may have negative impact on the viability of currently ongoing research lines – it is advised to invest and build on existing strengths. Since the previous evaluation, more focus in research topics has been brought, which is positively evaluated.

7. Recommendations

1. **Integration of Oncology and Reproduction within one research institute (see paragraph 3C page 7):** The committee recognizes the historical context on how these two research areas were united in one institute, and realizes that separation/merging these two research areas is a recurrent topic, and has been discussed in previous evaluations.

   Initially, the committee felt that the connection between these groups could be considered artificial, as an "arranged marriage", in which the balance between Oncology and Reproduction was not equal, with Oncology being much larger than Reproduction. However, during the course of the site-visit, the committee was positively surprised when this issue was discussed with the young, mid-career and senior scientists. After having completed the interviews, the committee observed that most researchers had either a neutral or positive attitude towards Oncology and Reproduction within one research Institute. Taken together, at present the current construction of Oncology and Reproduction in one institute appears to work well.

   Yet, the committee supports the plans to pursue a better connection or integration between these two research areas, and recommends continuing investing in this integration. Multiple research topics were mentioned for improving integration (i.e. prevention, lifestyle, microbiome, immunology). The committee has some doubts on adding new topics such as the microbiome and recommends that other, more related, areas may be worth considering (e.g. women's cancers, hormonal exposure, early onset cancers). Overall, the committee thinks that it would be wise to build on expertise that is already present in Maastricht.

   Additionally, while the committee feels that the current combined Oncology/Reproduction institute works, it is also recommended to schedule an evaluation in the future, to analyse if the integration between Oncology and Reproduction has improved.

2. **Research Programs (see paragraph 3C page 6):** The committee was enthusiastic about GROW appointing two young researchers as program leaders per research program. However, it remained somewhat unclear what the added value of the programs is. Are there recurrent program meetings? In response to the 2018 external review, focus has been shifted to improve synergy between the different programs. The committee views that program-specific activities and joint activities may be needed to reach this goal.

3. **Post-docs (see paragraph 4D, page 11):** The committee observed that the post-docs form a relatively small group within GROW. This is an important group of scientists - but also a vulnerable group. The post-docs form a talent pool that constitutes the next generation of research leaders. Compared to the PhD candidates for whom many training and support systems have been arranged, the committee feels that the post-docs may benefit from additional support, mentoring, career advice, visibility, and a clear view on their possibilities for making a next step in their career. A defined 'tenure track' at UM could add in defining a transparent road for career progress.

4. **Mid-career researchers (see paragraph 4 D, page 12):** During the interviews with mid-career researchers, in particular the assistant professors, teaching load was mentioned as a

burden which may hamper research progress, and the ability to successfully apply for research grants. Hopefully, the 'Recognition and Reward' program ('Erkennen en waarderen') forms a solid basis and guideline to differentiate between the different career profiles, and identify those researchers with potential for (individual) grant success and provide the required support. In addition, a form of tenure-track at UM could be a means to increase incentive to obtain personal grants.

5. **Sustainable staff size (see paragraph 3C, page 7):** While the total number of PhD candidates has increased substantially, the staff size has remained roughly equal, pointing towards increased supervision tasks. It is recommended to actively monitor if the amount of staff is sufficient for the increased supervision demands, and if staff needs to be increased accordingly.

6. **Internal vs external PhD candidates (see paragraph 3C, page 7 and paragraph 4B, page 9):** In the GROW report, a distinction is made between internal and external PhD candidates. Only during the site-visit it became clear that a large fraction of the external PhD candidates is appointed by Maastro and the MUMC+, and their 'external' status reflects where at the Maastricht campus they are embedded. More detailed labelling will help to obtain a clear overview of where PhD candidates are physically located. Still, a significant number of PhD candidates are appointed at affiliate hospitals. Although these candidates technically have access to all the networking, supervision and training activities of GROW, it appears that PhD candidates at peripheral institutions use these training opportunities less frequently when compared to PhD candidates at the Maastricht campus. To secure their scientific development and training, it would be good to actively engage these external candidates in GROW activities.

7. **Group science vs individual success in relation to talent (see paragraph 4 D, page 12)**: The committee has clearly witnessed that the GROW researchers successfully focus on team science. Whereas a 'team science' approach allows for a sustainable research model, many (inter)national funding schemes still focus heavily on individual performance. The committee feels that the team science approach at GROW should fit well in consortia funding schemes, while at the same time, it is advised to further focus on talent screening, talent recruitment and making sure researchers have time and support to improve in personal grant scheme success rates. GROW researcher were more successful in obtaining personal grants when compared to the previous reporting period. Yet, when compared to other Dutch research institutes, GROW institute researchers appears to be less successful in personal competitive grant schemes (i.e. ERC and vernieuwings-impuls of NWO). Although GROW researchers adopt a team-science approach, this can go hand in hand with personal grants. It is imperative that senior peers should take their responsibility in these systems; Researchers who have been successful in competitive personal grant schemes can guide junior researchers, while (past) grant evaluation committee members of funding bodies could act as mentors in funding support.

8. **Community building (see paragraph 3C, page 11 and 4D, page 12).** Based on the previous external evaluation, and the previous Scientific Advisory Board advice, community building was mentioned as an area to invest in. The committee agrees wholeheartedly with this

recommendation, and feels that this needs continuous support. The GROW management team actively stimulates community building by organising for example 'Grow-on-tour', and an annual Science day. These efforts are clearly recognized by the people we interviewed, and the positive role of the current MT and director herein was clearly acknowledged. Further improvement of community building should be focused on:

- Community building between Oncology vs Reproduction
- Community building between the different groups of researchers at MUMC+, faculty, Maestro and affiliated hospitals in the region.
- Community building between internal PhD candidates vs external PhD candidates. There is a significant group of external PhD candidates, and their connection to GROW appears less anchored when compared to PhD candidates at the Maastricht campus. The committee would recommend including these PhD candidates as much as possible in all the activities, as well as the research infrastructure, including PhD monitoring, and PhD training, including awareness on science integrity and diversity.

9. **Impact and external communication (see paragraph 3C, page 7)**: Without exception, the GROW researchers who were interviewed by the committee were very enthusiastic and proud about their research, and the quality of the research is high. The impact of the research could be increased by improving communication of the successes of GROW researchers.

   Improved external communication would benefit the impact examples in the self-evaluation (e.g. GROW has a major impact with clinical guidelines). However, the committee has seen many more success stories, ranging from the individual research projects that were presented at the poster session, to major accomplishments, including the OECI accreditation of both the comprehensive cancer centre and the comprehensive cancer regional network, and the societal impact of research on menstrual problems. This is not only unique to the Netherlands, but unique for Europe, and the committee feels that GROW researchers are too modest about these success stories. An improved external communication strategy may further empower researchers, and give them the attitude and visibility that will also help in grant success. In doing so, one clear contact point for communication support would be recommended.

   The successful accreditation of GROW's cancer network is a good example of team science, and also aligns well with the well-established connections to hospitals in the region, where a significant amount of the research is conducted. In the coming time, translational and clinical research will be significantly affected by changes in health care organization in the Netherlands. GROW and Maastricht University have a unique and powerful network to organize research with regional partners, which will be highly relevant in the coming time to sustain research. This is not only true for Oncology, but also for Reproduction.

10. **Artificial intelligence (see paragraph 3C, page 8 and 5C, page 16):** While AI is recognized as a key trend, it is unclear whether the current plans, such as implementing a training programme for scientists and the appointment of a GROW AI advisor, are sufficient to stay competitive and avoid falling behind in the areas not covered by clinical data science. A suggestion is to consider recruiting a specific PI with AI expertise who can bridge basic science and AI. Such PI(s) can work in close collaboration with basic or clinical scientists, ultimately requiring and resulting in more specific AI leadership.

Annex 1: Members of the External Review Committee

- **Prof. dr. Marcel van Vugt (chair):** Professor Molecular Oncology, director Comprehensive Cancer Center UMCG
- **Prof. dr. Kitty Bloemenkamp:** Maternal Fetal Medicine Specialist and Chair Birth Centre, Wilhelmina's Children Hospital, University Medical Centre
- **Prof. dr. Erik Sistermans:** Professor of Human Genetics, head of department of Human Genetics of AmsterdamUMC
- **Prof. Helen Coleman:** Lead of the Cancer Epidemiology Research Group at the Centre for Public Health at Queen's University Belfast, Deputy Director of the Northern Ireland Cancer Registry.
- **Dr. Jonas Teuwen:** Group leader Artificial Intelligence Netherlands Cancer Institute
- **Jorge Cuenca Escalona:** PhD Candidate Tumour Immunology Radboud Institute for Molecular Life Sciences
- Dr. Ir Roelinka Broekhuizen, secretary

Annex 2: Criteria of SEP 2021-2027

The main goal of an SEP evaluation is to evaluate a research unit in light of its own aims and strategy

Research quality

The quality of the unit's research over the past six-year period is assessed in its international, national or – where appropriate – regional context. The Review Committee does so by assessing a research unit in light of its own aims and strategy. Central in this assessment are the contributions to the body of scientific knowledge. The Review Committee reflects on the quality and scientific relevance of the research. Moreover, the academic reputation and leadership within the field is assessed. The committee's assessment is grounded in a narrative argument and supported by evidence of the scientific achievements of the unit in the context of the national or international research field, as appropriate to the specific claims made in the narrative. The protocol explicitly follows the guidelines of the San Francisco Declaration on Research Assessment (DORA)2 adopted by KNAW, VSNU and NWO.

Societal relevance

The societal relevance of the unit's research in terms of impact, public engagement and uptake of the unit's research is assessed in economic, social, cultural, educational or any other terms that may be relevant. Societal impact may often take longer to become apparent. Societal impact that became evident in the past six years may therefore well be due to research done by the unit long before. The Review Committee reflects on societal relevance by assessing a research unit's accomplishments in light of its own aims and strategy. The Review Committee also reflects, where applicable, on the teaching-research nexus. The assessment is grounded in a narrative argument that describes the key research findings and their implications, while it also includes evidence for the societal relevance in terms of impact and engagement of the research unit.

Viability

The extent to which the research unit's goals for the coming six-year period remain scientifically and societally relevant is assessed. It is also assessed whether its aims and strategy as well as the foresight of its leadership and its overall management are optimal to attain these goals. Finally, it is assessed whether the plans and resources are adequate to implement this strategy. The Review Committee also reflects on the viability of the research unit in relation to the expected developments in the field and societal developments as well as on the wider institutional context of the research unit.

The three main assessment criteria 1) research quality, 2) societal relevance and 3) viability are central in the assessment of the research unit. These three criteria include several aspects depending on the aims and strategy of the research unit. Among all relevant aspects, the research unit addresses at least the following four specific aspects: 1) Open Science, 2) PhD Policy and Training, 3) Academic Culture and 4) Human Resources Policy in concert with the main assessment criteria. The Review Committee should also take these into account.