Faculty of Applied Sciences

Long term strategic plan
Towards 2020
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What are the Faculty of Applied Sciences’ ambitions?
• The Faculty of Applied Sciences’ main ambition is to contribute to resolving the major social challenges of our time through its teaching and research. These challenges include a secure, safe, clean and efficient energy supply, health (e.g. effective medicines), security of food supply, green economy/bio-economy, safety and security (also in terms of information transfer) and innovation.

• The faculty is committed to excellence. In terms of research, it aims to be among the best in the world in a number of areas. Study programmes are of a high standard and students are expected to complete their degree programmes within the prescribed period. This goal places high demands on the efforts and quality of academics and support staff at all levels.

• The faculty also aspires to be a good employer. This means providing a safe working environment with the proper facilities and encouraging open communication and cooperation at every layer of the organisation. This includes cooperation within and between departments, and also between departments and support services. Support staff seconded to the faculty from the various departments of the University Corporate Office form an integral part of the faculty’s community. The faculty aims to optimise its services in a number of ways, including ensuring coherence and coordination between the various support services.

• Diversity is a matter of course at Applied Sciences. The permanent academic staff as well as the post-doctoral researchers and doctoral candidates come from all over the world. In the Master’s programmes, the aim is for 30% to 50% international students among the total intake. The faculty is working actively to increase the intake of women in degree programmes and academic positions. Extra efforts will be made in the coming years to attract and retain female academics of all ranks. The target is to ensure that 25% of permanent staff members (assistant professors, associate professors and full professors) are female. To achieve this, one in three hires has to be female.
What are the aims for education?
The Faculty of Applied Sciences endeavours to provide high-quality education, starting with a solid foundation at Bachelor’s level and further depth at Master’s level, with the aim of stimulating excellence among students.

**Degree programmes and research departments within the faculty**

The four Bachelor’s degree programmes are provided across all six of the faculty’s departments, which are also all responsible for the selection of available final Bachelor’s projects for all four programmes. Due to the areas of direct overlap with research in the Master’s final project and the related courses, the Master’s degree programmes are linked more exclusively to one or more departments. Cooperation between departmental directors and directors of studies is enhanced through an annual meeting on relevant themes, at which recent developments and action points are discussed and agreements made for the coming year. The Board of Examiners also consults annually with the faculty’s management team.

**Education Applied Sciences 2016**

4 BSc’s and 5 MSc’s

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**Joint programmes**

The faculty’s partnerships in the joint degree programmes with Leiden University (BSc MST, BSc LST) and the Erasmus University Rotterdam (BSc and MSc BN) will be continued intensively, with the aim of improving links between the various support systems, such as Blackboard. The faculty is working to optimise communications relating to the joint programmes in close cooperation with Rotterdam and Leiden. Coordination of the MSc SET will be transferred to the Faculty of EEMCS in 2016, and coordination of the MSc IE to the Faculty of SEPAM. Applied Sciences will continue to participate actively in both degree programmes by providing teaching, offering Master’s final projects and participating in boards of studies and boards of examiners.
Excellence and teaching formats
The emphasis in the faculty’s teaching is to strive for student excellence. The faculty runs informational activities and conducts matching processes to inform students of the demands placed on them and the level required in order to obtain a degree. Students are supported to complete their degree within the specified period during the degree programmes. Interactive modes of instruction are used in order to involve students as much as possible in the course material. Applied Sciences works in accordance with the studio classroom concept for a more intense learning experience. The Learning to Research – Researching to Learn model will be continued as a guiding principle, while also seeking new teaching formats. The two-track Honours programme (individually or in groups) is aimed at outstanding students and amounts to 20 ECTS for a standard study duration. One of the two tracks now involves working with industry – this is a new development and will be developed further in the coming years. Focus on blended teaching formats will be intensified: that is, conventional lectures combined with MOOCs, films and Just-in-Time Teaching methods, among others. The faculty is working to create an international community of Master’s students. The Bachelor’s degree programmes will continue to be taught in Dutch, with the exception of the Bachelor’s in Nanobiology, which will be taught entirely in English and begin admitting international students.

Enhancing quality of lecturers and extra resources
Training outstanding students requires outstanding lecturers. In the R&D cycle, the faculty will concentrate on improving lecturers’ performance as well as appreciating and rewarding those that excel. Education also plays a crucial role in the career path of academics. Development of teaching skills remains a point of concern; the compulsory University Teaching Qualification (UTQ) programme will support tenure trackers in this
and staff members who have passed the UTQ will be encouraged to further develop their professionalisation and teaching skills. The aim is to maintain the percentage of UTQ-qualified academics at at least 75% in the future. Teaching skills will be a major consideration in the appointment of assistant professors and associate professors. A table noting staff members’ area(s) of expertise will be drawn up for each degree programme. In addition, extra resources to support teaching will be made available structurally through the faculty’s allocation model. These resources will be used partly to reinforce the support from the E&SA department, and partly to fund additional staff for laboratory courses in the research departments.

**Student participation**

Good relationships and regular contact with study associations and the Faculty Student Council have a significant impact on the quality of teaching. New legislation will take effect on 1 September 2016 that will give boards of studies a greater say. This will lead to greater and more intensive consultation with students in relation to degree programmes.

**Teacher training programmes**

One of the aims of the SEC Master’s is to train a sufficient number of secondary school science teachers. In light of this responsibility to society, the faculty will further enhance the Master’s degree programme in this area as well as the programme’s communications track.

**More female students**

The prospectus information provided by the faculty will place greater emphasis on recruiting female students and adjusting the perceptions school pupils have of its degree programmes. Female role models will be included in the informational materials.
Bachelor's intake

Intake in Bachelor's and Master's degree programmes
The aim is for an intake of 150 to 250 first-year students per Bachelor's degree programme. For the Bachelor’s in Nanobiology, the intake will be limited to 100 for the time being due to limited capacity. The faculty is working to expand the facilities for this programme in order to increase student numbers up to 150.

Master’s intake

For the Master’s degree programmes, the aim is to increase the intake of first-year students as shown in the figure below. This is based on a transfer of 70% of the Bachelor’s degree students to the corresponding Master’s programme. For the joint degrees LST and MST the number enrolling in the MSc programmes LST and CE is divided by two, as about half the students go to the partner university. For LST, the number of transfers is somewhat lower as students can choose from a variety of Master’s programmes outside the TU Delft. The number of international Master’s students (both European and non-European) should be between 30% and 50% of the total intake. In this way, the faculty’s students will benefit from an international environment while adequately retaining specifically Dutch aspects of the programmes.
Pass rate in Bachelor’s degree programmes
Thanks to improved information (‘right student in the right place’), the introduction of modular courses and more intense teaching in the first year, it is feasible for 70% of Bachelor’s students to receive a positive binding recommendation on continuation of studies (Bindend Studie Advies, BSA) after the first year. The objective is to maintain this percentage in the coming years.

Positive binding recommendation on continuation of studies

In addition, the faculty will work to substantially increase the number of Bachelor’s students who earn their degree within four years: from 55% to 80% of re-enrolled students who receive a positive BSA. One action to be taken in this respect will be to monitor the turnaround time of Bachelor’s final projects more closely.

Bachelor pass rate
What direction is research heading in?
The strength of the Faculty of Applied Sciences lies in its **broad research portfolio** in the fields of physics, chemistry and biotechnology. This strong, monodisciplinary basis provides an excellent starting position for stimulating interdisciplinary and multidisciplinary research within and between the six research departments: Bionanoscience, Biotechnology, Chemical Engineering, Imaging Physics, Quantum Nanoscience and Radiation Science & Technology. As a result of the development of the Bionanoscience department, the faculty will also come to include the discipline of biology.

The faculty’s research is driven partly by curiosity and partly by utility, but always based on a fundamental scientific approach. At present, the **shift from engineering to science** is a major theme at universities of technology in general, and also at the Faculty of Applied Sciences. The faculty is deliberately seeking to achieve breadth in this respect: from fundamental science to application/valorisation. It will further strengthen its position by stimulating innovative research at the crossroads between disciplines. Academics will target their publications towards the most prominent scientific journals, with the aim of creating an impact factor (mean normalised citation score) of 1.4 or higher in all fields of research.

The faculty will follow new lines of research by bringing in **Principal Investigators**, who will be given the opportunity to extend their own lines of research, supported by start-up packages and the best infrastructure. Two research departments, Bionanoscience and Quantum Nanoscience, are already applying this model. The other four research departments will leave the current research groups more or less intact, but will offer starting and existing assistant and associate professors more opportunities to set up lines of research independently.

In order to generate sufficient resources for research, the faculty will place a greater emphasis on **proactively influencing the policy** of both national and European grant providers. It will promote and support participation in preliminary rounds and workshops, as well as forming consortia and other initiatives, seeking cooperation with the TU Delft Valorisation Centre.

**Research Profile**

![Research Profile Diagram]

- **Pragmatic approach**
- **Curiosity driven questions**
- **Application driven questions**
- **Fundamental approach**
- **Applied Sciences**
The faculty will particularly concentrate on attracting **personal grants**, both within the Netherlands (e.g. Veni, Vidi, Vici grants, the Gravity programme (zwaartekracht)) and in Europe (ERC grants).

Research also involves training **doctoral candidates** and it is crucial to focus on teaching and supervising them. The average turnaround time is currently unacceptably long. The objective is to reduce the average turnaround time for Doctoral programmes so that 80% of candidates obtain their doctorate within five years. The aim is to maintain an average population of 500 candidates at a time.

Applied Sciences will continue to actively take part in research **partnerships** within TU Delft, such as with the 3TU Federation, the IDEA League, Medical Delta, the LDE partnership (Leiden-Delft-Rotterdam), the Holland Particle Therapy Centre (HollandPTC), the Casimir Research School, the Kavli Institute, BE-Basic and QuTech.

**Data stewardship and Open Access** are points of concern for the faculty for the coming years. The guidelines provided by the Executive Board will be implemented in close consultation with researchers from the various departments.
How will the Faculty shape valorisation?
The Faculty of Applied Sciences will seek to enhance cooperation with businesses in various areas through Horizon 2020 projects and participation in the ‘top sectors’ defined by the Dutch government. Its focus will shift more towards forming consortia in which Applied Sciences will play an active role. The faculty will also invest in research facilities with a broader social application (e.g. VLLAIR, RID), as well as strategic relationships and projects (e.g. QuTech, HollandPTC). Improved links with the business community will provide new opportunities to raise funds for research projects. Efforts will be made in the coming period to support academics in this area and tenure trackers in particular. Gearing the acquisition of research projects more specifically towards businesses, will stimulate them to invest in these projects.

The already successful Medical Delta programme was set up with the universities and university medical centres of Leiden and Rotterdam. The faculty will continue to take advantage of the opportunities offered by the LDE partnership, in particular a research programme linked to HollandPTC.

Specific support will be provided to academics in the pre-start-up phase of ideas for the market. They will be encouraged to choose projects of interest to the market. Market orientation will become an essential part of applying for patents.

Contacts with strategic partners from industry are already excellent and will be further intensified. The faculty will maintain contact with stakeholders through strategic communications etc. The emphasis on visibility in the public domain, both nationally and internationally will continue and there will be an increased focus on communications about the faculty’s research.

**Valorisation through education** will take place by training Master’s students, PdEng candidates and doctoral candidates. The excellent prospects for alumni in the job market are a real asset for attracting outstanding students. In the coming years, the faculty will systematically analyse where Applied Physics alumni are employed.

The **faculty will support valorisation activities** through the planning offices and the Contract Management Bureau. The faculty will intensify its partnership with and optimise the support it receives from the Valorisation Centre through the secondment of one of their Business Relations Managers.

**PdEng programmes**
The three existing PdEng programmes (Process & Equipment Design, BioProcess Engineering and Chemical Product Design) all aim for an average intake of 12 trainees each. PdEng traineeships are two-year post-Master’s programmes that teach and train top-level Master’s graduates into certified Technological Designers in close cooperation with partners from industry. All these programmes maintain TU Delft’s historic (process) design and engineering signature in these fields and develop it as a strength in close cooperation with industry in the Netherlands.
What is the Faculty doing to attract and retain talent?
In order to make a real difference, you must be excellent at what you do. The faculty must boast outstanding talent in order to attract the best students and doctoral candidates and help them develop to their full potential. Therefore, academics are required to perform at a high level across the board and excel in at least one of the areas of research, teaching and valorisation.

There is a lot of competition in the international market for academic talent. Outstanding academics are in high demand; they can access fantastic facilities at renowned universities and receive start-up funding to set up their own groups. Applied Sciences has gained experience with providing **start-up budgets** in recent years and will make funds available in the coming period to make interesting offers to talented PIs.

An attractive **terms and conditions of employment package** is essential in order to remain internationally competitive at attracting talented academics. In conjunction with HR, Applied Physics is investigating how to optimise this package.

Offering good opportunities for **career development** is key to retaining talented academics, in terms of research, education, valorisation and organisation. At Applied Sciences, tenure trackers are eligible to receive a permanent appointment as an associate professor after completing their temporary employment contract, partly on the basis of recommendations from the Career Development Committee and the management team. This is in line with the opportunities offered internationally at top universities, and is therefore sufficiently competitive.

The faculty aims to be an attractive employer, in cooperation with the university as a whole. Attractive employers recognise the importance of autonomy and their employees are content, committed and enthusiastic. They concentrate on staff members and managers’ **personal development** and **developing the organisation**, which must be innovative and adapt to trends. The faculty has scope for departments to provide academics with the best possible facilities. The support services play an important role in this respect. HR supports the development of a range of structures within the faculty, such as the PI system.

Excellent organisations also require excellent supporters – staff members who not only make a substantive difference but also fit the **culture of the faculty** and TU Delft at large. For these reasons, the aim is not only to attract talented individuals in the short term, but also to invest in future loyalty and retention.
Retaining talent depends entirely on staff members’ levels of satisfaction – something that requires continuous attention from the faculty. A satisfaction survey was conducted among the faculty’s permanent staff in 2015. The response rate was high: 64%. One particularly interesting result of the survey was to see the tremendous enthusiasm and commitment from the Applied Sciences staff. With the support of HR, the departments discussed the results and determined where improvements could be made. There are plans to repeat this survey in 2019 and achieve an 80% response rate and the target figures in the table below.

‘Enthusiasm’ from the faculty’s staff can be seen, for example, in motivated colleagues who are willing to participate in the faculty’s Personnel Committee. Consultation with the Personnel Committee is and will continue to be an important platform for informing and obtaining advice from staff representatives.

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Bij ons op het werk

Is team-spirit erg belangrijk

Heeft iedereen zijn eigen kwaliteiten

Zijn we collegiaal

Laten we iedereen in zijn waarde

Delen we lief & leed

Zijn we eerlijk en positief

Werken we samen & vullen we elkaar aan

Moeten we het samen doen...

GAAN WE ERVOOR!
How does the Faculty provide optimal infrastructure?
The Faculty of Applied Sciences defines infrastructure for teaching and research as all facilities in buildings (labs, offices), large-scale research facilities (e.g. RID and VLL), equipment and ICT facilities for staff and students. It aims to create and maintain safe, liveable and cost-effective infrastructure and seeks to provide access to major international facilities.

The relocation of the Bionanoscience, Biotechnology and Chemical Engineering departments to the **new Applied Sciences building Mekelpark Zuid** will involve considerable effort in 2016. However, in addition to state-of-the-art lab facilities, the building will provide students with an excellent learning environment and opportunities for cooperation across departments. The faculty believes that the building will form an ecosystem for stimulating excellent science and will utilise it accordingly.

Details of the **renovation of the RID** associated with the new accommodation will take shape in the coming period. Plans for a renovated or new building to replace the existing **Applied Physics building** on Lorentzweg will also be development further. The faculty emphasises the importance of a cross-project approach by FMRE and will contribute to this by facilitating intensive cooperation between FMRE and users. It also supports the Executive Board’s plan to develop large groups of **special buildings for teaching purposes** on campus.

Ongoing investment in existing and new (large-scale) **research equipment** is essential in order to be able to conduct excellent research and attract leading academics. In consultation between the dean and departmental directors, the financial policy will include scope for such investments and the faculty’s reserves policy is focused on making this possible. In addition, the faculty is participating in the development of national road maps for large-scale research infrastructure.

Specific agreements will be made with the Executive Board on financing costs engendered by the Government in connection with the **Dutch Safety Requirements** imposed on the supervision of the RID research reactor.

The faculty will take a service-oriented approach in order to keep its **ICT infrastructure** for teaching, research and support up to standard. This will involve providing flexible, scalable and safe storage and computing facilities; offering staff and students the ability to use their own hardware; and creating access to a customisable environment containing the necessary facilities for various forms of research and cooperation.

It is very important for reliable and appropriate management information to be available in order to properly administer and manage the faculty. In the coming years, there will be an additional focus on developing **Business Intelligence**, in close cooperation with colleagues from the University Corporate Office. There will be a shift from data entry to data analysis due to the enormous predictive value of historical data, particularly in relation to finances.
How will Applied Sciences remain financially healthy?
The Faculty of Applied Science aims to cover its fixed costs through government funding. Revenue from commercial and contract funding is essential to further develop research. The guiding principle is a 1:1 ratio between government funding and commercial and contract funding budgets. The faculty considers this to be the optimum scenario. It is impossible to achieve a larger proportion of contract and commercial funding because the number of permanent academic staff is linked to government funding.

The university allocation model allocates Applied Sciences a substantial amount for its basic component. The faculty’s research involves the use of extensive and expensive laboratory facilities, which must be supported by highly qualified technical staff. The faculty emphasises that **funding for this basic infrastructure** is linked to the size of its basic component from the university allocation model. In connection with this, Applied Sciences maintains a sustainable faculty earnings model, which is structured according to the system used in the university-wide model.

The university **reserves policy** gives faculties scope to make more substantial investments, in consultation with the Executive Board. The faculty views this as an incentive to make the necessary investments in outstanding academics and infrastructure. Plans for this will be developed within Applied Sciences in consultation between the dean and the departments.
The Department of Bionanoscience is dedicated to conducting world-leading research at the interface between nanophysics and biology. This young, international department combines research into single-molecule biophysics, synthetic biology and cell biology.

Bionanoscience aims to understand the functioning of single cells in all their complexity down to the molecular level. Understanding the mechanisms that operate a cell is vital for (among other things) improving health care, creating molecularly targeted medicine and developing new materials and energy sources.

The department is part of the Kavli Institute of Nanoscience (kavli.tudelft.nl) established by the US-based Kavli foundation and the Casimir Research School (casimir.researchschool.nl). It is highly successful in attracting funding, especially from the European Research Council and the Netherlands Organisation for Scientific Research (NWO). The quality of research and impact of publications are both high.

Bionanoscience is a growing department with a progressive PI system, a good gender balance, and a flat organisational structure. This provides attractive career-perspectives for excellent junior faculty from around the world.

The new building gives Bionanosciences the space it needs to fully realise its ambitions for growth. Thanks to the state-of-the-art facilities, the department will be able to carry out top quality bionanoscience research. It is seeking to recruit a new group leader who specialises in cryoelectron microscopy. However, to successfully attract a Tenure Tracker specialised in this subject, the department really needs to have at least one cryoelectron microscope to work with, and preferably more.

The coming years

- The new Applied Sciences building will open its doors in May 2016. The department of Bionanoscience will be housed there, along with the Chemical Engineering and Biotechnology departments. This provides an excellent opportunity to further strengthen collaboration with these departments.
- The department will increase its focus on quantitative cell biology, in order to build a strong track record in that discipline and further mature into a dynamic multi-disciplinary department.
- Through its increasing number of research topics that bring the potential for collaborations with industry, Bionanoscience will focus on increasing its connections with such partners in the coming years.
- The new Master’s curriculum in Nanobiology at TU Delft will attract a new pool of talent that can strengthen the department.
Calcofluor white staining of a multicellular cluster of yeast.
The Department of Biotechnology engages in internationally-leading education programmes and ground-breaking research as a basis for scientific, technological and societal innovation in industrial and environmental biotechnology.

Within the department, scientists and engineers work in disciplines ranging from genomics, metabolomics and biocatalysis to fermentation technology, environmental biotechnology, bioprocess technology and downstream processing. Its research projects are characterised by combining and integrating quantitative experimental and engineering approaches, complemented by research into ethical and societal biotechnology issues. This broad range of biotechnology expertise enables the department to pursue an engineering approach to biotechnology that is firmly rooted in fundamental sciences.

The department has an excellent network of relationships with industry, government and water boards and, as a result, has gained a leading role in public-private partnerships including the Foundation BE-Basic (www.be-basic.org).

The transformation of biomass and biowaste into fuels, chemicals and plastics, is one of the grand challenges that the department of Biotechnology will keep working on. Besides fundamental knowledge on microorganisms and enzymes, new large research partnerships with academic and industrial partners will be set-up in order to develop socially responsible solutions with lower environmental impact.

The coming years

• The new Applied Sciences building will open its doors in May 2016. The Department of Biotechnology will be housed here, along with the Bionanoscience and Chemical Engineering departments. This will offer great opportunities for more intense collaboration between these departments.

• Inspiring recent successes in competitive funding programmes (e.g. the European Research Council, Vidi/Vici, Horizon 2020) are encouraging staff members to increase their efforts in exploring options for these grants even more vigorously, in order to open up new fundamental research lines.

• A new large-scale research facility on multi-parallel selection of novel microbial phenotypes and automated strain construction will be set-up. This facility will enable TU Delft and other partners in the Netherlands to remain at the forefront of Biotechnology.

• A TU Delft institute for Biosciences & Engineering is being set up in order to bring together all of the expertise within the university on cell processing and cell fundamentals.
Chemical Engineering

Water-in-water micro droplets flowing through the channels of a lab-on-a-chip device.
By generating knowledge and educating students, the Department of Chemical Engineering (ChemE) contributes to change in energy- and health-related issues.

ChemE develops the science behind and the technology used in functional systems, from molecules and nanostructures to the design of products and processes. In this work, international and multidisciplinary teamwork is of vital importance. There is a particular focus on energy-efficient processes, new solar energy conversion concepts, energy storage, (bio)sensors and targeted molecular delivery.

The activities of ChemE’s seven research sections range from synthesis of new organic and inorganic materials, structural and functional characterisation to developing devices and processes. ChemE is an active partner in the TU Delft Process Technology Institute (www.process.tudelft.nl).

The department has a proven track record in creating value for and with industry. Its ambitions focus on three broad themes that enjoy support from the entire faculty and are increasingly generating cash flow to the department. There is a high level of multidisciplinary collaboration within ChemE; the research sections remain distinct but manage to avoid becoming narrow scientific silos, as so often happens. The excellent body of staff has an above average success rate in winning personal grants and a high-quality publication record.

Chemical Engineering continues to carry out application-driven fundamental research, although the application is shifting from basic materials to more complex products. The department’s focus is also widening: from concentrating solely on the petrochemicals industry to exploring a wider field that includes the healthcare and energy sectors.

Michiel Kreutzer, head of department

The coming years

- The new Applied Sciences building will open its doors in May 2016. The Department of Chemical Engineering will be housed there, along with the Bionanoscience and Biotechnology departments. This will offer great opportunities to rejuvenate labs and for close collaboration between these departments, thus strengthening ChemE’s research profile.
- ChemE’s excellent reputation in discipline rankings attracts large numbers of students. The department has seen spectacular growth in enrolments. Without implementing selection procedures, this will put strain on facilities and faculty members. In the coming years, ChemE will look for ways to stabilise student enrollment.
- The department will focus on expanding its network in its areas of application rather than the discipline at large. The ‘health’ theme needs to grow faster in order to gain sufficient momentum within the department.
- There are relatively few female faculty members, particularly since the student population has evolved in this respect and is now well balanced. In the coming years, the department will completely overhaul its recruitment strategies and all staff members will constantly be on the look-out for talent. Responsibility for this will be shifted from research section to the central department. Recruiting junior staff members outside the ‘silos’ and broadening its search profiles will create a bigger pond for the department to fish in.
Microtubules (network of tiny tubes) responsible for structure and transportation processes in a cancer cell.
The Department of Imaging Physics (ImPhys) performs cutting-edge research and education in imaging science. It works to advance our fundamental understanding of physical phenomena, leading to innovative new imaging principles and revolutionary imaging instruments.

ImPhys invents imaging methods and builds imaging instruments, improving the ‘eyes’ with which researchers examine things on the nanoscale with light and particles and the ‘hands’ with which they manipulate structures in that world. Simultaneous light and electron microscopy enables functional and structural imaging to unravel biomolecular processes at a glance. ImPhys constantly improves diagnostic power for preventive medicine and patient stratification in health care by making quantitative biomedical imaging possible using hybrid computational-optical/acoustical imaging techniques.

The department offers a stimulating environment for educating students and conducting multidisciplinary research. It engages in internationally leading research to increase competitiveness and stimulate innovation through start-ups and public-private partnerships with major international companies. ImPhys brings science to society through research collaborations with top medical centres. It has a leading role in Medical Delta, the Delft Health Initiative, and international oil and gas consortium DELPHI.

Valorisation is more important than ever before. The establishment of the Van Leeuwenhoek Laboratory for Advanced Imaging Research (VLLAIR), with its focus on developing new instruments, is an excellent illustration of the department’s valorisation strategy for the coming years. By working together with partners from industry and top-class researchers, Imaging Physics aims to have an impact on society, in scientific as well as economic terms.

The coming years

- ImPhys will further strengthen its imaging research through early-stage collaboration with both partners from industry and advanced users of imaging instruments and software in the Van Leeuwenhoek Lab for Advanced Imaging Research (VLLAIR). Such partnerships are necessary to achieve a real economic or societal impact in addition to high-impact publications.
- The department is working to develop a multitude of 3D metrology technologies to enable the manufacture of the next generation of semiconductor devices and to miniaturise the current cleanrooms for fabricating nanostructures to a single table-top instrument.
- In the area of optical nanoscopy, the department aims to achieve another order of magnitude improvement in revealing molecular structure and function at the 1 nm scale and to facilitate the development of new drugs.
- In the area of healthcare, ImPhys aims to develop label-free optical imaging techniques for functional deep tissue imaging, to enhance diagnostic capabilities by introducing multi-modal 3D digital pathology, and to produce functional 4D clinical ultrasound for diagnostics, therapy and image-guided interventions.
Designer spin waves - Impression of individual atoms assembled to form a magnetic bit that can be switched through spin wave excitations.
The Department of Quantum Nanoscience seeks to advance our understanding of physical processes at the nanoscale, focusing on research seeking to achieve fundamental scientific and technological breakthroughs. Its approach is based on developing novel quantum materials, innovative production and measurement techniques, and advanced theoretical models.

This research is supported by state-of-the-art facilities such as the Kavli Nanolab Delft cleanroom facility. The Department of Quantum Nanoscience is part of the Kavli Institute of Nanoscience (kavli.tudelft.nl) established by the US-based Kavli foundation. It is also affiliated with the Casimir Research School (casimir.researchschool.nl).

Part of the quantum research work is ready to enter the next phase targeted towards products, such as the quantum computer and quantum internet. Following a quantum engineering approach and through goal-oriented research, this development work is taking place within the QuTech quantum institute. The research scientists at Qutech and the Principal Investigators (PI’s) are an important link between Quantum Nanoscience and QuTech.

It is vital to the future of Quantum Nanoscience to explore new research fields in the coming years, as a significant part of its work has recently been transferred to the QuTech quantum institute. This represents a shift in the department’s core focus, from electrical devices to optics, quantum materials and bio-materials. The specific directions of future research have not yet been defined and will depend on attracting the right people. For example, Kobus Kuipers, who will succeed me as Departmental Director, is not a quantum specialist, but his profile reflects the department’s need to broaden its research profile.

The coming years

- Quantum Nanoscience is seeking to broaden the scope of its research, focusing increasingly on explorative experimental and theoretical research into quantum materials and quantum devices. The direction in which this goes will be influenced by the new scientific talent that will join the department.
- Attracting excellent students is crucial to the department’s future development. The department strives to constantly increase staff diversity at all levels and to become more international. Furthermore, a targeted approach should lead to a better gender balance among staff, which is already visible in the student population.
- It is crucial for Quantum Nanoscience’s research to continuously maintain and renew infrastructure and instruments. This requires great flexibility and proactiveness and will remain a focal point in the coming years.
Radiation Science & Technology

Irradiation of a capillary.
The study of radiation is what binds all researchers at the Radiation Science & Technology (RST) department together. Although specific areas of interest vary from materials, energy and sustainable production to isotopes for health, all of its research is in some way related to radiation.

The department is proud to operate a small but significant nuclear research reactor. Working closely with the operational staff at the Reactor Institute Delft (RID), the department works to expand nuclear knowledge and develop new applications. With the OYSTER programme (Optimized Yield – for Science, Technology & Education – of Radiation), the department aims to expand the research reactor’s potential by improving and expanding its infrastructure.

The scientific staff members within RST offer a unique combination of radiation-related expertise and skills in-house. They are mature and enthusiastic, and bear responsibility for major large-scale projects, such as OYSTER, PEARL and Holland PTC R&D.

The department is the Dutch contact-point for the European Spallation Source (ESS) in Sweden – the world’s strongest neutron source – for which RST develops unique instruments. It is the Dutch gateway to the ESS and its expertise concerning innovative neutron instruments will define the Dutch academic contribution to this European project.

The RST/RID research reactor is a large-scale piece of infrastructure that costs millions of euros a year to run. One of RST’s great challenges is attracting funding to keep the reactor operational. The standard research programmes do not help to finance the department’s infrastructure, leaving it to a great extent dependent on TU Delft’s central resources. European research programmes offer more scope for funding and the department will be focusing on these in the coming years.

The coming years

• The department will focus on strengthening its research portfolio through partnerships in the areas of health and energy. Now with the installation of Holland PTC near the RID, the department will start a research line in the area of proton research.

• In order to expand the use of the nuclear facilities, RST will work to build partnerships within the Dutch and European scientific community. The first step is to raise awareness and increase the reactor’s visibility within different scientific domains in the Netherlands. This will create a strong base of users both nationally and across Europe, in order to increase European investment and build a cohesive network of facilities and infrastructure throughout the EU.
Science Education & Communication
The Science Education and Communication (SEC) section runs research programmes in Science Education and Science Communication along with one Master’s programme and two minor programmes.

With its focus on strategic science communication, the section takes a unique position compared to nearly all similar groups around the world, which focus on popularisation and public understanding of science. It is also unique in building conceptual and theoretical bridges between the academic domains of science education research and science communication research.

**Education**

There are two tracks within the SEC Master’s programme. Graduates of the Science Education track acquire a first-level teaching qualification for upper secondary education. Graduates of the Science Communication track learn about strategic communication surrounding innovative processes. Alumni become either communications professionals or engineers with extensive communications-related knowledge and skills. SEC also runs two minor programmes: Science Education and in Science Communication.

**Research**

SEC runs separate research programmes for Science Education and Science Communication. The Science Education programme centres on using design activities as (a) a pedagogical strategy for teaching scientific concepts and (b) a way of enhancing young children’s creative skills. The Science Communication programme focuses on continuously professionalising science communicators and on designing tools for strategic communication surrounding innovation processes.

**Cooperation**

The section works with universities and degree programmes throughout the Netherlands, and with the Royal Institute of Technology in Sweden and Imperial College London. It is home to the Wetenschapsknooppunt hub for promoting science and technology in primary schools and the Betasteunpunt Zuid-Holland for supporting the continuous professionalisation of science and math teachers.

**The coming years**

- The main challenge will be to deal with growing student numbers in both minors and the Master’s programme.
- In a world where it is crucial for new innovations to be socially responsible, the section senses an increasing urgency to make strategic communication more widely known as a research and teaching priority in the field of science communication worldwide.
- SEC also aims to increase its research output in terms of publications and completed doctoral theses.
### Key figures

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<th>2012</th>
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### OCW performance indicators

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### Teaching

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<td>Positive BSA*</td>
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### Research

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### Staff

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### Finances

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**Abbreviations**

- BA = Bachelor’s
- MA = Master’s
- BSA = binding recommendation on continuation of studies
- BKO = University Teaching Qualification
- OCW = Ministry of Education, Culture and Science

* Figures from April 2016