University of Amsterdam
Faculty of Science

2019 IN REVIEW

research

education

valorisation

Dear reader,

Just as we were finishing the production of our annual overview of 2019, the world-wide COVID-19 pandemic took hold. Suddenly we were all working from home, teaching, studying, doing whatever research activities we still could, and finding alternate ways to connect with our colleagues, students and collaborators all over the world.

Coincidently, we had already selected 'Connecting Science' as the central theme for this magazine. This was also the title of our proposition for the so-called 'sectorplan' funding we received in 2019, and it was chosen to signify the interrelationship between different disciplines and that of science to society.

I am proud to be the dean of a science faculty where researchers are always eager to explore that undiscovered space between disciplines. For example, read the interview with physicist Daniel Bonn (p.32) who regularly organises meetings for colleagues from the fields of physics, chemistry, computer science and biology to set up new research projects and shared labs. Or look at newly appointed MacGillavry Fellow Annemieke Petrignani (p.27), a chemical physicist studying the origins of life in space, who also has her eye on AI to tackle challenges related to big data and complex experimental studies.

And we are not just in it to satisfy our own curiosity; we take our role in society seriously. Plastics expert Gert-Jan Gruter (p.48) works on developing sustainable plastics and has made it his mission to clear up understandings about these plastics and recycling. Ekaterina Shutova (p.40) is an expert in the field of Natural Language Processing, who uses her background in linguistics and mathematics to develop machine learning techniques that can detect sexist and racist comments in social media posts. And one of the highlights of 2019 was the Gravitation grant for the MiCRop consortium, headed up by biologist Harro Bouwmeester (p.47). The consortium, which studies stress in plants, is expected to make important contributions to crop protection and global food supply.

But one of the most important ways for us to impact society is through the education we provide. Over the last few years our student population has grown from roughly 5,000 in 2015 to 6,625 in the current academic year. It is heartening to know that we are educating ever more scientific, curious and inquiring minds who will ultimately take up their role in society. We pride ourselves in providing research-based education, but the growth of recent years also meant some growing pains in our teaching organisation. As vice-dean Lex Kaper explains (p.10), we had to make some changes to bring teaching and research closer together. And so in this way, 'Connecting Science' takes on yet another dimension.

If anyone ever doubted the importance of these connections (not us at the Faculty of Science), these unprecedented times have made it abundantly clear: we need deep fundamental knowledge as well as close collaboration with other disciplines and stakeholders to adequately respond to the many challenges we are faced with today. We need scientists in society, now and in the future. We need science that connects.

Prof. Peter van Tienderen
Dean of the Faculty of Science

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I'm never at a loss for a new idea

From left to right: Lex Kaper, Chris Marcelis Mariska Enneking and Peter van Tienderen.

NEW ROOF EXPECTED TO DELIVER EXTRA 24,000 KWH IN SOLAR POWER

After an unprecedented storm took off a roof light in the central hall of Science Park 904 in 2018, a replacement window wired with photovoltaic cells was installed in 2019. This adds an extra potential yield of solar power of 24,000 kWh annually, on top of the 250,000 kWh delivered by the more than 1,000 solar panels on our roofs.
Besides the solar panels, a sedum roof and our own heat-cold storage system, other efforts to reduce our environmental footprint include: the recycling of 190 liters of helium (used in experimental research) through our own recollection system, the replacement of hundreds of light fixtures with LEDs and the placement of extra waste separation bins. Furthermore, printing was down 19% from the year before. In October, during the Week of Sustainability, we gave away 400 reusable water bottles to discourage students and staff from buying PET bottles with water. The three public water taps throughout the building, were used 62.000 times in 2019.

AND WE HAVE A NAME: LAB42!

In 2018 the UvA announced the development of a new building for research, teaching and co-creation in information sciences at Amsterdam Science Park. In 2019 a name was chosen for the building, designed by architecture firm Benthem Crouwel: LAB42. With LAB referring to its function as a breeding ground or laboratory in the field of information sciences, while the number 42 is well known by information scientists as the answer to the ultimate question about life, the universe and everything from the book The Hitchhiker's Guide to the Galaxy. Furthermore, in 2019 an interior design firm was chosen: Studio Groen + Schild. Preparations to commence the build will start in 2020 and the building is expected to be ready for use in 2022, which will become the new home base for the Informatics Institute and the Institute for Logic, Language and Computation and our taught programmes in the information sciences, in addition to several public-private partnership labs.

NEW DIRECTOR OF OPERATIONAL MANAGEMENT: CHRIS MARCELIS

In May 2019 director of Operational Management Rudi Rust announced his departure after 10 years at the Faculty of Science. He was succeeded by Chris Marcelis per 1 January 2020. As member of the Faculty's management team, he is responsible for the finance, ict, technology, real estate development, and business development/valorisation portfolios. Previously, Marcelis was managing director at the Geosciences Faculty at Utrecht University and held positions at STW/NWO and Paques Biosystems. He obtained a PhD in biological desulphurization processes at WUR and an MBA (MSc) at Twente School of Management.

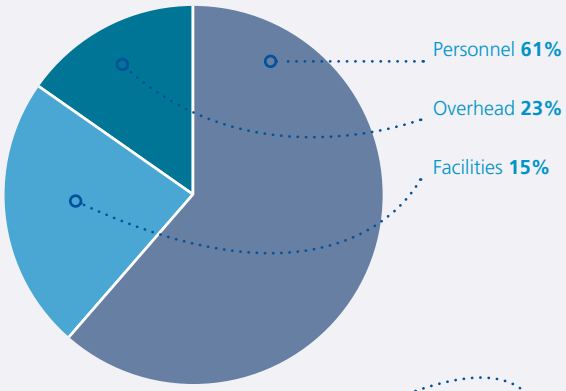
The Faculty of Science Management team now consists of: dean Peter van Tienderen, vice-dean Lex Kaper, director Operational Management Chris Marcelis and director of Personnel and Administration Mariska Enneking.

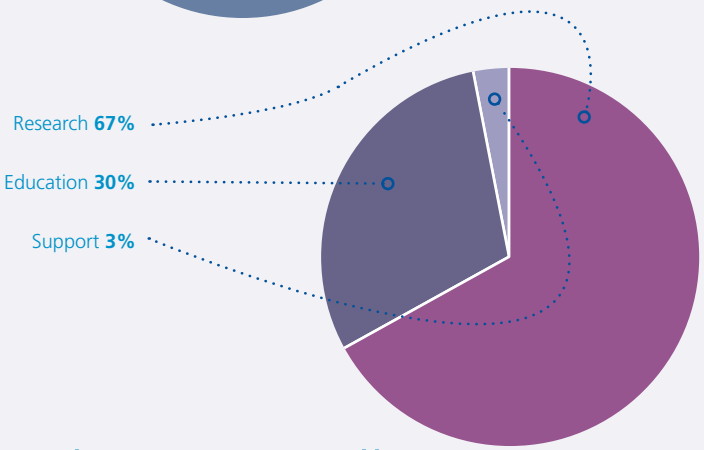
Funding & expenses

FUNDING

total **€168.6** million

EXPENSES





total **€161.7** million

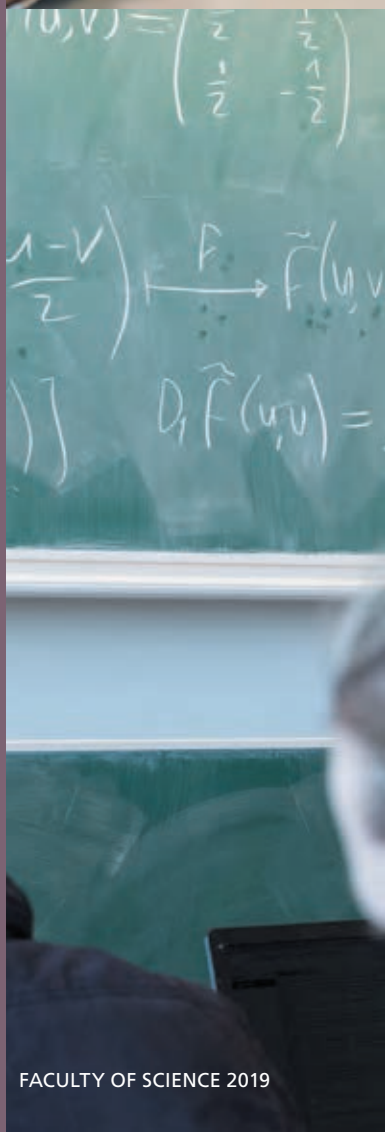
Education

AT THE FACULTY OF SCIENCE

At our Amsterdam Science Park campus, we educate nearly 7000 students in our research-based Bachelor's and Master's programmes. Students at the Faculty of Science are driven by different motivations; some want to go deep into one subject, others want to know how it all connects. Some are bitten by the research bug and will want to keep going, others are more eager to take what they have learned into another direction.

With our portfolio of specialised programmes and programmes that cross the boundaries of discipline, we offer a home to all of them. With an unwavering curiosity and eagerness to learn in common, they are part of a community of dedicated and intelligent peers and lecturers. Lecturers who are themselves always eager to learn more, whether it is to develop their own didactic skills or to innovate their teaching in order to help students take charge of their own learning process.

All with one clear aim: to inspire the next generation of scientists and set them on their own road to discovery.

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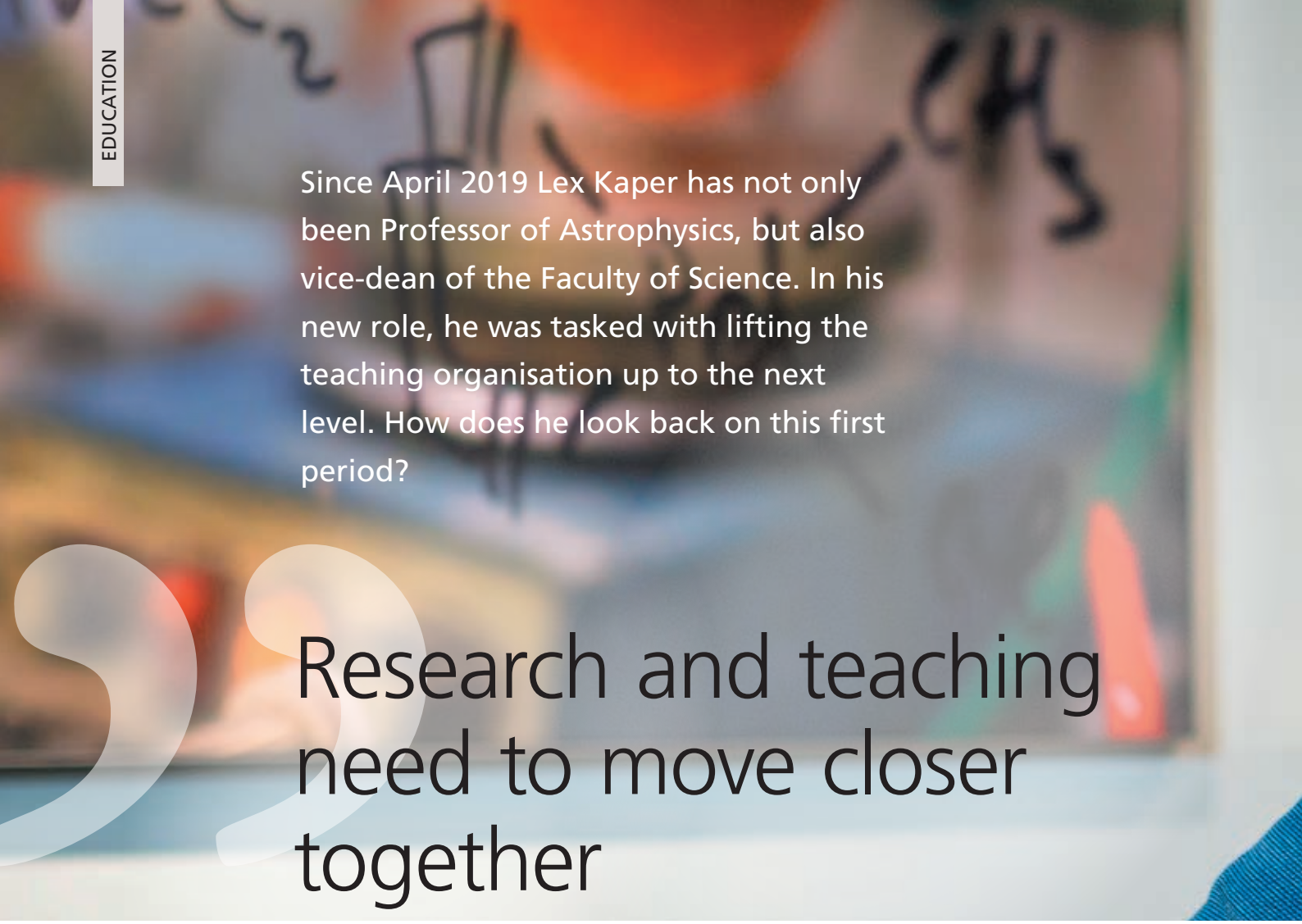


Since April 2019 Lex Kaper has not only been Professor of Astrophysics, but also vice-dean of the Faculty of Science. In his new role, he was tasked with lifting the teaching organisation up to the next level. How does he look back on this first period?

Research and teaching need to move closer together

Lex Kaper now has two offices at Science Park 904. One on the fourth floor at the Anton Pannekoek Institute for Astronomy, the other one in the Faculty Office on the second floor. At the moment he spends most of his time in the second one, where he has pinned up a poster of the Carina Nebula on the wall, a nebula in the Keel constellation. 'My astronomy colleagues do miss me, to be honest,' he says.

Report

Over the past year the Faculty of Science has been making preparations for a restructuring of the teaching organisation. This started with a report by psychologist Klaas Visser and organisation psychologist Henriette van den Heuvel which was published in 2018. They had spoken with 50 employees of the Faculty about the organisation culture. They identified a gap between the management and the staff, found out that teaching had a negative image as compared to research and discovered 'that people tended to refer issues to others instead of taking responsibility themselves.'
Appoint a vice-dean, was one of the recommendations in the report. Someone who can bring people together and can ensure a change of culture in which teaching is better valued.

Lex Kaper, professor of Astrophysics, applied for the job and started work on 1 April. 'I started out by talking to lots of people,' he recounts, looking back on that first period. 'In these discussions it became clear that teaching was viewed as a chore, as a reduction of research time. But the university is an institution for research and teaching.' And so he started various processes to make teaching a greater focus of attention within the organisation.

Research-based teaching

'We want research-based teaching,' says Kaper. 'Research and teaching need to be brought closer together, so that our education corresponds with new developments in research.' This is why the Bachelor's programmes are now subdivided into three clusters, as was already the case with the Master's programmes. 'Now we have Sciences (the exact sciences), Information Sciences, and Life and Earth Sciences. Each cluster has been assigned a director of education who leads the programme directors within the clusters.'

Raising teaching to the next level

Besides this organisational change a reward and promotion policy has been developed. 'At universities you are mostly assessed on the basis of research performance and not in terms of teaching performance,' explains Kaper, 'The number of publications is the only way you can build up an international profile for job applications.' From now on the Faculty of Science is taking a different approach. Researchers are no longer assessed only on the number of publications, but also on the teaching they provide.
'If for instance you can show that you were director of education for a certain period, then that counts as a step towards a professorship,' says

Kaper. Moreover there is now a compensation scheme for researchers who take on management roles. 'Financial compensation is provided to the department when someone carries out specific teaching-related tasks. Just as in my case. I now spend half of my time as vice-dean, which is why my research group is getting money to appoint a postdoctoral researcher to help supervise PhD students.'

Kaper is also investigating how the teaching task package can be better distributed. 'We think that teaching will take up less time when more support is available from people who handle logistical tasks.'

And a Lecturer Development Programme has now been developed for staff members who spend most of their time teaching. 'These are good lecturers and they make an important contribution to the teaching, but they're not automatically affiliated to a research group. This means they get disconnected from research.'

So in this programme they can get training for a subsequent job, which means that later they can, for instance, teach at other education institutions, such as the higher professional education sector. Kaper adds: 'Or alternatively they do indeed get the opportunity to do some research.'

Don't beat about the bush

Kaper enjoyed the first year. 'It's nice to see the organisation from a different perspective. It's not something you would usually see as a professor.' During the discussions he conducted with colleagues he noticed that being direct was the most fruitful approach. 'I've learned to say what I think, not to beat about the bush too much. And I've also tried to get people as involved as much as possible in the process.'

Nonetheless, he sometimes found it challenging. Especially when it came to getting support for implementing the report recommendations. 'Before I took up my new post, the idea of splitting up the College of Science hadn't been received well. So I had to connect to people and hold the whole thing together. Hoping that things would improve on the basis of better communication and a little more grease on the wheels of the organisation. Now we'll see how things turn out.'

MOSAIC

Does he still manage to do any research of his own? 'I have to make quite an effort to make it happen. The difficult thing is that I no longer manage my own schedule. So I can't do without the evenings and weekends,' he says. 'But I'm still supervising PhD students who are researching the formation of stars, star explosions and gamma bursts. And together with French researchers I'm working on the design of an instrument for the Extremely Large Telescope. This is MOSAIC, the multi-object spectrograph that will be installed on the platform alongside the ELT by the end of the decade. This will enable us to simultaneously measure the spectrum of up to 200 stars in other galaxies.' ■

Education news

FACULTY'S TEACHING AND LEARNING CENTRE

Off to a flying start

On 24 June 2019 the Faculty of Science held its first-ever Education Day, coinciding with the launch of the Faculty of Science Teaching & Learning Centre. With the slogan 'By lecturers, for lecturers' the TLC aims to improve quality of education by stimulating teaching innovation, knowledge sharing and the professional development of teachers.

AN IMPULSE TO EDUCATION QUALITY

'A real benefit of having a Teaching and Learning Centre at the Faculty of Science is that we can coordinate both the existing and to-be-developed activities aimed at teaching innovation and lecturer development. Among others, the TLC will take responsibility for the quality and organisation of the training programme for teaching assistants, the UTQ-programme ('BKO') for new lecturers and the coordination and nomination of lecturers for UvA-wide UTQ+ workshops and Advanced UTQ programmes,' head of the TLC Sylvia Witteveen explains.

Bringing the separate initiatives together and choosing an integrated approach, improved the visibility of the available resources and promotes cross-polination between initiatives. 'Take, for example, the Visible Learning Path Creator,' Witteveen continues, 'This is an example of how teaching innovation and professional development can go hand-in-hand.' (see also page 16)

VISIBILITY: LECTURERS' ROOM

Another goal of the Teaching and Learning Centre is to improve the visibility of everything that's on offer for lecturers. One way of doing so is by creating a physical lecturers' room, in addition to a virtual learning environment. The room will be home to a regular consultation hour for lecturers. Witteveen: 'The 'TLC living room' will function as a first point of contact for lecturers when they are looking for advice, coaching or training, or for project support when they are developing their own teaching innovation.'

EDUCATION DAY: TEACHING INNOVATION, PROFESSIONAL DEVELOPMENT AND KNOWLEDGE SHARING

During the Education Day, the three core aims of the Faculty of Science's TLC were highlighted in several ways. For example, there were presentations of multiple teaching innovation initiatives. In interactive sessions, participants experienced first-hand how these innovations will give a quality impulse to their teaching. After the presentations, Kareljan Schoutens awarded UTQ certificates to 32 Faculty of Science lecturers who successfully completed the course this year.

NEW VISUALISATION LAB AND SNE LAB

In 2019 a new Visualisation Lab and SNE Lab became ready for use. The SNE lab is used by Master's students in the programme Security and Network Engineering to conduct experiments. It is equipped with fast network connections to the SNE server room that students can patch themselves. In the past students have for example dissected the security of cars, done digital forensics on IOT (Internet of Things) devices or built radio networks to look at scaling and security aspects.
In the Visualisation Lab there are facilities available for students and researchers who work on the visualisation of scientific data and interactive virtual environments. The lab will be used for teaching and research, demonstrations and experiments with the visualisation equipment, which include an Oculus Rift, HTC Vive, Microsoft Hololens and several experimental set-ups. This equipment will also be used for a new taught programme on Scientific Visualisation and Virtual Reality that is currently under development.

ADVANCED UTQ CERTIFICATES FOR SEVEN FACULTY OF SCIENCE LECTURERS

On 7 March, Faculty of Science lecturers **Hanneke de Leeuw, Jan Brandts, Jan Gorter, Edwin van Lacum, Gertien Smits, Stefania Grecea** and **Natalie Cappaert** were awarded their Advanced University Teaching Qualification (Advanced UTQ). To obtain the certificate they completed an intensive programme that consisted of a lecture series and an individual assignment on an issue in their own teaching practice.

THREE ICT IN EDUCATION GRASSROOTS AWARDED

Two lecturers and one student of the Faculty of Science received funding for the project proposal in the ICT in Education Grassroots programme.

- **Jasper van der Heide**, student in the Information Science Bachelor's, received funding for a project to integrate the Jupyter Nbgrader grading programme with the digital learning environment Canvas. This programme reduces the time lecturers have to spend on grading, allowing more time for giving tailored feedback.
- **Toon Abcouwer** received funding for his project 'Learning by Sharing'. He had already built a wiki for the course Dynamics in Business and IT (www.adaptivecycle.nl), which has users all over the world, and will use the funding to expand this type of knowledge sharing by students to other courses.
- **Erwin van Vliet** received Grassroots funding for the implementation of Perusall. This online annotation tool helps students with the reading and digesting of the course materials. The lecturer can track the annotations students make and, for example, adjust the lecture based on the difficulties students encounter.

Standing, from left to right: Hanneke de Leeuw, Jan Gorter, Gertien Smits, Stefania Grecea. Kneeling: Jan Brandts and Edwin van Lacum. Not pictured: Natalie Cappaert.

Students as researchers

MASTER'S STUDENTS PRESENT THEIR RESEARCH AT LEADING MACHINE LEARNING CONFERENCE

Artificial Intelligence Master's students Luca Falorsi, Pim de Haan and Tim Davidson gave a plenary talk on 'Reparameterizing distributions' at the Conference on Artificial Intelligence and Statistics in Japan in April. The students developed a method to describe the movement of static objects in 3D. The so-called reparameterization trick is an important tool used in (unsupervised) machine learning, to directly learn distributions for observed data. The fact that these UvA students could present their work at this leading conference in Japan was quite special. From the 1,111 submissions only 28 researchers were invited to give a talk.

ALUMNI TRAINING PROGRAMME SHORTENS DELIVERY TIMES FORENSIC INSTITUTE

The Netherlands Forensic Institute (NFI) launched a unique pilot with six alumni from the University of Amsterdam's Forensic Science programme. Through a customised induction programme the recent graduates were quickly trained as draft-qualified DNA experts, allowing them to write draft reports in investigations where police have already examined the evidence themselves. The six alumni take as much work as possible out of the hands of DNA experts at the institute, expanding the volume of trace evidence that can be processed.

The knowledge they obtained during their Master's programme at the Faculty of Science, including previous training in the interpretation of DNA-profiles, enabled the alumni to follow this accelerated training programme. And the knife cuts both ways: on the one hand the alumni help speed up the delivery of reports at the NFI; on the other hand the pilot gives them the opportunity to land their dream job at the institute. 'Everything we learned comes to life here. You pass by the labs every day and you can see how colleagues examine evidence,' says one of them. 'And our former lecturers are now colleagues.'

BACHELOR'S STUDENTS PUBLISH RESEARCH ON DWARF GALAXIES

For the second year in a row, IoP/GRAPPA researchers Shin'ichiro Ando, Bradley Kavanagh and Oscar Macias supervised a workshop for Bachelor's students in the Physics & Astronomy programme (UvA-VU) that led to a published paper. The topic of this year's workshop was the potential discovery of dwarf galaxies and the role these may play in searches for dark matter. The students investigated the prospects for the Large Synoptic Survey Telescope, a new telescope which is currently under construction in Cerro Pachón, Chile, to discover new dwarf spheroidal galaxies. The students were responsible for the lion's share of the research that went into the paper, which was published in the *Journal of Cosmology and Astroparticle Physics*.

Prizes & awards

FOR STUDENTS AND ALUMNI

BACH SPEEDUP IS FAKE NEWS

As a classical music lover, when he saw articles popping up about Bach's music being played ever faster, David Erkelens, Master's Student in the Information Studies programme, was keen to learn more about that and decided to use it as the topic of his Master's project. He analysed nearly 20,000 records, including cantatas, violin concertos, organ trio sonatas and suites for cello solo. He found not only that the reports of speedup were largely exaggerated, if not untrue, but also that the speedup differs per category, and per region.

'The Brandenburg Concertos are ridiculously fast these days, their duration shortened by nearly 10% sometimes. However, the organ trio sonatas and cello suites are consistently being played slower,' says David. 'Moreover, the speedups appear to be localised. Speedups are more prominent in Western Europe than elsewhere in the world.'

'Data science can be messy business, but making it as objective as we can, defusing misinformation and *building a fact-finding culture* is an important aspect of academic practice,' explains David. By relating data analysis to demographics, anthropoloy, psychology and other related fields he gave his thesis a bit extra, as the seven reviewers of the International Conference on Data Analytics also agreed, and David was invited to present the work himself.

'Jonge Haan' award

Safi Graauw, alumnus of the Earth Sciences Master's programme, won the 'Jonge Haan' incentive award from the Dutch Advertising Association for a documentary he made on the positive effects of tree planting on the East African landscape. The video 'Seeds of Change' depicts the progress made in reforestation projects in regions seriously affected by deforestation and erosion. Graauw views the documentary as a way of introducing scientific research into landscape restoration in East Africa to a wide audience in an interesting and captivating manner.

National student symposium poster competition

At the national chemistry student 'PAC symposium' chemistry Master's student **Dieuwertje Modder** won the first prize in the 'Young KNCV' poster competition. With her poster, Modder presented her research project at the research group for Homogeneous, Supramolecular and Bio-inspired Catalysis at HIMS.

Best short paper at The Web Conference 2019

Bram van den Akker, Master's student Artificial Intelligence, won the best short paper award at The Web Conference 2019. For his project ViTOR: Learning to Rank Webpages based on Visual Features he was supervised by Ilya Markov (IvI).

UvA delegation highest ranked Dutch team at International Mathematics Competition 2019

Mathematics students from the University of Amsterdam won ten medals, including three gold medals, at the International Mathematics Competition 2019 for University Students in Blagoevgrad, Bulgaria. Since 2010 the UvA has been sending a team of students to participate in the International Mathematics Competition (IMC) in Blagoevgrad. This year the UvA team came in 19th place, making them the highest ranked Dutch University team, just as the year before. The students from the UvA team were trained for this competition during the honours course 'Training IMC 2019'. The best candidates in the course were selected to take part in the competition in Blagoevgrad.

Best Poster at SEMANTiCS 2019

Anthi Symeonidou, Master's Student Data Science won the best poster award at the SEMANTiCS 2019 conference. Her research project was supervised by Paul Groth (INDElab at IvI) and Viachaslau Sazonau at Elsevier.

Meeting on Cerebral Autoregulation best Poster Prize

Swetta Jansen, Master's student Computational Science, won the Best Poster Prize for jer presentation at the ninth International Meeting on Cerebral Autoregulation. The poster's topic was 'Parameter Optimization of a Mathematical Model Simulating Cerebral Autoregulation Using Data of Patients with Cognitive Disorders.'

Giving everyone insight into the curriculum with the Visible Learning Path Creator

As of the start of the new academic year in 2020, students of the Faculty of Science will be able to use the Visible Learning Path Creator, a web application that gives them insight into the interrelationship between the material of various courses. Ilja Boor, Stephanie Maijs and Sandra Cornelisse talk about how and why this teaching tool has been developed.

As a lecturer in the Bachelor's programme Psychobiology, Ilja Boor often encountered this problem: when she asked students to relate the recently presented course material to a previous course, they had difficulty answering this question. 'Students often experience courses as separate elements, which they start on a 'blank sheet' basis. On the other hand, they sometimes say they feel that material is being repeated, and they don't realise that we're actually going into more depth in the new course.'

She wondered if a solution to this might be found. 'It's precisely the act of interrelating material from different courses that helps to create a greater sense of meaning, study motivation and better retention.' A few years earlier, while preparing for an assessment panel, she had made an Excel overview of the structure and cohesion of learning paths in the curriculum. 'I had an enormous spreadsheet setting out all the learning objectives and exit

qualifications of the curriculum,' she recounts. 'But it wasn't of use to anyone, apart from the assessment panel.' There had to be a better way, right?

Her colleague Sandra Cornelisse joined Boor's mission, and together, they discovered a web application created at Utrecht University to give students insight into their study programme. They got permission to adopt and use the tool, but they soon felt that some things were missing; especially the link between learning objectives, learning paths and exit qualifications. This led to the idea of developing an application themselves, and so the Visible Learning Path Creator was born. Stephanie Maijs joined the team, and with funding from, among other sources, the UvA Grassroots Fund for ICT Innovation in Education and support from the Faculty of Science Teaching and Learning Centre, they got down to work.

Pilot version

Since summer 2019, a pilot version of the Visible Learning Path Creator (VLPC) has been available for the Bachelor's programmes Psychobiology, Biomedical Sciences, Mathematics, Computing Science, Artificial Intelligence and Information Science. The Bachelor's in Biology, Physics, Future Planet Studies and the Master's in Forensic Sciences will soon follow. Maijs opens up her laptop and shows the web application for the Psychobiology programme. The screen presents all the courses taught in each academic year. 'The colours indicate which courses are contained in this learning path,' says Maijs. 'And at what level.' When she clicks on a learning path with her mouse, a new screen appears, which shows what learning objectives from which courses contribute to this learning path. Within the Academic and Research Skills learning path, for instance, various learning objectives from various courses contribute to the learning path objective for acquiring writing skills. 'This clarifies the structure and cohesion between various learning objectives per course and the contribution they make to the learning path objective,' says Cornelisse. Students will be working with this tool as of the start of the new 2020 academic year; in the recent period, the main focus has been fleshing out the tool together with the lecturer teams from the various programmes and instructing the first lecturers on how to use the tool.

Making the learning objectives explicit

Providing the Visible Learning Path Creator with the right content was something of a challenge. Boor, Cornelisse and Maijs developed an approach in which they closely examined the structure and cohesion of the curriculum. They organised five meetings for each programme, in which senior lecturers determined the programme's objectives. 'We asked the lecturers: "does this approach lead to us delivering graduates with

the required knowledge and skills?"' recounts Cornelisse. 'Or are some objectives still missing?' 'To give one example, this analysis revealed that skills such as critical thinking were often not included explicitly in the courses, while it was indeed an objective of the programme,' adds Boer. 'By also making these learning objectives explicit, students can get corresponding feedback.'

Evaluation

The sessions proved to be a good opportunity for participating lecturers to zoom out a little more to curriculum level, but they found it quite demanding. Not everyone was full of enthusiasm at the first lecturer meeting, recounts Boor. In their busy lecturer lives, this represented 'another extra task'. But as soon as the lecturers saw the analysis of the entire curriculum, they were convinced. 'It gives them space and a language to analyse the curriculum together,' she says, 'and it has strengthened the collaboration among the lecturer teams.'

The lecturers who collaborated in providing content for the VLPC web application are correspondingly highly enthusiastic about it. When they teach a course, it gives them a solid grasp of what students should already be able to do and which related themes and skills will be coming in later courses. Sandra Cornelisse: 'The web application puts the teaching on the radar. Its development has generated lots of discussion about the content, structure and cohesion of the curriculum.' Boor adds: 'And we can now see whether the curriculum is in line with the learning objectives we want our students to fulfil upon graduation.'

Future tool

But the Visible Learning Path Creator isn't the end of the story, either. Ilja Boor has received a Comenius grant to expand the VLPC. This expansion will enable students to receive personal feedback by connecting the learning objectives to individual study results. 'By discussing the results of this with their mentor, students learn to reflect on their learning process, and thus to manage their own learning process too,' says Boor.

In addition, the trio have also started the Visible Teaching Methods and Assessment project. Cornelisse: 'In this follow-up project, we're working on aligning the teaching methods and assessment with the learning objectives within courses and learning paths, and we're providing support for lecturers in encouraging students to achieve the exit level with the right study habits.' 'To give one example, we're encouraging lecturers to assess higher learning objectives with an open-book exam instead of multiple-choice questions,' adds Maijs, 'and to use teaching methods in a way that means students don't start studying just three days before the exam.' ■

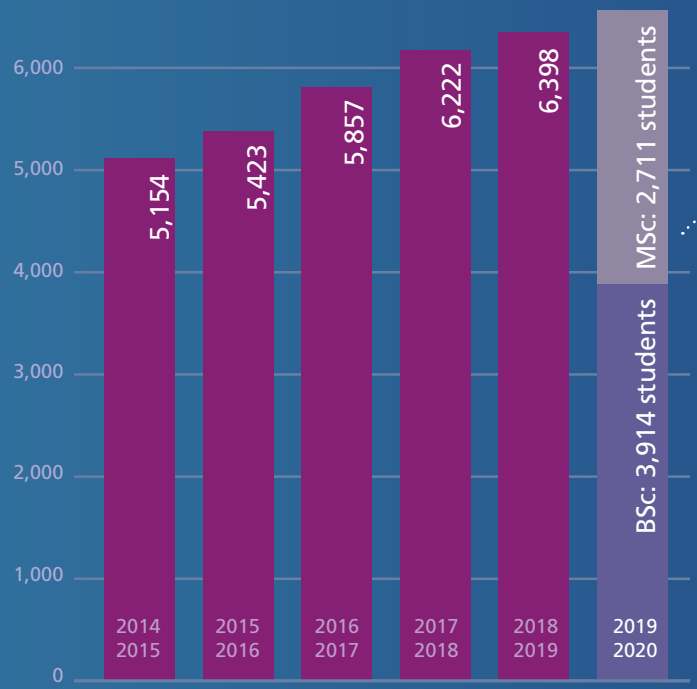
From left to right: Stephanie Maijs, Sandra Cornelisse and Ilja Boor

Neuroscientist **Ilja Boor** swapped the lab for teaching: since 2012, she has been affiliated with the Psychobiology programme at the Faculty of Science. Her colleague **Sandra Cornelisse** studied Psychobiology herself and, following her doctoral research and a postdoc, returned to her old programme as a lecturer and course developer. **Stephanie Maijs** is an assessment specialist and programme coordinator at Biomedical Sciences. All three are affiliated with the Teaching and Learning Centre of the Faculty of Science, where they are currently focusing on teaching innovation at the curriculum level.

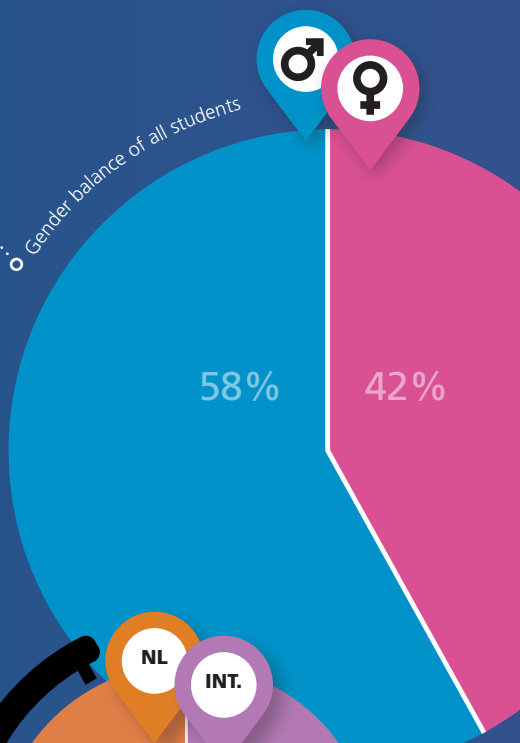
Facts & figures students

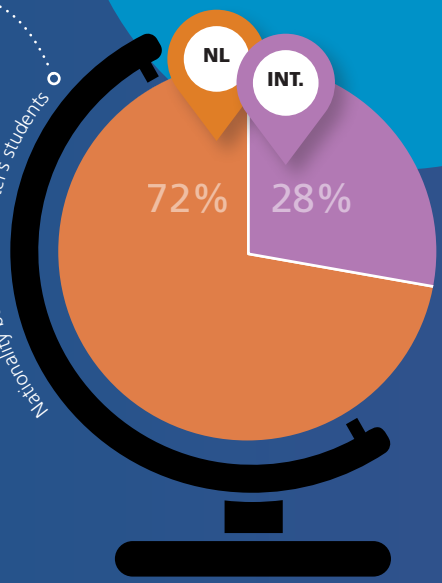
TOTAL STUDENTS 2019-2020

FULLTIME



6,625 students





BACHELOR'S STUDENTS

FULLTIME | ALL PROGRAMMES TAUGHT IN DUTCH

ARTIFICIAL INTELLIGENCE

students	427	▲ 2%	56
first year enrolment*	98	▼ 13%	

24% female
76% male

* enrolment quota

COMPUTER SCIENCE

students	372	▲ 7%	57
first year enrolment	136	▲ 13%	

8% female
92% male

INFORMATION STUDIES

students	315	▲ 6%	60
first year enrolment	115	▲ 12%	

20% female
80% male

▲▼ compared to final figures of 2018-2019

BIOLOGY

students	170	▲ 1%
first year enrolment	54	▼ 4%

37

46% female
54% male

BIOMEDICAL SCIENCES

students	355	▼ 10%
first year enrolment*	116	▼ 13%

104

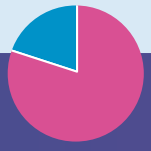
63% female
37% male

* enrolment quota

PSYCHOBIOLOGY

students	659	▲ 3%
first year enrolment*	221	▲ 10%

130



80% female
20% male

* enrolment quota

CHEMISTRY*

students	168	▼ 7%
first year enrolment	46	▼ 13%

41

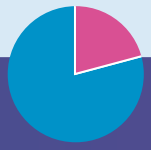
40% female
60% male

* joint degree with VU University Amsterdam

MATHEMATICS

students	221	▲ 2%
first year enrolment	81	▲ 9%

48



21% female
79% male

PHYSICS AND ASTRONOMY*

students	402	▶ 0%
first year enrolment	119	▲ 3%

75

22% female
78% male

* joint degree with VU University Amsterdam

FUTURE PLANET STUDIES

students	577	▼ 4%
first year enrolment	156	▼ 18%

120

49% female
51% male

NATURAL AND SOCIAL SCIENCES

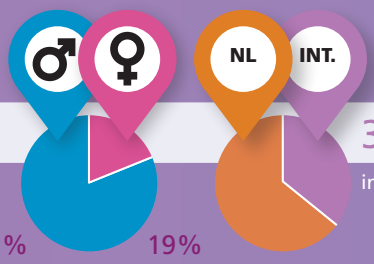
students	429	▼ 6%
first year enrolment	104	▼ 4%

97

47% female
53% male

MASTER'S STUDENTS

FULLTIME | ALL PROGRAMMES TAUGHT IN ENGLISH



ARTIFICIAL INTELLIGENCE

students	400	▼ 1%
first year enrolment	96	▼ 48%

108 | 81% | 19% | 36% international

COMPUTATIONAL SCIENCE*

students	169	▲ 31%
first year enrolment	70	▲ 21%

32 | 67% | 33% | 24% international

* joint degree with VU University Amsterdam

COMPUTER SCIENCE*

students	65	▲ 91%
first year enrolment	17	▶ 0%

39 | 83% | 17% | 22% international

* joint degree with VU University Amsterdam

INFORMATION STUDIES

students	230	▲ 7%
first year enrolment	141	▼ 15%

156 | 70% | 30% | 23% international

LOGIC

students	122	▲ 37%
first year enrolment	49	▲ 40%

28 | 81% | 19% | 71% international

SOFTWARE ENGINEERING

students	41	▼ 20%
first year enrolment	18	▼ 50%

30 | 93% | 7% | 20% international

SECURITY & NETWORK ENGINEERING

students	45	▲ 96%
first year enrolment	30	▲ 130%

9 | 89% | 11% | 4% international

BIOINFORMATICS AND SYSTEMS BIOLOGY*

students	61	▲ 85%
first year enrolment	18	▶ 0%

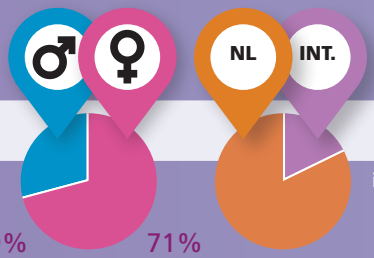
23 | 54% | 46% | 15% international

* joint degree with VU University Amsterdam

BIOLOGICAL SCIENCES

students	183	▶ 0%
first year enrolment	47	▼ 31%

46 | 41% | 59% | 28% international



BIOMEDICAL SCIENCES

students 475 ▲ 14%
first year enrolment 176 ▲ 18%

135

29% 71%

18% international

EARTH SCIENCES

students 93 ▼ 2%
first year enrolment 22 ▼ 12%

31

44% 56%

38% international

CHEMISTRY*

students 337 ▲ 42%
first year enrolment 56 ▼ 14%

85

57% 43%

19% international

* joint degree with VU University Amsterdam

MATHEMATICAL PHYSICS

students 2 ▼ 75%
first year enrolment no new students allowed*

100%

0% international

* programme ends in 2021

MATHEMATICS

students 100 ▲ 49%
first year enrolment 29 ▲ 26%

21

84% 16%

15% international

PHYSICS AND ASTRONOMY*

students 336 ▲ 20%
first year enrolment 136 ▲ 12%

83

76% 24%

30% international

* joint degree with VU University Amsterdam

STOCHASTICS AND FINANCIAL MATHEMATICS

students 23 ▼ 21%
first year enrolment 12 ▲ 140%

19

61% 39%

30% international

FORENSIC SCIENCE

students 88 ▲ 19%
first year enrolment 37 ▲ 16%

30

25% 75%

32% international

BRAIN AND COGNITIVE SCIENCE RESEARCH MASTER

students 137 ▼ 1%
first year enrolment 38 ▼ 19%

40

26% 74%

40% international

Research

AND VALORISATION AT THE FACULTY OF SCIENCE

Researchers at the Faculty of Science are driven by a shared passion for wanting to know how things work. Our eight research institutes cover the full range from astronomy to life, earth, physical, molecular, mathematical and information sciences. Whether our chosen instrument is a microscope or a telescope, whether we are unraveling the origins of life on earth or shaping its future for generations to come, we find each other in a curiosity that knows no bounds.

But our interest goes beyond satisfying our own curiosity; we want our research to have impact. Therefore, collaboration is a given. With each other, with our colleagues at the neighbouring research institutes at Amsterdam Science Park, and with peers at the national and international level. And also with societal partners and partners in industry. Where our research is often fundamental in nature, it is boosted by collaboration with application-oriented partners. We are positioned at the beginning of the knowledge value chain: our research has the potential to lead to innovation and new products through further development in society and industry. The many examples in this magazine illustrate that road from curiosity to impact.

Named after the ground-breaking crystallographer professor Carolina MacGillavry (1904-1993), the MacGillavry Fellowship is aimed at female scientists with a strong track record in one of the Faculty's scientific disciplines.

Meet our MacGillavry Fellows 2019

After two earlier rounds in 2010 and 2013, the Faculty of Science opened the Fellowship for a new round of applications in 2019.

Seven MacGillavry Fellows were appointed; all of them high-achieving researchers in their respective fields with the potential and ambition to obtain a leadership position as professor at the University of Amsterdam.

Dr Bahareh Afshari

Appointed at the Institute for Logic, Language and Computation | ILLC

Bahareh Afshari was the first of the newly appointed MacGillavry Fellows at the UvA's Faculty of Science. She joined the Institute for Logic, Language and Computation (ILLC) in January 2019. Her work lies at the intersection of mathematics and logic. The Logic and Computation group at ILLC, where Afshari is now assistant professor, focuses on the use of logical techniques to better understand a wide range of processes and behaviours involving computation. More specifically, Afshari's specialty lies in a field within modal logic called fixpoint logics. Before coming to Amsterdam, she held research and teaching positions at the University of Edinburgh, University of Oxford and Vienna University of Technology. She is also still currently an Assistant Professor at the University of Gothenburg (Department of Computer Science and Engineering).

Dr Flavia de Almeida Dias

Appointed at the Institute of Physics | IoP

Flavia de Almeida Dias joined the UvA Institute of Physics in March 2020. She is an expert on high-energy particle physics. De Almeida Dias used to be involved in the hunt for the Higgs boson at CERN's Large Hadron Collider Atlas experiment. Nowadays she focuses on the detection of other elusive particles, still at Atlas. Originally trained at the São Paulo State University in Brazil and California Institute of Technology in the US, throughout her work at CERN she was officially employed by the University of Edinburgh and after that the Niels Bohr Institute at the University of Copenhagen.

Dr Iris Groen

Appointed at the Informatics Institute | IvI

Iris Groen will join the UvA's Informatics Institute as an assistant professor in September 2020. It will be a return to her alma mater: she obtained her PhD at the UvA in 2014, under supervision of Steven Scholte, Sennay Ghebreab and Victor Lamme. She is an expert on the way our brain uses visual information to perceive and understand our natural surroundings. To study this, she uses a variety of cognitive neuroscience methods and techniques, including M/EEG, fMRI, TMS and ECoG. Her ultimate goal is to develop computation models based on her findings. At the moment she is still working as a postdoc at the WinawerLab at New York University, after having completed a postdoc at the National Institute of Mental Health, also in the United States.

MacGillavry Fellowship

Dr Diletta Martinelli

Appointed at the Korteweg-de Vries Institute for Mathematics | KdVI

Diletta Martinelli joined the group of Lenny Taelman in the Algebra, Geometry and Mathematical Physics programme at KdVI. Her research focuses on birational geometry. Diletta is also very active in the development of mathematical research and teaching in Africa. She obtained her PhD in 2016 at Imperial College London under supervision of Prof. Paolo Cascini and held two consecutive postdoc positions at the University of Edinburgh and the Mathematical Sciences Research Institute Berkeley.

Dr Antonija Oklopcic

Appointed at the Anton Pannekoek Institute for Astronomy | API

On 1 January 2020 astrophysicist Antonija Oklopcic exchanged her NASA Fellowship at the Harvard University for a position as assistant professor at UvA's Anton Pannekoek Institute for Astronomy. She is an expert in the field of exoplanets. One of her main interests is the theoretical modeling and characterisation of the atmospheres of these planets that exist in other solar systems than our own. Oklopcic obtained her PhD at the California Institute of Technology in 2017. After that she received a fellowship at Harvard University, and in 2019 she became a Sagan Fellow in the NASA Hubble Fellowship Programme at the same university.

Dr Annemieke Petrignani, Eng.

Appointed at the Van 't Hoff Institute for Molecular Sciences | HIMS

Dr Annemieke Petrignani was appointed a MacGillavry Fellow in the Molecular Photonics group at HIMS. Her research focuses on organic chemistry in space and in the origins of life. She obtained her PhD in atmospheric photo-physics at the FOM institute AMOLF and did a postdoc at the Max-Planck Institute for Nuclear Physics, Heidelberg, where her research focused on the spectroscopy and electron recombination of cold molecular ions relevant to molecular clouds where planet formation takes place. In 2011, she started working for the Leiden Observatory and in 2014 she started her own group at the University of Amsterdam after obtaining a Vidi grant to study the shape and size of hydrocarbons in space. She is also one of the co-founders of the Amsterdam Origins Centre (AOC). Her vision is to implement AI techniques to tackle the challenges related to big data and complex (experimental) studies.

Dr Verena Schoepf

Appointed at the Institute for Biodiversity and Ecosystem Dynamics | IBED

Verena Schoepf started her new position as tenure-track Assistant Professor and MacGillavry Fellow in the Department of Freshwater and Marine Biology at IBED. She is a marine biologist interested in understanding how reef-building corals are affected by climate and environmental change. Having a background in both biological and geological sciences, her research integrates eco-physiological, stable isotope and geochemical analyses to provide new insights into the mechanisms and traits that enable coral resistance to multiple climate change stressors and promote their adaptive capacity in a changing ocean. Verena came to Amsterdam from Australia, where she was a postdoctoral Research Fellow, and later also Research Programme Leader, at the ARC Centre of Excellence for Coral Reef Studies at the University of Western Australia in Perth. She obtained her PhD from Ohio State University, and her MSc and BSc degrees from the University of Innsbruck in Austria.

Veni, Vidi, Vici

VENI

The Netherlands Organisation for Scientific Research (NWO) awarded Veni grants worth up to €250,000 to seven Faculty of Science researchers. The Veni gives promising young scientists the opportunity to further elaborate their own ideas over a three-year period.

Dr Georgios Amanatidis
ILLC | Fair Division in Dynamic Environments

A crucial objective when allocating resources is that this is done in a commonly acceptable manner. Amanatidis will introduce suitable definitions of fairness in situations where the available resources change over time, as does for instance a food bank's inventory.

Dr Camila Correa | *IoP*
Interacting dark matter particles

The nature of dark matter is a great unsolved mystery. Correa will use state-of-the-art simulations to analyse signatures of forces between dark matter particles on galaxies colliding, filling a major gap in our understanding of dark matter. She will conduct part of her research at IoP.

Dr Gaurav Dugar | *SILS*
Big secrets of a tiny bug

Many proteins are located at specific places inside a cell depending on their function. In bacteria, DNA and RNA can also be localised together with membrane proteins in a process called 'transertion'. Dugar is going to develop new techniques to study transertion and its effects in bacteria.

Dr Ronald de Haan
ILLC | Sophisticated voting procedures

When voting on complex matters, simple winner-takes-all voting rules are inadequate. More adequate voting rules are hard to compute. De Haan will use methods from theoretical computer science to find out which kind of algorithms work well for these rules.

Melissa McClure | *API*
Jumpstarting life on terrestrial planets

Interstellar ices hold the initial organic molecular ingredients of life. McClure will trace the evolution of ice chemistry as stars form, to determine the complexity of the molecules that are delivered to forming planets.

Dr Masha van der Sande
IBED | Resilience of tropical forests

Van der Sande will investigate how plant characteristics help forests survive droughts and fires. The results will help to develop effective forest management strategies, and safeguard the important role of forests in reducing climate change.

Dr Bart Weber | *IoP/ ARCNL | Friction on demand*

Friction and wear are responsible for 20% of the world energy consumption. Everybody learns in school about the friction coefficient: the ratio of frictional and normal force. What is the origin of this relation and how can we tailor the friction coefficient? Weber will try to find answers.

VIDI

Two researchers at the Faculty of Science were awarded a Vidi grant by NWO, worth up to €800,000. The Vidi is aimed at experienced researchers who have carried out successful research for a number of years after obtaining their PhD. The grant will enable the researchers to develop their own innovative line of research and set up their own research group.

Dr Maris Ozols | *ILLC/IoP/ KdVI | Quantum Math*

Quantum computers can solve certain problems much faster, but finding new quantum algorithms is difficult. Using advanced mathematical techniques, Ozols will try to find new quantum algorithms and implement them in software.

Dr Ning Yan | *HIMS*
Heterogeneous catalyst design

Inspired by the elegant 'active centre' of enzymes, Yan will develop a bi-atom heterogeneous catalyst in this project. It will open up new opportunities for the catalysis and materials science communities.

VICI

One Faculty of Science researcher received a Vici grant from NWO in 2019. The Vici, worth €1.5 million, is one of the largest personal grants in the Netherlands and is targeted at outstanding senior researchers who have successfully demonstrated the ability to develop their own innovative lines of research and to act as coach to younger researchers.

Prof. Jaap van Buul
SILS/Sanquin research and Landsteiner Laboratory - Gatekeepers of the Vasculature

The blood vessel wall acts as gatekeeper between the blood and the surrounding tissue. In case of inflammation, white blood cells move through the vessel wall to deal with the inflammation. Van Buul will seek to better understand how white blood cells exit to clear harmful pathogens.

EUROPEAN Grants

The European Research Council (ERC) stimulates high-quality research in Europe by making funds available and supporting groundbreaking research.

STARTING GRANT

A Starting Grant is a personal grant of around €1.5 million that gives talented researchers the opportunity to conduct research for a period of five years. This year, the ERC awarded the starting grant to:

Dr Corentin Coulais | *IoP*
Mechanical metamaterials are artificially constructed materials with special structural properties that are used in e.g. prosthetics and aerospace. In this project Coulais will focus on a crucial aspect of metamaterials: their extreme mechanics under realistic conditions.

Dr Crystal McMichael *IBED*
Human disturbance of the Amazonia forest caused fire and deforestation over the last 2,000 years. McMichael's project will determine whether human disturbances occurred in locations that form the basis of global carbon models.

Dr Franciska de Vries *IBED*
Drought is severely threatening our ecosystems and can cause strong shifts in plant community composition. De Vries will study vulnerable species that regrow after drought. This knowledge is crucial for predicting and mitigating the effects of drought on our ecosystems.

Dr Zeynep Akata | *IvI*
Akata will conduct her project, titled 'Deeply Explainable Intelligent Machines', at Eberhard Karls Universität Tübingen in Germany, where she was named professor in October.

CONSOLIDATOR GRANT

The Consolidator Grant, averaging around €2 million, is meant for researchers who obtained their PhDs between seven and twelve years ago to enable them to consolidate their position as independent researchers.

Prof. Lenny Taelman | *KdVI*
Although problems like Fermat's Last Theorem have long been studied using tools from geometry, there has not been much interaction with the mathematics arising from string theory and number theory. In this project, Taelman will exploit hidden symmetries in geometry to solve problems in number theory.

Prof. Anna Watts | *API*
Watts will develop and refine a new technique for measuring mass and radius that exploits relativistic effects on X-rays emitted from hot spots on the neutron star's surface: 'Pulse Profile Modeling'. She will use data from NASA's Neutron Star Interior

ADVANCED GRANT

The Advanced Grant, totaling €2.5 million, is awarded on the basis of a researcher's academic excellence and research proposal.

Prof. Jan de Boer | *IoP*
The concept of effective field theory must be modified in order to be able to describe quantum gravity. In his project 'Can I see Quantum Gravity?' De Boer will come to a precise and quantitative description of these changes, ultimately connecting it to potential experimental discoveries.

Prof. Daniel Bonn | *IoP*
Mechanical friction in engines, machines and industrial processes is an immense global source of energy loss, but is still poorly understood scientifically. Bonn will open a window on the study of local stresses in complex materials, based on recent developments in fluorescence microscopy. He aims to tackle fundamental scientific problems in this field.

MARIE CURIE FELLOWSHIP

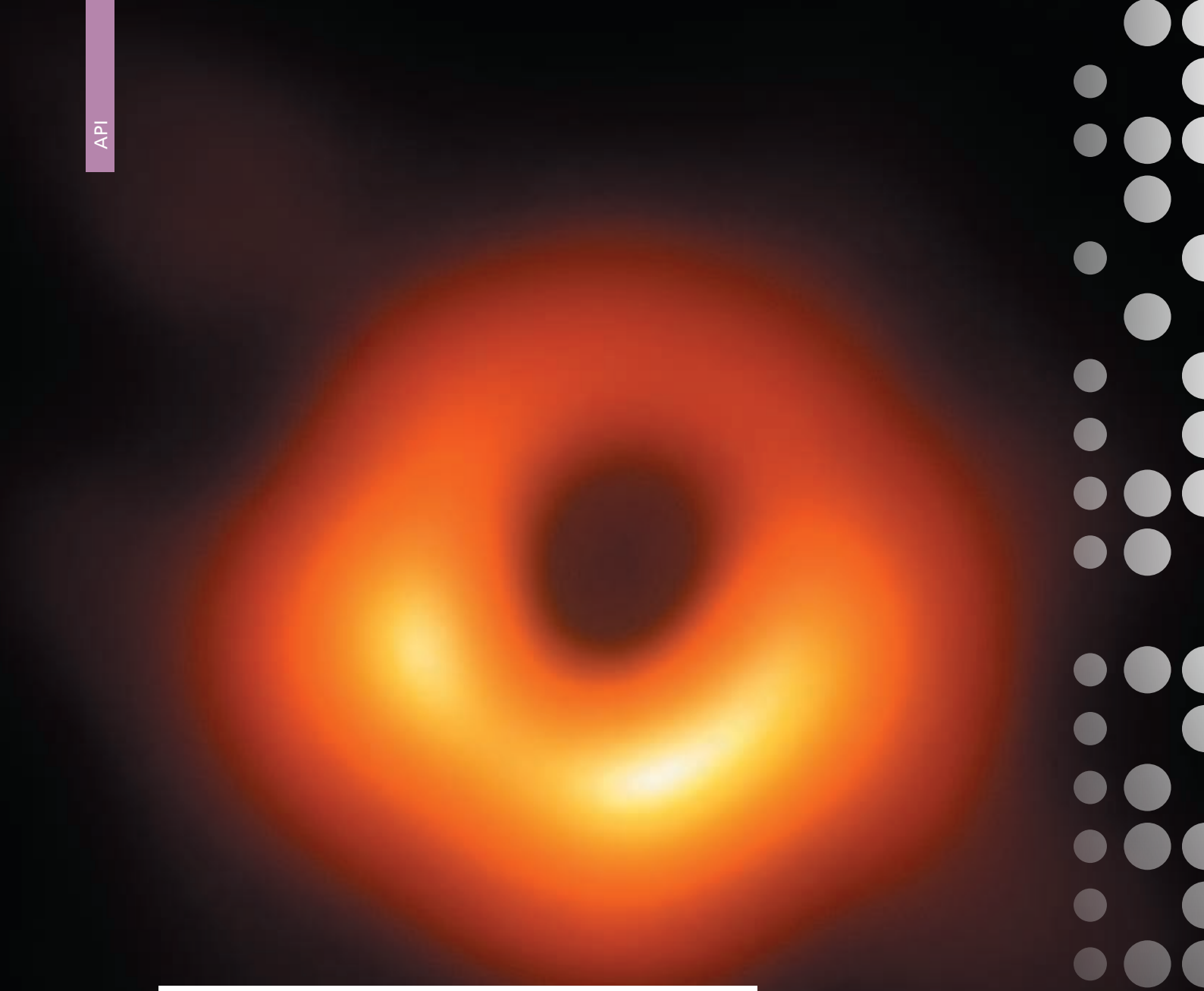
As part of the Horizon 2020 programme, four researchers received a Marie Curie Fellowship from the European Committee to conduct research at the Faculty of Science.

At ILLC **Dr Iacer Calixto** will build better and improved human language generation models that not only use vision and language, but also integrate the knowledge that we, humans, have about the world. He will work together with Raquel Fernández from ILLC's Dialogue Modelling group.

At SILS **Dr Lemeng Dong** will develop a new strategy to control cyst nematodes by altering the signaling relation between the host plant and the cyst nematodes. Dong will work in Harro Bouwmeester's Plant Hormone Biology group.

Dr Martina Ferraguti will work together with Yael Artzy-Randrup at IBED on the spillover of wildlife diseases into human populations, especially by mosquitos.

Dr Kenny Chun Yu Ng is going to study gamma rays from the sun at IoP, in collaboration with Shin'ichiro Ando at Gravitation and AstroParticle Physics Amsterdam (GRAPPA).



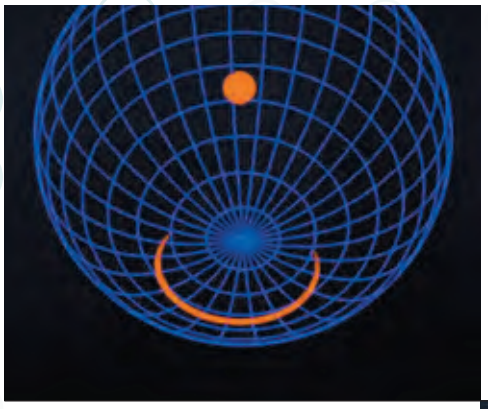
Astronomers capture first image of a black hole

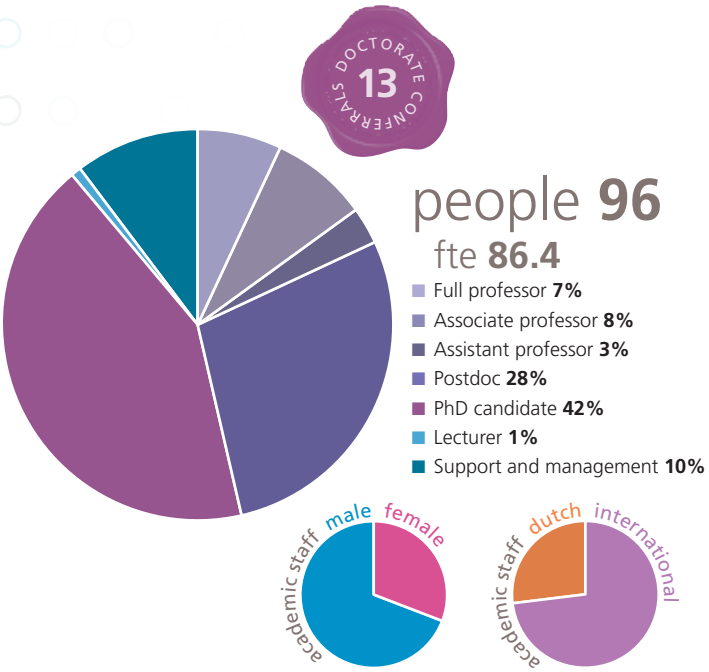
For the first time, astronomers were able to take a photo of a supermassive black hole and its shadow. They used the Event Horizon Telescope (EHT), a worldwide network of eight radio telescopes, that together form a virtual telescope the size of the earth. The photo shows the black hole at the centre of Messier 87, a massive galaxy in the nearby Virgo galaxy cluster. This black hole is 55 million lightyears from earth and is 6.5 billion times the mass of the Sun. It has a circular structure and a dark area in the middle, which is its shadow.

Four API researchers were part of this world wide project, with Sera Markoff, Professor of Theoretical High-Energy Astrophysics, being one of them: 'The size of the shadow is related to the mass of a black hole and we managed to actually measure the enormous mass of the black hole in M87,' she says. The results of this project were published in a special edition of Astrophysical Journal Letters. The next step is to increase the sensitivity of the EHT network for which the astronomers hope to build another millimetre telescope in Africa.

Anton Pannekoek Institute for Astronomy

Researchers at the Anton Pannekoek Institute for Astronomy (API) seek to understand the universe, the objects in it and their history. They test the laws of nature and find new laws.





Best measurements ever produced of a pulsar neutron star

An international team of scientists, including API astronomers, has succeeded in producing the first precise and dependable measurements of a pulsar, as well as the first surface map of one of these mysterious objects. Pulsars are small, compact neutron stars that rotate hundreds of times a second. They are the remnants of dead heavy stars. The pulsar that was measured is 1,100 lightyears from Earth, rotates 205 times a second around its axis, is 1.3 times heavier than the sun and has a diameter of only 25 kilometers. Also the magnetic field structure of this pulsar was much more complex than previously imagined.
The astronomers used an x-ray instrument aboard of the International Space Station, called the 'Neutron star Interior Composition Explorer'. These measurements help to understand more about the behaviour of ultradense matter in the star's core. The results were published in journal Astrophysical Journal Letters.

Pebbles determine the direction in which planets rotate

Planets and planetoids often rotate in the same direction around their own axis as their direction of travel around the star they orbit. The reason for this rotational movement remained a mystery. But API PhD candidate Rico Visser concludes that the 'pebble growth model' offers a solution.

In this model rocks grow into a larger objects such as planetoids by sweeping up small pebbles that are slowed down by gas. This takes place during the early phase of the formation of the solar system, in which gas and dust still exist in planet-forming discs around stars. It has now emerged that pebbles orbiting between the star and the planetoid remain in the vicinity of the planetoid for a longer period. As a result, the pebbles in the inner orbits will collide with the planetoid at a certain angle and, whip the celestial body around like a spinning top in a prograde direction. Just like Earth does. Visser's findings were published in the journal Icarus.

Daniel Bonn is an expert in the field of soft, solid matter and fluids that don't flow in a normal manner. He's never at a loss for a new research idea: dripping teapots, mayonnaise that doesn't become stiff and getting to the bottom of the fundamental question: what is friction?

I'm never at a loss for a new idea

Above Daniel Bonn's desk, a roll of adhesive tape hangs from a strip light. 'This experiment has been running for a year,' he says. 'If the adhesive is a solid material, then the roll of tape stops rolling down. But if it's a fluid, then it doesn't stop.' The little roll once began in a completely rolled up state and now it's dangling a metre lower on a strip of adhesive tape. 'So the adhesive is a fluid, although a very slow-moving one.'

Teapot effect

Bonn is Professor of Complex Fluids and head of the Van der Waals-Zeeman Institute, part of the Institute of Physics. 'When I look around me I see things I don't understand,' he says when asked how he thinks of his experiments. 'I'm never at a loss for a new idea.'
This sense of wonder is also the basis for his assignments given to his students. 'Dream up an experiment on Friday afternoon,' is one assignment he gives them. This was how they recently discovered the 'teapot effect', where drops frequently run along the spout after pouring a cup of tea.

This student experiment resulted in a well-founded scientific publication. 'If you want to prevent the stream of tea getting stuck to the mouth of the teapot, then you have to make the edge very sharp, or make the spout from a material to which water doesn't stick, such as Teflon.'

'Something like that teapot experiment may seem insignificant,' says Bonn. 'But it relates to a major class of problem in which the interaction between a fluid flow and a solid surface is important.' He explains that you see this reflected in issues involving the nozzles of devices designed to spray agricultural pesticides. 'When the sprayed medium gets caught on the nozzle, it starts to flutter like a flag. This leads to little droplets that can quickly get blown away by the wind and pollute the surface water. That's something you want to prevent.'

Duct tape and Post-its

Bonn started his career with a degree in physical chemistry at the UvA and only later moved into physics when he gained his PhD by examining the question: what happens to a drop on a solid surface when you change the temperature? He did many of his experiments at the *École Normale Supérieure* in Paris. 'A lab held together with string, rubber bands, duct tape and Post-its. But everything was possible and everything was allowed.'

After that he no longer wanted a career in industry, something he had originally envisaged. 'In the science sector you have the freedom to do what you want, when you want and how you want,' he says. 'In

industry you have to carry out your research much too quickly and you also have to justify yourself a lot.' So he remained as a scientist in Paris for twenty years. Then ten years ago he made a full return to the UvA.

Collaborating with companies

Companies often collaborate with Bonn's department. His most recent major project was conducted together with Unilever and concerned the mechanical properties of light mayonnaise. 'Mayonnaise gets its stiffness through little drops of oil that are positioned close together,' he explains. 'You have to use less oil in light mayonnaise, so you get a problem with the stiffness. Unilever creates this necessary stiffness by adding starch to the water. This makes it possible to produce mayonnaise with just 30 percent oil, instead of 80 percent. But then you have to make sure that the stability and flow properties remain the same as for normal mayonnaise. We contributed to this by looking at the difference in flow characteristics between normal and light mayonnaise.'

ERC grant

In 2019 Bonn received an ERC Advanced grant worth 2.5 million euros for research focusing on friction among other things, which involves mechanical parts in machines rubbing against each other. 'All components that provide mechanical work lose energy due to friction, usually in the form of heat,' he says. 'And this leads to the loss of between 20 and 30 percent of the entire global energy consumption.'

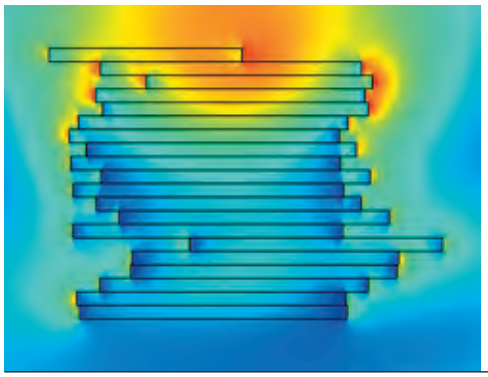
The fundamentals of friction are not well understood. 'You'd think that it's a problem that was already solved in the Middle Ages,' says Bonn. 'Leonardo da Vinci tried to get to grips with it by pushing wooden blocks over a plank.' Bonn wants to quantify the experiments of Da Vinci and is collaborating with his colleague, chemist Fred Brouwer. 'He makes 'magic' molecules that emit light when you press on them,' says Bonn. 'Using this we can look at the contact surfaces between two surfaces sliding over each other.'

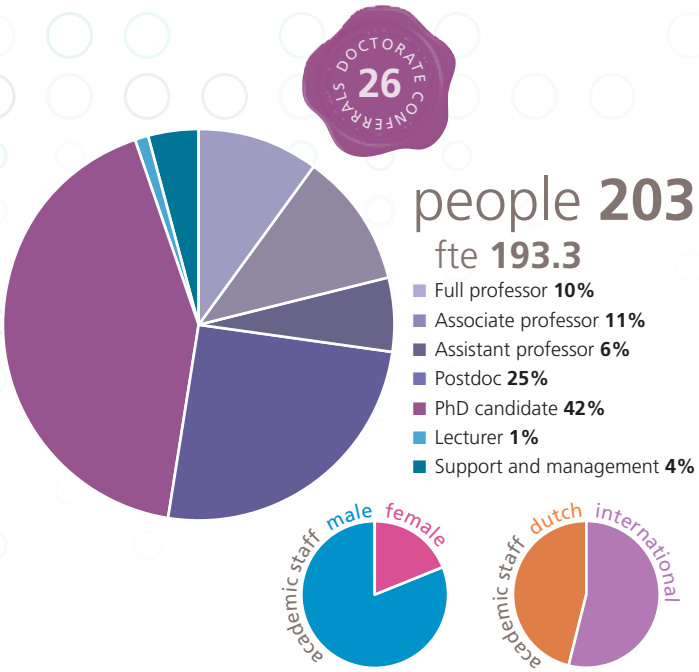
Cross-pollination

With a fair degree of regularity Bonn organises meetings for researchers from the departments of Physics, Chemistry, Computing Science and Biology, and this often leads to new research projects or shared labs. 'The Faculty of Science brings me great colleagues. It's great to share a building with different disciplines. That results in cross-pollination and so you're able to try out crazy ideas and new techniques.' ■

Institute of Physics

The Institute of Physics (IoP) covers a broad spectrum of both experimental and theoretical physics. Topics range from string theory, particle physics and astrophysics, to hard and soft condensed matter and quantum computing.





Photosynthesis at nanoscale

A team of researchers, led by IoP's Antonio Capretti, discovered a new regime of energy transfer that plays an important role in the process of photosynthesis in plants. 'Higher plants' that have a vascular system to transport water and minerals, also have a membrane inside their chloroplast, in which light-dependent reactions of photosynthesis occurs. Inside this membrane are small stacks of nanoscale layers that interact with the infalling light. The researchers found that because of this nanoscale structure, the light distribution evolves across the chloroplast in ways that seem very counterintuitive. Photosynthesis is intensively studied within the Solardam initiative: it is crucial for the plant's life, but ultimately for ours too.

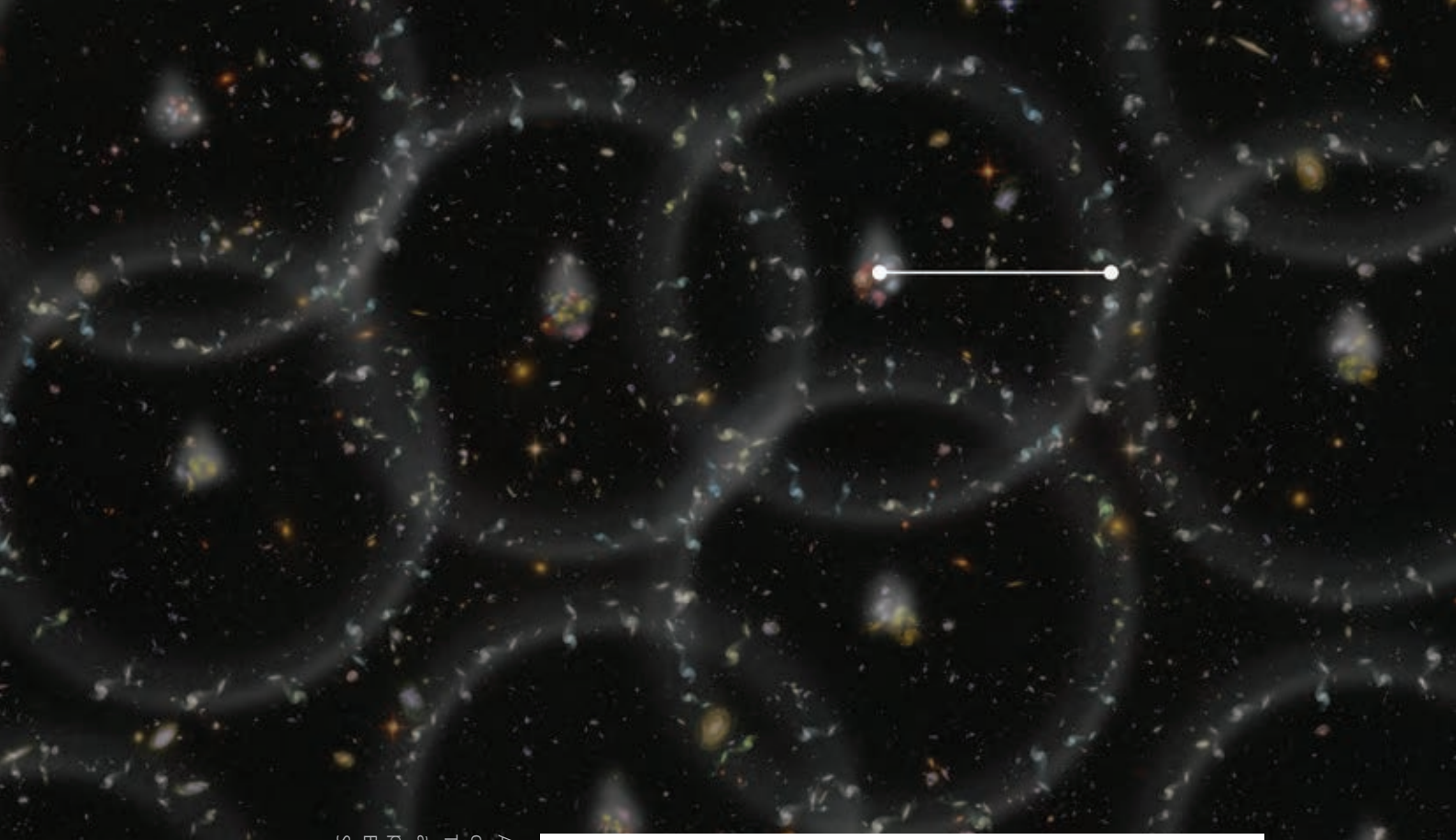
The XENON experiment in which IoP and Nikhef researchers found an incredibly slow decay time of the rare isotope Xe-124. Image: XENON collaboration.

Slowest radioactive decay ever measured

While actually searching for dark matter, researchers from Nikhef and the IoP-Institute for High Energy Physics did a spin-off measurement: they measured the slowest radioactive decay ever. The XENON experiment takes place in the underground Gran Sasso laboratory in Italy and uses several tons of cold, liquid xenon. In a rare form of this element, isotope Xe-124, they measured a decay time of 18 billion trillion years. 'At human time scales, one would simply call this stable, but there really is a measurable decay,' says Patrick Decowski (IoP and Nikhef). 'The fact that we find a reliable value indicates the precision with which we can measure this type of effect.' This world record was published in Nature's April issue.

IoP hosts FYSICA 2019

FYSICA, the annual physics conference of the Netherlands' Physical Society (NNV), was held at Amsterdam Science Park this year. From secondary school teachers to researchers, the conference was attended by all kinds of physicists. Kobus Kuipers kicked off the programme with a lecture about his research on nanophotonics. Physics Nobel Prize winner Gérard Mourou closed the day with a talk about the physics of very short and intense laser pulses. The rest of the day visitors were invited to attend focus sessions, lab tours, a physics market, award ceremonies and other physics-related activities, like the entertaining evening programme: a musical theater show called 'Vibrating World'.



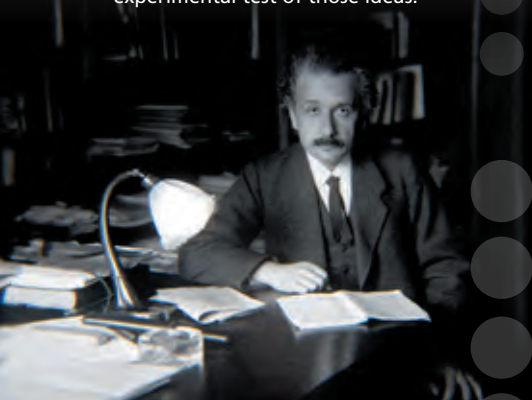
An artist's impression of the shell-like clustering of galaxies in the universe. The precise shape of the shells is subtly affected by neutrinos that were produced just moments after the Big Bang. Image: Zosia Rostomian (LBNL), SDSS-III, BOSS.

Neutrinos seen in the clustering of galaxies

In early times, the universe was an energetic mix of strongly interacting particles. The first particles that broke free from this dense soup were neutrinos. These neutrinos are still around us today, but are very hard to detect directly because they are so weakly interacting. Together with a team of international cosmologists, Daniel Baumann and Benjamin Wallisch (both working at IoP), have succeeded in measuring the influence of neutrinos on the way galaxies have become clustered during the evolution of the universe.
When a pebble is dropped into a pond, it creates ripples on the surface of the water that travel outwards in concentric circles. Similarly, the regions in the primordial plasma with the largest densities produced shells of matter (mostly protons and electrons) propagating outwards at almost, but not quite, the speed of light. This outward push of matter was created by the large number of high-energy photons in the early universe.
About 380,000 years after the Big Bang, the free electrons were captured by protons and the spreading of these shells of matter stopped. The resulting frozen shells of matter became the dense regions in which an excess of galaxies would eventually form.
The presence of neutrinos affected this process in a subtle, but relevant way. After the neutrinos decoupled from the rest of the primordial matter, they started travelling at the speed of light, slightly faster than the rest of the matter. The shells of neutrinos therefore overtook the shells of matter and slightly deformed them, creating small distortions in the seeds for the formation of galaxies at much later times.
The influence of the cosmic neutrinos on the large-scale structure of the universe should be detectable by carefully analyzing the clustering of galaxies. And that's what Baumann and Wallisch did. They studied data of 1.2 million galaxies, out to a distance of about 6 billion light years. Their statistical analysis confirms the expected signature of the bath of cosmic neutrinos that fills all of space. This new measurement constitutes an interesting confirmation of the standard cosmological model which links the production of neutrinos one second after the Big Bang to the clustering of galaxies billions of years later. These findings were published in Nature Physics in February 2019.

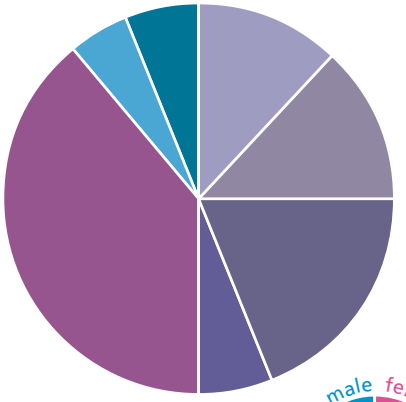
'Chasing Einstein' premieres at InScience Festival

Does dark matter really exist? And if not, do we truly understand Albert Einstein's theory of relativity? 'Chasing Einstein', a film about dark matter and gravity, premiered during the InScience Festival in Nijmegen. IoP's Margot Brouwer and Erik Verlinde play an important role in the film: Verlinde is well known for his ideas about the nonexistence of dark matter and the role that gravity plays in this; Brouwer was part of the team that carried out the first experimental test of those ideas.



Korteweg-de Vries Institute for Mathematics

The Korteweg-de Vries Institute (KdVI) advances the science of mathematics, both in its theoretical and applied aspects, and aims to stimulate the application and appreciation of mathematics in other academic disciplines and in society as a whole.

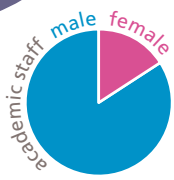


DOCTORATE 11 CONFERRALS

people **77**

fte **64**

- Full professor **12%**
- Associate professor **13%**
- Assistant professor **19%**
- Postdoc **6%**
- PhD candidate **39%**
- Lecturer **5%**
- Support and management **6%**



Raf Bocklandt at 'Universiteit van Nederland'

On 13 March 2019 the '*Universiteit van Nederland*', an organisation that promotes the public understanding of science, hosted an evening dedicated to mathematics titled 'From Pi to Pythagoras'. Raf Bocklandt was one of the speakers to give a lecture to a live audience of about 100 people. In his talk 'How do you find a hole in an invisible space?' he explained how mathematicians look for holes in abstract spaces and how these invisible holes can have peculiar consequences in everyday life. With the help of balloons, donuts, chocolate eggs and many other props he showed how abstract mathematics can be both fun and surprising. This event was recorded and the lectures are now publicly available on the YouTube channel of the '*Universiteit van Nederland*'.

NWO KLEIN Grant for Arnoud den Boer

Arnoud den Boer was awarded an NWO KLEIN grant to investigate the existence of colluding self-learning algorithms in a cartel. Whether such self-learning price algorithms exist is an unresolved question, but legal scholars agree that algorithmic collusion is undesirable, yet – under some circumstances – not forbidden by anti-trust law. The grant funds one PhD position.

NETWORKS remains in full swing

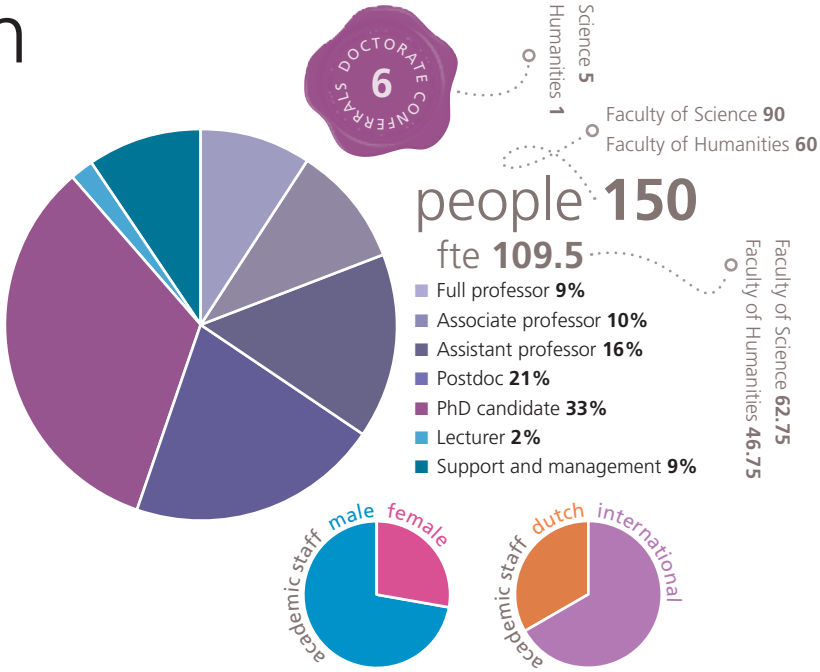
The research consortium NETWORKS, a partnership of KdVI with CWI, the University of Leiden and Eindhoven University of Technology funded with an NWO Gravitation Grant, remains in full swing. It has already resulted in about 25 PhD defenses, five of which at the UvA. The current phase of the programme is characterised by an intensification of the ties with other disciplines. This resulted in an interdisciplinary workshop with researchers from economics and the social sciences, exploring scope for further interaction. At KdVI the research line on transport and logistics, which includes a joint project with TNO, is also gaining momentum.

Sunny and interactive edition of 'Leve de Wiskunde!'

On 5 April 2019 KdVI welcomed about 70 high school teachers of mathematics and 60 of their students for the 17th edition of the '*Leve de Wiskunde!*' (Long live Maths!) conference. The aim of this annual conference is to bring high school audiences in touch with the kind of mathematics that is studied and practiced at the university level. There were talks by Jan Wiegerinck, Arnoud den Boer, Erik Winands, Maris Ozols. Furthermore, Raf Bocklandt served up 'The most delicious proofs in Geometry' and Zoë Schroot got all participants to tie knots during her lecture 'All tied up'. During the lunch break the participants could play outside with life-size mazes.

Institute for Logic, Language and Computation

ILLC studies the processes involved in the encoding, transmission and comprehension of information. The concept of 'information' is given a broad interpretation, encompassing not only the characteristics of formal languages and information flows in natural language processing, but also human cognitive activities such as reasoning and listening to music.



Outreach: MasterClass Logic for math teachers

In 2019 ILLC organised two masterclasses aimed at math teachers in order to provide them with background knowledge about logic and the relation between logic and mathematics in particular.

ILLC is preparing for the Eurovision Song Festival

Ashley Burgoyne of ILLC's Music Cognition Group has been leading a team of AI and musicology students on various projects surrounding the Eurovision Song Festival. Although the Song Festival 2020 was cancelled, Ashley and master's students Janne Spijkervet are participating in the VPRO-sponsored AI Song Contest, for which international teams will compete to produce the best AI-generated Eurovision-style song.

Syntax meets Semantics

Syntax Meets Semantics (SYSMICS 2019) was the closing conference of the Horizon 2020 Marie Curie RISE project. The conference was held in January, in Amsterdam, and hosted by ILLC. Seventy participants from external and partner universities attended the meeting. The scope of the conference included algebraic, proof theoretic and relational approaches towards the study of non-classical logics. The programme also featured a public lecture in De Balie by Frank van Harmelen (Vrije Universiteit Amsterdam) about logic and AI.

Books by ILLC researchers

Rens Bod: A world full of patterns

The idea that the world can be understood on the basis of patterns and underlying principles is one of the most important insights of man. In his new book '*Een wereld vol patronen*' (A world full of patterns), ILLC's Rens Bod elaborates on this unique human search that began more than 40,000 years ago with the scratching of bar patterns on mammoth bones and led to the sciences of today. Bod, specialised in digital humanities and the history of humanities, shows what role patterns and principles have played in different cultures.

Henkjan Honing: The Evolving Animal Orchestra

Even those of us who can't play a musical instrument or lack a sense of rhythm can perceive and enjoy music. Research shows that all humans possess the trait of musicality. We are a musical species—but are we the only musical species? Is our musical predisposition unique, like our linguistic ability? In The Evolving Animal Orchestra, Henkjan Honing (ILLC's Music Cognition Group) embarks upon a quest to discover if humans share the trait of musicality with other animals.

Franz Berto: Impossible worlds

Franz Berto, who teaches and works in logic and ontology at ILLC, wrote a book together with Mark Jago, philosopher at the University of Nothingham, UK. 'Impossible worlds' is a book about the metaphysics of impossible worlds. It issues complex topics in metaphysics, logic, and the philosophy of language.

Smart investments: focus on AI research

Together with the City of Amsterdam, the business community, social partners and other research institutions, the University of Amsterdam is conducting groundbreaking research on new algorithms, their applications and their impact on society. The Informatics Institute is a key player in many of the initiatives, collaborations and networks that are being set up with the aim to develop responsible AI technologies and retain AI research talent within Europe.

• The knowledge institutions of Amsterdam, the UvA being one of them, have joined forces and are investing 1 billion euros in the development of responsible AI technologies over the next ten years, by setting up research programmes, attracting top scientists and educating students with state-of-the-art knowledge of AI. The focus will be on related technological areas: machine learning, hybrid intelligence and explainable AI. The aims are high: to employ at least 800 researchers, train 5,000 Bachelor's, Master's and PhD students, have 10,000 students that follow an AI-minor and develop 100 spin-offs and 100 startups.

• The UvA was selected by the European Laboratory for Learning and Intelligent Systems (ELLIS) as an 'ELLIS Unit' to keep talent in machine learning and related AI research fields in Europe. Max Welling, professor of Machine Learning at the UvA and leader of the ELLIS Unit in Amsterdam, based at the Informatics Institute: 'I am very excited that the UvA has decided to wholeheartedly support this important movement to make Europe competitive in AI. This ELLIS Unit will further strengthen our position in machine learning and artificial intelligence in Europe and facilitate the exchange of top researchers and students in the field of AI.'

• At the Faculty of Science, the AI4Science lab was launched. A joint initiative of the institutes for astronomy (API), biodiversity (IBED), chemistry (HIMS), informatics (IvI), life sciences (SILS) and physics (IoP), the lab's aim is to solve scientific data problems with modern machine learning approaches. The initial focus will be on five projects from completely different fields: understanding radio phenomena, chemical structures, bird migration, gravitational waves and gene regulation networks. But even though these projects cover a wide range of scientific fields, the underlying question the AI4Science lab aims to answer is the same: How can we detect, classify, and predict relevant patterns in scientific data if they are hidden within large amounts of non-relevant data? AI4Science is embedded within IvI's Amsterdam Machine Learning lab (AMLab).

• The Ministry of Education, Culture and Science (OCW) awarded a Gravitation grant, worth €19 million to a consortium that will develop hybrid intelligence, a combination of artificial and human intelligence. IvI professors Maarten de Rijke and Max Welling are attached to this consortium, led by VU University Amsterdam.

• With Maarten de Rijke already appointed University Professor of AI and Information Retrieval in 2018, in 2019 the UvA announced the appointed of three further University Professors with a focus on AI in different disciplines. They are: Tobias Blanke (Humanities and AI), Ivana Išgum (AI and Medical Imaging) and Natali Helberger (Law and Digital Technology, with a special emphasis on Artificial Intelligence).

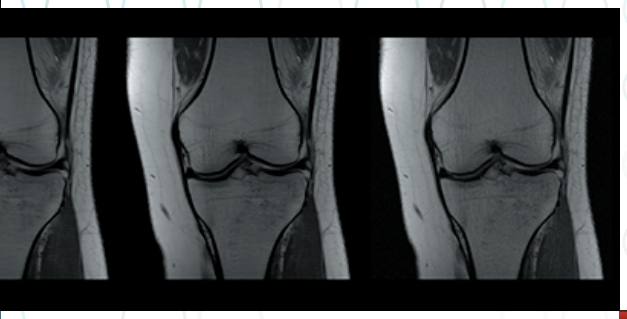
Working together on autonomous driving

The UvA, TNO and CWI announced their collaboration on a project called 'Meaningful Control of Autonomous Systems'. The focus will lie on case studies in two application areas, namely autonomous and cooperative driving and justice and public services. The three organisations complement each other well in this area. TNO has knowledge about safe data sharing, explainable AI and human behaviour. CWI specialises in deep learning and statistical machine learning. And the UvA has, on the one hand, the Faculty of Law with all its legal and ethical knowledge, and on the other hand, the Informatics Institute with its knowledge of deep learning, information retrieval, computer vision and secure data exchange.

The UvA, TNO and CWI signed a Letter of Intent in October 2019, entitled 'Meaningful Control of Autonomous Systems.'

Informatics Institute

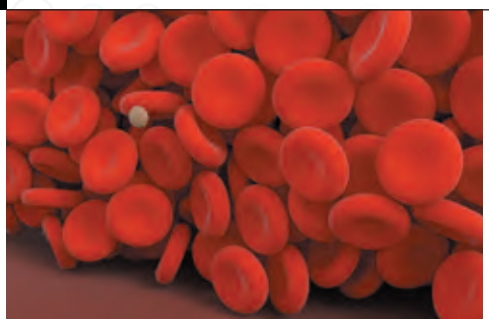
The Informatics Institute (IvI) conducts fundamental and applied research in the areas of information, complexity, and system engineering.



Two multi-coil 4x accelerated challenge submissions (left and center) and their corresponding ground truth image (right). Image: Facebook AI

AI makes MRI scans ten times faster

Facebook AI and academic medical centre NYU Langone Health created 'fastMRI', an open project for AI researchers to accelerate MRI scans through AI. The aim was to make scans as much as ten times faster than they are today, thereby improving patient experience and making scans less expensive. 34 AI teams could experiment with a large dataset of de-identified MRI knee measurements. IvI's PhD student Patrick Putzky led a team that was ranked among the strongest performers.



Simulation of flow of red blood cells. Image: CompBioMed

Physics of Fluids for blood flow research

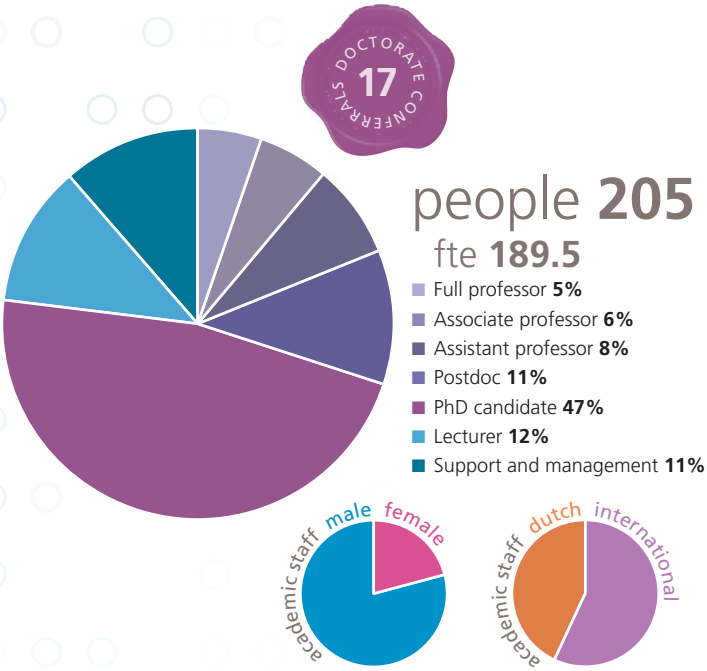
Gábor Závodszky, computer scientist at IvI, published an article about a new model for the flow of red blood cells in blood; it featured on the May cover of scientific journal Physics of Fluids. Red blood cells are fairly soft and easily deformable. During the flow of blood, they constantly collide with each other and with other obstacles, and sometimes they accumulate. In order to be able to make a good model of blood, it is necessary to include collisions and the deformability of red blood cells. Until now, this has often not been sufficiently taken into account in models. Závodszky and his colleagues from IvI have expanded an existing model with the deformability of the red blood cells. This is important, because a more precise model helps doctors to better predict the behavior of blood in all sorts of diseases.

Rik Helwegen © CBS, Sjoerd van der Hucht Fotografie

Fair algorithms

In Dutch society, more and more decisions are being made by automated systems which are based on algorithms. But how fair is the use of algorithms? Master's student Artificial Intelligence Rik Helwegen developed a practical method which ensures that the use of algorithms elicits impartial answers to complex questions. 'Local authorities are increasingly experimenting with a data-driven approach,' says Helwegen. 'To this end, they are adopting machine learning algorithms. But when ethnicity or other sensitive background characteristics of people influence the decision-making of such authorities, this may give rise to ethical or legal objections.' The underlying principle of Helwegen's method is that the outcome of the model must be the same if the parameter of a sensitive personal characteristic is switched, for example, from a non-Western background to a Western background. He has been awarded an innovation budget by the Ministry of the Interior and Kingdom Relations to conduct further research.

Starting 1 January 2020 Alfons Hoekstra was appointed the new director of the Informatics Institute. Hoekstra, professor of Computational Science and Engineering, has been affiliated with the UvA since 1994. He succeeds Marcel Worring.



Ekaterina Shutova is leading the Amsterdam Natural Language Understanding Lab at ILLC. She develops ways to make computers understand language like humans do. To this end she creates models of the meaning of texts and the emotions they convey, and works on algorithms that detect abusive language in online comments.

How can we improve algorithms to be more human-like?

Ekaterina Shutova is a researcher at the Institute for Logic, Language and Computation. In 2019 Facebook awarded her with a grant for a project on abusive language detection. With two students, a collaborator from King's College London and a Facebook researcher she now works on the development of a machine learning technique that detects sexist and racist comments in social media posts.

A lot of online moderation is still done manually, Shutova says. There are machine learning techniques that can do this work too, but they often have biases in their datasets, due to how the data were collected. When a model is trained to detect abusive language in one dataset, which was sampled from specific topics, for instance 'women in sports', the computer learns that there is an association between sports and sexism. 'But that's not what you want. The model cannot be applied to another dataset and may learn incorrect associations,' she explains.

Therefore she wants to create a dataset that is not biased. So she selects a wide range of topics, like politics and environmentalism, and then draws a selection of comments. After several rounds of annotation she uses statistical models to explicitly check for biases. Shutova: 'If we find any, we improve the data by adding new texts.'

She is still in the process of developing this technique, and likes the collaboration with Facebook. 'It's nice that my fundamental work has a societal impact,' she says. 'It is not something we just develop at the lab. That's very gratifying.'

Natural Language Processing

Shutova studied linguistics and mathematics at St. Petersburg State University, followed by a PhD in Cambridge and a postdoc at the University of California at Berkeley. Since 2018 she works at the UvA as assistant professor of Natural Language Processing (NLP).

The field of Natural Language Processing (NLP) develops technologies that allow their users to extract information, automatically translate texts and communicate with machines. Scientific research in NLP aims to answer questions like: What is the mechanism of language? How does language work in the human brain? And how can we model language patterns that are usable for smart digital applications? To answer these questions, knowledge about language, neurobiology, maths, logic, psychology and Artificial Intelligence are combined.

Semantic composition and emotions

Shutova's research interests contribute to another big question in the field of NLP: how can we improve our models to be more

SMART

An increasingly complex and data-rich world calls upon our widely recognised expertise in fields such as language processing, networks, data science, quantum technology, computational science and artificial intelligence. Collaborations such as those Ekaterina Shutova conducts with Facebook, but also for example the public-private partnership labs in the Innovation Centre for Artificial Intelligence (ICAI), are a testament to the Faculty of Science's position as a 'smart' partner in research. This position will be further solidified with the build of LAB42, a co-creation building for the information sciences at Amsterdam Science Park. LAB42 is to open in 2022 and will be home to our Bachelor's and Master's programmes in computer science, information science, artificial intelligence and logic. It will also house the Informatics Institute and the Institute for Logic, Language and Computation, as well as co-creation labs.

human-like? She is interested in modelling emotions: how can you interpret the difference between the actual content of a sentence and the affect a speaker expresses?
'If someone says I feel drained, the word drained itself doesn't have a negative impact,' Shutova explains. 'But if you feel drained, it has a negative meaning. It means you're tired.'

She also specialises in semantic composition models. That means she focuses on the fact that there's a difference between what words mean, and what these words mean when they are put together in a sentence. Shutova: 'Take the example: I enjoyed the film. This sentence could mean that you enjoyed watching a film, or that you enjoyed shooting a film. Depending on the context.' She models the meanings of sentences like this using mathematical models and 'deep' learning algorithms.

Human-like learning algorithms

But researchers working with such deep learning models, face a major problem: the models are not easy to adapt to new application contexts. Just like in the earlier mentioned Facebook example: when a situation changes a bit, the model doesn't work anymore. 'When you train models, you need large amounts of data,' tells Shutova. 'But you cannot have a big dataset for every task, scenario or language. The solution is to design an algorithm that is able to learn from small numbers of examples.' This field is called meta-learning. Together with several students, she works on this new area of research at the moment.

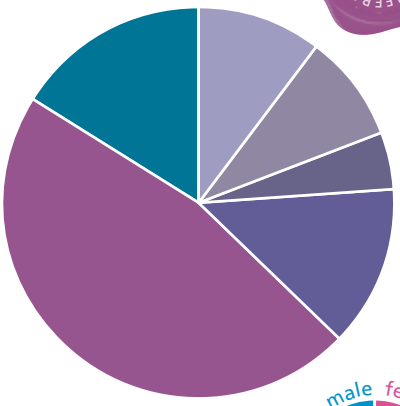
Working at UvA

Shutova enjoys working at the UvA. She has interesting colleagues, likes teaching and is inspired by the extremely motivated students. 'There's a lot of NLP and Artificial Intelligence research going on at the UvA. At ILLC we conduct research on machine translation, dialogue systems, interpretation of NLP models and semantics, with leading researchers in each of the areas. I also like the fact that all different areas of AI are well represented at the university, with very strong machine learning, computer vision and information retrieval groups at the Institute of Informatics. Many universities only excel in one or just a few of these areas.' ■

Van 't Hoff Institute for Molecular Sciences

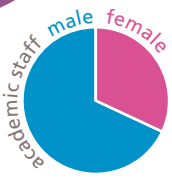
The Van 't Hoff Institute for Molecular Sciences (HIMS) performs internationally renowned chemistry research, curiosity driven as well as application driven, within four recognisable themes: Computational- and Analytical Chemistry, Synthesis & Catalysis, and Molecular Photonics.

DOCTORATE CONFERRALS 20



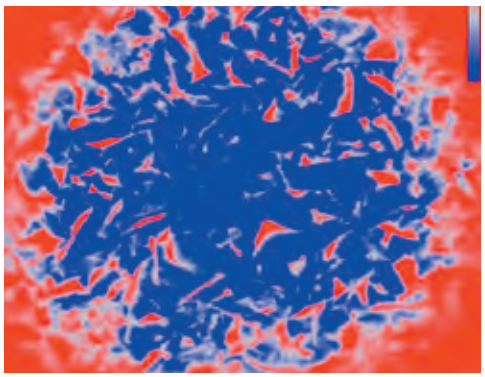
people **145**
fte **137.9**

- Full professor **10%**
- Associate professor **9%**
- Assistant professor **5%**
- Postdoc **13%**
- PhD candidate **47%**
- Support and management **16%**



Slippery when wet: how does lubrication work?

Friction and wear are responsible for a large fraction of the world's energy consumption and therefore contribute enormously to greenhouse emissions. Literally every moving object dissipates energy through friction. To reduce friction and wear, sliding and rolling contacts are typically lubricated. Lubrication facilitates the sliding of objects, which is of immense importance in technology, geology, biology and many other areas. Researchers from IoP and HIMS developed a new method using fluorescent molecules to quantify both the area of (near) contact between two objects and the thickness of the liquid layer that separates them. These are essential ingredients for the theoretical description of lubrication of rough surfaces, which were further developed in this research project. The results were published in the scientific journal Sciences Advances.

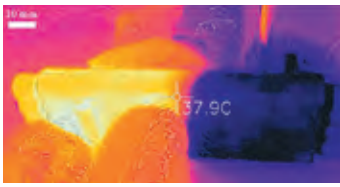


Lubrication: Fluorescence intensity image of the contact between a polystyrene sphere and the glass substrate. Image: HIMS / Science Advances

Generation of an amine dehydrogenase by enzyme engineering. Image: Dr Marcelo Masman, HIMS Biocatalysis group.

New enzymes for the synthesis of important pharmaceutical products

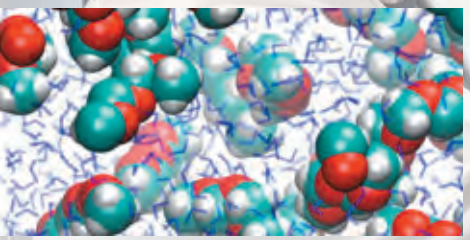
By means of structural-guided protein engineering, Francesco Mutti, Tanja Knaus, Marcelo Masman, Vasilis Tseliou and Maria Corrado have created a new family of amine dehydrogenase enzymes with unprecedented catalytic properties. The new enzymes are an important addition to the current enzyme toolbox for the synthesis of α-chiral amines, and are relevant for the synthesis of important pharmaceutical products such as antidepressants. The new enzymes make their production more chemically efficient and sustainable. The research method was published in Nature Communications and a patent application was filed.



A 3D-printed microscopic separation device with a heating and cooling jacket. T(cold) = 10°C (right) and T(hot) = 70°C (left).

Unraveling a million compounds from very complex mixtures

Many things that we encounter in daily life have an immensely complex chemical composition. Regular chromatography has the ability to separate up to 'only' 10,000 compounds. HIMS researchers explore a three-dimensional approach of liquid chromatography, that should unravel up to a million compounds from very complex mixtures. The team developed 3D-printed microscopic separation devices with a heating and cooling jacket for the optimal separation of compounds. The results of this work will benefit many fields of science, including (molecular) biology, chemistry, health, food, renewable energy and high-tech materials.)



Chemists were able to explain the counterintuitive behavior of polyoxymethylene (POM) and polyethylene glycol (PEG) in water. Image: HIMS

Mysterious solubilities of PEG and POM polyethers finally resolved

Chemists from HIMS and the Max Planck Institute in Mainz were able to explain the counterintuitive behaviour of polyoxymethylene (POM) and polyethylene glycol (PEG) in water. PEG, a common ingredient in cosmetic products, dissolves perfectly in water. Its molecular repeat unit contains slightly negatively charged oxygen atoms, which makes the polymer hydrophilic. POM however, has relatively more oxygen but instead forms an insoluble hard plastic, known to every chemist from the Keck clips used in chemistry labs. Bernd Ensing found that the oxygen atoms in POM are less charged because there are fewer carbon atoms to borrow charge from. This induction hypothesis was elegantly proved by computer simulations of fictitious modified POM molecules carrying PEG-like charges. It then dissolved perfectly in water. The results were published in Nature Communications.

On the road to circular chemistry with SusPhos

In 2019, the UvA launched spin-off company SusPhos, with the aim to contribute to a circular economy in phosphorus and to establish a sustainable use of this resource. As a key ingredient in fertilisers, phosphorus is essential for feeding the world-population. Phosphate fertilisers approximately double the amount of food that can be produced in agriculture. In addition, phosphates are used in flame-retardants and many other products. However, phosphorus is also a scarce element; most is lost in water bodies after consumption, leading to algae growth and pollution. Because of the current unrenewable fossil mining, recovering phosphorus from waste streams is essential to secure future availability of this precious element.

Marissa de Boer, Chris Slootweg and Bas de Jong – researchers at HIMS – developed and patented the SusPhos technology. It is the first technology to use phosphorus-containing waste material such as struvite as a resource, and upcycle it to competitive high-quality products such as fertilisers and high-end flame-retardants. It has the potential to completely change the phosphate market that currently still relies on fossil resources. At the same time, the technology helps to tackle the issue of uncontrolled algae growth caused by phosphorus-containing waste streams.

2019 was a very successful year for the company SusPhos and its research staff at HIMS, receiving many grants, prizes and a loan. The Innovation Fund Noord-Holland provided the company a convertible loan of €300,000, which allows the building of a pilot plant in 2020. SusPhos CEO Marissa de Boer received the Amsterdam Science & Innovation Award 2019 and a €7,500 cheque for further development. Dutch science foundation NWO and Holland Chemistry gave SusPhos the ‘Gouden KIEM’ for best Dutch start-up in chemistry. And PhD student Steven Beijer won the Unilever Research Prize 2019 for his Master’s research entitled ‘Creating valuable phosphorus products from low-value feedstocks.’

Lastly, Chris Slootweg, Associate Professor at HIMS, received a KIEM GoChem grant to further develop the SusPhos process, so that magnesium and ammonium salts can be recycled from waste streams too.

How did baleen whales become our planet's giants?

Fleur Visser (IBED and NIOZ) and an international team of researchers published in scientific journal Science why baleen whales evolved to be such huge animals, and why others did not. Whales and dolphins can be divided into two groups: filter-feeding baleen whales and toothed whales that hunt one prey at a time. Extremely large body size can only be maintained if the energy intake during foraging is considerably and consistently greater than the energy released during the search for prey. The researchers concluded that baleen whales achieve unparalleled foraging performance because they can swallow enormous amounts of water, fish and krill at once, while toothed whales are often limited by the supply of their prey.

It is unlikely that baleen whales will get even bigger. Visser: 'Ultimately, they are limited by the maximum availability of seasonally abundant prey and the speed at which they can eat them – here, the limit seems to have been reached.'

A blue whale, photographed with a camera drone. This individual is 23 metres long, photographed in May 2018 at Terceira Island, the Azores. Photo: Machiel Oudejans, Kelp Marine Research, photographed under licence number LMAS-DRAM / 2018/01

Signing of the agreement between the Mesdag Dairy Fund and the UvA on 8 November 2019. Left to right: Albert Tietema (IBED), Jan Cees Vogelaar (Chair Mesdag Dairy Fund) and Annemarie van Wezel (Scientific Director IBED). Photo: Monique Kooijmans

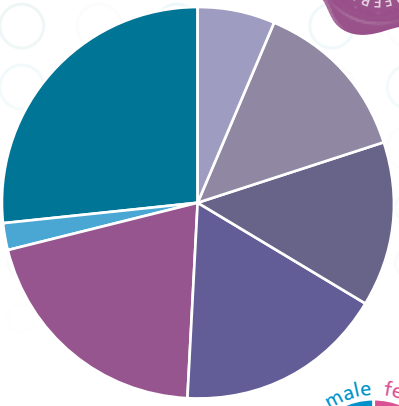
Measuring nitrogen deposition around two dairy farms

In November, an agreement was signed in which the Mesdag Dairy Fund commissioned IBED researchers Albert Tietema, Emiel van Loon and Roland Bol to measure the reach and quantity of nitrogen deposition around dairy farms and in nature conservation areas. The research is aimed at determining the distribution pattern of the nitrogen deposition around the source by using methods that can determine the actual nitrogen deposition in the soil. Thus far these quantities were only calculated based on models. The researchers will initially focus on measuring the distribution of deposition around two dairy farms, both located near natural areas (heath or forest). How far does the influence of the company on the environment extend? Is it a few hundred meters, which means that most of the nitrogen ends up on the farm yard, or is it a matter of kilometers and are sensitive natural areas affected? The project will last three years an there will be substantive contact with the National Institute for Public Health and the Environment (RIVM).

Institute for Biodiversity and Ecosystem Dynamics

IBED aims to increase our understanding of the diversity and dynamics of ecosystems, from the molecular and genetic level to entire ecosystems. How do organisms interact with each other and with their non-biological environment?

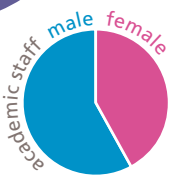
DOCTORATE CONFERRALS 13



people **139**

fte **120.2**

- Full professor **6%**
- Associate professor **14%**
- Assistant professor **14%**
- Postdoc **17%**
- PhD candidate **20%**
- Lecturer **2%**
- Support and management **27%**



More natural enemies due to flower strips

Flower strips at the edge of agricultural fields create a buffer between crop and ditch, thereby limiting the spillage of nutrients and pesticides into the water. They also support insect biodiversity. IBED researcher Paul van Rijn studied 30 agricultural fields with flower strips. After a two-year long monitoring programme, he concludes that insect diversity clearly increases with the amount of flowering forbs. The fields with flower strips had a higher number of wild bees, hoverflies, lacewings and ladybeetles. Also, the amount of aphids in potato fields declined faster in fields with more natural enemies like lacewings and hoverflies. Van Rijn: 'The results indicate that flowering field margins in combination with pest monitoring can contribute to agrobiodiversity in two ways: by providing habitat and food for a range of insect species and by reducing the use of insecticides.'

Climate change impacts on tropical mountain biodiversity

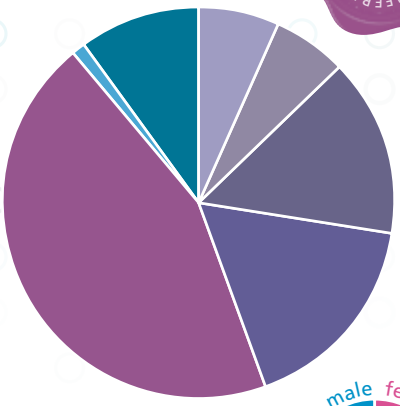
An international team of researchers, co-led by IBED's Daniel Kissling, investigated different scenarios of how the elevational ranges of fleshy fruited plants and fruit-eating birds might alter in the Manú National Park in Peru due to climate change. Ecological communities will be reshuffled. In tropical mountains many plant and animal species will change their geographical distributions upslope due to higher temperatures. This will result in mismatches between plants and birds. Kissling: 'Future functional diversity and functional identity will most likely decrease at low elevations in the tropics, as we expect that the number of lowland species emigrating, or going extinct from low elevations, will exceed the number of persisting, warm-adapted species.' The findings were published in the scientific journal Diversity and Distributions in June.

Marmalade hoverfly on a *Glebionis segetum* in a field margin flower strip. Picture: Paul van Rijn

Manú National Park in south-east Peru, where the study data was collected. Copyright: Corey Spruit / Wikimedia Commons.

Swammerdam Institute for Life Sciences

Research at SILS spans the biological processes in humans, animals, plants and micro-organisms. The exchange of information and extension of research across disciplinary boundaries is a key characteristic.

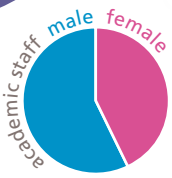


DOCTORATE CONFERRALS 20

people **241**

fte **225**

- Full professor **7%**
- Associate professor **6%**
- Assistant professor **15%**
- Postdoc **17%**
- PhD candidate **45%**
- Lecturer **1%**
- Support and management **10%**



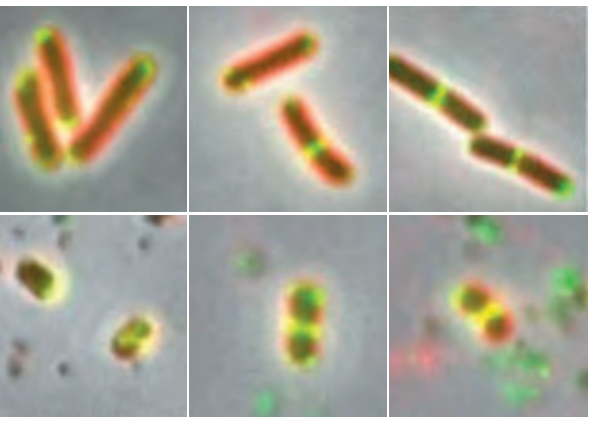
How brains track the location of other beings

The hippocampus constantly keeps track of one's own location in an environment. It uses this information map to create and consolidate personal memories. Cyriel Pennartz (SILS) led a group of neuroscientists that investigated how the hippocampus is also involved in tracking the location of other individuals and objects. After an experiment with rats, robots and a maze, they concluded that the brain encodes and stores information about the location of others in a different way than it does when the information concerns ourselves. This fundamental research provides handles to study what could go awry in brain disorders by which social functioning is heavily compromised, such as autism.

Citrus fruits come in many varieties and tastes, from sweet to extremely sour. Photo: Pixabay

Finally an answer to the riddle: how can lemons be so extremely sour?

Biologists have long sought for the mechanism that enables cells of lemons to become acidified to such an extreme extent. They can have a pH as low as 2. Ronald Koes, Francesca Quattrocchio and their team finally solved this riddle. They analysed a range of citrus fruits, including sweet and sour lemons, oranges and pomelo's, and found that in sour fruits, two genes called CitPH1 and CitPH5 were very active. Koes: 'Now that we have finally found the genes that are responsible for the acidity of the fruits, breeders can develop new varieties much more easily. They can now detect how acidic the fruits will be – and thus, what they will taste like – in very young plants, years before they will produce their first fruits.'



Bacillus subtilis bacteria in their normal state (top) and the 'zombie state' (bottom). Picture: Leendert Hamoen

The discovery of a previously unknown survival strategy of bacteria

Bacteria that are exposed to antibiotics or very few nutrients, can sometimes survive by 'going to sleep'. Leendert Hamoen and a team of international biologists have discovered another survival strategy: a kind of zombie mode, in which the bacteria slow down extremely. The team worked with Bacillus subtilis, a bacterium that occurs in the soil. Due to a mutation it can't turn into the sleeping mode. But when they were starved, some of the bacteria were found to survive this for a long time. Hamoen: 'Normally, Bacillus is rod-shaped; but the starved bacteria shrank until they were almost spherical. All kinds of processes that are normally active in the bacterium were altered, but did not stop completely. The bacteria even continued to divide, once every four days; more than a hundred times slower than usual.' If more bacteria are found to be able to switch to this zombie state, it will throw a whole new light on how bacteria can escape antibiotics.

€20 million for plant stress research

A consortium headed by the University of Amsterdam was awarded a Gravitation grant of over €20 million by the Ministry of Education, Culture and Science (OCW) to study the relationship between plants and the microorganisms that live on their roots. In due course, this project is expected to make a significant contribution towards the sustainable improvement of the global food supply, one of the biggest societal challenges of today.
The root microbiome is the community of bacteria and fungi that inhabit the interior and surface of plant roots, as well as the surrounding soil. The bacteria and fungi help mobilise nutrients from the soil, protect the plant against stresses such as drought, and play an import role in plant health. However, little is currently known about how plants recruit these friendly microorganisms and how they in turn assist and protect their hosts.
The project, headed by SILS' Harro Bouwmeester, has been dubbed MiCRop and is a collaboration between the University of Amsterdam, Wageningen University, VU University Amsterdam, Utrecht University and the Netherlands Institute of Ecology.
Bouwmeester, professor of Plant Hormone Biology, explains: 'We will investigate a large number of crucial food crops, such as cabbage, potatoes, tomatoes, beans, grains, cucumbers and pumpkins as well as their wild relatives. We will use the latest techniques to study how the association between plants and the bacteria and fungi on their roots changes under suboptimal conditions, such as drought, nutrient-poor soil or the presence of diseases and insects. We will investigate which mechanisms plants use to recruit friendly microbes and with which processes the microbes in turn enhance the plant's resistance to stress.'
The researchers are not only concerned with acquiring fundamental knowledge, but also with its application. According to Bouwmeester, 'We're working with some 25 partners from the plant breeding and biologicals industry. The collaboration with eight CGIAR institutes is also very important to us.' CGIAR, the Consultative Group for International Agricultural Research, is a global, intergovernmental organisation dedicated to the improvement of agriculture and the global food supply, particularly in developing countries. According to Bouwmeester: 'In these countries, in particular, there is much to gain in terms of improving plant tolerance to a multitude of stresses, such as drought and pests. With this study, we hope to make a significant contribution to that.'

Gert-Jan Gruter is an expert in the field of sustainable plastics. He applies his knowledge of plastics and recycling to LEGO bricks, new sustainable packaging and textiles, and making plastic from CO_2. He also writes regular columns for Chemistry Today, in which he addresses misunderstandings surrounding plastics and recycling.

There are a lot of misunderstandings with regard to plastics and recycling

Recently Gert-Jan Gruter has been engaged with LEGO again. Not actually playing with it like he used to, but in order to change the material from which the toy is made. Ever since the 1960s the little coloured bricks have been made from the high-quality plastic ABS (acrylonitrile butadiene styrene). 'This makes them very durable and expensive, and they can certainly be used for two generations,' says Gruter. But the little bricks of ABS are made of fossil raw materials and cannot be recycled effectively. 'First you have to sort the pieces by colour and then create a separate recycling flow for each colour,' he explains. 'That's why LEGO wants to replace its pieces with a more sustainable plastic that can easily be recycled into new bricks.'

But a LEGO brick has to meet a lot of criteria: the material must be strong, have some flexibility – certainly not too rigid because these bricks have to be clicked onto each other countless times – and the material must not show signs of ageing. Gruter and a PhD student have now developed a number of polyesters that have a chance of meeting the LEGO quality requirements and also of being chemically recyclable. 'LEGO has already started the first tests,' he says.

From fundamental to applied research

Since 2016 Gert-Jan Gruter has been affiliated with the UvA as professor by special appointment of Industrial Sustainable Chemistry. He studied organic chemistry at VU University Amsterdam and also did his doctoral research project there on ring-shaped molecules that can link into each other. 'That was super-fundamental research,' he says about this, while he believes that now he's one of the most applied researchers at the HIMS.

Besides this, for the last twenty years he has been Chief Technology Officer at Avantium, a company that develops plastics on the basis of natural raw materials. Gruter explains: 'Our philosophy is that for all materials we only want to make use of carbon that is already above the ground: biomass, CO_2 and recycling are the only options here.'

PEF instead of PET

One of Avantium's flagship projects is PEF (polyethylene furanoate), a plastic made from woodchips, starch or beet pulp. A year from now, in the town of Delfzijl, the first factory will open that will deliver PEF to companies such as bottle manufacturers that until now have used the plastic PET, which is made from fossil fuels.

GREEN

The transition to a sustainable, circular economy is one of the most important developments in society today. The Faculty of Science has much to offer in addressing this challenge, from expertise in developing alternative energy sources, to finding green ways for crop protection and – indeed – the development of biodegradable plastics. Through collaborations with industry and founding our own spin-offs such as Plantics, a producer of bio-materials, we bring those solutions to life.

In addition, the company is working on techniques to make plastics from CO_2. With the help of electricity and oxygen the CO_2 is first converted into formic acid, then into oxalic acid and then into plastic. 'Because polyester-based plastic always requires alcohols and acids,' explains Gruter.

Working at the UvA

The professorship by special appointment at the UvA gives Gruter the chance to conduct research into other sustainable plastics, into the biological degradability of plastics such as PEF and he also has time to write columns for the scientific journal Chemistry Today about plastics and recycling. There are a lot of misunderstandings in this area, he says. 'For instance, biopolymers and bioplastics are plastics made by nature itself, such as cellulose, DNA and starch. But then you also have biobased polymers, which are plastics made in a factory from natural raw materials. These don't automatically degrade when they enter the environment.'

These misunderstandings also exist with regard to recycling. 'You often read that if you recycle 80 percent, you also need 80 percent less raw materials. That's not true because many plastics downcycle.' This means that plastics that were originally packaging are later turned into road reflector posts or waste bins. 'At a certain moment the plastic is of such poor quality that it is burned as waste and released as energy and CO_2.' Only two percent of all plastics is recyclable on a closed-loop basis, meaning that time after time a plastic remains pure enough to stay the same product.

Sense of guilt

Besides this, Gruter is also taking part in a totally different research project. Together with social psychologist Frenk van Harreveld (UvA) he is researching what consumers think about sustainable packaging and what they would be prepared to pay for this. 'People feel guilty about their use of plastic. This is why those reusable Dopper bottles are such a success. Each bottle replaces 25 PET bottles.' The research has also revealed that consumers don't recognise biobased plastics. 'There are around 25 logos that indicate that plastic packaging is sustainable, biobased or compostable,' he says. 'So we need to do more about communication and recognisability. Make all biobased plastics red, for example.'

Think tank

Dean Peter van Tienderen recently set up a think tank at the Faculty of Science on the theme of 'Green', says Gruter. He is one of the participants. 'Sustainability is an important theme for HIMS and the Faculty of Science, but the UvA doesn't really have a profile yet when it comes to 'green research'. I think that the UvA can really boost this by researching plastics. Plastic has so many facets: in terms of health, psychology, philosophy, biology and legal aspects. After all, in recent years the environment and climate change have really become one of the most important issues for humanity.' ■

Prizes, honours & awards

Prof. Peter Schoenmakers (HIMS) was awarded the 2019 Dal Nogare award for his achievements in the field of chromatography. The Dal Nogare award of the Chromatography Forum of the Delaware Valley honours scientists for their significant contributions to the fundamental understanding of the chromatographic process.

PhD student **Tessel Bouwens** (HIMS) won the Poster Prize at the Royal Society of Chemistry's Faraday Discussion on Artificial Photosynthesis, held March in Cambridge. On her prize-winning poster, Bouwens presented a 'Ring Launching Solar Cell'. With this concept she proposes to solve the problem of charge recombination in p-type dye-sensitized solar cells by using pseudorotaxanes.

In May two Faculty of Science spin-offs won the Academic Startup Competition. **Kepler Vision Technologies**, originating at IvI and founded by **Harro Stokman**, develops computer vision and machine learning technology that enables body language recognition in videos. **Erik Manders** at SILS founded **Confocal.nl** in 2016, which established a breakthrough in confocal microscopy technique. The winners were offered a trip to Silicon Valley where they can learn how to scale up their innovation.

Dr Selma de Mink and **Prof. Sera Markoff** (API), were honoured for their outstanding contributions to astronomy. De Mink received the Pastoor Schmeitsprijs for her research on heavy stars, the precursors of supernovae and black holes. Markoff won the Willem de Graaff prize for her public outreach activities. She regularly goes to schools to introduce young children to astronomy and organised a stargazing evening combined with an iftar celebration during Ramadan.

Historian of Physics **Prof. Jeroen van Dongen** (IoP) was invited to give the prestigious Elizabeth Paris Public Engagement Lecture during the annual American History of Science Society meeting that took place in Utrecht in July. His lecture was about the historiography of science, in which 'provincialising Europe' has become an important theme, while the field itself is centered around a predominantly American literature.

Together with two international colleagues **Dr Samaya Nissanke** (IoP) received the New Horizons Prize, which recognises early-career achievements in physics and mathematics. They developed novel techniques to extract fundamental physics from astronomical data.

Prof. Willem Bouten (IBED) received an honourable at the 2019 Impact Awards mention for his important contribution to the valorisation of ecological research, based on his work on developing lightweight GPS trackers for birds.

In September 2019 the Event Horizon Telescope collaboration was awarded the Breakthrough Prize in Fundamental Physics. The prize goes to the 347 scientists that co-authored the six papers that announced the first image of a supermassive black hole, taken by means of an Earth-sized alliance of telescopes. Among the laureates are API's **Sera Markoff**, **Oliver Porth**, **Koushik Chatterjee** and **Doosoo Yoon**.

Lorentz Fellowship for Hal Caswell

In January 2019 ecologist Prof. Hal Caswell (IBED) was awarded the Distinguished Lorentz Fellowship 2019/20 for his research on mathematical models of population dynamics. This fellowship will allow him to develop better models to study human, animal, plant and even cell population dynamics. In September he was also awarded the Rollie Lamberson Award together with a group of mathematicians from the University of Louisiana, for their outstanding paper about population's recovery processes following a disturbance.

Athira Menon wins 1st and 2nd prize in FameLab finals

Athira Menon, postdoc at ApI, won the Dutch final of FameLab on 9 May. A month later she earned a shared second place in the international FameLab final, leaving behind some of the most talented science communicators from 31 countries. FameLab is a pitch competition for young researchers, in which they have only three minutes to explain their research to the general public. Menon impressed the audience and the jury with her pitch about gravitational waves and things that happen after a supernova.

Obituaries

Tom Gregorkiewicz 1950-2019

On 7 July 2019, beloved colleague Tom Gregorkiewicz (IoP) unexpectedly but peacefully passed away.
Gregorkiewicz received his Master's degree in experimental physics from Warsaw University, after which he earned his PhD degree with research on implantation defects in silicon.
In 1985 he joined the University of Amsterdam, where he was Professor of Optoelectronic Materials since 2003.
Gregorkiewicz's group garnered great international recognition for their work on the physics behind the potential of efficiently harvesting and managing solar power using semiconductor nanocrystals.
After officially reaching the retirement age, Gregorkiewicz actively chose to continue his research. He was an inspiring researcher, mentor and teacher and possessed a great drive. His enthusiasm in teaching and research are sorely missed.

Anne Troelstra 1939-2019

On 7 March, Anne Troelstra sadly passed away at the age of 79.
As emeritus professor of Pure Mathematics and the Foundations of Mathematics, Anne was still regularly seen at ILLC.
Beginning in 1957 as a mathematics student, he remained at the UvA all his life, except for a number of visiting professorships. Between 1970 to 2000 he was full professor and became the recognised authority on intuitionism and constructivism.
During his career Anne trained numerous students and PhD candidates, and he continued to fulfil an active role at ILLC after his retirement.
We remember Anne as an honest, open and supportive colleague with a sharp intellect.

Lex Kaper was appointed professor of Observational Astrophysics and Instrument Development, and he was appointed as the Faculty of Science's vice-dean and director of education. Kaper studies the formation, evolution and death of massive stars. He also focuses on gamma-ray bursts – the cosmic explosions in which gamma radiation is released – using them to investigate the properties of distant galaxies. Kaper is the Principal Investigator for X-shooter, the world's most powerful spectrograph, which was mounted on ESO's Very Large Telescope in 2009.

Annemarie van Wezel was appointed professor of Environmental Ecology and director of the Institute for Biodiversity and Ecosystem Dynamics. Van Wezel's research combines chemistry, toxicology and environmental policy. As professor, she will focus primarily on chemical processes in aquatic and terrestrial ecosystems and their impact on living organisms, including human health. In her teaching, she will also focus on environmental chemistry and risk assessment.

Alfons Hoekstra was appointed professor of Computational Science & Engineering. Hoekstra's research focuses on modelling and simulating complex systems, with an emphasis on multiscale models of human physiology and pathology. As professor, Hoekstra will concentrate on various applications of the 'Virtual Physiological Human', like the simulations of coronary stents and acute cerebral infarction, and fundamental and applied research into haemostasis and thrombosis. He will also investigate how supercomputers could calculate the impact of uncertainties in multiscale models.

JANUARY | FEBRUARY | MARCH | APRIL | MAY | JUNE

In Januari, **Marta Volonteri** was named professor by special appointment of Black Hole Formation and Growth. The chair was established on behalf of the Science Plus Foundation (Stichting Bèta Plus). Volonteri's research focuses on the evolution of the massive black holes residing in the centre of galaxies in connection to the cosmic evolution of galaxies. As professor by special appointment she will carry out research on the physics of accretion and energy/momentum injection by black holes.

Peter Coveney was named professor by special appointment of Applied High Performance Computing. The chair was established on behalf of the Science Plus Foundation. His current work focuses on highly scalable methods for virtual human scale simulation of blood flow, and molecular dynamics for applications in drug discovery and personalised drug treatment. As professor by special appointment, Coveney will research and develop codes which run efficiently on the largest peta- and exascale architectures, aimed at building complex problem-solving environments.

Inge Huitinga was named professor by special appointment of Neuro-immunology, specialising in the pathology of multiple sclerosis (MS). The chair is initiated by the Netherlands Institute for Neuroscience (NIN-KNAW) at behest of the Dutch MS Research Foundation. Huitinga studies the molecular and cellular factors underlying MS. As professor she will be researching the role of the immune system in psychiatric disorders such as depression and bipolar disorder. She remains director of the Netherlands Brain Bank and leader of Neuro-immunology group at the NIN-KNAW.

Jaap van Buul was named professor by special appointment of Molecular Cell Biology of Cell Migration. The chair was established on behalf of the Sanquin Foundation. Van Buul will focus on implementing advanced microscopic techniques in functional cell biological processes such as the migrating white blood cells in their attempt to pass through the vascular wall. He is the co-founder and chair of the Dutch Endothelial Biology Society and president of the Dutch Society for Cell Biology.

Linda Amaral-Zettler was named professor by special appointment of Marine Microbiology. The chair was established on behalf of NIOZ (Royal Netherlands Institute for Sea Research). Her research focuses on the relationships between microbes and the mechanisms that determine their diversity, distribution, survival and impact on local and global processes. Serving as a link between the complementary expertise and resources at both NIOZ and IBED, the chair she holds will facilitate collaborative research on aquatic microbial ecology at the highest international level.

Full professors 2019

In July, **Anna Watts** was appointed professor of High-Energy Astrophysics, in particular relativistic nuclear astrophysics. Watts studies neutron stars. Her goal is to understand the processes which drive their rotation and the violent dynamical events such as thermo-nuclear explosions, magnetic flares and starquakes. As professor she will focus on nuclear astrophysics in relativistic compact objects.

Gianfranco Bertone was appointed professor of Theoretical Astroparticle Physics. Bertone conducts research at the intersection between particle physics, cosmology, and astrophysics. In his work, he has in particular been contributing to the modern quest for dark matter. As professor, Bertone will be exploring new ways to identify dark matter by taking advantage of the opportunities arising from upcoming astronomical surveys and gravitational wave observations.

Sander Woutersen was appointed professor of Physical Chemistry. Woutersen's will use the latest spectroscopic methods to focus on issues at the interface of chemistry and physics. In recent years, he studied the mechanisms behind protein folding and the formation of amyloids, catalysis, proton transport, and the movement of molecular machines. As professor he will focus primarily on unravelling dynamic molecular structures, molecular self-assembly and soft matter at the molecular level.

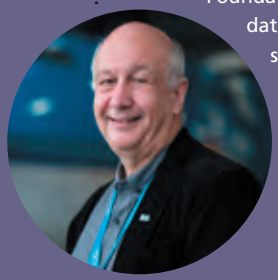
JULY | AUGUST | SEPTEMBER | OCTOBER | NOVEMBER | DECEMBER

Professors by special appointment

Herma Cuppen was named professor by special appointment of Simulation of Restructuring in Molecular Solids. The chair was designated on behalf of the Science Plus Foundation. Cuppen studies molecular movements in solids, which initiate processed that can ultimately be seen at the macroscopic scale, and can – for instance – have a decisive influence on the shelf life of drugs. She will combine her chair at the UvA with her chair of Computational Chemistry at Radboud University.

Benny Åkesson was named professor by special appointment of Design Methodologies for Cyber-Physical Systems. The chair was established on behalf of TNO (Netherlands Organisation for Applied Scientific Research). Åkesson specialises in the areas of model-based engineering and real-time systems. The goal of this research is to reduce the development time and cost of complex cyber-physical systems, particularly in high-tech industries, such as manufacturing systems, cars, medical equipment and aircrafts.

In July, **Jan-Willem den Herder** was named professor by special appointment of High-Energy Astrophysics, in particular Space Instrumentation. The chair was established on behalf of the Jan van Paradijs Fund. Den Herder is primarily involved in the development of new satellites for use in high-energy astrophysics. He will focus on strengthening collaboration between the UvA and SRON on this subject. Future instruments required for missions that are tasked with very precisely observing time-dependent information, will benefit from this.



Leon Gommans was named professor by special appointment of Data Exchange Systems. The chair was designated on behalf of the Science Plus Foundation. Gommans conducts research into systems that enable data exchange based on digital data marketplaces. Within the scope of his chair Gommans will study generically applicable base models that make it possible to securely share data between autonomous parties. Gommans is one of the driving forces behind Amsterdam Data Exchange (AMDEX).

At the Faculty of Science we participate in research activities that are geared towards the development of applications for the benefit of society at large; activities that are often conducted in large national and international collaborations, and funded through research consortia and public-private partnerships. We also reach out to schools and the general public to demonstrate the value of our research. Through various activities, our Outreach team reaches thousands of children and grown-ups across all age groups.

Science & society

A selection of projects with societal impact granted in 2019

GRANT FOR ALZHEIMER'S RESEARCH

The Dutch Brain Foundation awarded €555,555 to Prof. Helmut Kessels (SILS) to conduct research on the natural protection mechanism of the brain against Alzheimer's and how these mechanisms can be activated in an active learning brain. Kessels and his team will share their findings with Alzheimer scientists, clinicians and behavioural psychologists in order to put the results into practice as quickly and efficiently as possible.

NVWA FUNDS MECHANISMS OF ANTIBIOTIC RESISTANCE STUDY

A team of microbiologists at SILS, led by Prof. Stanley Brul and Prof. Benno ter Kuile, received funding from the Netherlands Food and Consumer Product Safety Authority (NVWA) to study mechanisms of antibiotic resistance in microbes. They will study the mechanism behind newly emerging antibiotic resistance in bacteria that play a role in food safety.

EU FUNDING FOR RESEARCH ON DIGITAL PATHOLOGY

Dr Zhiming Zhao (IvI) will join the CLoud ARtificial Intelligence For pathologY (CLARIFY) and will lead the work package of Cloud oriented algorithms for data management. He received a EU Grant to fund two PhD students. They will aim to develop a robust automated digital diagnostic environment based on cutting-edge technologies, such as digital image processing, artificial intelligence, cloud computing and block chain.

SELF-LEARNING MACHINES HUNT FOR EXPLOSIONS IN THE UNIVERSE

The National Science Agenda awarded CORTEX – the Center for Optimal, Real-Time Machine Studies of the Explosive Universe with a €5 million grant. The CORTEX consortium consists of 12 partners from academia, industry and society, who will work together to make self-learning machines faster, figure out how massive cosmic explosions work, and innovate systems that benefit our society. The participating IoP and API researchers include: Dr Joeri van Leeuwen, Dr Samaya Nissanke and Dr Antonia Rowlinson.

IDEA GENERATOR PROGRAMME FUNDING FOR TWO RESEARCHERS

The National Science Agenda's Idea Generator programme funded the proposals of paleoecology researcher Dr William Gosling (IBED), and chemistry researcher Dr Chris Slootweg (HIMS). Gosling will conduct research into whether different types of pollen in urban areas have been chemically altered and whether these changes vary over the course of a year. Slootweg aims to develop an efficient transformation of greenhouse gases methane and carbon dioxide into the platform chemical acetic acid, which will contribute to the optimisation of the carbon cycle and a waste-free society.

EC FUNDS INNOVATIVE TRAINING NETWORK FOR QUANTUM CLOCKS

The European Commission supports the new MoSaiQC Innovative Training Network for quantum clocks. These clocks, making use of modern quantum technology, will be ultra-precise and have many applications in science, technology and society, for instance in synchronising ultra-fast telecommunication networks. Prof Florian Schreck (IoP) will coordinate the network. The grant will be used to hire 15 PhD students over a period of four years.

By appealing to people's natural curiosity it's possible to make tricky scientific principles accessible

Joséphine Blaazer, PhD student of plant-herbivore interactions at IBED, talks about what she does to introduce younger generations to science and to show them how it impacts life as they know it.

Can you tell us a bit about your research?

In 2016 I started my PhD project on the subject of plant-herbivore interactions. With the main focus on crop protection I'm seeking a way of making plants resistant to pests such as insects, caterpillars and mites in a sustainable way, making the use of harmful pesticides unnecessary. This is important, because many pesticides are really bad for the environment, but we're also under major pressure to produce enough food to feed the world.

What made you decide to engage in science education for children?

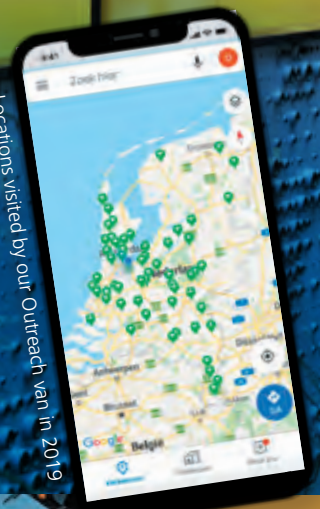
I think it's really special to teach children, and adults for that matter, about where food comes from and the route it has taken before landing on our plates. The origin of crops is an issue that's ever more removed from us, while it's actually so important: not only in my research area of food supply, but also in view of climate change. By showing the possibilities of biology and technology, I hope to inspire others.

How do you use your own research or skills for supporting school activities?

In the course of my doctoral research I've discovered that I really enjoy teaching. What's more, this is very relevant work: many people have ornamental plants at home or grow fresh herbs or tomatoes, and these too can be plagued by fungi or small insects. By appealing to people's natural curiosity it's possible to make tricky scientific principles and insights accessible to all. We work with as many different organisms as possible: from tiny mites to fat caterpillars, from tomatoes to beans and tobacco plants. We also often get asked how we can protect cannabis plants from mites. So you can see that the gap between science and society is much smaller than people often think.

Do you have any advice for other researchers who want to take part in outreach?

If you're passionate about your subject, then outreach activities are a fantastic way of communicating your passion, especially when you combine it with carrying out small experiments. I can still remember what I did and saw at the information session for Biology, almost ten years ago. So if you take part in outreach you have an opportunity to make a big and lasting impression on school students. For instance, we'll show live prey-predator battles under the microscope on tomato plants, and even if this takes place on a small scale – literally! – kids are really impressed when they see this. If ten years from now they are students, or maybe even scientists, who still remember this, then I've succeeded!



Locations visited by our Outreach van in 2019

OUTREACH

In 2019 our Outreach team organised **227 activities** for **children aged 4-18**, with a combined total of **11,561 participants**. The annual **Science Park Open Day** in October drew roughly **1,500 visitors**. Every month a scientist from the Faculty of Science gives a **children's lecture** at NEMO Science Museum and we have a pool of around **65 students** going out to schools across the country in our **Outreach van**.

Science4all

what we are doing to promote diversity and inclusion

The Faculty of Science aims to be an inclusive community where every person, regardless of race, gender or cultural background, feels welcome and valued. In our policies and in our actions we strive to stimulate diversity and inclusion in our Faculty community.

Grassroots

In March 2019 we started the grassroots programme Science4all. Staff and students were invited to apply for financial support for projects aimed at improving diversity and inclusivity at the Faculty of Science. Granted projects were:

EDUHUB

Khaled Tamimy (student), Erik van Halewijn (student), Jeroen Goedkoop (staff), Bart Groeneveld (staff)

EduHub is a social initiative that aims to stimulate inclusiveness in education by acknowledging the starting position of future students. In this project Faculty of Science students give free study support to pupils from a lower socio-economic background in the Amsterdam East neighbourhood close to Amsterdam Science Park. The students visit a local community centre and the school pupils visit Science Park 904.

ALTAIR+

Sera Markoff (staff), Sulayman el Mathari (student), Marieke Hohnen (staff) and Rasjied Sloot (staff)

Neighbourhood children and their families were invited to an 'Evening of Knowledge' and Iftar (a festive breaking of the daily fast) during Ramadan. Through a series of activities the project aims to increase interest and participation in STEM fields within the local community, increasing the diversity of our public events as well as hopefully the number of incoming BSc students from the neighbourhood, The activities were also aimed at promoting a sense of local connectedness and inclusivity.

INCLUSIVE AI FIELD TRIP TO BNAIC/BENELEARN 2019

Maximilian Isle (PhD Candidate)

Six mentors from the Inclusive AI initiative at IvI took their mentees on a field trip to the BNAIC/BENELEARN 2019 conference in Brussels, with financial support from a Grassroots Science4all grant. UvA-IAI takes its inspiration from organisations such as Black in AI, Women in ML and Queer in AI, which all aim to celebrate diversity and foster participation from underrepresented groups in AI. In the IAI initiative, young AI researchers establish a similar space for Master's students Artificial Intelligence at the UvA.

ASPIRE: ASTRONOMY SUMMER PROGRAMME FOR INTERNATIONAL RESEARCH EXPERIENCE

The Anton Pannekoek Institute for Astronomy welcomed eight international students for its inaugural edition of the Astronomy Summer Programme for International Research Experience (Aspire). The goal of the programme is to offer research experience to students from countries or groups where opportunities to do research is scarce. The Master's and Bachelor's level students spent 10 weeks at the astronomy institute, working on individual research projects advised by postdoctoral fellows. The group consisted of six women and two men and come from Argentina, Brazil, Bolivia, El Salvador, Kenya, Pakistan, Venezuela, and Zambia.

ORGANIC COUTURE WITH A QUEER MESSAGE

Iza Awad, (student), Raoul Frese (staff)

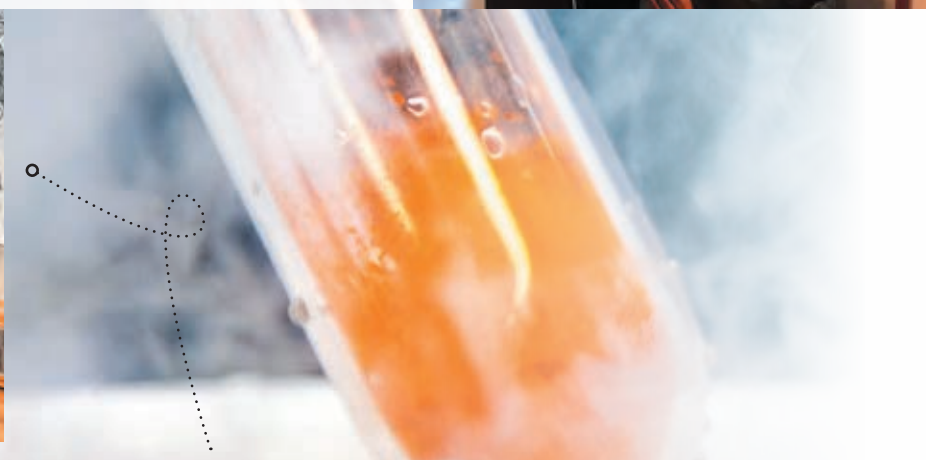
As part of his minor at the Hybrid forms lab at the Vrije Universiteit Amsterdam, Iza Awad - student in the joint UvA-VU Chemistry Master's – developed a new organic Kombucha fabric. He presented this fabric in a fashion show that included a queer message. For the production of the clothing pieces, Awad used a living organic Kombucha fabric, consisting of Kombucha Bacterial Cellulose. With his biodegradable 'living fashion', Awad aims to reform the idea of fashion, and take a step towards a future where sustainable inclusive fashion is the standard. Awad, who identifies as queer himself, is a vocal supporter of the lhbt+-community and uses his collection to send a queer message. 'I want nobody to feel excluded by my collection. I don't care whether you're a man, woman, non-binary person, full-figured or slim; everybody belongs in this world, and my fashion is for everyone.'

MACHIEL KEESTRA APPOINTED AS DIVERSITY OFFICER

In 2019 Machiel Keestra was appointed as the new Diversity Officer for the Faculty of Science. Diversity is an important theme in Keestra's work. As philosopher, he is attached to the Institute for Interdisciplinary Studies, where he teaches classes in philosophy of science and interdisciplinary research methods in the Natural and Social Sciences Bachelor's programme and the research master Brain and Cognitive Sciences. Together with several guest lecturers, he also teaches in the UvA elective course 'Diversity: Navigating a Cultural and Political Minefield'. His research with the Institute for Logic, Language and Computation focuses on the emergence of 'neuro-disciplines' such as neuro-ethics and neuro-anthropology. As part of the research group 'Neurocultures & Neuroaesthetics', he studies how the diversity of perspectives in such interdisciplinary topics can be optimally utilised.

He is supported in his work as Diversity Officer by student assistant Marwa Ahmed and the Faculty's Diversity Sounding Board.

From left to right: Fatiya Munkaila (Diversity Talks), Bart Groeneveld and Jeroen Goedkoop (Faculty of Science), Khaled Tamimy, Erik van Halewijn and Artur Moejes (Diversity Talks) after the announcement of the ECHO-grant



ECHO-FUNDING FOR STUDENT IMPACT CENTRE

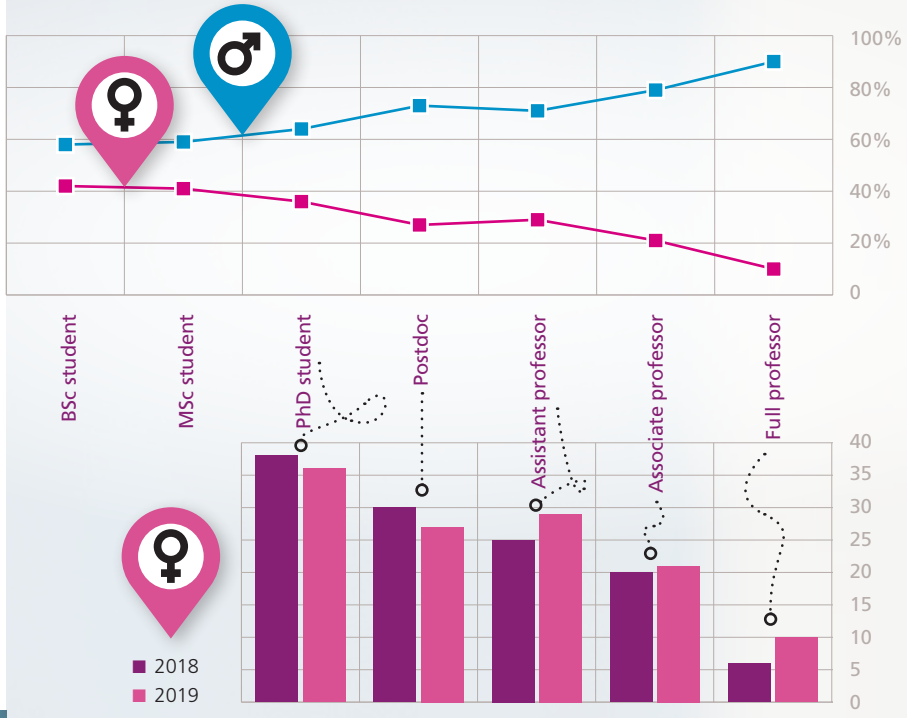
In 2019 the Faculty of Science was awarded an 'ECHO'-grant worth €200,000 by the minister of Education, Culture and Science for a proposal to set up a Student Impact Centre at the Faculty. The aim of the Student Impact Centre is to support, coordinate and shape initiatives by students that are aimed at making a societal impact. There are already several of such initiatives at the Faculty, including the aforemention EduHub. One key objective of the Student Impact Centre is to narrow the gap in access to university education between school children from richer and poorer economic backgrounds, which often coincides with differences in cultural background.

In addition, the Student Impact Centre aims to stimulate students to develop their competences in societal engagement. Jeroen Goedkoop, project leader in the area of narrowing the education gap and was one of the applicants for the grant: 'Besides setting up the platform and organising the activities, we see a role for students in making the Faculty of Science's study associations more inclusive as well as fostering a more inclusive environment in our Faculty in general.' The Student Impact Centre also fits with the UvA Education Vision, which includes student engagement as an important theme. Goedkoop: 'If this pilot proves successful, it might be rolled out the UvA as a whole.'

FACULTY OF SCIENCE PARTICIPATES IN NEIGHBOUR DAY 2019

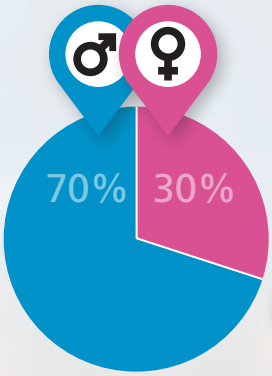
On National Neighbour Day 2019 local school children and residents of the Indische Buurt participated in several activities at the initiative of community centre Cybersoek, the Faculty of Science and student organisation Diversity Talks. The initiative was aimed at introducing local elementary- and high school students to the natural sciences. Participants had the opportunity to assemble robots, investigate their own DNA through genes-in-a-bottle and proof their logical insight through river crossing. The event was fully organised and run by UvA-students. This enabled participants to ask questions regarding studying, the university and the underlying theory and mechanisms of the experiments.

Facts & figures gender balance

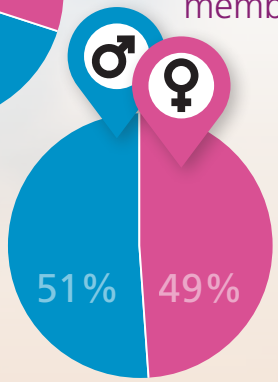


Improving the gender balance among scientific staff at the Faculty of Science continues to have our full attention. In 2018 we implemented several policy changes with this aim, including the institution of a minimum number of women on appointment committees and a reading panel that checks vacancy texts for inclusive language. In 2019 we held a new recruitment round for the MacGillavry Fellowship (see p.26) and the percentage of female professors rose from 6% in 2018 to 10%.

1,039 academic staff members



678 support staff members



Facts & figures nationalities

51 nationalities
341 international students

EXCHANGE STUDENTS 2019-2020

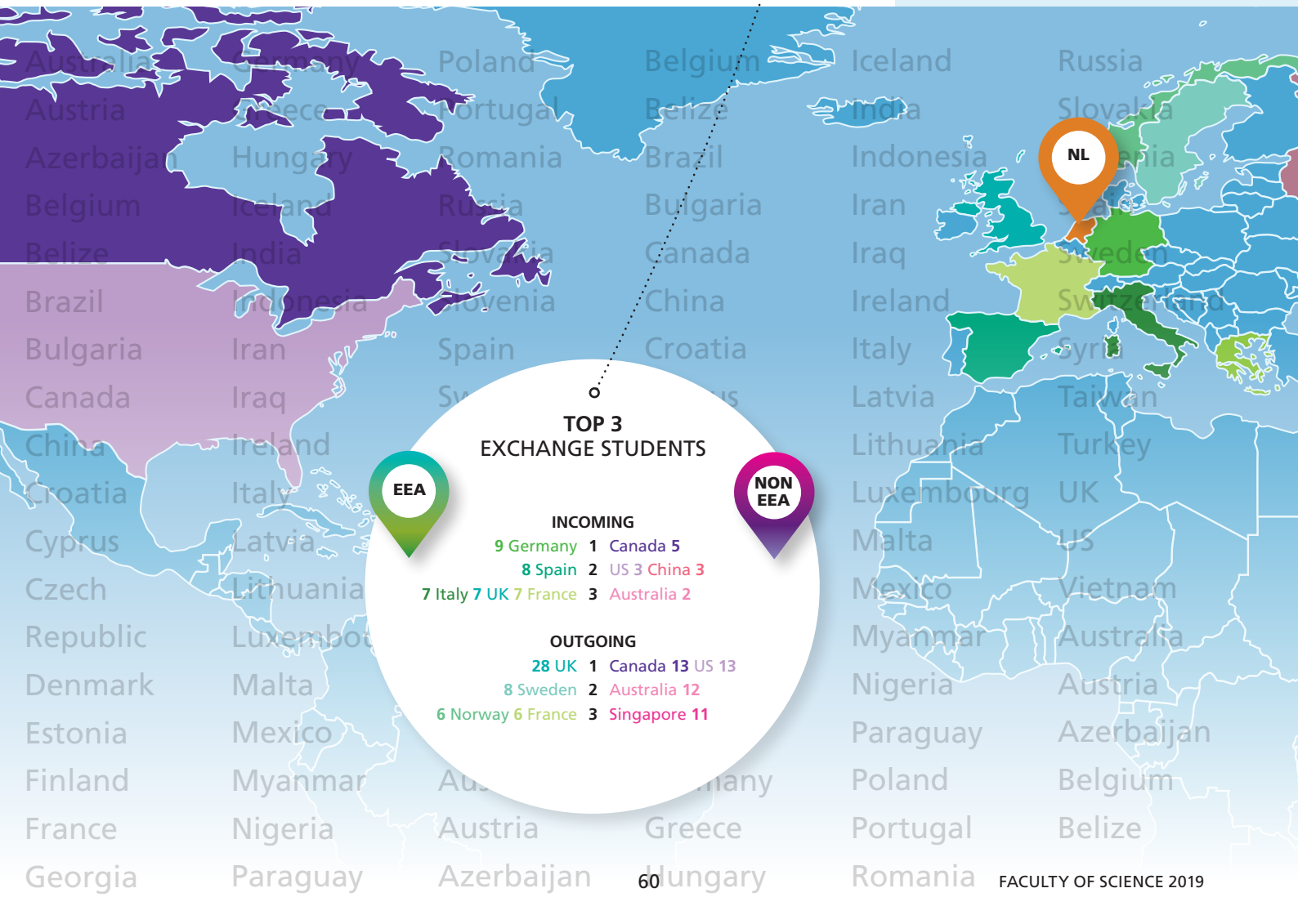
INCOMING STUDENTS		EEA	NON-EEA
students	72	57	15
countries	21	14	7

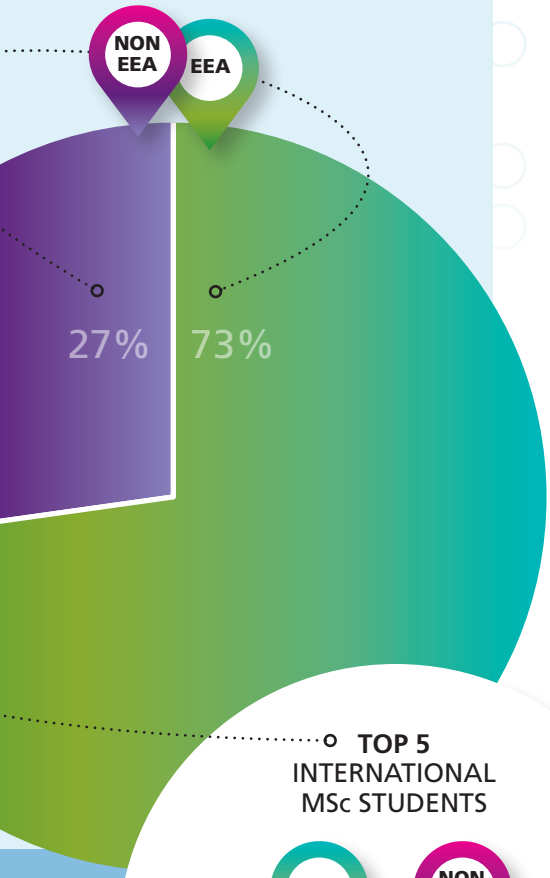
OUTGOING STUDENTS		EEA	NON-EEA
students	142	65	77
countries	23	11	12

EEA: European Economic Area

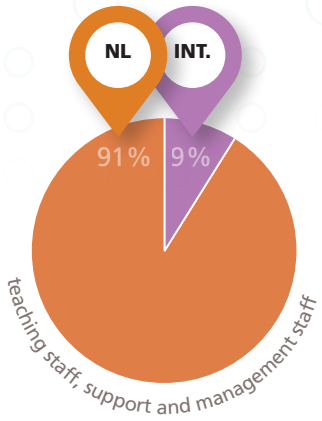
INTERNATIONAL MSc STUDENTS 2019-2020

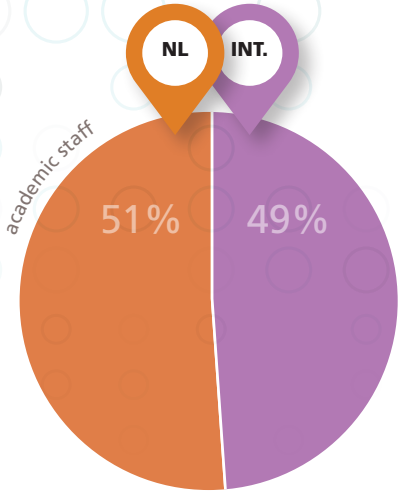
FULLTIME





NATIONALITY OF STAFF

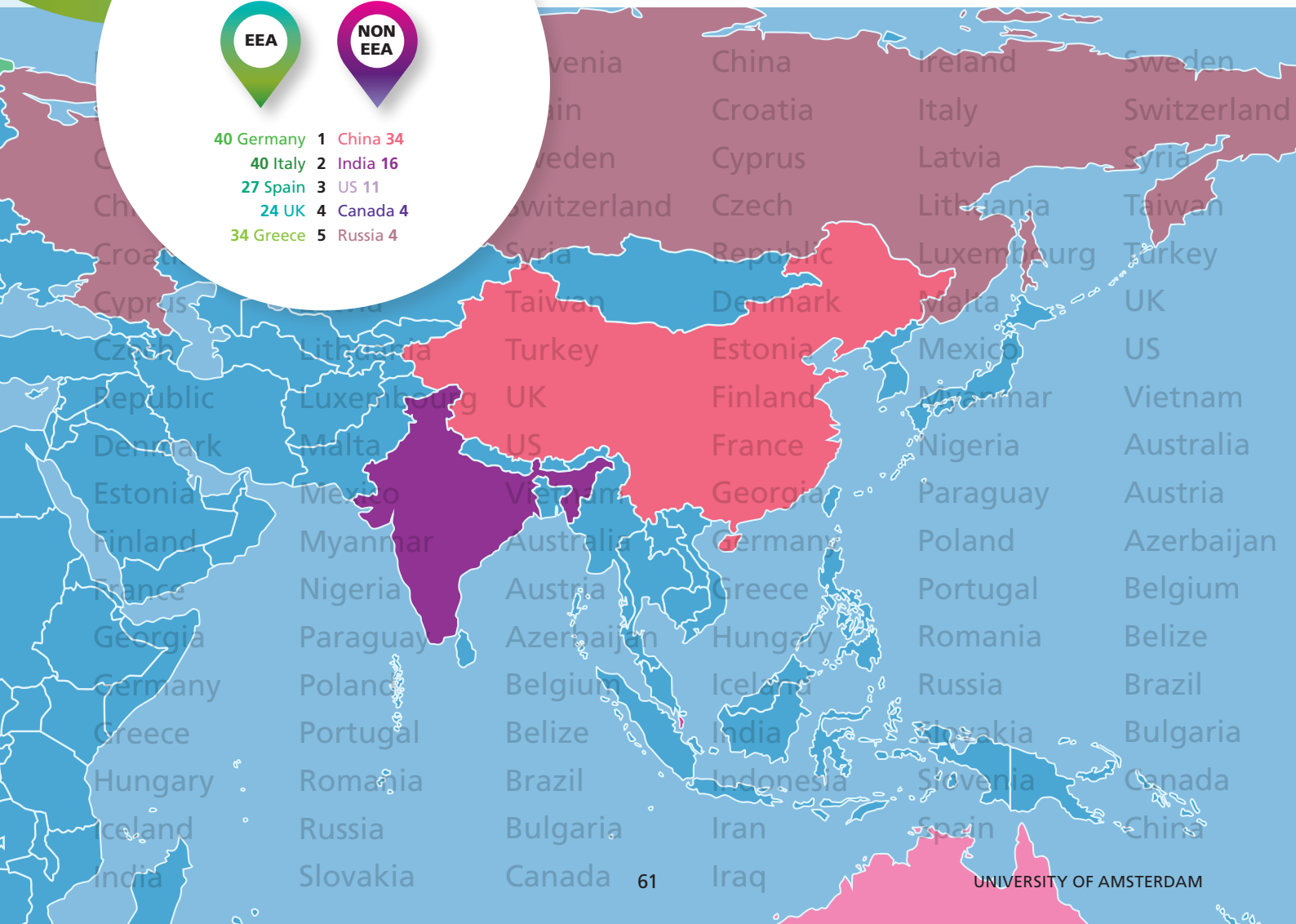




905 people

TOP 5
INTERNATIONAL
MSc STUDENTS

EEA		NON EEA
40 Germany	1	China 34
40 Italy	2	India 16
27 Spain	3	US 11
24 UK	4	Canada 4
34 Greece	5	Russia 4



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