

# CHALLENGING FUTURE GENERATIONS

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Complementary in knowledge  
and talent, driven to contribute  
to societal transitions.

**TU/e** EINDHOVEN  
UNIVERSITY OF  
TECHNOLOGY

 **WAGENINGEN**  
UNIVERSITY & RESEARCH



Utrecht University



UMC Utrecht

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## INTRODUCTION

### CREATING A GLOBAL IMPACT WITH THE NEW KNOWLEDGE ALLIANCE

Eindhoven University of Technology (TU/e), Wageningen University & Research (WUR), the University of Utrecht (UU) and the University Medical Center Utrecht (UMC Utrecht) are joining forces to turn their complementary fields of expertise towards creating solutions for the society of the future.

The aim of this partnership is to contribute to finding societal solutions in the areas of health, food, energy and sustainability. The knowledge alliance poses an explicit challenge to future generations: top young researchers from the academic institutions will be taking the lead, and the representatives from our Young Academies will be joining forces. Specifically, we will be exploring the interface between disciplines with respect to Living Technologies, Education and Artificial Intelligence, and Personalised, Precise, Preventive Health is the initial theme uniting our collaboration.

Participants will be able to use each other's laboratories and research equipment. We will encourage and enable students to take courses at other institutions and will also work on developing new forms of education. Examples include interdisciplinary project groups in which students from different institutions work together on a specific issue, otherwise known as 'challenge-based learning'.

TU/e and the two Utrecht institutions have had a formal agreement since 2011. This has led to the successful joint master's programmes in regenerative medicine and medical imaging, for example. In addition, there are a series of joint research projects in fields such as regenerative medicine and solar fuels. Collaboration with WUR is also already underway in the agri-food & high-tech field. Backed up by these successful collaborations, TU/e, WUR, UU and UMC Utrecht are now confidently taking the next step.

This magazine takes you to the heart of the collaboration. It outlines existing partnerships and new initiatives, there are interviews with the researchers and scientists involved, and we talk about our ambitions. We hope that you enjoy this magazine, and that it both inspires you and challenges you to join us!

Challenging future generations

Eindhoven University of Technology, Wageningen University & Research, the University of Utrecht and the University Medical Center Utrecht



Photo credits: Ivar Pel

## MOVING BEYOND COMPETITION

WUR's Rector Magnificus Arthur Mol and Jessica Duncan, chair of Wageningen Young Academy, share their excitement about the alliance.

### EXCITED FROM THE START

**JD:** When Arthur explained the assignment: that the alliance was giving the four Young Academies to us, we were surprised. We actually started to look for hidden cameras. This seemed too good to be true. After we realised it was true, I thought what a great opportunity – to build a partnership between the future generation of scientists, and come up with projects that have scientific and societal relevance.

**AM:** I was enthusiastic about working together right from the start because of the huge complementarity between our institutions. Research on health, food and big data provide key elements for ensuring quality of life on a global scale. Our institutions speak the same language and aim for the same hands-on research projects based on in-depth, basic science. Cooperation is essential for the future of our universities.

### CROSSING BORDERS

**AM:** The alliance focuses largely on young researchers, from the Young Academies to students as well. They understand the need to involve all disciplines in the upcoming projects, from computer science to biology and from social science to technology.

**JD:** We are moving beyond competition: all four YAs are committed to addressing societal challenges. We're coming together to collaborate and build on all of our strengths.

### OPPORTUNITIES FOR THE FUTURE

**JD:** After just two brainstorm sessions with all four YAs, we came up with some pretty exciting ideas for new and unusual collaborations. We're already seeing the pay-off for bringing all these scholars together. We're moving fast.

**AM:** It's clear that younger generations of scientists are ready to step up when given the opportunity. Interesting ideas are already developing. With what we already know about the role of nutrition and lifestyle and the development of genomics and big data, we have some interesting times ahead of us. And the same applies to developments in other areas, such as climate.



**ARTHUR  
MOL**

Rector Magnificus of  
Wageningen University & Research



**JESSICA  
DUNCAN**

Chair of Wageningen Young Academy

## OUR SOCIETAL IMPACT

Future generations face unprecedented challenges. Systemic transitions are urgently needed in the context of climate change, resource depletion and socio-economic and health inequalities. To find solutions to these societal challenges, cooperation between different disciplines is essential, and to this end the Young Academies of TU/e, WUR, UU and UMC Utrecht have joined forces. Our complementary expertise enables us to focus on finding solutions for challenges in the areas of Health, Food & Sustainability, Inclusion & Diversity and Climate Change & Pollution.

### OUTSIDE THE BOX

We are committed to building initiatives through interdisciplinary collaborations across our four institutions. A key approach in our collaboration is thinking outside the box. Believers in 'high risk, high gain', we work towards bold ideas that go beyond traditional research. We push beyond the limits of traditional funding streams and contemplate longer-term initiatives for lasting impact. In this, our main aim is to initiate unusual collaborations that are led by young (starting and early career) researchers; the next generation of leaders.

### SUSTAINABLE DEVELOPMENT GOALS

We will work to stimulate collaboration and exchange between young researchers who would probably not team up under normal circumstances. In imagining solutions, we draw inspiration from international aspirations and frameworks such as the Sustainable Development Goals, the Paris Agreement on Climate Change and the EU's New Green Deal. We also envision initiatives that can move us beyond these goals. We have mechanisms in place to build up interdisciplinary programmes that address pressing societal challenges. This uniquely positions us to develop new collaborations that promote novel ideas.



Photo credits: Kees Rutten

# NEW INITIATIVES

## INITIATIVE

### ARTIFICIAL INTELLIGENCE FOR HEALTH

Artificial intelligence (AI) is a key technology that now influences almost all domains and disciplines. AI is already widely present in our daily lives through its use in applications such as search engines, chatbots, spam filters, and personalised ads and recommendations.

AI is expected to continue playing a transformative role in society with the rise of autonomous vehicles, personalised healthcare and monitoring systems. All four partners in the alliance have unique track records and resources and have made their own contributions in terms of artificial intelligence expertise.

#### PREVENTION AND CARE

The theme AI for Health represents a joint challenge for the parties within the alliance, with the focus being on prevention and care. The theme is a good example of an application area in which different AI techniques need to be combined, requiring multidisciplinary research. Among other things, the goal is to attain a competitive position within the AI landscape for the alliance. We want to facilitate existing

collaborations within the alliance and foster new ones, for example by linking multiple initiatives on the same topics and encouraging new joint initiatives. Utilising the combined internal and external networks of the four partners will also be helpful. Altogether, this should lead to more fruitful collaborations, more effective grant applications, and a better and greater impact in the field of prevention and care.

#### CENTRAL STRUCTURE

To accomplish these goals, we propose a central organisational structure that provides support to AI-related research. The organisation should facilitate information collection and dispersion, enable researchers within the alliance to find each other, bring those researchers together by means of mobility funds, and help the researchers to develop their research programmes, build partnerships with external organisations and enhance their impact.



Photo credits: Vincent van den Hoogen

The platform will focus on three strategic activities:

- 1 Organising platform activities to connect researchers and facilitate the exchange of knowledge and expertise
- 2 Establishing and reinforcing mission-driven research groups in the field of Living Technologies
- 3 Establishing accessible infrastructure for integrated molecular, cellular and tissue engineering

#### CATALYST FOR FURTHER COOPERATION

This programme will capitalise and expand upon the existing strengths across the alliance institutions and aims to establish a leading role for the alliance in the ongoing synthetic biology revolution. As such, the programme may serve as a blueprint and catalyst for further strategic cooperation within the alliance.

## INITIATIVE

### EDUCATION

Society is currently facing complex, multi-faceted challenges. Accordingly, there is an increasing demand for academics to contribute to solving these complex real-world problems. As a result, the research landscape is changing from one that values monodisciplinary, individual pursuits, to a new reality in which researchers conduct curiosity-driven, multidisciplinary research. The most exciting discoveries of all are being made at the crossroads between disciplines.

#### ACADEMICS OF THE FUTURE

Based on our complementary expertise, we want to educate the academics of the future. These professionals have a T or  $\pi$ -shaped profile, combining deep discipline-specific knowledge and expertise with a general level of understanding and communication skills that enables them to work and communicate with colleagues from other disciplines in a diverse environment. We will collaborate to create a joint, innovative educational programme to train and engage students who shape the future, to conduct world-class research and to address important societal challenges (e.g. energy, health, circularity and nutrition).

## INITIATIVE

### PERSONALISED, PRECISE, PREVENTIVE HEALTH

In the field of Personalised, Precise, Preventive Health, we see possibilities to overarchingly work together, combining the strengths of our institutions. We are enthusiastic to explore this field further in the coming years. Our healthcare system is bursting at the seams; there are major health disparities in society due to differences in educational level and economic situation. Citizens' choices and behaviour influence their health (food, exercise, smoking, alcohol), but we are not yet enabling citizens to make sufficiently healthy choices and achieve behavioural change.

Moreover, urbanisation brings with it questions about healthy physical living environments, and the ageing of the population is leading to an increased demand for care and turning life-threatening diseases into chronic treatable diseases.

#### INTEGRATED CHAIN APPROACH

On the basis of our complementary expertise, we work together with regional, national and international stakeholders in an integrated chain approach to research and education in the field of Personalised, Precise, Preventive Health.

Our goal is to create or catalyse:

- 1 Innovative didactic concepts aiming at the development of personal and professional skills. Our primary approach will be through challenge-based and evidence-informed education focusing on real-world societal challenges;
- 2 Vibrant student and staff exchange across alliance programmes to enhance multi-, inter- and transdisciplinary education, without organisational and regulatory barriers
- 3 Flexible and innovative programmes that allow students to create their own study path.

#### COMPLEMENTARY DISCIPLINES

The added value of this strategic collaboration is the creation of an attractive and innovative educational programme by 1) combining the different but complementary disciplines in which we train our students, focusing on energy, health, circularity and nutrition, 2) learning from each other's different didactic approaches, and 3) learning from each other's best practices and expertise in connecting education with external partners such as industry or government, didactics and educational research, future learning spaces, internationalisation and lifelong learning.

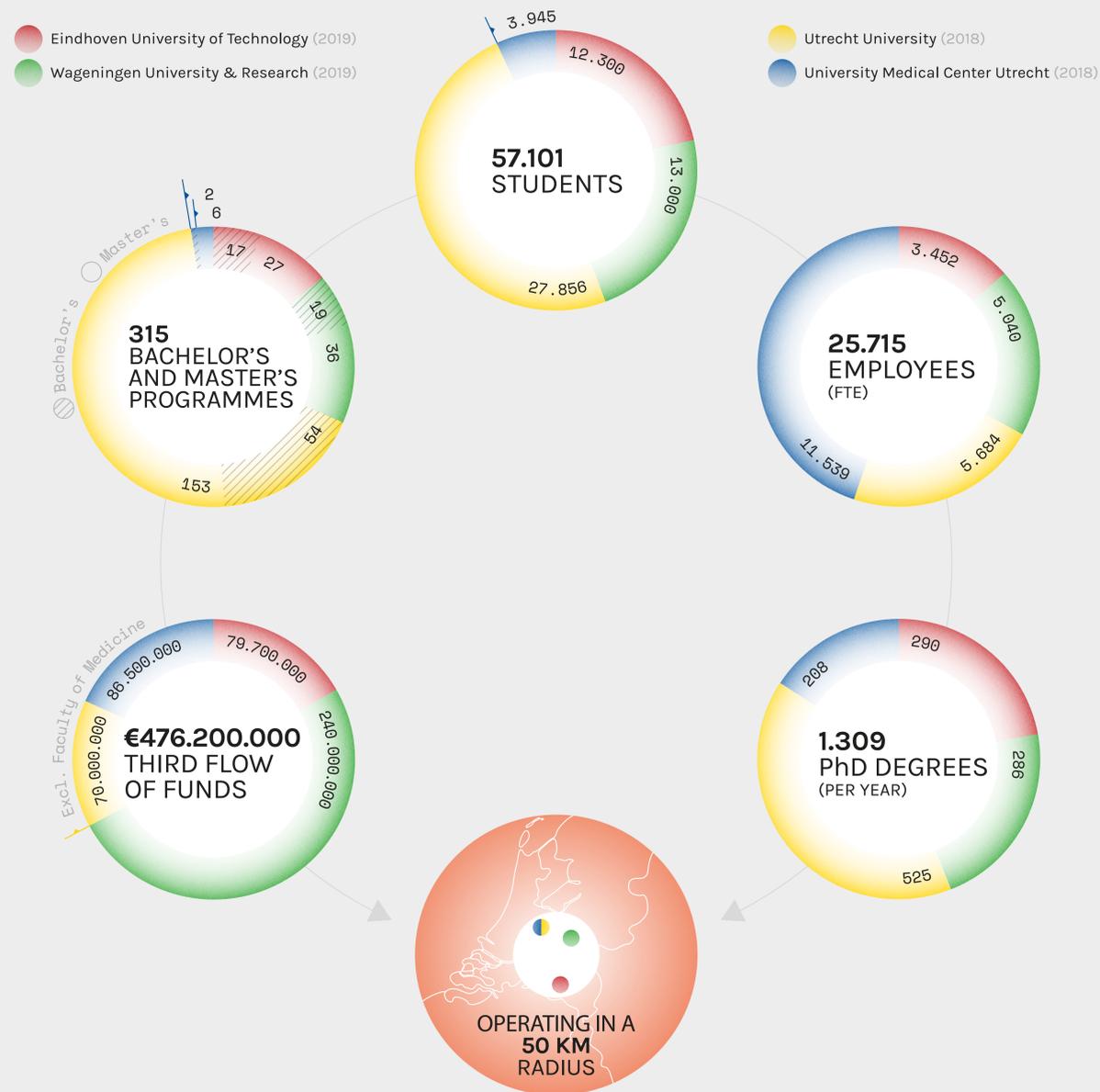
We distinguish the following three elements:

- 1 Primary prevention by people themselves through healthy lifestyle choices: healthy food and healthy behaviour. This is supported by the provision of healthy food, information about nutrition, behaviour and behavioural change (e.g. through nudging) and the development of young people, and by having people monitor themselves, e.g. through using 'wearables'.
- 2 Tailor-made healthcare through measurement: with increasingly better and more accessible measurement techniques such as imaging, DNA sequencing and biosensors linked to ever-growing knowledge about the human body, metabolism and organs, we are better informed about the body than ever before. We are now able to predict diseases even before someone falls ill, and thus take preventive measures, e.g. by eliminating or repairing genetic errors.
- 3 Personalised & precise medicine: If someone falls ill, we can arrive at a tailor-made diagnosis and treat them very precisely. The treatment becomes less invasive, more effective and contributes to the prevention of new diseases or the aggravation/chronicity of the existing disease. We do this through precision medicine in genetics, regenerative medicine and the application of new technologies such as personalised 3D-printed devices, and artificial cells that directly and effectively fight diseases in the human body.



Photo credits: Ivar Pel

# ON FIRM FOOTING TO CHALLENGE FUTURE GENERATIONS



## INTERVIEW

### YOUNG ACADEMIES: FORERUNNERS OF THE ALLIANCE

Engaging in extensive collaboration for years. They are the testing ground for the alliance... or rather, its forerunners. "We're already used to taking an interdisciplinary approach. Multiply that by four, and you'll unleash huge potential."

Each of the four institutions has a YA: a collaborative platform for young, talented scientists from various fields. These ambitious academics are therefore no strangers to interdisciplinary collaboration. Susanne Knittel, Chair of the UU-YA: "I regularly work with geologists or jurists; they're inspiring people who I wouldn't normally have the opportunity to meet. Diversity among scholars is a source of new insights and ideas."

#### MAJOR THEMES

The four YAs are working together on four themes: Inclusion & Diversity, Health, Food & Sustainability, Climate Change & Pollution. Right from the very first meeting last November, there were already proposals for collaborations. Marianne Boes, Chair of UMC Utrecht-YA: "This is an easily accessible avenue for collaborative brainstorming about major social issues. By joining forces, we're able to devise innovative solutions for pressing social challenges." Susanne adds: "We've met twice now, and each time we wanted to keep talking for hours. There's so much enthusiasm!"

#### INTERDISCIPLINARY COLLABORATION

The goal: to develop new, viable insights or applications that have major social impact. "We can only make significant developments if we work together in a truly interdisciplinary fashion. And that takes time," says Susanne. However, Marianne can already see the potential for progress in the short term: "It doesn't have to take us a decade to achieve significant results. I'm currently talking to TU/e academics about new applications for sensors that you wear on your arm and that measure your blood values. We lack the technical know-how for this at UMC Utrecht, while at TU/e they don't know which proteins they should be measuring. When we put our heads together, the energy starts to flow immediately."

#### SPEAKING EACH OTHER'S LANGUAGE

"At the YA, we're already used to talking to experts from other faculties, learning each other's language and taking an interdisciplinary approach," says Susanne. "These are all young people with cutting-edge, out-of-the-box ideas. Multiply that by four, and you'll unleash huge potential." Incidentally, the collaborating YAs are by no means an elite club. "We're ambassadors for young academics, and we want to attract talent," says Susanne. Marianne: "That's why each member is encouraged to bring someone along to our alliance meetings."

#### "UNUSUAL COLLABORATIONS"

The four YAs have labelled their radical new efforts "unusual collaborations". According to Marianne, there is added value in contemplating issues outside of your own discipline. "During our meetings, I don't sit at the Health table. I deliberately choose to bring a fresh approach to other fields." Both academics believe that the YAs are the driving force behind the alliance. Marianne: "YA members are young, open to collaboration, and are in direct contact with the next generation. The most significant innovations come from research that is taking place right now - and we're guiding those scientists of the future."



**SUSANNE KNITTEL**

Photo credits: Ed van Rijswijk

Susanne Knittel is a university lecturer in comparative literature. German by origin, she obtained her doctorate in Italian and comparative literature from Columbia University in New York. She conducts research in the field of cultural heritage, with a specific focus on Holocaust and genocide studies. She has been Chair of the Young Academy at Utrecht University since 2017. The YA has more than 40 members.



**MARIANNE BOES**

Marianne Boes is a senior researcher in Immunology. For twelve years, she studied and was a research leader at MIT and Harvard University, specialising in immunology and cell biology. In 2008 she transferred her research group to UMC Utrecht, and last year took on the role of Chair to the newly formed Young Academy, which numbers 16 members.

# BUILT ON EXISTING COOPERATIONS

Without a solid foundation, you can't build on future challenges. In the past, the four world-class institutions have collaborated with each other in numerous research areas. Backed up by these successful collaborations, TU/e, WUR, UU and UMC Utrecht are now confidently taking the next step. The following are some examples of existing collaborations.

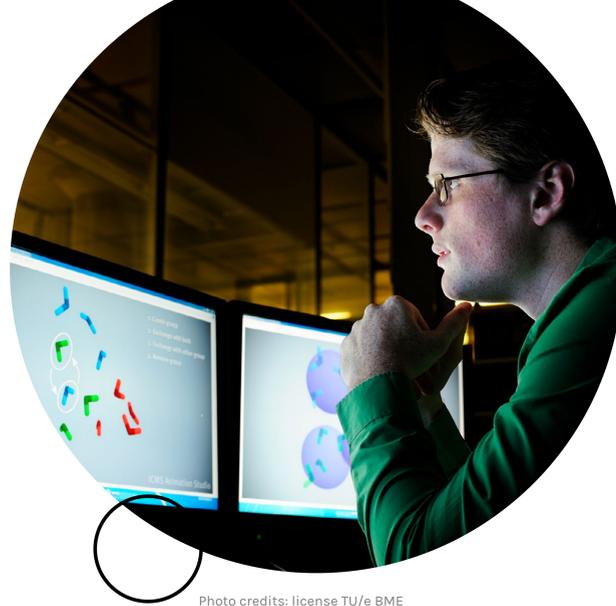


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## EXISTING COLLABORATION

### SOLAR FUELS: EINDHOVEN AND UTRECHT EXPERIENCE A CHALLENGING CHEMISTRY

Scientific research into solar fuels is still in its infancy. Except for Professors Emiel Hensen (TU/e) and Bert Weckhuysen (UU), who have been something of a dynamic duo in this research field for years now.

There has been a strong research axis between the two institutions in the field of catalysis since 1991. Weckhuysen: "We're definitely not the 'here today, gone tomorrow' types. Whenever we talk about the necessary energy transition, catalysis always comes up. "Within their partnership, Hensen and Weckhuysen develop new technologies for the storage of renewable energy in chemical bonds. "That's why we've successfully proposed that the Solar Fuels research programme be one of the priorities within our strategic alliance."

#### SUSTAINABLE FUELS

The Solar Fuels programme investigates whether catalysis can be used to directly produce fuels from electricity, carbon dioxide and water, and how to go about doing so. For example, how do you make hydrogen from water under the influence of solar-generated electricity? We can use hydrogen to convert carbon dioxide into substances such as energy carriers and raw materials for the production of other materials.

#### CUTTING-EDGE RESEARCH

TU/e has expertise in modelling the conversion of molecules on catalytic surfaces, while researchers in Utrecht use experimental spectroscopy techniques to view the exact functioning of catalysts with light. There is an exciting synergy between these two approaches. As Hensen explains, "The most exciting discoveries in science take place at the intersection between disciplines."

#### FUTURE PROSPECTS

Research into solar fuels is a long-term prospect, which makes it all the more important to invest in new people and new insights. The partnership between TU/e and UU contributes to this on the intellectual, educational and social levels. For example, a research school provides training for young talent, and partnerships with the business community and the creation of social support for sustainable energy transition are high priorities. "Thanks to the alliance, we can really go for this."

**Exciting discoveries take place at the intersection between disciplines**

## EXISTING COLLABORATION

### MASTER'S PROGRAMME IN MEDICAL IMAGING: THE BEST OF BOTH CITIES

The two-year master's programme in Medical Imaging is the result of close collaboration between the imaging divisions at UMC Utrecht and TU/e respectively. Students can reap the benefits of the state-of-the-art facilities and knowledge provided by both leading institutions in a single programme.

Medical imaging such as MRI or ultrasonography is growing in importance in medicine, and therefore has a significant influence on current and future healthcare. Clinical and technical specialists are increasingly working together to arrive at diagnoses, detect disease early, support medical interventions and evaluate the effectiveness of treatments. In order to provide the best possible training for their students, Utrecht and Eindhoven are joining forces and combining their knowledge in the highly technology-oriented Medical Imaging master's programme.

#### STRENGTH IN NUMBERS

These two leading organisations are offering students a unique opportunity to grow professionally and participate in the development of imaging and image analysis. Both the Utrecht Center for Image Sciences and Eindhoven's Department of Biomedical Engineering will be making their expertise and state-of-the-art equipment available for the programme. Elements of physics, mathematics, computer science and biomedical engineering will be combined in a range of courses, international internships and in-depth research projects.

#### CONTRIBUTE TO INNOVATION

Students can specialise in areas such as image acquisition, image analysis, computer-aided diagnosis and image-based treatment. There are also opportunities for carrying out research projects within renowned international research groups. The master's programme delivers multidisciplinary researchers who contribute to innovation at the cutting edge of biomedical sciences, engineering and clinical application.

## EXISTING COLLABORATION

### EINDHOVEN HIGH-TECH MEETS WAGENINGEN AGRI-FOOD

Researchers from WUR and TU/e are working together within the Sustainable Food Initiative (SFI) and AgriFoodInnovation (AFI) on innovations and research in the food value chain. Their work is based on data science and AI, precision agriculture, printed food and plasma technology. And that's just the start.

SFI and AFI are focused on the development of radical innovations in the production of sufficient healthy, safe food in a sustainable manner. This is facilitated by smart "crossovers" between agri-food and high-tech with the aim of gaining maximum benefit from rapid developments in AI, Robotics, Sensing, Photonics and Computer Vision. Two examples of ongoing collaborative projects include data science that enables the exchange and combination of complex food models to accelerate sustainable innovations in the food industry, and the more effective use of vegetable residual flows.

#### READY TO START

Wageningen and Eindhoven are also working together on data-driven precision agriculture, plasma technology for water and air purification, mini-spectrometers, printed food, computer vision for recording the behaviour of individual animals in stalls, and picking robots. A number of projects are already under way, others are ready to commence, and further project proposals are being developed.

#### LIKE-MINDED

It's no coincidence that high-tech and agri-food are crossing paths more and more frequently. In 2016, WUR joined the cooperative federation formed by the technical universities in Delft, Eindhoven and Twente, to form what is now known as 4TU. TU/e and WUR had already been working together synergistically for a long time. The researchers at Wageningen and Eindhoven also share a similar mentality, according to Wageningen rector Arthur Mol: "Our universities are organised in almost the same way, with the people 'on the ground' having a great deal of freedom. Our researchers don't create a huge fuss about what they're doing; rather, they're people with a very practical mentality."

#### CREATING OPPORTUNITIES

Jakob de Vlieg, professor of Applied Data Science at Eindhoven, sees the partnership growing. "Eindhoven has a great deal of expertise in robotics, sensing technology, chemistry and artificial intelligence, while Wageningen is a world leader in agri-food. This creates energy, new opportunities and scientific challenges with a great deal of social and economic impact."

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## EXISTING COLLABORATION

# ONE HEALTH: COLLABORATION IN NCOH

The Netherlands Centre for One Health (NCOH) aims for an integrated One Health approach to tackling the global risk of infectious diseases. NCOH is committed to creating durable solutions for this major challenge by bundling world-leading academic research in the Netherlands in the area of One Health.

The world is currently facing health and environmental challenges with regard to infectious diseases that affect daily life. Human, veterinary, wildlife and ecosystem health are closely interrelated, and an integrated One Health approach is therefore essential.

### SCIENCE-DRIVEN PARTNERSHIP

NCOH unites leading academic research institutes in undertaking multidisciplinary research in the fields of public, veterinary, wildlife and ecosystem health. This science-driven partnership focuses on research aimed at increasing knowledge on antibiotic resistance, emerging infectious diseases, smart farming and healthy ecosystems. It stimulates collaboration between academic and research institutes, governments, non-governmental organisations, public health institutes and industrial partners, both in the Netherlands and beyond.

### DURABLE SOLUTIONS

In 2014, a proposal was made to combine forces in the field of One Health in the Netherlands. Wageningen University & Research sought a structural national collaboration (WUR) with UMC Utrecht and the Faculty of Veterinary Medicine of Utrecht University. This resulted in the foundation of the NCOH in 2016, chaired by Professor Dick Heederik (Utrecht University). Other knowledge partners joined the collaboration at a later stage, including Erasmus MC, Leiden University, LUMC, Radboudumc, Amsterdam UMC, KNAW and RIVM. The four NCOH strategic research themes focus on studying the interactions and connections between human, veterinary, wildlife and environmental health in pursuit of durable solutions to several large-scale societal challenges:

- Tackling Antimicrobial Resistance (scientific director: Professor Marc Bonten, UMC Utrecht)
- Emerging Infectious Disease Preparedness (scientific director: Professor Marion Koopmans, Erasmus MC)
- Smart & Healthy Farming (scientific director: Dr. Annemarie Rebel, WUR)
- Healthy Wildlife & Ecosystems (scientific director: Professor Andrea Gröne, Utrecht University)

[More information is available at ncoh.nl.](https://www.ncoh.nl)

## EXISTING COLLABORATION

# WHAT WILL INNOVATIONS MEAN FOR THE SOCIETY OF THE FUTURE?

In 2017, Utrecht historian Bas van Bavel collaborated with Wageningen ecologist Marten Scheffer on groundbreaking research into inequality in nature and society. They made the surprising discovery that ecological, mathematical and historical insights complemented each other beautifully.

According to Van Bavel, interdisciplinary collaboration is essential. "Take the energy transition. We need to make technological progress of course, but you also have to have adequate legislation and regulations, as well as insight into human behaviour in order to make this transition into a success."

### SOLUTIONS FOR SOCIETY

The alliance could lead to great opportunities. "It's not just about collaborating interdisciplinarily on a biomedical or technological solution, it's also about thinking together about the meaning of our solutions for the society of the future." An example is the healthcare system. The field of genetics is creating completely new treatment options and is changing our understanding of ourselves and our

personal identity. The expansion of treatment options as a result of technological development raises questions, for instance, about the accessibility of affordable therapy for everyone.

### CENTRAL CHALLENGE

Van Bavel goes on to observe that there is still little understanding of the effects of patent law and ownership on discoveries in the life sciences. "The right of access to the best available medicine and how we share the costs of that form a central challenge, especially when it goes beyond health problems and extends to 'enhancement'."

"We can only tackle these big questions together. The alliance can create the time and space for us to get to know each other better, and to analyse these challenges together. This will enable us to gain an understanding of the entire chain from the initial technological or biomedical issue to the social outcome and the actual effect on the well-being of people. That will be a huge step in the right direction."

**BAS VAN BAVEL**

Photo credits: Ed van Rijswijk



## EXISTING COLLABORATION

# REGENERATIVE MEDICINE

Regenerative medicine is a dynamic and rapidly advancing life sciences field in which a variety of biomedical and biotechnical research areas converge with clinical care.

The aim is to develop novel therapies to restore or regenerate living tissue as part of treatments related to tissue degeneration, organ failure, ageing or trauma. Clinical problems with high societal relevance, such as heart and kidney failure and osteoarthritis are targeted.

### COMPLEMENTARY PARTNERS

In 2011, Eindhoven University of Technology, Utrecht University and UMC Utrecht initiated a strategic alliance to promote innovation in research, education and patient care. The multidisciplinary collaborations between stem cell and other biologists, material and imaging scientists, engineers and medical doctors ensure that research activities stay at the forefront of the field and foster a fruitful environment for innovation. Partners complement each other in the

areas of biotechnology and biomedical expertise.

### FROM REGENERATIVE BONES TO NOVEL BIOMATERIALS

The following are some examples. In musculoskeletal tissue regeneration, we are studying and improving various options for designing regenerative bone and cartilage implants and creating 3D printing techniques and novel biomaterials. In vascular regeneration, the goal is to create an implantable bio-compatible vascular graft by combining an off-the-shelf synthetic material that, when implanted, attracts a patient's own cells to replace the damaged tissue, and over time biodegrades.

We have established a combined (UU/TU/e) education programme in Regenerative Medicine & Technology (RMT) at the master's level, for the purpose of training multidisciplinary scientists. The collaboration has also led to a prestigious NWO Zwaartekracht grant (2017) on Materials-Driven Regeneration (MDR). In addition, there is close collaboration within other consortia such as RegMedXB.



## EXISTING COLLABORATION

# THE FIELD OF TENSION BETWEEN MAN AND MACHINE

The interaction between human autonomy and artificial intelligence (AI) presents major scientific, technological and ethical challenges. Reason enough for UU, TU/e and UMC Utrecht to explore this field of tension in the alliance programme 'HUMAN autonomy perspective of Artificial Intelligence' (HUMAN-AI).

Artificial autonomous systems can learn to understand and predict our thoughts, feelings and goals, and respond to them and provide advice on what to do to improve our health and well-being. However, this gives people a feeling of reduced autonomy because they sense they are being watched in everything they do and are being guided by complex, autonomous technologies that they do not understand or control.

*Our programme can become an important platform when it comes to the future role of artificial intelligence and the digitalisation of society*

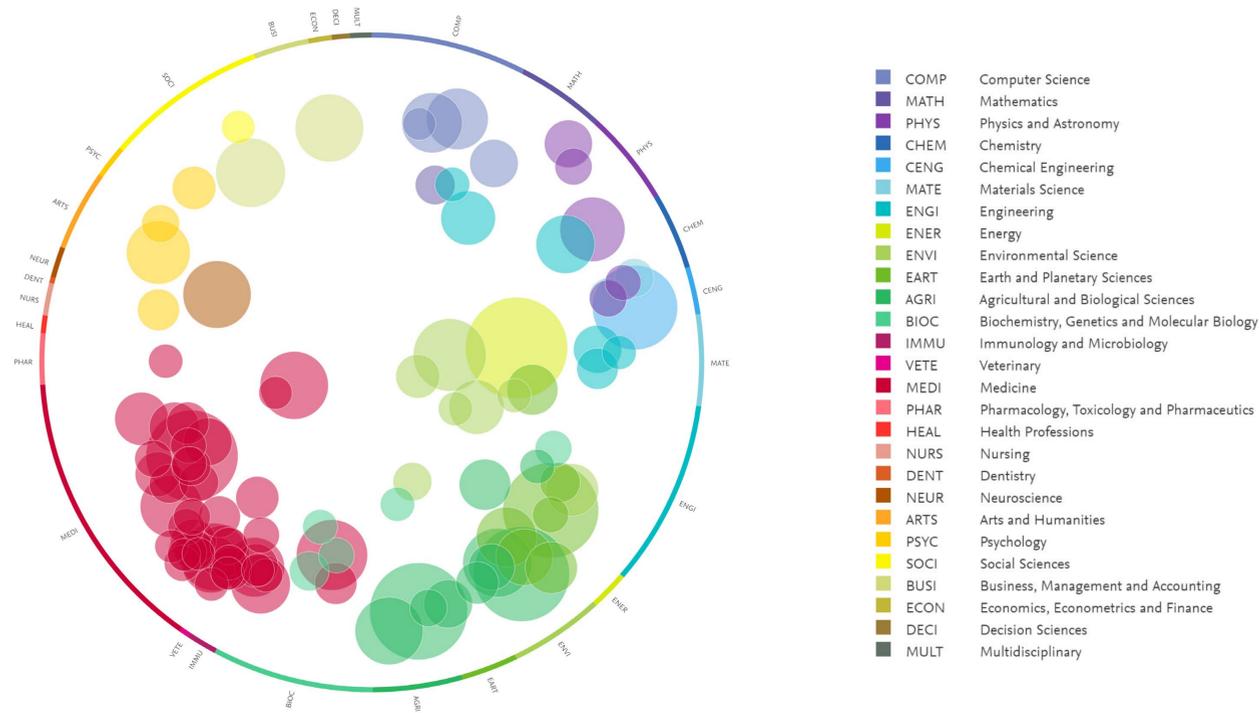
### MAKING AI TRANSPARENT AND COMPREHENSIBLE

The goal of the alliance partners is therefore to use technological developments to increase human autonomy, improve human performance and facilitate interaction with the physical and social environments. Under the leadership of professors Henk Aarts (UU) and Panos Markopoulos (TU/e), researchers work together with international experts from various fields such as social, educational and computer sciences, healthcare and ethics.

### THE FUTURE ROLE OF AI

Together they develop models and methods that can predict and evaluate how people respond to changing interaction with AI. This then makes AI transparent and comprehensible. Markopoulos: "Because we can combine existing expertise in the fields of technological design, cognitive and social modelling and the evaluation of artificial autonomous systems, our programme can become an important platform for the future role of AI in the digitalisation of society."

## COMPLEMENTARY COMPETENCES



Overview of the top 100 topic clusters of the four institutions combined based on publications from 2014 to February 2020. Together the four institutions share knowledge on all scientific disciplines. (@2020 Elsevier B.V. All rights reserved. SciVal, RELX Group and the RE symbol are trademarks of RELX Intellectual Properties SA, used under license.)

### TOPIC CLUSTER

- Topics are collections of documents that are clustered by direct citation relations. Topics can be seen as specific science domains.
- Topics are clustered into topic clusters to give a broader overview of the research done by the institutions instead of focussing on underlying niche topics.

### OUTSIDE RING & COLOURS

- The outside ring indicates the disciplines based on journal categories (All Science Journal Classification system) of the journals in which the articles are published.
- The size of a journal category on the ring is based on the total number of journals in this category that are indexed in Scopus.
- The abbreviations and colours are explained in the legend above.

### BUBBLES

- One bubble represents one topic cluster.
- The bubble size represents the number of articles in the Topic Cluster by the group of institutions (WUR, TU/e, UU, UMC Utrecht) or the individual ones.
- The position of the bubble is determined by the journals in which the articles are published. When a bubble is close to the edge of the Wheel, the Topic Cluster is more influenced by an individual journal category. When the bubble is closer to the centre, articles are published in more diverse journal categories, indicating that a topic cluster is more interdisciplinary.

(source: SciVal)

## INTERVIEW

# SIX QUESTIONS FOR ARNO HOES

ARNO HOES

Dean and Vice-Chair of the Executive Board of UMC Utrecht



### 1. Why are you so enthusiastic about the partnership?

To solve the world's big problems, you need to work together with everything you have. For that, you need a broad alliance that is complementary and brings together the necessary world-class knowledge. We are creating something truly extraordinary.

### 2. What kind of problems are you referring to?

For example: how do we keep healthcare affordable in the future? We will have to do more about prevention, for which you need basic life sciences, and relevant data collected by using advanced sensors, for example, as well as insight into nutrition and its effects. And if you want to inform people effectively and change their behaviour, then you need social and humanities scientists. Because the issue is so broad and complex, the input of leading experts from different disciplines is necessary, and we can get that through our alliance.

### 3. How do the institutions complement each other?

Naturally, there's some overlap and that's a good thing too - you have to have some common ground. At the same time, the institutions can learn a lot from each other. There is already a lot going on: the Young Academies are entering into discussions with each other, and we're working together on numerous collaborative projects. One nice example is that we do a lot of research into stem cell biology and organoids in Utrecht. The partnership with TU/e and WUR is already providing a lot of extra information in this regard.

### 4. Where will the alliance be in ten years' time?

There will be joint institutions - virtual or otherwise - that generate knowledge for application in real situations.

A lot of exchange will take place among both staff and students, mediated by long-distance learning or attending/teaching at different institutions. Students will receive a multidisciplinary education; within ten years' time, there will no longer be any students who haven't studied at multiple faculties or institutions. And collectively we'll receive significant subsidies, for example in the fields of artificial intelligence, prevention or organoids/stem cells.

### 5. Do you think other universities will follow your example?

Working together across faculties is the way of the future. Other Dutch and international universities are already doing that too. However, there is no other combination quite like ours. All four alliance institutions have unique qualities. For example, no other university possesses the same agricultural expertise as Wageningen, and the Faculty of Veterinary Medicine in Utrecht is the only one in the Netherlands. You won't find a combination like ours anywhere else.

### 6. What does this collaboration mean for you personally?

I'm prepared to invest a lot of energy into it, and I'm getting an incredible amount of energy back as a result, because I'm able to see that we really can make a difference. What we're ultimately doing it for is to have a real impact on society: with a multidisciplinary approach, we can tackle the major social problems that we want to solve.

“There is no other combination quite like ours”

# JOIN THE CLUB!

Challenging future generations



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