



Radboud Institute for Health Sciences

The mission of the Radboud Institute for Health Sciences (RIHS) is to improve clinical practice and public health. It does so by providing evidence of the efficacy and efficiency of existing and new tests, treatments and policies as well as innovative modes of health care delivery, by training young researchers in methodologies for obtaining such evidence, and by developing new methodologies for improving research programmes in this field.

As evidence is typically obtained in probabilistic and qualitative rather than deterministic and mechanistic ways, research tends to be done among patients or the general population rather than through laboratory-based models. The Institute's focus is on developing methodologies that optimise personalised healthcare and on the application of these tools in disease-oriented research themes. In line with Radboudumc's mission of having a significant impact on healthcare, the Institute aims to bridge the gap between science and society. Societal impact is at the core of the Institute's ambitions.

Training of young researchers within the Institute is organised in a Royal Netherlands Academy of Arts and Sciences (KNAW)-accredited Graduate School.

Research at Radboudumc is organised in 18 themes. Five of these are embedded exclusively in the Donders Centre for Neuroscience and one is in the Radboud Institute for Molecular Life Sciences (RIMLS). The theme 'Healthcare improvement science' is exclusive to RIHS. Within the other 11 themes RIHS researchers work closely together with colleagues at RIMLS. We believe that optimal progress can be achieved when molecule, man and population-oriented researchers work together on the same disease-oriented 'playing field'.

Healthcare improvement science

Theme leader: Prof. Gert Westert

The main focus here is on the structure, process and outcomes of healthcare in daily practice, with the aim of improving performance and delivery from the perspective of the patient. Researchers study existing and new interventions at both the micro and the macro level. Their aim is to explore which interventions or structures work in what circumstances. Immediate value for patients is paramount.

Cancer development and immune defence

Theme leader: Prof. Joop Jansen

Researchers working on this theme investigate resistance to therapy, the tumour micro-environment, cancer-cell trafficking and the interaction between the immune system and cancer. This basic knowledge is translated into novel forms of therapy designed to target tumour cells. Strategies are also developed for expanding and manipulating immune cells for clinical use, exploiting and boosting the power of the immune system. For the translational part of this work, researchers carry out phase I, II and III clinical trials.

Rare cancers

Theme leader: Dr Carla van Herpen

Despite the rarity of each of the 'rare' cancers (*i.e.* an incidence <6/100,000 per year), they represent in total about 22% of all cases of cancer. Due to their low frequency, rare cancers pose particular challenges. The main aim is to improve diagnosis and prognosis and to perform personalised clinical studies and translational bench-to-bedside research in patients with rare cancers. This is performed in a national and international collaborative setting and in relationship with patient advocacy groups, where applicable.

Tumours of the digestive tract

Theme leader: Prof. Iris Nagtegaal

Research on this theme is designed to improve the prognosis and treatment of patients with tumours of the digestive tract, with a focus on sporadic and hereditary forms of colorectal and pancreatic cancer. The aim is to achieve better prevention of cancer in high-risk patients and to develop and implement new diagnostic tools for staging and therapy response. In addition, researchers are developing treatment innovations, ranging from improved surgical techniques to immunotherapy.

Staff

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	Prof. C. Rosman (o)

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| Prof. H.M.J. van Schrojenstein Lantman (o) | Prof. H. Vermeulen (o) |
| Prof. L.J. Schultze Kool (o) | Prof. J.F. Verzijlbergen (o) |
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| Prof. D.J.O. Ulrich (o) | Prof. S.N. de Wildt (o) |
| Prof. J. van der Velden (o) | Prof. J.H.W. de Wilt (o) |
| Prof. A.J.A.M. van der Ven (o) | Prof. J.R.L.M. Wolf (o) |
| Prof. A.L.M. Verbeek (o) | Prof. G.A. Zielhuis (o) |
| Prof. N.J.J. Verdonschot (p) | |

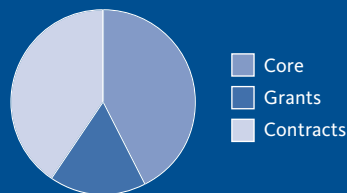
Tenured

Full Professors	24.2 FTE
Associate Professors	9.7 FTE
Assistant Professors	54.1 FTE
Researchers	80.3 FTE

Non-tenured

Researchers	151.0 FTE
Doctoral candidates	148.8 FTE

Research staff funding



Urological cancers

Theme leader: Prof. Jack Schalken

Research involves identifying and evaluating the usefulness of new biomarkers and imaging techniques for risk, diagnostic, prognostic and predictive assessment in prostate, bladder and kidney cancer. In addition, new and existing prevention and treatment modalities in these types of cancer are evaluated. Synergistic multidisciplinary research collaboration – from molecular life sciences to population sciences – ensures a focus on utility for patients and public health.

Women's cancers

Theme leader: Prof. Leon Massuger

The goal of this theme is to improve the patient-centred quality of care when treating women's cancers (breast, ovary, cervix, vulva, endometrium and pregnancy-related cancer). This is done in partnership with patients through prevention, early diagnosis and the implementation of new management strategies supported by a better understanding of carcinogenesis and tumour development, paying special attention to hereditary causes, preservation of fertility and individual post-treatment care.

Infectious diseases and global health

Theme leader: Prof. Mihai Netea

Researchers within this theme aim to have a significant and global impact on the control, treatment and elimination of infectious diseases. The theme combines cutting-edge research in immunology, microbiology, pharmacology and novel 'omics' methodology, with translational and implementation research in immunology and infectious diseases. There are two research lines: Infectious diseases & host defence, and Poverty-related infectious diseases.

Inflammatory diseases

Theme leader: Prof. Irma Joosten

Chronic inflammation is currently among the leading

causes of morbidity and mortality in the Western world. Researchers working on this theme aim to translate results from the molecular and population level to the individual patient in order to improve diagnosis, disease management and the treatment of (chronic) inflammatory disorders.

Mitochondrial diseases

Theme leader: Prof. Jan Smeitink

The mission within this theme is to better understand the cellular bio-energetics in health and disease at all levels of complexity. Knowledge thus gained will enable the development of preventive measures and help to make substantial contributions to developing rational treatment strategies for mitochondrial diseases.

Reconstructive and regenerative medicine

Theme leader: Prof. Wout Feitz

The focus within this theme is on the development and clinical translation of innovative diagnosis and therapies, including regenerative medicine and nano-medicine, for personalised care and cure of patients needing reconstruction of lost or damaged tissues. This is achieved through transdisciplinary research by leading research groups in medicine, dentistry, biochemistry, chemistry, biology and materials science.

Renal disorders

Theme leader: Prof. Joost Hoenderop

Current and future care of patients with renal and renal-related disorders can be considerably improved. To achieve this, researchers working on this theme aim to increase knowledge of the molecular and immunological basis of rare glomerular and tubular disorders; they develop biomarkers for optimal prediction of disease prognosis; and apply strategies for preventing and improving renal replacement therapy.

Vascular damage

Theme leader: Prof. Gerard Rongen

In this theme the aim is to increase understanding of the causes and consequences of vascular injury and to translate this knowledge into improved personalised cardiovascular healthcare. Early detection of atherosclerosis, primary and secondary prevention of atherosclerosis, optimal treatment of atherosclerosis to preserve end organ function, and the implementation of effective diagnostics and therapies in practice are key focus areas.

Research facilities

RIHS hosts some of the 19 formal Radboudumc Technology Centers (www.radboudumc.nl/en/research/technology-centers), which offer research facilities for both internal and external researchers:

- The *Biobank*, an infrastructure for collecting, storing and managing biomaterial and associated clinical data in a standardised manner. It contains large databases and biobanks of general population samples (e.g. the Nijmegen Biomedical Study) and of specific patient groups (e.g. those with congenital malformations, cancer, rheumatoid arthritis and inflammatory bowel disease).
- The *Clinical trials* centre, which offers logistics and data management for adult and paediatric human intervention studies.
- Consultation facilities for *statistics, health economics and transmural research*.
- The *Minimal Invasive Technology expert Center* (MITeC) field lab, which is used to evaluate surgical innovations.
- The Technology Center *Data stewardship* (started in 2016), which provides practical knowledge, services and solutions to ensure good research practice according to the FAIR criteria (Findable, Accessible, Interoperable, and Re-usable), in a way that suits each individual study and researcher. In order to support

this, a newly developed Digital Research Environment (DRE) will be implemented in 2017.

- *Human performance*, which comprises the most important human in vivo measurement techniques.
- A *3D lab*, which offers 3D imaging and 3D printing for technological innovations in daily clinical practice.

In December 2016, State secretary Sander Dekker announced that the Radboudumc technology centres are listed on the NWO Roadmap for Large-Scale Scientific Infrastructure that will be given top priority in Dutch science in the next four years.

In addition to these technology centres, the RIHS has additional research facilities such as:

- Academic networks of GP practices (including the GP Continuous Morbidity Registration), nursing homes, institutions for people with an intellectual disability, municipality health services, care facilities for homeless people and dental care sites.
- The 'Koploper programme', a healthcare innovation in which professionals in primary care, public health, allied healthcare workers and the hospital jointly develop new approaches to prevention and care.
- A Systematic Review Centre for Laboratory animal Experimentation (www.syricle.nl).
- Consultation services designed to improve the quality of care (IQ healthcare).
- An online platform for Personal Health Communities (MijnZorgnet).

Collaboration

Although several research lines in the RIHS play a leading role worldwide, the Institute as a whole is best known in the Netherlands. To secure a transition to a more international level, RIHS is currently identifying attractive foreign research institutes and graduate

schools in order to set up strategic alliances.

Furthermore, RIHS annually offers at least two (three in 2016) junior researcher positions for projects proposed by a RIHS researcher, together with an international partner. PhD candidates, once appointed, carry out at least one year of the research abroad.

In 2016 Radboudumc started collaborating with Rijnstate Hospital in Arnhem, CWZ in Nijmegen and Sint Maartenskliniek in Nijmegen, making use of a regional PhD fund. A researcher from the regional hospital working with a Radboudumc (junior) Principal Investigator can submit an application to the fund.

Each year, a researcher or teacher from abroad is honoured with the 'Richard Grol Visiting Scientist Award'. In 2016 this award went to Trish Greenhalgh (Professor of Primary Care Health Sciences at the University of Oxford), an internationally recognised academic working in health services research/primary health care and a practising General Practitioner.

There are formal collaborations with the Universities of Twente, Eindhoven and Groningen for, e.g. MITeC. At the Institute level, there is a formal partnership in the KNAW-accredited research school CaRe (www.researchschoolcare.nl), together with CAPHRI (UM), NIVEL and APH (formerly EMGO+; VUmc).

The Institute has formal ties with the HAN University of Applied Sciences and with the Nederlands Paramedisch Instituut. The Institute is also a formal partner in 'Sterker op eigen benen' ('Stronger on your own two feet'), a consortium of five service providers for people with intellectual disabilities. Within the Academic Collaborative Centre AMPHI the Institute collaborates with 15 care organisations (including 60 nursing homes). with seven Dutch Community Health Services (GGDs) and within

UKON, the university network for long-term care in Nijmegen, RIHS collaborates with 15 care organisations (including 60 nursing homes). RIHS has collaborated with the Netherlands Comprehensive Cancer Organisation (IKNL), the National Expert and Training Centre for Breast Cancer Screening (LRCB), the RIVM, NIVEL, and the Dutch Ministry of Public Health, Welfare and Sport (VWS) for many years.

The RIHS collaborates in research and/or faculty exchanges with many universities around the world and with the European Union/ECDC, the WHO, UNESCO, the Centre on Birth Defects and Developmental Disabilities, various Centres for Disease Control and Prevention, INSERM (Paris), several Cochrane Centres, the MRC and the Institute for Cancer Research in London and deCODE Genetics in Reykjavik, Iceland. Within the scope of the EU 7th Framework and Horizon 2020 Programmes EuroTARGET, EURENOMICS, InSup-C, PACE, FAPIC, EYE-RISK, ENSAT-HT, MURAB, the Institute collaborates with numerous public and private organisations.



Dr Geraline Leusink (Associate Professor and Medical Director at the Care Organisation Siza) is an expert in primary care, in particular long-term care. She explores how new technologies can be made applicable in the everyday lives of people with disabilities. She aims both to increase the independence of people with disabilities and to provide higher quality innovations in care. Since it is important that future physicians experience working in long-term care, her students are confronted with the challenges faced in such care.

Research results

In 2016, two PhD theses received the predicate *cum laude*: Dr Niek Hugen ('Clinical and biological aspects of mucinous colorectal cancer') and Dr Ingrid Sturkenboom ('Occupational therapy for people with Parkinson's disease: towards evidence-informed care').

In November RIHS organised the international 'Radboud New Frontiers' conference 'Bridging the gap between biology and daily practice' for more than 250 scientists. Some other research highlights are listed below.

Healthcare improvement science

Professors Maroeska Rovers and Gert Westert, together with their colleagues, nicely summarised the evidence regarding the quality of patient-reported outcome measures (PROMs) validated in patients with obstructive sleep apnoea (Abma *et al. Sleep Medicine Reviews*, 2016).

Doctors Henk Eilander, Viona Wijnen and Jan Lavrijsen showed that a considerable number of patients with long lasting disorders of consciousness (even those who are

still unconscious one to six months after injury) can recover and lead an independent or semi-independent life in the long term following specialised rehabilitation (Eilander *et al. Brain Injury*, 2016).

Cancer development and immune defence

A systematic review of animal studies by Dr Carlijn Hooijmans showed that there is no indication to suggest that locally administered anaesthetics are harmful during surgery in cancer patients. Volatile anaesthetics, however, might increase metastasis in animal models and clinical trials investigating this possibly harmful effect should receive priority (Hooijmans *et al. PLoS One*, 2016).

Rare cancers

The group led by Prof. Bram van Ginneken presented a novel Computer-Aided Detection (CAD) system for pulmonary nodule detection in CT scans. The promising results and the low computation time make the system highly suited for use as a decision aid in a lung cancer screening scenario (Setio *et al. IEEE Transactions on Medical Imaging*, 2016).

Tumours of the digestive tract

A case-control study by Prof. Hans de Wilt demonstrated that surgery of colorectal liver metastases leads to better survival than systemic therapy (de Ridder *et al. European Journal of Cancer*, 2016).

Urological cancers

An extensive meta-analysis by the group led by Prof. Maroeska Rovers, including all previous studies that evaluated magnetic resonance imaging (MRI) for detecting tumour growth outside the prostate, demonstrated that MRI is not sensitive enough to find all such tumours (de Rooij *et al. European Urology*, 2016).

Prof. Jelle Barentsz and his colleagues published a global standardised method designed to make and analyse MRI

prostate images (Weinreb *et al. European Urology*, 2016). Their paper was selected as the best clinical research paper published in the top journal *European Urology* in 2016.

Women's cancers

Dr Joanne de Hullu and her colleagues estimated BRCA1/2 mutation carriers' cumulative ovarian cancer risks after risk-reducing salpingectomy at various ages with delayed oophorectomy several years later, compared with risk-reducing salpingo-oophorectomy. They showed that the risk differences are small. This information can be used in counselling BRCA1/2 mutation carriers, thus facilitating a personalised, well-informed choice of strategy (Harmsen *et al. Obstetrics and Gynecology*, 2016).

Infectious diseases and global health

Dr Teun Bousema and colleagues published the first conclusive efficacy study on the use of low-dose primaquine to prevent malaria transmission (Dicko *et al. Lancet Infectious Diseases*, 2016).

Prof. Andre van der Ven and colleagues analysed the medical data of more than 350,000 African children and showed that vaccination of African babies directly after birth seems to be favourable for their growth and health, while vaccination later in life may have negative effects (Berendsen *et al. EBioMedicine*, 2016).

Inflammatory diseases

Dr Tjard Schermer showed that a diagnosis of Chronic Obstructive Pulmonary Disease (COPD) should not be based on a single spirometry test (Schermer *et al. NPJ Primary Care Respiratory Medicine*, 2016). This finding will have implications for current clinical guidelines.

Mitochondrial diseases

Dr Chris Verhaak showed that quality of life, fatigue and mental health problems in patients with mitochondrial disorders are only partly reflected by clinical assessments.

KEY PUBLICATIONS

- Abma, I.L., Wees, P.J. van der, Veer, V., Westert, G.P. & Rovers, M.M. (2016). Measurement properties of patient-reported outcome measures (PROMs) in adults with obstructive sleep apnea (OSA): A systematic review. *Sleep Medicine Reviews*, 28, 18-31.
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- Hooijmans, C.R., Geessink, F.J., Ritskes-Hoitinga, M. & Scheffer, G.J. (2016). A Systematic Review of the Modifying Effect of Anaesthetic Drugs on Metastasis in Animal Models for Cancer. *PLoS One*, 11(5), e0156152.
- Kool, R.B., Kleefstra, S.M., Borghans, H.J., Atsma, F. & Belt, T.H. van de (2016). Influence of Intensified Supervision by Health Care Inspectorates on Online Patient Ratings of Hospitals: A Multilevel Study of More Than 43,000 Online Ratings. *Journal of Medical Internet Research*, 18(7), e198.
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KEY PUBLICATIONS

- Ridder, J.A.M. de, Stok, E.P. van der, Mekenkamp, L.J., Wiering, B., Koopman, M., Punt, C.J.A., Verhoef, C. & Wilt, J.H.W. de (2016). Management of liver metastases in colorectal cancer patients: A retrospective case-control study of systemic therapy versus liver resection. *European Journal of Cancer*, 59, 13-21.
- Rooij, M. de, Hamoen, E.H.J., Witjes, J.A., Barentsz, J.O. & Rovers, M.M. (2016). Accuracy of Magnetic Resonance Imaging for Local Staging of Prostate Cancer: A Diagnostic Meta-analysis. *European Urology*, 70(2), 233-45.
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Dissertations	85
Scientific publications	2094
Patents	1

In order to support patients more effectively, integration of patient-reported outcomes, alongside symptoms of their disease, is warranted in clinical practice (Verhaak *et al. Orphanet Journal of Rare Diseases*, 2016).

Reconstructive and regenerative medicine

The team led by Dr Thomas Maal presented and validated an innovative semi-automatic tool designed to quantify the displacement of jaw segments in orthognathic surgery. Their method provides clinicians with a powerful new tool that can be used to evaluate and optimise the accuracy of 3D planning in bimaxillary surgery. (Baan *et al. PLoS One*, 2016).

Renal disorders

Prof. Saskia de Wildt, Dr Carin Verlaat and their colleagues have shown that inflammation and organ failure significantly reduce drug metabolism (cytochrome P450 3A activity), which may importantly impact the efficacy and safety of drugs in critically ill patients (Vet *et al. American Journal of Respiratory and Critical Care Medicine*, 2016).

Vascular damage

Dr Dick Thijssen's group showed that exercise training tends to be more effective in reducing visceral adipose tissue compared with diet interventions in overweight and obese subjects. This suggests that changes in body weight represent a poor marker for adaptation in visceral adipose tissue, especially when performing exercise training, and indicates that in clinical practice caution should be taken when interpreting changes (or the lack of changes) in body weight after exercise training interventions (Verheggen *et al. Obesity Reviews*, 2016).

Awards and acknowledgements

- Prof. Bart Kiemeneij was elected as new member of the Academia Europaea.
- Dr Teun Bousema received the Radboud Science Award. This award allows him to translate his malaria research into learning and teaching materials that are suitable for primary school pupils.
- Rebecca Verheggen won a Christine Mohrmann stipend for promising female PhD candidates. She will use the grant to work at Oxford University in the UK.
- Prof. Stefaan Bergé was elected Trainer of the Year 2016 by the association for residents 'De Jonge Specialist'.
- Dr Jakko van Ingen was presented with the European Respiratory Society (ERS) Research Award for his contribution both as a clinician and as a scientist to improving the diagnosis and treatment of diseases caused by non-tuberculous mycobacteria.
- Dr Jo Frencken was awarded China's prestigious International Scientific and Technological Cooperation Award for his decade-long efforts promoting more accessible cavity treatment of Chinese people.
- Dr Loes Derikx was awarded the best thesis award by the European Society of Biomechanics for her thesis, which was entitled 'Femoral fracture risk prediction in metastatic bone disease'.

Societal impact

Societal impact is at the heart of RIHS research. Much – if not most – RIHS research has direct societal impact and it is implemented in clinical care or public health. For this, RIHS encourages researchers to act in close collaboration with public organisations on topics with high societal relevance. RIHS research leads, *e.g.*, to more personalised treatment, to better cooperation between healthcare providers, to more efficient diagnostic protocols, and through all this to better and more efficient healthcare. Research results are shared with the professional and lay community through contributions to guidelines

or protocols, professional and popular publications, newspaper and radio, board membership of national and international societal advisory groups and policy institutes, outreach activities and public-private collaborations.

Some highlights in 2016 were:

- RIHS organised a patient information meeting for bladder cancer patients and a public evening about the future of cancer research.
- RIHS organised a tour in Radboudumc for secondary school students.
- The RIHS PhD training in Epidemiology which leads to registration with the Foundation for training Medical-biological Scientific Researchers ('Stichting voor opleiding tot Medisch-Biologisch Wetenschappelijk Onderzoeker'; SMBWO) was re-accredited for a period of five years by the Netherlands Association of Epidemiology.
- Ten years after her appointment as a full professor, Prof. Merel Ritskes-Hoitinga held a public lecture on the status and future of animal research.
- During the Lowlands festival researchers from the Department of Anaesthesiology investigated whether you can tolerate more pain when listening to your favourite music instead of music you hate.
- FertilityConsult, an online fertility clinic, went 'live', an initiative of Radboudumc and Jeroen Bosch hospital.
- CMyLife, a platform for patients with chronic myeloid leukaemia – an initiative of Prof. Nicole Blijlevens – was launched.
- SCREENIVF, an instrument designed to screen psychosocial risks in IVF couples, which was developed by Dr Chris Verhaak and Radboudumc colleagues, was implemented in the European Guidelines for clinical practice of the European Society of Human Reproduction and Embryology and adopted by more than 1000 European fertility clinics (Gameiro *et al. Human Reproduction*, 2016).

- The team led by Prof. Ria Nijhuis-van der Sanden developed a practice guideline for anterior cruciate ligament rehabilitation for the Netherlands (Engelen-van Melick *et al. British Journal of Sports Medicine*, 2016).
- Prof. David Burger was a member of the Paediatric Antiretroviral Working Group (PAWG) that advised WHO on dosing recommendations for treating HIV-infected children under the age of five (Mulenga *et al. Lancet Infectious Diseases*, 2016).
- In collaboration with the Oxford University Clinical Research Unit in Vietnam, Prof. Heiman Wertheim showed that use of a rapid (five-minute) test can reduce antibiotic misuse when treating respiratory infections (Do *et al. Lancet Global Health*, 2016). Cutting the number of unnecessary antibiotic prescriptions is a key way to prevent the spread of antibiotic-resistant infections.
- Dr Tijn Kool showed that the Dutch healthcare inspectorate identifies the same hospitals as 'at risk' as those that patients rate as underperformers (Kool *et al. Journal of Medical Internet Research*, 2016).
- Dr Hein Janssens devised and developed a medical app for supporting diagnosis of gout without the need for microscopic investigation by a rheumatologist.
- Dr Jeroen Hasselaar edited a free book on integrated palliative care.
- The limited company 'Atro Medical' was established as a spin-off of Prof. Nico Verdonchot's laboratory. This company will prepare the first in-men study of the permanent meniscus prosthesis that is being co-developed by his laboratory.
- Prof. Henny van Schrojenstein Lantman-de Valk was honoured as an Officer in the Order of Orange-Nassau and Dr Sylvie Lo Fo Wong was honoured as a Knight in the Order of Orange-Nassau.
- Prof. Jan Kremer has been appointed as chairman of the Quality Council (Kwaliteitsraad) of the National Health Care Institute (Zorginstituut Nederland), and he is a

member of the Council for Health and Society (RVS) ('Raad voor Volksgezondheid en Samenleving'), which advises the Dutch government and parliament on health-related issues.

- Prof. Maria Hopman was appointed chairman of the Nijmegen Stedelijk Network, an organisation of CEOs and directors in all fields in Nijmegen, including the Mayor and City Council Members.
- Dr Eddy Adang, Prof. Theo van Achterberg, Prof. Maria Hopman, Prof. Ellen Kampman, Prof. Bart Jan Kullberg and Prof. Gerhard Zielhuis are members of the Health Council of the Netherlands.
- Prof. Koos van der Hoeven, Prof. Bart Kiemeney, Prof. Judith Prins and Prof. Peter Siersema are members of the scientific council of the Dutch Cancer Society.
- Prof. Pim Assendelft, Prof. Judith Prins, Prof. Maroeska Rovers, Dr Tom Scheenen and Prof. Gerhard Zielhuis are board members of the Dutch Innovational Research Incentives Scheme (Veni-Vidi-Vici).
- Prof. Nicole Blijlevens is a member of the Horizonscan working group Oncology and Haematology of the Ministry of Health, Welfare and Sport.
- Prof. Gerard Rongen is a member of the Central Committee on Research Involving Human Subjects ('Centrale Commissie Mensgebonden Onderzoek'; CCMO).
- Dr Teun Bousema is a member of the Scientific Advisory Board of Médecins Sans Frontières.

Future research

The Institute will continue to invest in research facilities such as biobanks as well as in large national and international networks. The focus of research will increasingly be on personalised healthcare and patient-centred interventions. For example, Dr Erik Bischoff and Dr Tjard Schermer will further develop their smart app for personalised management of Chronic Obstructive Pulmonary Disease (COPD) exacerbations (EFRO grant).

Prof. Maroeska and Dr Joanna in 't Hout will promote tailored health care by improving methods designed to investigate subgroup effects in treatment response when there are multiple individual participant datasets (ZonMw TOP subsidy). Together with two Radboudumc spin-off companies, ScreenPoint Medical and Thirona, Prof. Bram van Ginneken's group will focus on automatic interpretation of chest radiographs, mammograms, retinal images and chest CT scans (€4.6 million grant of the Dutch Technology Foundation STW for a consortium of five academic groups and seven companies).

Non-tuberculous mycobacteria are emerging causative agents of severe and treatment-refractory infections. With a prestigious NWO Veni grant Dr Jakko van Ingen will build a system to mimic human infections and assess the efficacy of smart combinations of antibiotics designed to combat these, and later, other bacteria. The best combinations can then proceed into clinical trials. Another NWO Veni grant was awarded to Dr Giesje Nefs. She will examine psychological predictors of nocturnal hypoglycaemia (low blood glucose), which is common in people with type 1 diabetes. Furthermore, she will investigate the consequences for daily life and the best approach to treating (and dealing with concerns about) very low blood glucose.

Dr Marit Tanke will use a prestigious Harkness Fellowship in Health Care Policy and Practice to investigate the way care of complex patients is organised. She will assess which cost components can be avoided by reducing lower-value care and inefficiencies in the system and how these factors can be influenced by regulatory systems and/or health insurers.

The ageing of the Dutch population will present enormous quality and efficiency challenges in healthcare. Cost-effectiveness will be central to healthcare policy for the next few decades. Three research groups will perform



Director Professor Bart Kiemeney

After a short career as a physiotherapist, Bart Kiemeney was trained as an epidemiologist at Radboud university medical center (Radboudumc). From 1992-1994 he received further training in clinical epidemiology at the University of Washington, Seattle WA and in genetic epidemiology at Johns Hopkins University, Baltimore MD. In 2003 he was appointed Professor of Cancer Epidemiology at Radboud University. His research focuses on the genetic causes and pharmacogenetics of urological cancers.

research on healthcare costs and effectiveness, with grants from the ZonMw programme 'DoelmatigheidsOnderzoek': Dr Mark van den Boogaard ('The impact of nUrsing DELiRium Preventive Interventions in the Intensive Care Unit (UNDERPIN-ICU)'), Prof. Ria Nijhuis-van der Sanden and Dr Thomas Hoozeboom ('Is Coach2Move cost-effective in day-to-day physiotherapy practice?') and Dr Bastiaan Klarenbeek ('Pelvic Floor rehabilitation to improve functional Outcome and quality of life after surgery for Rectal CancER: a randomised controlled trial. FORCE trial').

The consortium 'Sterker op eigen benen', a collaboration between care organisations for people with intellectual disabilities (ID) and the Radboudumc, will develop a structural health monitoring system for people with ID using a grant of the Ministry of Health, Welfare and Sport. This project is led by Dr Geraline Leusink.

Dr Leon Bijlmakers and his partners will scale up the delivery of accessible, elective and emergency surgery at district hospitals to national level programmes in three African countries with a European Horizon 2020 grant. Other projects that will be performed with Horizon 2020 money are: 'HBM4EU: European Human Biomonitoring Initiative' (Dr Paul Scheepers), 'HYPERTRANS: Transport

of hyperpolarised substrates for metabolic imaging' (ERC Proof of Concept grant, Dr Tom Scheenen), 'HOME_EU: Homelessness as unfairness' (Prof. Judith Wolf), 'PanACEA: a Pan-African Consortium for the Evaluation of antituberculosis Antibiotics' (Dr Martin Boeree, Dr Rob Aarnoutse), 'PedCRIN: Paediatric Clinical Research Infrastructure Network' (Prof. Saskia de Wildt).

With a Bas Mulder Award from Alpe d'HuZes/KWF Dr Geert Litjens will try to improve treatment selection for prostate cancer patients, using digital pathology and 'deep learning'. Other projects that received awards from the Dutch Cancer Society are: 'Fluorescence image-guided surgery in patients with peritoneal carcinomatosis of colorectal origin' (Dr Mark Rijkema), 'Impaired Spermatogenesis and Testosterone Deficiency in Male Survivors of Childhood Cancer: a DCOG-LATER study' (Dr Jacqueline Loonen), 'Chemotherapy or not? Practice changing approach for the selection of patients for accurate chemotherapy treatment after colon cancer diagnosis' (Dr Jeroen van der Laak), 'Standardising training for endoscopic resection of large non-pedunculated colorectal polyps: It is prime-time to change practice' (Prof. Peter Siersema), 'Diagnostic accuracy of contrast-enhanced diffusion-weighted MRI for liver metastases of pancreatic cancer: towards

adequate staging of pancreatic cancer'(Dr John Hermans), 'Favorable and unfavourable effects of risk-reducing salpingo-oophorectomy (RRSO) in women at high genetic risk of ovarian cancer' (Prof. Angela Maas).

In 2017, the Institute also plans to strengthen its expertise in, *e.g.* data engineering/big data in health sciences, in data integrity when establishing a digital research environment, and in healthcare research among refugees and low-income subgroups in the population. The policy of the Institute, along with that of the other two Radboudumc institutes, is in the recently published Research Agenda 2025 (www.rihs.nl/about-us/reports). ◀