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I am pleased to present to you the Annual Report of NUTRIM offering a flavour of our critical mass, infrastructure and academic activities mainly focused on educational and scientific achievements in 2014.

NUTRIM strongly believes in connecting and integrating different disciplines to create truly new scientific insights and innovative health solutions for society. Within Maastricht University Medical Centre (MUMC+) “Metabolism and nutrition” is prominently positioned as innovation platform which stimulates an outlook of our research to specific disease profiles as well as to healthy living. This also allows us to optimally contribute to a paradigm shift from reactive medicine to predictive, preventive, personalized and participatory (P4) medicine. In 2011 we initiated the interfaculty research programme “Eatwell” (www.um-eatwell.nl) to join unique strengths of Maastricht University within the nutrition and health domain and accelerate novel insights from biomedical research into effective health promotion strategies. The first awarded projects ended in 2014 and we are now exploring how to optimally link “Eatwell” to other initiatives at the Maastricht Health Campus and at the Greenport Campus Venlo within the Knowledge Axis Limburg. To optimally anticipate on new regional and (inter)national developments, we decided to extend the management of our four research lines with a co-research line leader. We welcome Patrick Schrauwen (Research Line 1), Steven Olde Damink (Research Line 2), Jeroen Kooman (Research Line 3) and Maurice Zeegers (Research Line 4) in the team.

In 2011 NUTRIM obtained a prestigious grant by the national research council NWO for the Graduate programme “Metabolism and Chronic Disease”. In 2013, after a tough competition, the first PhD positions were awarded to the first four talented students (two basic scientists and two medical doctors). NUTRIM will continue the Graduate Programme by allocating a maximum of three PhD positions each year using institutional funding combined with a financial contribution by the selected supervisory team. An excellent and personal insight in the ambitions and experiences of the NUTRIM Graduate Programme is provided by the interviews with respectively the first awarded PhD students and the responsible NUTRIM graduate programme committee (page 22).

Every year NUTRIM welcomes new members and has to say farewell to others. 36 Students started their PhD project, 47 students defended their thesis in 2014, and all of them obtained a new professional challenge at the University, in the Clinic or in Industry. Nicole Bouvy was appointed Professor of “Innovative Surgical Techniques” and Chris Evelo Professor of “Bioinformatics for integrative systems biology” while Prof. Wim Saris and Prof. Marleen van Baak held their valedictory lecture. For his many years of service to society, Wim Saris was appointed Officer in the Order of Orange Nassau by His Royal Highness. As first and former Director of NUTRIM (1992-2005) Wim has also greatly contributed to the success of our Research School.

I would like to thank the scientific staff, support staff, students and our external partners for their valuable contribution to NUTRIM in a pleasant atmosphere, and look forward to a bright future in a challenging academic climate.

Annemie Schols, Director NUTRIM
The mission of NUTRIM is to promote translational research into chronic metabolic and inflammatory disorders with a high societal burden that will contribute to personalized lifestyle and medicine approaches. In its PhD programme NUTRIM aims to meet the demand for scientists who are acquainted with novel fundamental research concepts and are equipped to optimize the translation from science to the clinic and to public health.
Collaborating Departments

- Anatomy & Embryology
- Bioinformatics
- Clinical Chemistry
- Genetics & Cell Biology
- Health Promotion
- Human Biology
- Imaging including Nuclear Medicine and Radiology
- Internal Medicine
- Medical Microbiology
- Movement Sciences
- Ophthalmology
- Paediatrics
- Pharmacology & Toxicology
- Plastic Surgery
- Respiratory Medicine
- Surgery

The mission is implemented by the following objectives:

- To enable and manage an excellent research programme that encompasses the entire spectrum of basic, translational, clinical, and prevention projects providing NUTRIM with a distinct international health sciences profile that optimally fits within the Maastricht UMC+ care vision and organization.
- Availability of unique patient cohorts and biobank as well as an internationally distinct, state of the art infrastructure for metabolic phenotyping allowing a network-based approach linking tissue and organ systems within chronic metabolic disorders.
- To mentor scientists at different stages of their academic career.
- To facilitate the sharing of knowledge and expertise both within the national graduate School VLAG and by collaboration with other universities, research institutions, and national and international networks.

Research

Research within NUTRIM is structured in four research lines:

Research line 1: Metabolic Syndrome
- Programme 1: Energy balance and obesity
- Programme 2: Diabetes and cardiovascular disease risk

Research line 2: Gut-liver homeostasis
- Programme 1: Gut-liver metabolism
- Programme 2: Intestinal integrity and defence

Research line 3: Chronic inflammatory disease and wasting
- Programme 1: Inflammation and oxidant-antioxidant networks
- Programme 2: Skeletal muscle weakness in ageing and disease

Research line 4: Gene-environment interactions
Research Line 1 ‘Metabolic Syndrome’

Research line leader: Prof. Dr. R.P. Mensink, Professor of Molecular Nutrition with emphasis on lipid metabolism; Department of Human Biology
Co-Research Line Leader: Prof. P. Schrauwen, Professor of Metabolic aspects of type 2 diabetes mellitus; Department of Human Biology

**Tenured faculty: Scientists**

**Department of Health Education**
- Prof. Dr. S.P.J. Kremers, Professor of Prevention of Obesity
- Prof. Dr. N.K. de Vries, Professor of Health Education and Promotion
- Dr. P.T. van Assema
- Dr. R.M. Meertens
- Dr. J.M. de Nooijer

**Department of Human Biology**
- Prof. Dr. M.A. van Baak, Professor of the Physiology of Obesity
- Prof. Dr. E.E. Blaak, Professor of the Physiology of Fat Metabolism
- Prof. Dr. F. Brouns, Professor of Health food innovation
- Prof. Dr. W.D. van Marken Lichtenbelt, Professor of Ecological Energetics and Health
- Prof. Dr. R.P. Mensink, Professor of Molecular Nutrition with emphasis on lipid metabolism
- Prof. Dr. J. Plat, Professor of the Physiology of Nutrition with special attention for Sterol Metabolism
- Prof. Dr. W.H.M. Saris, Professor of Human Nutrition
- Prof. Dr. P. Schrauwen, Professor of Metabolic aspects of type 2 diabetes mellitus
- Prof. Dr. M.S. Westerterp-Plantenga, Em. Professor of Regulation of Food Intake
- Prof. Dr. K.R. Westerterp, Em. Professor of Human Energetics
- Dr. T. Adam
- Dr. G.H. Goossens
- Dr. J. Hoeks
- Dr. G. Plasqui
- Dr. K. Venema

**Department of Imaging**
- Prof. Dr. F. Mottaghy, Professor of Nuclear Medicine
- Dr. M.E. Kooi
- Dr. V. Schrauwen-Hinderling

**Department of Internal Medicine**
- Dr. B. Havekes

**Department of Movement Sciences**
- Prof. Dr. M.K.C Hesseling, Professor of Movement Sciences

**Department of Ophthalmology**
- Dr. T. Berendschot

**Department of Surgery**
- Prof. Dr. N. Bouvy, Professor of Innovative Surgical Techniques
- Prof. Dr. L.W.E. van Heurn, Professor of Child Surgery

**Tenured faculty: Support staff**

**Department of Health Education**
- L.M.J. Kolenburg

**Department of Human Biology**
- H. Aydeniz
- A.P. Gijzen
- G. Hul
- M.M. Hulsbosch
- P.F.M. Schoffelen
- W.B.M. Sluijsmans
- J.H.C.H. Stegen
- J.L.J. Wouters

**Department of Movement Sciences**
- Dr. G. Schaart
- C.F.P. Kornips
Research

Research within Research Line 1 is concentrated around two complementary and interacting research programmes.

**Programme 1.1: Energy balance and obesity**

One main focus of programme 1.1 is on intervention strategies for long-term maintenance of energy balance and food intake. Studies are centred on relations between diet(ary components), energy expenditure, physical activity and body composition. The number of studies on (neuro)endocrine mechanisms, brain signalling, and genetic predisposition is increasing. The purpose of another line of research within programme 1.1 is to understand and influence health/energy balance-related behaviours, also in interaction with biological factors, and to develop interventions suitable for large-scale dissemination.

**Programme 1.2: Diabetes and cardiovascular disease risk**

The research of programme 1.2 aims to identify / characterize how nutrition, physical activity, environmental factors, and clinical interventions can have beneficial molecular, metabolic and functional effects. Focus is on skeletal muscle, (brown) adipose tissue, blood vessels, the liver, and the intestine. Studies are in particular designed to obtain insight into the relationships between life-style, lipid and glucose metabolism and low-grade systemic inflammation. Knowledge obtained from studies under 'normal' conditions is applied to study and understand metabolic disturbances involved in aetiology of e.g. type 2 diabetes mellitus and cardiovascular disease.
## List of ongoing PhD Studies in 2014

<table>
<thead>
<tr>
<th>Title of research</th>
<th>PhD Student</th>
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<tbody>
<tr>
<td>Adipogenic capacity as a mediator of weight gain</td>
<td>Stefan Camps</td>
</tr>
<tr>
<td>Adipokines and metabolism</td>
<td>Birgitta Kolk</td>
</tr>
<tr>
<td>Age, health and physical activity</td>
<td>Giulio Valenti</td>
</tr>
<tr>
<td>An adipocytes-driven mechanism for weight regain after weight loss: the yo-yo effect</td>
<td>Roel Vink</td>
</tr>
<tr>
<td>Analysis of fibre fermentation in microbiota from lean and obese individuals</td>
<td>Marisol Aguirre Morales</td>
</tr>
<tr>
<td>Anti-reflux surgery</td>
<td>Selwyn van Rijn</td>
</tr>
<tr>
<td>Bariatric Surgery in Children; BASIC trial</td>
<td>Yvonne Roebroek</td>
</tr>
<tr>
<td>Bioactive ingredients for health</td>
<td>Nadine Severins</td>
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<tr>
<td>Blunted beta2-adrenergic responsiveness in obesity: role of hypoxia?</td>
<td>Karianna Teunissen-Beekman</td>
</tr>
<tr>
<td>Brown adipose tissue activity and thyroid hormone</td>
<td>Evie Broeders</td>
</tr>
<tr>
<td>Brown fat metabolism: effects of cold acclimatisation</td>
<td>Anouk van der Lans</td>
</tr>
<tr>
<td>Building European governance on overweight and obesity: political, legal and scientific perspectives</td>
<td>Daphne Pommé</td>
</tr>
<tr>
<td>Cellular and molecular aspects of weight regulation: The adipose tissue</td>
<td>Freek Bouwman</td>
</tr>
<tr>
<td>Coaching on Lifestyle (Cool) project: Evaluation of a lifestyle coach pilot</td>
<td>Celeste van Rinsum</td>
</tr>
<tr>
<td>Complications after abdominal surgery: anastomotic leakage, adhesions and wound dehiscence</td>
<td>Kevin van Barneveld</td>
</tr>
<tr>
<td>Determinants of long-term maintenance of intervention-induced lifestyle changes in chronically ill patients</td>
<td>Jessie Meis</td>
</tr>
<tr>
<td>Dietary fatty acids and cardiometabolic health</td>
<td>Dorien Pieters</td>
</tr>
<tr>
<td>Dietary polyphenols as modulators of lipid oxidation and mitochondrial function</td>
<td>Jasper Most</td>
</tr>
<tr>
<td>Droplets preventing the overflow: PLINS-coated lipid droplets in insulin sensitivity and mitochondrial function</td>
<td>Sabine Daemen</td>
</tr>
<tr>
<td>Dynamic LED lighting, thermal comfort, health, and energy savings in buildings</td>
<td>Marije te Kuive</td>
</tr>
<tr>
<td>Ectopic fat</td>
<td>Lucas Lindeboom</td>
</tr>
<tr>
<td>Effects of diet and dietary components on human endothelial function</td>
<td>Sanne van der Made</td>
</tr>
<tr>
<td>Effects of dietary factors on HDL functionality</td>
<td>Charlotte Talbot</td>
</tr>
<tr>
<td>Effects of dietary ingredients on vascular function via increasing apoA-I production</td>
<td>Latte Smolders</td>
</tr>
<tr>
<td>Effects of differential gut and systemic SCFA availability on parameters of body weight control and insulin sensitivity</td>
<td>Emanuel Canfora</td>
</tr>
<tr>
<td>Effects of knock down of gut microbiota by antibiotics on parameters of body weight control and insulin sensitivity</td>
<td>Dorien Reijnders</td>
</tr>
<tr>
<td>Effects of short-term dietary intervention on molecular signatures in man</td>
<td>Stan Gaj</td>
</tr>
<tr>
<td>Emerging role for autophagy in human adipocyte lipid metabolism and metabolic diseases like type II diabetes</td>
<td>Qing Xu</td>
</tr>
<tr>
<td>Endocrinologic regulation of lipolysis in obese subjects: Impact of exercise intervention</td>
<td>Kenneth Verboven</td>
</tr>
<tr>
<td>Evaluating Obesity Treatment</td>
<td>Eric Aller</td>
</tr>
<tr>
<td>Exercise programs and physical activity in COPD</td>
<td>Willem Gosens</td>
</tr>
</tbody>
</table>
Factors influencing diet and physical activity among Canadian Inuit
Victor Akande

Fatty acid handling in the obese hypertensive state
Rudi Stinkens

Focus on resistance: an innovative, resistance-based intervention to improve body composition and to promote physical activity in adolescents (12-18 years) with overweight or obesity
Gil van Hoof

How to prevent pressure ulcers
Luuk de Wert

Human brown adipose tissue in type 2 diabetes
Mark Hanssen

Immune modulation by plant sterols and stanols
Florence Brüll

Intraperitoneal Mesh Adhesion Formation in Ventral Hernia Repair
Marc Schreinemacher

Kidney donation after cardiac death: Identifying pathological processes in ischemia-reperfusion injury and developing strategies to enhance transplant outcome
Tim van Smaalen

Influence of circadian rhythm, glucocorticoids and their receptors on human energy metabolism
Dirk van Moorsel

Long-term outcomes after ileal pouch-anal anastomosis in children and adults
Joyce Manyi Bakia

Meshes and intra-abdominal adhesions
Leontine van den Hil

Mitochondrial lipotoxicity and diabetes: human studies
Lena Bilet

Muscle mitochondrial malfunction in type 2 diabetes
Ellen Lenaers

New insights into anastomotic leakage following colorectal surgery
Audrey Jongen

Normal body weight but adipose body composition: determinants, metabolic consequences and the interaction with physical activity and diet
Siti Wulan

Nutritional modulation of apoA-I production
Sophie van der Krieken

The role of oxygen tension in adipose tissue dysfunction in the pathophysiology of obesity and type 2 diabetes
Max Vogel

Optimizing the beneficial health effects of exercise for diabetes: focus on the liver!
Bram Brouwers

Oxyphytosterols: the answer to the controversy about the potential atherogenicity of plant sterols
Sabine Baumgartner

Parenting practices related to children’s snack intake
Dorus Gevers

Personalised nutrition; An integrated analysis of opportunities and challenges
Cyril Marsaux

Please treat again later! Fine-tuning treatment-timing in type 2 diabetes mellitus
Jan Hansen

Preservation of metabolic flexibility by acetyl carnitine formation
Yvonne Bruls

Mathijs Drummen

Prevention of diabetes through lifestyle intervention: Effects in children
Ike Dorenbos

Prevention of obesity in childhood
Manon Ernst

Process and impact evaluation of the ‘gezonde slagkracht’ programme
Kimberly Grêaux

Regulating muscle mitochondrial capacity in type 2 diabetes, the large potential of small microRNA inhibitors
Dennis Dahlmans

Relation between thermo-physiology and behavioural control of body temperature
Hannah Pallubinsky

Relevance of vascular function markers
Peter Joris
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<tbody>
<tr>
<td>Role of resveratrol in prevention of type 2 diabetes</td>
<td>Marlies Ligt</td>
</tr>
<tr>
<td>Specifying fatty acid composition of myocellular lipid droplets by microscopy</td>
<td>Anne Gemmink</td>
</tr>
<tr>
<td>Surgical treatment of morbid obesity in adolescents</td>
<td>Givan Paulus</td>
</tr>
<tr>
<td>Tailoring an existing lifestyle intervention to reduce metabolic syndrome in individuals with low SES from different ethnic origins</td>
<td>Dorit Teuscher</td>
</tr>
<tr>
<td>The might of microRNA in muscle mitochondrial metabolism</td>
<td>Alexandre Houzelle</td>
</tr>
<tr>
<td>The prevention of anastomotic leakage and adhesions after colorectal surgery</td>
<td>Anne-Claire Bosmans</td>
</tr>
<tr>
<td>The search for the ileal mesh: New materials in hernia surgery</td>
<td>Ruben Vogels</td>
</tr>
<tr>
<td>The significance of brown adipose tissue and muscle thermogenesis for development of obesity</td>
<td>Maarten Vosselman</td>
</tr>
<tr>
<td>Thermogene ingredients</td>
<td>Pilou Janssens</td>
</tr>
<tr>
<td>Vascular function and comorbidity in subjects with diabetes</td>
<td>Thomas van Sloten</td>
</tr>
<tr>
<td>What does a diabetic patient ‘need;’ to eat healthy, exercise and to stop smoking</td>
<td>Robin van Lieshout</td>
</tr>
</tbody>
</table>
Research line 2 ‘Gut-liver homeostasis’

Research line leader: Prof. Dr. A.A Masclee, Professor of Internal Medicine, in particular Digestive Diseases; Department of Internal Medicine, section Gastroenterology
Co-Research Line Leader: Dr. S.W.M. Olde Damink; Department of Surgery

Tenured faculty: Scientists
Department of Anatomy & Embryology
Dr. S.E. Köhler

Department of Genetics & Cell Biology
Dr. R. Shiri-Sverdlov

Department of Internal Medicine
Prof. Dr. A.A.M. Masclee, Professor of Internal Medicine in particular Digestive Diseases
Dr. J.M. Conchillo
Dr. D.M.A.E. Jonkers
Dr. G.H. Koek
Dr. M.J. Pierik
Dr. F.J. Troost

Department of Medical Microbiology
Dr. J. Penders

Department of Paediatrics
Dr. A.C.E. Vreugdenhil
Dr. D.A. van Waardenburg

Department of Surgery
Prof. Dr. C.G.M.I. Baeten, Professor of Colorectal Surgery
Prof. G. Beets, Professor of Surgical Oncology
Prof. Dr. C.H.C. Dejong, Professor of HepatoPancreatoBiliary Surgery
Dr. K. Lenaerts
Dr. S.W.M. Olde Damink
Dr. M. Poeze
Dr. S.S.M. Rensen
Dr. F. Schaap
D. S. Xanthouleas

Tenured research support staff
Department of Genetics and Cell Biology
P. van Gorp

Department of Internal Medicine
M.A.M. Hesselink – van der Kruijs
M. Elizalde Vialta
B.T.C. Boonen

Department of Surgery
B.T.C. Boonen
Dr. H.M.H. van Eijk
M. Hadfoune
Programme 1: Gut-liver metabolism
Research in programme 1 with respect to gut liver metabolism is focused on inter-organ adaptive responses to alleviate compromised liver function under conditions of stress, obesity, metabolic syndrome, liver failure, and systemic insults (sepsis, ischaemia). A close interaction between clinicians and basic researchers in RL2 has resulted in a truly translational approach and setting with 1) excellent surgical models (major liver surgery, resections) for metabolic studies 2) focus on obesity and metabolic syndrome, Non Alcoholic Fatty Liver Disease (NAFLD) and Non Alcoholic SteatoHepatitis (NASH) in cooperation with surgical clinics for bariatric surgery) and 3) animal models for liver regeneration and NASH, allowing us to explore it’s underlying molecular mechanisms. In NASH cholesterol metabolism in Kuppfer cells is a focus and collaboration with groups working on atherosclerosis has been established (CARIM). Disturbances in the enterohepatic circulation (EHC) are another central theme in which research focuses on the role of bile salt signalling in the aforementioned disorders.

Programme 2: Intestinal integrity and defence
Research in programme 2 focuses on barrier (dys) function in the gastrointestinal tract, innate immune defence, luminal factors (microbiota, nutrients, chemicals), the neuro-endocrine-immune system and gut brain axis in health and disease. Since the start of RL2 in 2008 we have focussed research on intestinal integrity and defence on specific disease entities within the Maastricht UMC+ with clinical expertise at academic level patient care. Intestinal homeostasis is studied in several preclinical human and animal models in which disruption of intestinal integrity is central, such as intestinal ischemia-reperfusion, intestinal hypo perfusion, food deprivation, parenteral nutrition and obesity. Population based, well phenotyped cohorts form the basis of programme 2. These cohorts consist of: a) IBD (chronic inflammatory bowel diseases), a population based cohort of 6000 patients from the South Limburg region (biobank n=2000, research data base coupled to EPD (Electronic Patient Dossiers)) b) IBS (Irritable Bowel Syndrome) cohort of 600 well phenotyped patients with 300 controls (biobank, patient data) and c) colonic polyps cohort (n=10.000; GROW, collaboration with NUTRIM for sec prevention (diet, lifestyle)) d) patients with NAFLD and NASH (cohort started in 2014) These population based well phenotyped cohorts allow research with focus on interaction between chronic disease, inflammation, lifestyle and diet, metabolism, (epi) genetics and malignant transformation.
<table>
<thead>
<tr>
<th>Title of research</th>
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<tbody>
<tr>
<td>Alterations during gut Ischemia/Reperfusion</td>
<td>Dirk Schellekens</td>
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<tr>
<td>Arginase: Effector or bystander molecule in asthma?</td>
<td>Roy Cloots</td>
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<tr>
<td>Bile salt toxicity and hepatic regeneration in the small liver remnant after partial hepatectomy</td>
<td>Kim van Mierlo</td>
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<tr>
<td>Decreased arginine de novo synthesis as cause of multiple organ failure during sepsis: mechanistic studies in experimental and human sepsis</td>
<td>Nina Wijnands-Kentgens</td>
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<tr>
<td>Diet and disease activity in patients with Inflammatory Bowel Disease</td>
<td>Corinne Spooren</td>
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<tr>
<td>Disease mechanisms and markers for non-alcoholic steatohepatitis in a population with non-alcoholic fatty liver disease</td>
<td>Pauline Verhaegh</td>
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<td>Does AMPK alter cholesterol trafficking to inhibit hepatic inflammation?</td>
<td>Jieyi Li</td>
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<tr>
<td>Effect of the probiotic LCS on symptoms, visceral sensitivity and faecal flora in patients with IBS</td>
<td>Annemieke Thijissen</td>
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<tr>
<td>Effects of nutritional intervention on gut health and metabolic function in health and obesity</td>
<td>Bouke Salden</td>
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<tr>
<td>Epidemiology and risk factors of microscopic colitis</td>
<td>Bas Verhaeg</td>
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<tr>
<td>Exploring new targets in the prevention and treatment of human intestinal ischemia/reperfusion injury</td>
<td>Marin de Jong</td>
</tr>
<tr>
<td>Integrated care for inflammatory bowel disease patients in the Netherlands with the novel telemedicine tool myIBDcoach: a randomized controlled trial</td>
<td>Kostan Reisinger</td>
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<tr>
<td>Intestinal cell damage, inflammation and wound healing in major gastrointestinal surgery</td>
<td>Wout Mares</td>
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<tr>
<td>Intestinal flora and innate immunity in IBD and after pouch surgery</td>
<td>Danyta Tedjo</td>
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<tr>
<td>Intestinal microbiota in IBD</td>
<td>Evelien Neis</td>
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<tr>
<td>Inventory of human SCFA metabolism and microbiota</td>
<td>Lisa Vork</td>
</tr>
<tr>
<td>Irritable Bowel Syndrome: Assessment of Individual symptom patterns</td>
<td>Tom Houben</td>
</tr>
<tr>
<td>Lysosomes in metabolic inflammation</td>
<td>Tine Comhair</td>
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<tr>
<td>Metabolic and signalling pathways in steatosis and steato hepatitis</td>
<td>Liliane Mpabanzi</td>
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<tr>
<td>Modulation of ammoniagenesis in patients with hepatic encephalopathy</td>
<td>Ragier de Ridder</td>
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<tr>
<td>NASH : exploring the gut-liver axis</td>
<td>Tim Hendrikx</td>
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<tr>
<td>Non-alcoholic fatty acid disease</td>
<td>Alexander Bodelier</td>
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<tr>
<td>Novel and non-alcoholic makers of disease activity in inflammatory bowel diseases</td>
<td>Mike Jeurissen</td>
</tr>
<tr>
<td>Novel diagnosis and treatment options for non-alcoholic steatohepatitis</td>
<td>David van Dijk</td>
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<tr>
<td>Novel insights in pancreatic cancer cachexia</td>
<td>Mark van Avesaat</td>
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<tr>
<td>Nutrient sensing in the gut with emphasis on the role of the enteric nervous system</td>
<td>Ruben Visschers</td>
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<tr>
<td>Optimisation of the treatment of patients with an enteroctaneous fistula</td>
<td>Zsa Zsa Weerts</td>
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<tr>
<td>The role of the farnesoid X receptor in the development of intestinal and liver damage</td>
<td>Kiran Koelfst</td>
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<tr>
<td>Pathophysiology of Irritable Bowel Syndrome - Involvement of nociceptive processing</td>
<td>Steven Jeuring</td>
</tr>
<tr>
<td>Perturbed enterohepatic circulation and signalling of bile salts; pathological role in liver disease and therapeutical options</td>
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</table>
Title of research
Phenotypic characterization, visceral perception and intestinal permeability in IBS
Preventing progression of burn depth (and enhancing wound healing) by supplementation of pharmaco-nutrients in a mice cutaneous burn wound model
Prevention of diabetes through lifestyle intervention: Effects in children
Quality and safety of colonoscopy
Remnant liver function and volume assessment in resectional liver surgery
Role of arginine in B-cell development
Role of bone metabolism and perfusion in the development of fracture non-union
Short-chain fatty acid administration and its influence on insulin sensitivity and obesity
The effect of a high-protein diet on fatty liver
The effect of pulmonary inflammation on protein turnover and their regulatory processes in skeletal muscle
The effects of pre- and probiotics on intestinal barrier function and immune function
The ORANGE II trial: An international multicentre randomised controlled trial of optimised recovery after left lateral hepatic sectionectomy:
Laparoscopic versus open surgery within an enhanced recovery programme
The ORANGE II-Trial: An international multicentre randomised controlled trial of optimised surgical recovery after left lateral hepatic sectionectomy: open versus laparoscopic surgery within an enhanced recovery ERAS® programme
The role of digestive enzymes and protease-activated receptor-2 in the pathophysiology of human intestinal ischemia-reperfusion and pancreatitis
The role of intestinal barrier function in liver cirrhosis
The role of oxidative stress in NASH
The role of the novel semi-synthetic flavonoid monoHER in the prevention of sinusoidal obstruction syndrome in patients undergoing oxaliplatin-based chemotherapy before partial liver resection
The secrets of interval colorectal cancers: biology or technology?
Towards a psycho-neuro-physiological model in irritable bowel syndrome
Usefulness of I-FABP in the diagnosis of celiac disease

PhD Student
Zlatan Mujagic
Kim Wehrens
Elke Dorenbos
Ankie Dirrix-Reumkens
Toine Lodewick
Selvakumari Sankaranarayanan
Dennis Meesters
Kirsten van der Beek
Sonia Garcia Caraballo
Chiel de Theije
Ellen Wilms
Simon Dello
Edgar Wong-Lun-Hing
Claire Leenarts
Kirsten Pijls
Sofie Walenbergh
Jinfang Zhao
Chantal le Clerq
P. van der Veek
Marlou Adriaanse
Fabienne Smeets
Martijn Arts

Research
Research line 3 ‘Chronic inflammatory disease and wasting’

Research line leader: Prof. L.J.C. van Loon, Professor of Exercise Physiology and Nutrition; Department of Movement Sciences
Co-Research Line Leader: Prof. J.P. Kooman, Professor of the Pathophysiology of Chronic Renal Failure; Department of Internal Medicine, section Nephrology

Tenured faculty: Scientists
Department of Health Promotion
Dr. A. Oenema

Department of Internal Medicine
Prof. Dr. J. Kooman, Professor of the Pathophysiology of Chronic Renal Failure
Dr. J.P.W. van den Bergh
Dr. M.H.L. Christiaans

Department of Medical Microbiology
Prof. Dr. P.H.M. Savelkoul, Professor of Medical Microbiology
Dr. F.R. Stassen
Dr. P.F.G. Wolffs

Department of Movement Sciences
Prof. Dr. L.J.C. van Loon, Professor of Exercise Physiology and Nutrition
Dr. K. Meijer
Dr. H.H.C.M. Savelberg
Dr. L.B. Verdijk

Department of Paediatrics
Prof. Dr. L.J.J. Zimmermann, Professor of Paediatrics
S. Straetemans
Dr. G. van Well

Department of Plastic Surgery
Prof. R.R. van der Hulst, Professor of Plastic, Reconstructive and Hand Surgery

Department of Respiratory Medicine
Prof. Dr. A.M.W.J. Schols, Professor of Nutrition and Metabolism in Chronic Diseases
Prof. Dr. E.F. Wouters, Professor of Pulmonology
Dr. H.R. Gosker
Dr. R.J.C. Langen
Dr. N. Reynaert

Department of Toxicology
Prof. Dr. A. Bast, Professor of Human Toxicology
Dr. G.R.M.M. Haenen
Dr. G. Hageman
Dr. G.J. den Hartog
Dr. A. Weseler

Tenured faculty: Support staff
Department of Medical Microbiology
M.L. Boumans
C.C. Driessen
G.E.L.M. Grauls

Department of Movement Sciences
P.J.B. Willems
A.H.G. Zorenc

Department of Respiratory Medicine
E. Ten Hoor - Groot
M.C.J.M. Kelders
Ch. de Theije

Department of Toxicology
R.J.A. Bartholomé
M.J.H.J. Reijnders-Dritty
Research

Programme 1: Host-defence and metabolic networks
This programme focuses on the study of innate immunological processes in relation to a variety of environmental exposures like smoke, inorganic dust, particulate matter and bacterial and viral organisms in stable conditions and during exacerbations of COPD. Moreover, understanding of the cellular and molecular redox-regulating mechanisms in inflammation is important to design anti-oxidant strategies for the treatment of various inflammatory disease conditions, with relevance also beyond COPD. More insight into these mechanisms may also aid in the prevention or treatment of muscle wasting, as well as other systemic complications in chronic diseases and cancer cachexia. Research on oxidant-anti-oxidant balances in local and systemic compartments forms an important topic in this programme.

Programme 2: Skeletal muscle weakness in ageing and disease
Skeletal muscle tissue exhibits a remarkable plasticity in response to the environment. Questions concerning the control, reversibility, and functional consequences of adaptive modifications of muscle architecture are key domains of the research of programme 2. Programme 2 covers the broad spectrum of disturbances in energy and substrate metabolism to molecular mechanisms and modulation of muscle protein synthesis, breakdown and regeneration, translating into phenotypic alterations in muscle structure and function as well as body composition. In addition, the role of shared pathophysiological mechanisms, such as inflammation and oxidative stress, in the pathogenesis of systemic complications of ageing and chronic organ diseases are studied in a translational manner. Moreover, the assessment of physical (in)activity and performance in both health and disease forms an important line of research.

Whereas a significant part of this programme is dedicated to studying ageing in healthy subjects, the most important disease studied in this programme is COPD. COPD is a highly prevalent chronic disease that can serve as a model for understanding systemic consequences of other chronic diseases, such as chronic kidney disease, type 2 diabetes, rheumatoid arthritis and heart failure. It becomes increasingly clear that shared underlying mechanisms can be identified in the pathogenesis of systemic complications of different chronic diseases, which are in itself models of premature ageing. The interaction between investigators focusing on muscle metabolism and body composition phenotypes in healthy ageing and those focusing on chronic diseases in this RL provides ample opportunity for identification of underlying mechanisms for muscle wasting and abnormalities in body composition such as seen in cachexia, sarcopenia or sarcopenic obesity. This may facilitate the design of innovative treatment strategies supporting more healthy ageing, even in those patients with chronic organ diseases. In addition to chronic organ diseases, cancer cachexia represents an important model of acute muscle wasting. The study of the pathophysiology and phenotyping of the most important wasting conditions encountered in clinical practice in this RL guarantees considerable societal impact. Recently, the programme has been further strengthened by including the study of bone disorders in ageing and chronic disease, applying state-of-the-art diagnostic techniques. The study of the musculoskeletal interaction provides more insight into the pathogenesis and diagnosis of systemic complications of chronic disease.
### List of ongoing PhD Studies in 2014

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<thead>
<tr>
<th>Title of research</th>
<th>PhD Student</th>
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<tbody>
<tr>
<td>Adaptation profile to optimize interaction between user and arm orthosis (ADAPT)</td>
<td>Hans Essers</td>
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<td>A-footprint</td>
<td>Michiel Oosterwaal</td>
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<tr>
<td>Ambulatory monitoring of knee loading during ADL, towards personalized treatment</td>
<td>Ruud Gransier</td>
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<td>and rehabilitation strategies for knee osteoarthritis patients</td>
<td>Bregje van de Wier</td>
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<td>Antioxidants in NASH</td>
<td>Joost de Jong</td>
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<td>Assessment of fracture healing and bone strength by high-resolution peripheral</td>
<td>Kristin Jonvik</td>
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<td>quantitative computer tomography (HRpQCT)</td>
<td>Kristien Lemmens</td>
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<td>Beet-ing your competitors; Dietary nitrate to enhance sports performance</td>
<td>Robert Mann</td>
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<td>Bioactivity of flavonoid metabolites</td>
<td>Karin Sanders</td>
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<td>Biomechanical Determinants of Injury Risk in Long-distance Running</td>
<td>Lowie Vanfleteren</td>
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<td>Cachexia in COPD and lung cancer</td>
<td>Rasanne Beijers</td>
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<td>Cardiovascular aspects in COPD patients</td>
<td>Marika Leenders</td>
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<td>Centraal vet en perifere spier: partners in crime in COPD</td>
<td>Coby van de Boal</td>
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<td>Clinical benefits of nutritional intervention in the elderly</td>
<td>Anouk Vaes</td>
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<td>Clinical outcome of nutritional rehabilitation on physical functioning and</td>
<td>Jessie Meis</td>
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<td>cardiometabolic risk profile in COPD patients with muscle atrophy</td>
<td>Sarah Mount</td>
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<td>Daily physical activity levels in COPD</td>
<td>Ana Stoïkova</td>
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<td>Determinants of long-term maintenance of intervention-induced lifestyle changes</td>
<td>Brenda Berendsen</td>
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<td>in chronically ill patients</td>
<td>Marloeu Dirks</td>
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<td>Development of the M2Health Index</td>
<td>Irene Eurlings</td>
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<td>Education and integrated care in advanced COPD</td>
<td>Todor Krastev</td>
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<td>Effectiveness and cost-effectiveness of package 3 of the BeweegKuur, a lifestyle</td>
<td>Andrea Scharmga</td>
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<td>intervention for people with an overweight related health risk</td>
<td>Mayke van Dort</td>
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<tr>
<td>Electrostimulation of skeletal muscle tissue to prevent muscle atrophy</td>
<td>Willem Gosens</td>
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<tr>
<td>Epithelial cell plasticity and alveolar wall remodelling in COPD</td>
<td>Birke Benedikter</td>
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<td>Evaluatie van de nieuwe borstconstructietechniek Autologe Vettransplantatie (AFT)</td>
<td>Gill ten Hoorn</td>
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<td>Evaluation of bone erosions in rheumatoid arthritis and osteoarthritis by</td>
<td>Paul Peeters</td>
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<td>high-resolution peripheral quantitative computer tomography (HRpQCT) compared to</td>
<td>Timothy Perkins</td>
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<td>standard imaging techniques</td>
<td>Herman Ijzerman</td>
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<td>Evaluation of the interaction between COPD and the presence of vertebral</td>
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<td>fractures, bone strength and thoracic spine deformities in the ECLIPSE study</td>
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<td>Exercise programs and physical activity in COPD</td>
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<td>Exosomes derived from the airway epithelium - Immune regulators with a role in</td>
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<td>COPD?</td>
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<td>Focus on resistance: an innovative, resistance-based intervention to improve</td>
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<td>body composition and to promote physical activity in</td>
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<td>adolescents (12-18 years) with overweight or obesity</td>
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<td>Gene profiling of LPS-a benzoapyrene coated crystalline silica in lung epithelial</td>
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<td>cells and fibroblast</td>
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<td>Gene profiling of the response of bronchial epithelial cells to particles</td>
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<tr>
<td>Improving mobility in diabetic patients through resistance training</td>
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</tbody>
</table>
Title of research
Inter-individual susceptibility for viral and/or bacterial respiratory infections in humans
Interrupting sitting time improves insulin sensitivity and lipid metabolism in people with diabetes mellitus type 2
Investigating obesity as adjuvant on (extra-) pulmonary immunity in lung disease: grave consequences?
Liraglutide with or without NEAT in type 2 diabetes mellitus: Effects on HbA1c, weight, blood pressure, quality of life and health care costs
Long distance effective utilitarian biking
Lower limb muscle function in COPD (Eclipse)
Make or break’ skeletal muscle: regulation of muscle plasticity by GSK-3b
Micro-architecture of hand joints in rheumatic diseases
MicroRNAs: critical modulators of the innate antiviral immune response in COPD exacerbations
Fluorescence imaging in abdominal surgery
Muscle health and function; Clinical nutrition
Muscle health and function; Sports nutrition
Muscle mass preservation
Musculoskeletal properties and fractures in patients with diabetes mellitus type 2.
Neuropsychological functioning in COPD
Nocturnal protein supply during sleep as a dietary strategy to improve muscle mass in elderly
Nutrition, medicine and health: claims and regulations
On measuring bone quality in fracture healing
Optimizing muscle protein synthesis in sports and healthy ageing.
Personalized multi body modelling
Physical activity and ADL in patients with COPD and/or CHF
Prospective evaluation of bone strength, physical activity, falls, subsequent fractures and mortality in patients presenting with a recent clinical fracture
Regulation of muscle oxidative phenotype by hypoxia in COPD
Sports nutrition and exercise metabolism
Subclinical phenotypical alterations in early chronic kidney disease
Survival of the weakest: the origin of atrophying species in COPD
Systemic effects and comorbidity in COPD are associated with markers of accelerated ageing
The effect of pulmonary inflammation on protein turnover and their regulatory processes in skeletal muscle.
The effects of physical activity and prolonged sitting on physical fitness and functioning
The impact of the macronutrient composition of a nutritional supplement on postprandial skeletal muscle protein synthesis in elderly
The negative effects of food supplements on elderly
The patient with a recent fracture, secondary osteoporosis and metabolic Bone Diseases (SECOB) and the Fracture Liaison Service
The prospects of vertebral and non-vertebral fractures

PhD Student
Charlotte Volgers
Bernard Duvivier
Niki Ubags
Dirk van Moorsel
Harry Haenen
Linda Veld op ‘t
Nicky Pansters
Michiel Peters
Carla Bellinghausen
Jacqueline van den Bos
Jeroen van der Velde
Jean Nyakayiru
Remy Martens
Judith Ceelen
Poornima Gopal
Chiel de Theije
Jeroen van der Velde
Irenefleur Kramer
Misha Vrolijk
Sandrine Bours
Robert van der Velde
Title of research
The role of anti-oxidants and the compliment system in the pathophysiology of ischemia reperfusion injury in patients with breast reconstruction
The role of autophagy and satellite cell function in skeletal muscle plasticity
The role of JNK kinases and the Keap1/Nrf2 system in antioxidant mechanisms involved in drug induced liver injury.
From the experimental evidence up to the clinical level
The role of mitophagy in the loss of oxidative capacity in chronic disease
Transitions in dialysis: A survey on the effects of dialysis and transplantation on cardiovascular and nutritional state, physical activity and quality of life
Walking stability and efficiency in COPD patients

PhD Student
Marieke van den Heuvel
Anita Kneppers
Miguel Zoubek Aranda
Pieter Leermakers
Natascha Broers
Wai-Yan Liu
Research line 4 ‘Gene-environment interactions’

Research line leader: Prof. Dr. F.J. van Schooten, Professor of Genetic Toxicology; Department of Pharmacology and Toxicology
Co-Research Line Leader: Prof. M.P.A. Zeegers, Professor of Complex Genetics; Department of Genetics & Cell Biology, section Complex Genetics

Tenured faculty: Scientists
Department of Bioinformatics
Prof. C. Evelo, Professor of Bioinformatics for Integrative Systems Biology
Dr. S.L.M. Coort
Dr. L.M.T. Eijssen
Dr. E. Willighagen
Department of Clinical Chemistry
Prof. Dr. M. Dieijen-Visser, Professor of Clinical Chemistry
Dr. D. de Boer
Dr. D. de Boer
Dr. P.P.C.A. Menheere
Dr. K.H. Wodzig
Department of Genetics & Cell Biology
Prof. Dr. M.P.A. Zeegers, Professor of Complex Genetics
Dr. M.J.F. Gielen
Department of Human Biology
Prof. Dr. E.C. Mariman, Professor of Functional Genetics
Dr. J.W. Renes
Department of Pharmacology & Toxicology
Prof. Dr. F.J. van Schooten, Professor of Genetic Toxicology
Prof. Dr. W. Passchier, Hon. Professor of Risk Analysis
Dr. A. Boots
Dr. J.W. Dallinga
Dr. R. L. Godschalk
Dr. C. Neef

Tenured faculty: Support staff
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N. da Silva Nunes
Department of Human Biology
F.G. Bouwman
Department of Toxicology
L.M. Maas
E.J.C. Moonen
D.M.F.A. Pachen
M.J. Reijnders-Dritty

Research
Research
The major research area within research line Gene-environment Interactions is the combined effects of dietary and toxic (among other environmental) exposures and genetic background on chronic diseases. The research fits within the strategic programme of the Faculty Health Medicine and Life Sciences (FHML) and the Maastricht University Medical Centre+ (MUMC+) in which prevention of disease and quality of life is an important focus. The programme focuses on environment-diet-gene interactions in its basic and applied research into common chronic disorders. Traditionally, diseases of interest are inflammatory lung and bowel disease, metabolic syndrome, and cancer. The aim is to deliver internationally competitive translational research leading to prevention strategies in populations and improved treatment and disease management. The programme’s objective is to develop and validate novel biological markers, environmental or behavioural factors that can help to determine pathological processes, with the aim to obtain early indicators to guide treatment or to protect health by adjusting diet. More recently nutrigenomics research is more focussed on health in which health is not just defined as the ‘absence of disease’, or ‘a state of complete wellbeing [WHO definition 1948]’ but more in terms of ‘resilience’, as ‘the ability to adapt and to self-manage, in the face of social, physical, and emotional challenges’.

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<td>Adipogenic capacity as a mediator of weight gain</td>
<td>Stefan Camps</td>
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<tr>
<td>An adipocyte-driven mechanism for weight regain</td>
<td>Nadia Roumans</td>
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<tr>
<td>An adipocytes-driven mechanism for weight regain after weight loss: the yo-yo effect</td>
<td>Roel Vink</td>
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<tr>
<td>Cellular and molecular aspects of weight regulation: The adipose tissue</td>
<td>Freek Bouwman</td>
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<tr>
<td>Connecting the worlds of semantic web and network biology</td>
<td>Elisa Cirillo</td>
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<tr>
<td>Development of high throughput toxicogenomics-based in vitro screens for rapid prediction of toxicity class</td>
<td>Sandra Janssen</td>
</tr>
<tr>
<td>Emerging role for autophagy in human adipocyte lipid metabolism and metabolic diseases like type II diabetes</td>
<td>Qing Xu</td>
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<td>Flux visualization</td>
<td>Anvesha Dutta</td>
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<td>HealthPotential: Unlock your secret to a healthy life</td>
<td>Kelly Stewart</td>
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<tr>
<td>Identify markers of direct immunotoxicity using in vitro human cell models</td>
<td>Jia Shao</td>
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<tr>
<td>In vitro and in vivo analysis of exhaled breath in lung diseases</td>
<td>Rianne Fijten</td>
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<tr>
<td>Pulmonary inflammation in DNA damage and repair</td>
<td>Quan Shi</td>
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<tr>
<td>Smoking and bladder cancer</td>
<td>Frits van Osch</td>
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<tr>
<td>Sound science: Selective citation in science based decision-making</td>
<td>Miriam Urlings</td>
</tr>
<tr>
<td>Sugar-treated tobaccos are important sources for the production of aldehydes in cigarette smoke, and make a significant but preventable contribution to health risk</td>
<td>Nuan Ping Cheah</td>
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<tr>
<td>The investigation of biological processes involved with Nano toxicology to improve safety assessment of new nanomaterials, using systems biology approaches</td>
<td>Bart Smeets</td>
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<tr>
<td>The role of diet on the recurrence and progression of bladder cancer</td>
<td>Sylvia Jochems</td>
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<tr>
<td>The role of Nox4 in the lethal progression of pulmonary fibrosis - implications for new therapy strategies</td>
<td>Carmen Veith</td>
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<tr>
<td>Topography of smoking and smoke components exposure as assessed by biomarkers in human smoking trials</td>
<td>Charlotte Pauwels</td>
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<tr>
<td>Twin research and environmental geocoding to unravel nature versus nurture</td>
<td>Esme Bijnens</td>
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<tr>
<td>Usability study of pathway analysis combined with other data interpretation methods</td>
<td>Martina Kutmon</td>
</tr>
<tr>
<td>Using metabolomic analysis of volatile organic compounds (VOCs) in breath as biomarkers for healthy and disturbed gut</td>
<td>Agnieszka Baranska</td>
</tr>
<tr>
<td>Vital role of essential fatty acids for pregnant women</td>
<td>Nikos Stratakis</td>
</tr>
</tbody>
</table>
NUTRIM Graduate Programme: a new tradition

The first interview is with the four members of the committee who are responsible for the annual selection of the laureates. The second interview features the four PhD students who were the first to receive the scholarship in 2013, which at the time was funded by NWO, the Netherlands Organisation for Scientific Research. In 2014 and 2015 NUTRIM has continued the programme with own scholarships.

Following an inspection of the quality of research and the programme track for master’s and PhD students, NUTRIM was awarded the prestigious NWO Graduate Programme grant. The four-person ‘GP committee’ then selected the first four laureates, who commenced their PhD in summer 2013. The most important difference to a normal PhD tracks is the tremendous freedom granted to the PhD student to write his or her own research plan, to choose his or her own supervisors and also the emphasis on interdisciplinary collaboration.

"Even though normal PhD students already receive plenty of opportunities in this area," stresses one committee member, “and you don’t yet know whether these people will turn out to be good researchers,” says another. The GP committee explains why NUTRIM is nonetheless happy to continue the programme.

Theoretically NUTRIM could have rested on its laurels after the award of the Graduate Programme grant by NWO. Once you’ve received the grant, as a school you aren’t eligible a second time and moreover it’s only after the PhD students have completed their tracks that you have a real picture of the programme’s ‘added value’. But the board saw it as a good beginning to a new tradition and so awarded several comparable scholarships in the following two years as well. Three-quarters of the money came from the programme’s own budget and a quarter was guaranteed by the PhD thesis supervisor. In this way, the PhD student’s salary is paid and he or she can apply on his or her own initiative for supplementary scholarships to cover other research costs.

The four members of the GP committee are sitting together at the table: Annemie Schols, Ronit Shiri-Sverdlov, Roger Godschalk and Harry Gosker. Coincidentally, the latter is also supervisor of one of the three PhD students who were awarded the scholarship in 2014. Only two of the three available scholarships were awarded in 2015 because there was no third candidate who met the criteria. Lowering the bar in order to fulfil the quota is not an option.

How do you select these PhD students?
Gosker: "There are three rounds. In the first round we chiefly look at the CV. Someone who has spent a while studying abroad, who has already written a paper or acquired a scholarship, for instance, will already have an advantage. Things like this show that someone is rising above the average." Godschalk: “In the second round, external assessors judge the quality of the research proposal and the committee looks at things like: does it fit in NUTRIM and is optimum use made of all expertise present in the school.” Sverdlov: "And the third round, the interview with the committee and a few other NUTRIM members, is very important as well. Then you can see whether someone has really come up with it all himself or herself, or whether it’s more the work of an intended PhD thesis supervisor.”

What distinguishes the laureates from normal PhD students?
Schols: "To begin with they have designed their own project, although we don’t yet know whether that will ultimately be an advantage or disadvantage. They are innovative projects and thus are vulnerable as well. The ultimate result of the PhD dissertation may turn out very differently than anticipated.” Gosker: "The expectation that they will collaborate on an interdisciplinary basis carries the risk of them biting off more than they can chew. And as a supervisor I notice that I approach such PhD students a little more reservedly than I do others, even though I think that self-reliance is important in every PhD track.”

Gosker: “Normal PhD students are encouraged to work together as well, of course, but these people already have more of an innate drive to do this. They are intrinsically motivated to carry out research.” Sverdlov: “Things seem to go more easily for them, especially at the start, because they begin the PhD track with more self-confidence.”

It almost sounds like an ideal form for all PhD tracks.
Schols: "You have to be realistic: not everyone has what it takes. You have all kinds of PhD students and I don’t even think it would work if you had only this type of PhD student in a research group. Someone who begins slowly and uncertainly can still become a successful researcher with good supervision. We put these PhD students on a pedestal to some extent, but they respond well to their special status. To give one example, this year they themselves organised the annual information meeting for new master’s students. And I think it’s great that some of the four from the first year’s selection have indeed applied for supplementary scholarships and are thus empowering themselves to carry out their research in an optimum way. These four are going to make it.”
Nonetheless, one female PhD student wonders whether she can combine a career in the scientific community with, say, a young family. Godschalk: “If you decide to go into science then you must indeed be prepared to relocate now and again.” Schols: “I think it’s a pity she has doubts, all the more so because the climate for women with children has improved considerably in the scientific community since the time when I had mine.” Sverdlov: “What I find ideal is that I can organise my own time and thus spend plenty of time with my four children. I can regularly pick them up from school and work in the evening or, if necessary, at night.” Schols: “It’s easier here than if you work for a company, for instance. And yes, you have to put in long hours as a scientific researcher, but then your work also feels like a kind of hobby. In that respect I find the combination of training as a medical specialist and scientific research more problematic. It would be a pity if Van Dijk and Koelfat, for instance, weren’t able to do any research during their years of specialisation. I regularly talk to the dean of the medical faculty here and at the hospital about this issue.”

What motivates NUTRIM to continue to invest in this programme?
Gosker: “You retain talented researchers at your school, or you attract them here.” Schols: “In principle the programme is open to external students as well, and in the future we can place a greater focus on this, for instance through the school network or the PIs. We have something to offer PhD students. As an institute we aim above all to facilitate researchers, in all kinds of ways. And we see this as a great instrument for getting researchers to work together, bottom up.”
Gosker: “And with a bit of luck you also retain these researchers in the future, too.” Sverdlov: “I expect that this will benefit the level of NUTRIM in the long term. And nonetheless the experience is still very valuable for people aiming to get the scholarship, but who narrowly fail to make it.” Schols: “I took on someone like that this year as a regular PhD student.”

How do you think things can be improved in the future?
Schols: “We hope to inspire other schools within the faculty to continue this programme. If this can be taken up across the faculty then the resulting collaboration will be even broader, between institutes as well. And to some extent we’re still searching for our role as committee after the laureates have been selected. We see them once a year and apart from that our door is always open to them. And so far there haven’t been any situations where we would have needed to intervene.” Godschalk: “Of course, the progress of a project lies primarily with the PhD thesis supervisor and the other supervisors. We’re more of a secondary sounding board.” Schols: “But we make sure that the groups with whom our PhD students collaborate also get the credit for this, for instance as co-supervision. To this end we also hold a discussion with the designated supervisors regarding the definitive award of the scholarship. After all, this is a different kind of trajectory than the regular one.” Sverdlov: “But all PhD students are given equal chances here.” Schols: “Absolutely. And moreover, it’s not a given that these people’s PhD theses will be better than those of other PhD students.” Sverdlov: “It’s mostly a question of talent and hard work. And luck, too…”

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Sverdlov:
“It’s mostly a question of talent and hard work. And luck, too…”
The first four NUTRIM-NWO Graduate School laureates
“A PhD research project is like a painting”

In 2013 they were the first four young researchers to receive a prestigious NUTRIM-NWO Graduate School grant. They are hoping to complete their research projects, which they are completely organising themselves, in two years from now. How are they doing and what have they learned so far?

According to the NWO website, the goal of the NWO Graduate Programme is to strengthen the PhD system by offering highly talented young researchers a PhD position at an outstanding research school. They write their own research proposal, which has better chances if it is based on an interdisciplinary approach, and they seek out their PhD thesis supervisor themselves. This formula appealed to the four researchers who stopped by for the interview this Friday morning.

Birke Benedikter: “I really wanted to get a doctoral degree, but not just anywhere. I have specific interests and there weren’t many existing projects that gelled with these. Two weeks before the decision on this scholarship was announced it turned out I had been accepted at another PhD location. But I said no to that, even though I had not yet received this scholarship. It was simply something I really wanted.” David van Dijk feels just the same: “I didn’t want to do just any old PhD research and had been exploring my options for more than a year. I was very interested in cachexia and the theme fits this grant perfectly, because the problem doesn’t play out just at the level of surgery. It’s a metabolic issue and so it’s a pretty obvious step for me to call on other expertise within NUTRIM. And now I’m more of my own boss, too: I myself chose what I wanted to research and how.” Jan Hansen adds: “I found it really important to create my own project, because it’s amazingly motivating to research what you’ve come up with yourself. Of course, your supervisor helps you to steer your course, but you define your own direction. You don’t have that position when you start a project where the professor already has a four-year plan ready for you.” Van Dijk: “If you’ve come up with it yourself, you know exactly why you’ve made certain choices and it’s easier to take on the steering role.” Kiran Koelfat: “I come from the north of the Netherlands and actually I wanted to go back there after my master’s, but then I got this chance to write a research proposal. This subject was very new here and the environment is outstanding for the work. NUTRIM is a leader in the field of metabolism, so I decided to keep going here. And this is a good place for translating things to the level of the patient. That’s exactly what I wanted.”

“A PhD research project is like a painting: you have an image in your mind, but it turns out very differently, and you may even need to cut out some parts of the work because you can see it’s not going to work out.”

A big family
All four are working together successfully with various sections or departments within NUTRIM. Koelfat: “There’s a great willingness to collaborate, and that’s a nice thing about this big family.” Hansen: “There are many possibilities for studying the human metabolism, from mass spectrometry to the Metabolic Research Unit Maastricht (M-RUM), and of course the international network of professors.” Benedikter: “My research and David’s are now being linked up by someone from the latest group of laureates from the Graduate Programme.” Hansen: “Because our projects are highly innovative and specific they’re not so easy to connect. And precisely this innovation was an important criterion for this scholarship.”

About once a year the researchers meet with the supervisory committee who selected them at the beginning of the process. Then they discuss the progress of the projects and
The first four NUTRIM-NWO Graduate School laureates
they can also contact the committee if they experience any sticking points, for instance with a supervisor. But the chances of this are fairly small, as they themselves recognise, because they have chosen their supervisors themselves. “We knew who we would be working with,” says Benedikter. In addition, this year they organised a mini-symposium at which they presented their research and they bump into each other in the corridors from time to time. Koelfat: “We’re a group – it feels that way because we all started at the same time and in principle we’ll be finishing together as well. We support each other, although we don’t see each other every week.” This isn’t so much at the level of content; it is more about moral support. Koelfat chuckles: “Then, sighing, we say, ‘We’ve only got two years left!’”

Focus
And that brings the conversation to the lessons learned in the first two years. Koelfat: “At a certain point I wanted to do far too many projects at the same time, but then my supervisor said – and rightly so – ‘Focus’. You’ve only got four years and then you need to deliver a clear answer to a question.” Benedikter: “Your supervisor helps you keep your goals realistic.” Koelfat: “You’re a bit like a young cook who opens a restaurant and has chefs from various restaurants looking over his shoulder.”

Above all Benedikter has learned to deal with frustrations. “You often have a nice hypothesis and all the literature points in one direction; you feel sure that an experiment will deliver a certain result. But when you carry it out you get the opposite, or even worse, nothing happens at all, you become more realistic about what doing research really involves.” Hansen: “I see a PhD research project as being like a big painting. You paint and you think: ‘This is going to be really nice, it’ll be finished in four years and every detail fits perfectly.’ And gradually you see: the bit at the top right doesn’t fit completely yet and you do better to cut off the piece at the bottom left because it’s not going to work out. It’s a flexible work of art and you have to learn that it changes over time. It won’t turn out the way you imagined at the start.” Benedikter: “If an experiment doesn’t deliver what it’s supposed to, then it’s up to you to decide when to stop because otherwise it’ll cost you a year.” Van Dijk: “What’s very important for me is to achieve some success in the interim in order to keep going. Because my research is so broad I can always continue with something else if one area isn’t going so well. Above all, I’ve learned to think scientifically. I had already done a fair amount of research, but I’ve become more critical and I now set up my research more thoroughly. At congresses I’m much more critical about other research.

I now see basic mistakes in other people’s results that I didn’t notice before.” Hansen: “You start to feel a sense of responsibility. All the data you send out into the world will be examined by everyone and basically they assume that what you have published is correct. So you also become more critical of your own work.”

Looking ahead
After another two years, the four years will be over. Van Dijk recently had a long talk with his supervisor in which they discussed what has been achieved and what should be realistic to complete before the summer of 2017. “Then the scholarship will really be over, so it’s important to finish then.” Benedikter: “It’s hard to look ahead because you never know how things will go. In the first six months I didn’t look ahead at all, and then the next six months went faster than expected. Sometimes you spend months on something you thought you could complete within three weeks. But I assume that I’ll get it finished on time.” Koelfat: “A PhD is a process with ups and downs, and you spend most of the last year writing your papers. At the moment I’m still mostly busy collecting lots of samples.” Hansen: “After nine months I had to troubleshoot and remove a large part of my dataset, because unfortunately it didn’t produce anything. Oh well, that’s part of the work,” he laughs nonchalantly. Asked about this, he says: “I’ve got through the denial phase and now I’m in the acceptance phase. It would have been a nice cherry on the cake, but the study still stands.”

Permanent position
For two of the four the future is still not set in stone. Hansen: “I would like to continue doing research, and preferably in this field. I find the subject really interesting and I’ve already invested so much time in it that I’ve become part of the research community. But I don’t know whether this would be at a university or at a company.” Benedikter: “I enjoy doing research and would like to continue for another ten years. I also really like teaching, going to congresses and brainstorming with other scientists. The nice thing about this work is that you are constantly being encouraged to develop your abilities. But the research world is very uncertain, too. I would like to get a permanent position fairly soon, instead of having to move every two years - possibly with a young family - to another post-doc job.”

The ultimate role model for the two soon-to-be surgeons is Steven Olde Damink, who also combines work as a surgeon with a professorship, including a large laboratory and teaching tasks. Van Dijk: “I think that as a doctor you can easily bring research to the clinic
The first four NUTRIM-NWO Graduate School laureates

and vice versa, certainly if you’ve got a basic research background. Many clinics give their doctors time for scientific research, so you don’t have to do it all in your own time.” Koelfat: “Although Steven also devotes his day off to science.” Van Dijk: “Surgery is becoming ever more specialised: you need to do a minimum number of surgical procedures per year in order to be allowed to carry out a certain procedure, so if you decide to do more science, you have to be careful not to lose too much clinic time.” Koelfat: “Olde Damink is a role model because he seems to have found the balance between many different activities.”

• David van Dijk (1987) studied medicine and then worked for a year and a half as a resident in the intensive care unit and the surgery department at Atrium MC in Heerlen. In 2013 he was hired at the Surgery Department of the MUMC+ to write a research proposal. The NWO Graduate Programme appealed to him because it offers participants the chance (and encourages them) to work on an interdisciplinary basis. “I work with more sections and departments at NUTRIM than I can count. I consciously chose to do broad research because I want to learn as much as possible in these four years.” Van Dijk is researching the extreme loss of weight and muscle (cachexia) suffered by cancer patients, especially those with pancreatic cancer. He is investigating various points of departure that could explain this extreme cachexia: protein metabolism, bacteria in the intestine, malabsorption and the destruction of fat and muscle cells by tumour cells.

• Birke Benedikter (1989) works in the Medical Microbiology and Respiratory Medicine Departments where she researches extracellular vesicles in Chronic Obstructive Pulmonary Disease (COPD); vesicles are small membrane bubbles or blisters secreted by cells which, thanks to their content (proteins, RNA, lipids) can influence the behaviour of other cells. “It has been established that these vesicles contribute to processes of inflammation in the lung such as asthma and sarcoidosis, but little is known so far about their role in COPD.” Benedikter hopes to change this situation, for instance by using mass spectrometry. During her graduation internship in the Maastricht research master’s in Biomedical Sciences she already worked on a small research proposal while at the Department of Medical Microbiology. “I don’t like being told what I should research; I want to determine that myself. And that’s something that immediately appealed to me about this scholarship.”

• Jan Hansen (1986) also did the research master’s in Biomedical Sciences in Maastricht, after having attended the Excellence Bachelor’s Programme in Molecular Medicine in Germany and having worked as an analyst for a year and a half. During his graduation internship with Prof. Patrick Schrauwen he studied metabolic disruptions in diabetes sufferers. Now, as part of the Human Biology Department, he is investigating whether these disruptions are related to the biological clock and whether this interaction can cause obesity and type 2 diabetes. “Over the last hundred years this clock has had to deal with the changes in lifestyle, such as 24/7 lighting, more food and less exercise. If you force mice to eat during the inactive phase of the day, for instance, then they get fatter than the mice who receive the same calories in the active phase. I’m researching how the cell can use this clock to switch metabolic processes on and off as required. And which genes in that process can be related to target genes which we know are disrupted in obesity and type 2 diabetes.” He is working at both the cellular level and with human studies.

• Kiran Koelfat (1985) completed the four-year Doctor-Clinical Investigator (AKO) master’s in Maastricht: “I always wanted to be a doctor, but it was only through research activities during my bachelor’s that I also became interested in research.” The combination of clinical work and science is also reflected in his research subject. He is investigating the consequences of disrupted bile salt signalling for intestinal and liver function in patients with a perturbed enterohepatic cycle (the circulation of, among other things, bile salts between the intestine and the liver). Bile salts carry out important signalling function by activating nuclear and membrane-bound bile salt-sensing receptors present in both the small intestine and the liver. An interruption of this cycle causes intestinal and liver dysfunction, especially in patients with intestinal failure (short bowel and enterocutaneous fistulas). During his master’s internship he discovered in a surgical animal model of an interrupted enterohepatic cycle that the activation of a bile salt receptor prevents liver damage and reduces the loss of intestinal fluid. In his PhD research project he hopes to translate this knowledge to the level of the patient by testing the concept in a relevant patient population.
Awards and personal grants

Coby van den Bool
ESPEN (European Society for Clinical Nutrition & Metabolism) Research Fellowship 2014

Mariëtte Boon
ZonMW Rubicon Award for research ‘Becoming slimmer with fat’

Bram van den Borst
NRS (Netherlands Respiratory Society) Swierenga Thesis Award 2014

Christopher McCrum
Kootstra Talent Fellowship 2014 for talented PhD Student

Marlou Dirks
ECSS (European College of Sport Science) Young Investigators Award

Gijs Goossens
EFSD (European Foundation for the Study of Diabetes) - Novo Nordisk Rising Star Fellowship 2014

Jessica Gubbels
Veni Award for research ‘A bigger picture: applying the ecological perspective to childhood overweight’

Tim Hendrikx
Kootstra Talent Fellowship 2014 for talented Postdoc

Joris Hoeks
Vidi Award for research ‘The Might of MicroRNA in Muscle Mitochondrial Metabolism’

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Kootstra Talent Fellowship 2014 for talented Postdoc

Joris Hoeks
Vidi Award for research ‘The Might of MicroRNA in Muscle Mitochondrial Metabolism’

Kiran Koelfat
NVGE (Netherlands association for Gastro-Enterology) Gastrostart subsidy

Irenefleur Kramer / Martijn Poeze
OTC grant ‘Muscle atrophy in hip fractures’

Emmani Nascimento
DFN (Dutch Heart Foundation) - pilot grant

Michiel Oosterwaal
VvBN (Netherlands Society for Kinesiology) PhD Day Presentation Prize Human Movement Sciences

Wim Saris
Royal Honour: Prof. Saris was awarded a royal decoration at the occasion of his farewell lecture.

Prof. Saris was appointed Officer in the Order of Orange Nassau foto lintje oplepeld

Dirk Schellekens and Givan Paulus
Maastricht UMC+ Science Day Poster Award

Lisje Schellen
B.J. Max Prijs - TVVL Platform for Man and Technology

Rutger Schols
NVE (Dutch Association for Endoscopic Surgery) Innovation Prize

Esther Sleddens
NHS (Netherlands Heart Foundation) - Stipend Junior Postdoc

TIFN project team incl.
Joop Roels Impact Award ‘Validation of biomarkers’

Frederik-Jan van Schooten
Kootstra Talent Fellowship 2014 for talented PhD Student

Mireille Stijns
Unilever Research Prize 2014

Carmen Veith
Kootstra Talent Fellowship 2014 for talented PhD Student

Luuk de Wert
Kootstra Talent Fellowship 2014 for talented PhD Student
Resources and funding

Three types of funding are distinguished. Direct funding originates from the central means of the University as provided by the government. Research funds comprise funding (received in competition) from national science foundations and governmental organizations such as NWO, STW, and KNAW. Finally, NUTRIM has contracts with third parties for specific (contract) research activities (industry, EU programmes) and project funding by charities. This also includes to some extent (relatively small) income from licenses on intellectual property of the University and royalties in relation to marketing of related products. Every year a significant part of NUTRIM’s research programme is financially supported by external funding.

Funding 2014 at institutional level (in k€ and in % per year)

<table>
<thead>
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<th>Funding</th>
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<td>Research funds</td>
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<td>Contracts</td>
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<tr>
<td>Total</td>
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Input figures of scientific staff in fte as per 31 December 2014

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<th>Department</th>
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<td>0,20</td>
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<td>Pharmacology &amp; Toxicology</td>
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<td>6,83</td>
<td>5,45</td>
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</table>
**Output figures**

The total number of full articles published in (Social) Science Citation indexed Journals was 435. NUTRIM publications are in various scientific domains listed in the table on the right. The scores in the figure represent the average impact factor*) of NUTRIM-publications in a domain versus the average impact factor*) of the journals in the domain. The schedule below shows that the average impact factors*) of NUTRIM-publications all domains are higher than the average of each domain.

*) Impact factors of 2013

Apart from publications in SCI-SSCI indexed Journals, NUTRIM researchers published 99 publications in non-SCI-SSCI indexed journals, in national journals, as also book chapters, books and other professional output, 32 letters to editor / editorials in SCI-SSCI indexed Journals and 47 theses.

**Societal impact and relevance**

NUTRIM researchers are often in the news. They are interviewed for radio, television, newspapers, internet platforms, etc., in the Netherlands as well as abroad. They are also invited for lectures.

For an overview of media contacts in 2014 go to: http://www.maastrichtuniversity.nl/web/file?uuid=3c248d7b-ef91-472d-ba95-

**NOTE:** document in Dutch
**NUTRIM Top publications**

Percentage of NUTRIM publications in journals ranked Top 1 (top percentile), Top 10 (top decile) and Top 25 (top quartile) in corresponding domains:

<table>
<thead>
<tr>
<th></th>
<th>Top 1</th>
<th>Top 10</th>
<th>Top 25</th>
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<tr>
<td></td>
<td>3.4%</td>
<td>28.7%</td>
<td>66.2%</td>
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<tr>
<td>Average if:</td>
<td>13.967</td>
<td>7.181</td>
<td>5.227</td>
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<td>Highest if:</td>
<td>54.420</td>
<td>54.420</td>
<td>54.420</td>
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<tr>
<td>Lowest if:</td>
<td>2.927</td>
<td>1.944</td>
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For all NUTRIM 2014 publications go to:

[www.maastrichtuniversity.nl/web/institutes/fhml/nutrim/publications.htm](http://www.maastrichtuniversity.nl/web/institutes/fhml/nutrim/publications.htm)
<table>
<thead>
<tr>
<th>Support</th>
<th>Project leader</th>
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<tbody>
<tr>
<td>&gt; € 500,000</td>
<td>Willighagen E.</td>
<td>e-NanoMapper - A database and ontology framework for Nanomaterials design and safety assessment</td>
<td>EU</td>
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<tr>
<td></td>
<td>Schols A.M.</td>
<td>Sarcopenia and Physical Reality in older people: multi-component treatment strategies - SPRINTT</td>
<td>IMI</td>
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<td></td>
<td>Schols A.M.</td>
<td>Eat Well Beats Globesity</td>
<td>MUMC+</td>
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<td></td>
<td>Loon van L.J.C.</td>
<td>Active aging</td>
<td>TI Food and Nutrition</td>
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<tr>
<td></td>
<td>Hoeks J.</td>
<td>Defining the best dairy protein to facilitate post-exercise muscle protein synthesis</td>
<td>Industry</td>
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<td></td>
<td>Schols A.M.W.J.</td>
<td>The Might of MicroRNA in Muscle Mitochondrial Metabolism / Vidi</td>
<td>ZonMw</td>
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<tr>
<td>€ 200,000 - € 500,000</td>
<td>Bast A.</td>
<td>Risk communication</td>
<td>the Netherlands Food and Consumer Product Safety Authority</td>
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<td></td>
<td>Bergh van den J.P.W.</td>
<td>Various research projects on metabolic bone diseases, biomechanics and osteoporosis</td>
<td>Weijerhorst Foundation</td>
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<tr>
<td></td>
<td>Blaak E.</td>
<td>Effect of prebiotic fibres on intestinal Health and Functioning</td>
<td>TIFN</td>
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<td></td>
<td>Derikx J.</td>
<td>The role of digestive enzymes and protease-activated receptor-2 in the pathophysiology of human intestinal ischemia-reperfusion and pancreatitis</td>
<td>Dutch Digestive Foundation</td>
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<td></td>
<td>Gubbels J.S.</td>
<td>A bigger picture: applying the ecological perspective to childhood overweight</td>
<td>NWO Social Sciences</td>
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<td></td>
<td>Kremers S.P.J.</td>
<td>The context of childhood overweight: How parenting contributes to energy balance</td>
<td>Dutch Heart Foundation</td>
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<td></td>
<td>Kremer S.P.J.</td>
<td>Life style coach</td>
<td>CZ Insurance Company</td>
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<td></td>
<td>Marken Lichtenbelt van W.D.</td>
<td>Towards real energy performance and control by predicting monitoring, comparing and controlling</td>
<td>RVO-NL</td>
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<td></td>
<td>Schols A.M.W.J.</td>
<td>Synergy between Experimental research and Medical excellence to outweigh Cancer Cachexia</td>
<td>Maastricht UMC+</td>
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<td></td>
<td>Schooten F.J.</td>
<td>Topography of smoking and smoke components exposure as assessed by biomarkers in human smoking trials</td>
<td>RIVM</td>
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<td></td>
<td>Schrauwen P.</td>
<td>Metabolic flexibility</td>
<td>Industry</td>
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<td></td>
<td>Schrauwen P.</td>
<td>Metabolic Homeostasis and mental and physical fatigue</td>
<td>Industry</td>
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<td></td>
<td>Zeegers M.P.A.</td>
<td>Sound Science: Selective citation in science based decision-making</td>
<td>CEFIC</td>
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<tr>
<td>€ 100,000 - € 200,000</td>
<td>Blaak E.</td>
<td>MIRDIE: Molecular biomarkers of food intake</td>
<td>ZonMw</td>
</tr>
<tr>
<td></td>
<td>Bouvy N.D.</td>
<td>New strategies to prevent anastomotic leakage after colorectal surgery</td>
<td>azM</td>
</tr>
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<td></td>
<td>Keszthelyi D.</td>
<td>Research into visceral pain perception with high resolution fMRI</td>
<td>Sint Annadal Foundation</td>
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<tr>
<td></td>
<td>Mariman E.</td>
<td>Lipid screening in (bio)materials by mass spectrometry</td>
<td>ET</td>
</tr>
<tr>
<td></td>
<td>Masclee A.A.M.</td>
<td>Gastrointestinal Health / Barrier and Immune</td>
<td>TI Food and Nutrition</td>
</tr>
<tr>
<td></td>
<td>Meijer K.</td>
<td>ADAPT. Adaptation profile to optimise interaction between user and arm orthosis</td>
<td>STW</td>
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</tbody>
</table>
### List of research projects started in 2014

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Title of Research Project</th>
</tr>
</thead>
<tbody>
<tr>
<td>Savelberg H.H.C.M.</td>
<td>SIT LESS3: The effect of low intensity physical activity on insulin sensitivity, mood and cognitive performance</td>
</tr>
<tr>
<td>Schols A.M.W.J. / Remels A.</td>
<td>Inactivation of GSK-3β: A breath of fresh air in the regulation of skeletal muscle oxidative phenotype</td>
</tr>
<tr>
<td>Zeegers M.P.A.</td>
<td>Diet, smoking and surviving bladder cancer: the Bladder Cancer Prognosis Programme</td>
</tr>
<tr>
<td>Zeegers M.P.A.</td>
<td>Sound Science: Determinants of protocol provision, quality and concordance, an application within the research of phthalates</td>
</tr>
</tbody>
</table>

**Support < € 100,000**

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Title of Research Project</th>
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</thead>
<tbody>
<tr>
<td>Blaak E.E.</td>
<td>Targeting adipose tissue oxygen tension to improve insulin sensitivity in humans</td>
</tr>
<tr>
<td>Brouns F.J.P.H.</td>
<td>Building European governance on overweight and obesity: political, legal and scientific perspectives</td>
</tr>
<tr>
<td>Keszthelyi D.</td>
<td>EMS Pain measurement in IBS</td>
</tr>
<tr>
<td>Kooman J.P.</td>
<td>New methods for detoxification of blood: opening pathways to easier, safer, smaller and ultimately portable artificial kidney systems</td>
</tr>
<tr>
<td>Marken Lichtenbelt van W.D. / Boon M.</td>
<td>Becoming slimmer with fat</td>
</tr>
<tr>
<td>Meijer K.</td>
<td>Active Health</td>
</tr>
<tr>
<td>Meijer K.</td>
<td>MOTEK: CAREN: Computer-assisted environment movement system ('Flight simulator') - 0,3 fte. technician support salary (L1 News item 14 October – in Dutch)</td>
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</table>

http://www.mumc.nl/actueel/mumc-tv/3854451821001-flight-simulator-voor-maastricht-umc

<table>
<thead>
<tr>
<th>Researcher</th>
<th>Title of Research Project</th>
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</thead>
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<tr>
<td>Mensink R.P.</td>
<td>Food Biomarkers Alliance</td>
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<tr>
<td>Olde Damink S.W.M.</td>
<td>Molecular profiling by imaging massa spectrometry &amp; development of temperature controlled sample sprayer</td>
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<tr>
<td>Pierik M.J.</td>
<td>Integrated care for inflammatory bowel disease patients in the Netherlands with the novel telemedicine tool myIBDcoach: a randomized controlled trial</td>
</tr>
<tr>
<td>Poeze M. / I. Kramer</td>
<td>Diagnostic and prognostic biomarkers for inflammatory bowel disease</td>
</tr>
<tr>
<td>Savelberg H.H.C.M.</td>
<td>Muscle atrophy in hip fractures</td>
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<tr>
<td>Savelberg H.H.C.M.</td>
<td>Improving the cost-effectiveness of therapeutic shoes for diabetic patients with a previous foot ulcer using an in-shoe pressure device</td>
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<tr>
<td>Schaap F.G.</td>
<td>Effect of sitting less on glucose regulation in type 2 diabetes patients</td>
</tr>
<tr>
<td>Schols A.M.W.J.</td>
<td>Effect of rifampicin on bile salt secretion; a PET-CT study in volunteers as prelude towards treatment of post-resectional secretory liver failure</td>
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<tr>
<td>Schrauwen P.</td>
<td>Nitrates supplementation to improve metabolic efficiency and enhance exercise training in patients with COPD</td>
</tr>
<tr>
<td>Sverdlov R.</td>
<td>Enhanced glucose clearance via bone morphogenetic protein 9 (BMP9) mediated activation of human brown adipose tissue metabolism in type 2 diabetes</td>
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<tr>
<td>Zeegers M.P.A.</td>
<td>Evaluation and validation of cathepsins as a biomarker for NASH</td>
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<td>Zeegers M.P.A.</td>
<td>Nutritional influence in early life and cognitive development of adolescents: the Maastricht Essential Fatty Acid Birth Cohort (MEFAB)</td>
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**Industry**

- Lung Fund
- NUTRIM
- ECPI

**Lung Fund**

- NUTRIM
- ECPI
**Thesis defences and careers of finished PhD Students**

In 2014 the unprecedented number of 47 theses was delivered. All PhD Students found jobs.

### Employment after thesis defence:

<table>
<thead>
<tr>
<th>Working in a scientific (and or clinical) setting in The Netherlands</th>
<th>Working in a scientific (and or clinical setting) setting abroad</th>
<th>Working in a non-scientific setting in The Netherlands</th>
<th>Working in a non-scientific setting abroad</th>
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<td>86%</td>
<td>19%</td>
<td>11%</td>
<td>4%</td>
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### Elhaseen Elamin
**Present occupation:** Postdoc at Maastricht University, NUTRIM, Department of Internal Medicine  
**Supervisor:** Prof. Dr. A.A. Masclee  
**Thesis defence:** 23 January  
**Title:** Ethanol and intestinal barrier: human intervention and mechanistic in vitro studies  
The main goals of the studies described in this thesis were to evaluate effects of moderate ethanol intake on small and large intestinal permeability in humans, and to study effects of ethanol and its metabolites including acetaldehyde and fatty acid ethyl esters (FAEEs) on intestinal epithelial barrier function, aiming to elucidate possible mechanisms in vivo and in vitro. The studies described in this thesis support the rationale for investigating effects of moderate ethanol intake and its oxidative and non-oxidative metabolites on intestinal epithelium. Although results were obtained in vitro, this thesis shows beneficial effects for the products of non-digestible fermentable dietary fibres SCFAs as preventive tools against ethanol-related barrier dysfunction. Studies addressing effects of moderate ethanol consumption and its metabolites including acetaldehyde and FAEEs on intestinal barrier and the protective factors are critically important in the investigations toward the search of preventive and therapeutic strategies for ALD.

### Anja Rosenow
**Present occupation:** Analytical Development Specialist at Genzyme, Antwerp Area, Belgium  
**Supervisors:** Prof. Dr. E.C.M. Mariman, Dr. J.W. Renes  
**Thesis defence:** 7 February  
**Title:** Identification and regulation of (novel) human adipokines: a proteomic approach

### Sanne Gerards
**Present occupation:** Postdoc at Maastricht University, NUTRIM, Department of Health Promotion  
**Supervisors:** Prof. Dr. N.K. de Vries, Prof. Dr. S.P.J. Kremers, Prof. Dr. P.C. Dagnelie  
**Thesis defence:** 12 February  
**Title:** Childhood obesity prevention; Rationale, implementation and effectiveness of the Lifestyle Triple P intervention  
This PhD research shows that parents play an important role in the development of childhood obesity. Parents of obese children are often unaware of their child’s overweight, and they experience more problems raising their children. Children who are raised with both strict and involved styles eat healthier, are more physically active and weigh less. Furthermore, an intervention to prevent further weight gain in obese children (Lifestyle Triple P) was evaluated. This intervention is based on the Positive Pedagogic Programme (Triple P) and is aimed at parents of obese children aged 4-8 years. Half of the 86 families participating received the intervention, which included group sessions and individual sessions by telephone addressing three themes: parenting, nutrition and physical exercise. The control group only received brochures on these themes. Although the intervention showed positive effects on both children and parents’ behaviour, such as soft drink consumption, it proved to be ineffective in reducing further weight gain.

### Madhu Katika
**Present occupation:** Senior Scientist at Twente University, The Netherlands  
**Supervisors:** Prof. Dr. A.A. Masclee, Prof. Dr. R. Stockbrügger, Dr. D. Jonkers  
**Thesis defence:** 12 February  
**Title:** Application of toxicogenomics to study direct immunotoxicants

### Caroline Khalid - de Bakker
**Present occupation:** Resident at Spitalzentrum Biel, Switzerland  
**Supervisors:** Prof. Dr. A.A. Masclee, Prof. Dr. R. Stockbrügger, Dr. D. Jonkers  
**Thesis defence:** 12 February  
**Title:** ‘Screening modalities for colorectal cancer: Results from a workplace based cohort in the Netherlands’  
Population screening by means of the faecal occult blood test (FOBT) was launched in the Netherlands in January 2014, making colorectal cancer screening a highly topical subject. Early detection of tumours and their pre-stages
(intestinal polyps) by means of the faecal test and colonoscopy can dramatically reduce the incidence and mortality of colorectal cancer. In the Netherlands, 2400 lives could be saved. This dissertation investigates the feasibility and diagnostic benefits of screening via colonoscopy in a defined population group. It also evaluates alternative screening methods, such as an immunological FOBT (FIT), lifestyle/risk factors and sigmoidoscopy. Further, faeces and blood were collected to identify and evaluate non-invasive markers for adenomas and/or colorectal cancer, as it is important to minimise patient discomfort and stress during examinations as far as possible.

Jennifer Ather

Present occupation: Lab Manager at the Department of Medicine, University of Vermont, USA

Supervisors: Prof. Dr. E.F. Wouters, Dr. Y. Janssen-Heininger, University of Vermont, USA

Thesis defence: 13 February

Title: The epithelial-dendritic cell interface in pulmonary disease

Asthma affects millions of people worldwide, and the incidence of this multi-faceted syndrome continues to rise. This thesis investigates the role of airway epithelial cells, which first encounter inhaled particles and pathogens, in the modulation of immune cell activities. The results demonstrate that specific airway epithelial signalling molecules orchestrate the downstream responses of innate and adaptive immune cells, thereby regulating pulmonary inflammation, the development of allergic asthma, and even the response to corticosteroids, a common treatment for asthma. This suggests that manipulation of a single cell type in the lung could have multiple effects for the control of pulmonary disease.

Elisabeth Romme

Present occupation: Staff member of Ciro Horn

Supervisors: Prof. Dr. E.F.M. Wouters, Prof. Dr. F.W.J. Smeenk (Catharina Hospital Eindhoven), Dr. E. Rutten (Ciro Horn)

Thesis defence: 20 February

Title: Bone imaging and strength in chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) is a lung disease predominantly caused by smoking. COPD patients often suffer from osteoporosis and arteriosclerosis. This PhD dissertation describes a new method for the assessment of osteoporosis on chest computed tomography. Chest computed tomography is also used to assess arteriosclerosis. The study results show a relation between osteoporosis and arteriosclerosis. They also show that arteriosclerosis is an accurate predictor of death. This thesis finds that chest computed tomography provides information not only on pulmonary disorders, but also on non-pulmonary disorders, such as osteoporosis and arteriosclerosis.

Anke van Summeren

Present occupation: Project Engineer Basic Research at Estee Lauder Companies, Liège Area, Belgium

Supervisors: Prof. Dr. E. Mariman, Prof. Dr. J. Kleinjans, Dr. J. Renes

Thesis defence: 12 March

Title: Proteomics investigations; Towards mechanisms and biomarkers for drug-induced hepatotoxicity

Darren Booi

Present occupation: Plastic Surgeon at Orbis Medical Centre, Sittard and at Clinic Valkenhorst, Valkenburg a/d Geul

Supervisor: Prof. Dr. R.R.W.J. van der Hulst

Thesis defence: 14 March

Title: Partial flap loss and fat necrosis in autologous breast reconstruction

Stefania Tuinder

Present occupation: Staff member of Maastricht UMC+, Department of Plastic Surgery

Supervisors: Prof. Dr. R.R. van der Hulst, Dr. D.A. Lataster

Thesis defence: 14 March

Title: Anatomical, radiological and clinical findings on perforator flaps

Pieter Hoogland

Present occupation: Medical doctor at the Department of Surgery, Zuijderland Medical Centre, Heerlen

Supervisor: Prof. Dr. L.W.E. van Heurn

Thesis defence: 28 March

Title: Kidney transplantation form donors after cardiac death

Maurice Sillen

Present occupation: Physiotherapist / Project leader at Ciro Horn

Supervisors: Prof. Dr. E.F. Wouters, Dr. M.A. Spruit, Dr. F. Fransen (CIRO+BV Horn)

Thesis defence: 10 April

Title: Neuromuscular electrical stimulation in dyspneic COPD patients: a new training modality
This PhD dissertation focuses on neuromuscular electrical stimulation (NMES) and muscle strength training used as training forms for patients with chronic obstructive pulmonary disease (COPD) characterised by severe shortness of breath and muscle weakness. The effects of two different forms of NMES (high-frequency, HF-NMES and low-frequency, LF-NMES) and muscle strength training are compared with each other. In total, 120 subjects participated in this study. There was an increase in maximum muscle strength in patients in the HF-NMES group and the muscle strength training group, whereas there was no increase in the LF-NMES group. Endurance and quality of life increased in all groups. Moreover, these forms of muscle training have a minimal impact on these patients' respiratory system.

Menno Slingerland
Present occupation: Teacher at Fontys Sport-Hogeschool, Maastricht
Supervisors: Prof. Dr. M.K.C. Hesselink, Dr. L. Borghouts (Fontys Hogeschool / University Eindhoven)
Thesis defence: 16 April
Title: Physical education's contribution to levels of physical activity in children and adolescents
Physical education can play a potentially important role in stimulating children and adolescents to exercise more. Children spend a large part of their youths at school, where physical education is compulsory. This study shows that physical education is responsible for roughly one-third of the daily exercise requirements and that teachers could intensify this relatively easily, thereby leading to a higher contribution. An important objective of physical education is to motivate students to continue exercising throughout their lives. This dissertation proves that, as it is being offered now, physical education does not necessarily achieve this.

Marjet Munsters
Present occupation: Start-up Clinical Research Associate at PPD (Research & Development in health and nutrition), Bennekom, The Netherlands
Supervisor: Prof. Dr. W.H.M. Saris
Thesis defence: 17 April
Title: Dietary strategies to modulate the metabolic profile and substrate partitioning

Jeroen Heemskerk
Present occupation: Gastro-intestinal, Laparoscopic Surgeon at Laurentius Hospital, Roermond
Supervisors: Prof. Dr. C.G.M.I. Baeten, Prof. Dr. N. Bouvy
Thesis defence: 16 May
Title: Robot-assisted laparoscopic surgery
Laparoscopic surgery is designed to be minimally invasive for patients to ensure a faster recovery time. These surgeries, however, can be technically challenging. A surgical robot was therefore developed to assist the surgeon during the operation. This study tested a daVinci robot in Maastricht. The use of a surgical robot in a laboratory (test) setting led to faster and more precise suturing, among other things. Its use in the operating room, however, was less beneficial: the robot was expensive and slow and did not lead to a better surgical outcome. For now, it seems that the daVinci robot offers little added value in a surgical setting.

Celine op den Kamp
Present occupation: Resident General Practition at Maastricht UMC+
Supervisors: Prof. Dr. A.M.W.J. Schols, Dr. A.C. Dingemans, Dr. R. Langen
Thesis defence: 16 May
Title: Cachexia in patients with non-small cell lung cancer
Cancer cachexia is a paraneoplastic feature that frequently occurs in patients with non-small cell lung cancer (NSCLC). Progressive body weight loss and disproportionate wasting of skeletal muscle are the most distinct characteristics of the syndrome. The presence of cancer cachexia is associated with major negative consequences, i.e. low tolerance and responsiveness to anti-tumour therapy, decreased muscle performance, declined quality of life and a significant increase in cancer-related mortality. Currently, no effective therapeutic intervention can prevent or reverse these negative consequences of cancer cachexia. Although studies in experimental cancer cachexia have increased our understanding on putative molecular mechanisms that lie at the basis of cancer cachexia, most of these findings remain to be validated in the different stages of cancer cachexia in the clinical setting. The current dissertation provides a comprehensive characterization of phenotypic aspects and molecular signatures of muscle atrophy involved in progressive stages of cachexia in patients with non-small cell lung cancer (NSCLC).
**Fahad Gulraiz**  
**Present occupation:** Postdoc at Maastricht UMC+, Department of Medical Microbiology  
**Supervisors:** Prof. Dr. C.A. Bruggeman, Dr. F. Stassen  
**Thesis defence:** 22 May  
**Title:** Exogenous interferons for the prevention of respiratory viral infections: Evaluation of different aspects in vitro

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**Bas van Bussel**  
**Present occupation:** Resident Internal Medicine at Maastricht UMC+  
**Supervisors:** Prof. Dr C.D.A. Stehouwer, Dr. C.G. Schalkwijk, Dr. R.M.A. Henry  
**Thesis defence:** 28 May  
**Title:** Endothelial dysfunction and low-grade inflammation: determined by diet and cause of arterial stiffness  
A healthy diet prevents cardiovascular disease from developing. Endothelium, a thin layer of cells lining the interior surface of blood vessels, plays an important role in the development of cardiovascular disease. This PhD dissertation investigates young, old, healthy and sick populations, and shows that a healthy daily diet (rich in fish, fruit, vegetables, low-fat dairy products and with moderate alcohol consumption) keeps endothelium “healthy”. This thesis, therefore, provides insight into the relation between diet and the development of cardiovascular disease and reveals the role of endothelium in particular.

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**Max Moalin**  
**Present occupation:** Teacher at Zuyd Hogeschool / University, Heerlen, The Netherlands  
**Supervisors:** Prof. Dr. A. Bast, Dr. G.R.M. Haenen, Dr. G.P.F. Strijdonck (Zuyd HS)  
**Thesis defence:** 11 June  
**Title:** Quercetin and its methylated metabolites: the chemical basis of activity

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**Jan-Willem van Dijk**  
**Present occupation:** Teacher at HAN University, Nijmegen, The Netherlands  
**Supervisor:** Prof. Dr. L.J.C. van Loon  
**Thesis defence:** 5 June  
**Title:** Exercise strategies to optimize glycaemic control in type 2 diabetes  
This dissertation describes a series of experiments aimed at evaluating the modulatory effect of different exercise characteristics on glycaemic control. The volume of exercise (or exercise dose) is postulated as the main factor driving the subsequent improvements in glycaemic control. The other exercise characteristics, including the type, intensity, duration, and frequency of exercise, can be used to tailor exercise programs to the needs and capabilities of the individual patient with type 2 diabetes. In addition to structured exercise, also non-exercise physical activities, such as activities of daily living, are shown to be effective in improving glycaemic control. The novel information described in this dissertation can be used to optimize exercise therapy in the prevention and treatment of type 2 diabetes.

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**Matthew Randall**  
**Present occupation:** Postdoctoral Associate at the University of Vermont, College of Medicine, Burlington, Vermont  
**Supervisors:** Prof. Dr. A. Bast, Dr. G.R.M. Haenen, Dr. A. van der Vliet (Un. of Vermont)  
**Thesis defence:** 25 June  
**Title:** The selective toxicity of acrolein  
Acrolein, as an exogenous pollutant found in cigarette smoke, is commonly associated with cigarette smoke-related diseases. To design more efficacious therapeutics for this set of diseases we must understand how acrolein affects cellular physiology and manifested pathological conditions. The aim of this research was to further identify a role for acrolein in pathophysiology of cigarette smoke-related lung disease. In this thesis we identified that: (1) Acrolein not only directly promotes pro-inflammatory gene expression but also, indirectly via inhibition of glucocorticoid signalling; (2) Thioredoxin reductase alkylation by acrolein has a direct impact on the activation of mitogen activated protein kinases (MAPKs); (3) The ability for our cells to adapt to environmental toxins (such as acrolein) demonstrates their dynamic nature and flexibility; and (4) Protein alkylation by acrolein may reflect a reversible signalling mechanism rather than irreversible protein damage. Researchers are now challenged with rethinking how thiol-reactive compounds affect proteins and cell signalling pathways as well as how potential repair mechanisms and adaptation influence disease pathogenesis.

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**Bob Touwslager**  
**Present occupation:** Resident Paediatrics at Maastricht UMC+  
**Supervisors:** Prof. Dr. L.J.I. Zimmermann, Prof. Dr. C.D.A. Stehouwer, Dr. A.L.M. Mulder, Dr. M. Gielen  
**Thesis defence:** 27 June  
**Title:** Short- and long-term cardiometabolic consequences of infant growth: size matters  
In this thesis, the ‘developmental origins of health and disease’ hypothesis is studied in healthy term children from birth to the age of two years in the context of endothelial function.
It was shown that accelerated growth is associated with impairment of endothelial function. This is supportive of a possible harmful role for accelerated infant growth in the development of later cardiometabolic diseases. Second, in a series of twin studies, the determinants and heritability of early growth were studied. In these twins the role of genetic and environmental factors in the associations between early life factors and later cardiometabolic diseases was furthermore examined in detail.

**Eline van Ewijk**  
**Present occupation:** Postdoc at Maastricht University, NUTRIM, Department of Human Biology  
**Supervisors:** Prof. Dr. P. Schrauwen, Dr. V. Schrauwen-Hinderling, Dr. E. Kooi  
**Thesis defence:** 1 July  
**Title:** Magnetic resonance imaging and spectroscopy: a non-invasive window into lipotoxicity

In obese people, fat also accumulates in non-adipose tissues (ectopic fat accumulation). This could cause adverse effects (lipotoxicity), which could play an important role in the development of chronic diseases, such as diabetes. This dissertation researched the relationship between ectopic fat accumulation, mitochondrial function in the heart and liver, and cardiac function using non-invasive magnetic resonance techniques (MR). We explain the complicated relationship between ectopic fat accumulation, mitochondrial function and organ function, which depend on the organ itself and the time the measurement is performed.

**Els de Smet**  
**Present occupation:** Quality Control at Sharp Packaging Solutions, Antwerp, Belgium  
**Supervisors:** Prof. Dr. J. Plat, Prof. Dr. R.P. Mensink  
**Thesis defence:** 2 July  
**Title:** Plant stanol esters: focus on intestinal lipoprotein metabolism

Plant sterols and stanols are natural food ingredients found in plants. It was already shown in 1950 that they lower serum low-density lipoprotein cholesterol (LDL-C) concentrations. Meta-analysis has reported that a daily intake of 2.5 g plant sterols/stanols reduced serum LDL-C concentrations up to 10%. Despite many studies, the underlying mechanism remains to be elucidated. Therefore, the proposed mechanisms that have been presented over the past decades will be described and discussed in the context of the current knowledge. In the early days, it was suggested that plant sterols/stanols compete with intestinal cholesterol for incorporation into mixed micelles as well as into chylomicrons. Next, the focus shifted toward cellular processes. In particular, a role for sterol transporters localized in the membranes of enterocytes was suggested. All these processes ultimately lowered intestinal cholesterol absorption. More recently, the existence of a direct secretion of cholesterol from the circulation into the intestinal lumen was described. First results in animal studies suggested that plant sterols/stanols activate this pathway, which also explains the increased faecal neutral sterol content and as such could explain the cholesterol-lowering activity of plant sterols/stanols.

**Mariëlle Bouwens**  
**Present occupation:** Resident Gastroenterology at Maastricht UMC+  
**Supervisors:** Prof. Dr. A. Masclee Dr. S. Sanduleanou  
**Thesis defence:** 4 July  
**Title:** The serrated lesion: endoscopic characterization and clinical implications

Colonoscopies may be used to detect and remove colon polyps, therefore preventing polyps with malignant characteristics from developing into colon cancer. This thesis shows that some of the ‘serrated polyps’, although previously considered to be benign polyps, do have the potential to develop into colon cancer. This thesis describes the endoscopic characteristics of and risk factors associated with serrated polyps in order to allow these polyps to be accurately identified. Furthermore, gastroenterologists carrying out endoscopies are found to be able to differentiate benign from malignant polyps in an accurate and correct way when examining the colon. In the long term, this may prove to be cost effective as it will no longer be necessary for pathologists to evaluate all polyps as is the case at present.

**Celien Vreuls**  
**Present occupation:** Pathologist at Amphia Ziekenhuis, Breda, The Netherlands  
**Supervisors:** Prof. C.H.C. Dejong, Dr. A. Driessen, Dr. G. Koek, Prof. S. Olde Damink  
**Thesis defence:** 4 July  
**Title:** Sinusoidal obstruction syndrome: a multidisciplinary approach
Christina Bosetti  
**Present occupation:** Researcher at Istituto di Ricerche Farmacologiche ‘Mario Negri’, Milan, Italy  
**Supervisors:** Prof. Dr. M.P.A. Zeegers, Dr. C. La Vecchia, Istituto di Ricerche Farmacologiche ‘Mario Negri’  
**Thesis defence:** 3 September  
**Title:** Epidemiology of pancreatic cancer: a global approach

Samefko Ludidi  
**Present occupation:** Scientific Health Consultant at Health by Science Company and at Maxima Medical Centre, Veldhoven, The Netherlands  
**Supervisors:** Prof. Dr. A.A. Masclee, Dr. D. Jonkers, Dr. J. Conchillo  
**Thesis defence:** 3 September  
**Title:** Clinical aspects of irritable bowel syndrome, with a special focus on visceral hypersensitivity and intestinal permeability

Charlotte de Jonge  
**Present occupation:** Surgical Resident at Zuijderland Medical Centre, Sittard  
**Supervisors:** Prof. Dr. W.A. Buurman, Prof. Dr. N. Bouvy, Prof. Dr. J.W. Greve (Atrium), Dr. S.S. Rensen  
**Thesis defence:** 5 September  
**Title:** Endoscopic treatment of obesity and metabolic disorder; Basic and clinical studies on the effect of the Duodenal-Jejunal Bypass Liner

Ronald van Dam  
**Present occupation:** Consultant / HPB Surgeon at Maastricht UMC+, Liver, pancreatic and minimal invasive surgery  
**Supervisors:** Prof. Dr. C.H.C. Dejong, Prof. Dr. S.W. Olde Damink  
**Thesis defence:** 12 September  
**Title:** Clinical optimization in liver surgery

Susan Keino  
**Present occupation:** Nutrition Educator at Moi University, School of Public Health, Kenya  
**Supervisors:** Prof. Dr. H.W. van den Borne Dr. G. Plasqui  
**Thesis defence:** 1 October  
**Title:** The double burden of malnutrition: A study of food security, physical activity and nutritional status among women and children in Narok Country, Kenya

Jochen Raimann  
**Present occupation:** Senior Principal Scientist at Renal Research Institute, New York  
**Supervisors:** Prof. Dr. J. Kooman, Prof. Dr. P. Kotanko, New York Prof. Dr. N. Levin, New York, Dr. F. van der Sande  
**Thesis defence:** 2 October  
**Title:** Clinical relevance of dialysate constituents in haemodialysis treatment: Focus on sodium and glucose

For patients suffering from renal failure renal replacement therapy by means of dialysis is a life-saving procedure. Despite technological progress since the development of the first artificial kidney by Willem Kolff in the early 1940s in the Netherlands, outcomes in this population remain poor. Dialysate constituents do possibly affect outcomes and agreement on adequate prescription of dialysate composition is needed. Including reports of prospective and retrospective research this thesis aims to investigate the relationship between the dialysis prescription of glucose and sodium on various outcomes, and the value of longitudinal observation of serum sodium concentrations and blood pressure.
Thesis defences and careers of finished PhD Students

Bianca van Bree
Present occupation: Scientist at the R&D Department of Pharming Group N.V. Leiden, The Netherlands
Supervisors: Prof. Dr. P. Schrauwen, Prof. Dr. M.K.C. Hesselink, Dr. J. Hoeks
Thesis defence: 17 October
Title: Mitochondria, lipotoxicity and skeletal muscle metabolism: Implications for type 2 diabetes mellitus

Daniel Keszthelyi
Present occupation: Resident Internal Medicine at Maastricht UMC+
Supervisors: Prof. Dr. A. Masclee, Dr. F.J. Troost
Thesis defence: 23 October
Title: The intestinal barrier function: An integrative approach to understanding gastrointestinal pathophysiology
This thesis investigated the (patho)physiology of intestinal barrier function. Previous studies indicate that an impairment of the intestinal barrier appears to play a key role in the development of several diseases. In this thesis, we investigated specific aspects of intestinal barrier function, with particular emphasis on irritable bowel syndrome (IBS) and microscopic colitis.
In particular, we were interested in the possible role of serotonin in the regulation of the barrier function and its relation to visceral hypersensitivity. In this thesis, we showed that increased serotonergic metabolism after oral administration of the serotonin precursor, 5-hydroxytryptophan (5-HTP), resulted in increased visceral perception, and induced an increase in intestinal mucosal barrier function in healthy individuals. We hypothesized that this reaction takes place in the context of a protective reflex to prevent the uptake of harmful substances into the lamina propria. In IBS patients, we saw an increased nociceptive and metabolic response to 5-HTP, without a reinforcement of the intestinal barrier. Failure to reinforce barrier function in response to potentially noxious stimuli, signalled through serotonin, may therefore represent an important pathophysiological mechanism in IBS and, in particular, visceral hypersensitivity.

Milan Geybels
Present occupation: Postdoc at Fred Hutchinson Cancer Research Centre, Seattle, USA
Supervisors: Prof. Dr. F.J. van Schooten, Prof. Dr. P.A. van den Brandt, Dr. B.A.J. Verhage
Thesis defence: 29 October
Title: Advanced prostate cancer risk, selenium, and oxidative stress: The role of genetic variation and environment

Mariëlle Coolsen
Present occupation: Resident Surgeon at Maastricht UMC+
Supervisors: Prof. Dr. C.H.C. Dejong, Prof. Dr. S. Olde Damink
Thesis defence: 31 October
Title: Enhanced perioperative care in liver and pancreatic surgery
This research aims to improve patient care after liver or pancreas surgery. An evidence-based accelerated recovery programme (Enhanced Recovery After Surgery, ERAS) was developed, implemented and evaluated; it reduces the stress reaction after such a procedure and accelerates the recovery, with no additional disadvantages. It appears that such a protocol indeed shortens the length of stay in hospital following surgery, without additional complications. However, following the protocol is more difficult when complications occur. Patients and health care providers appeared positive about such a protocol, however they found a functional recovery more important than a quick discharge from hospital.

Steven Vanhoutvin
Present occupation: Clinical Projects Manager at Antoni van Leeuwenhoek Hospital (NKI) Amsterdam, The Netherlands
Supervisors: Prof. A.A. Masclee, Prof. Dr. R.J. Brummer, Dr. F. Troost, Dr. D.M.A. Jonkers
Thesis defence: 6 November
Title: The colorectal response to butyrate in health and IBS

Wim van den Hof
Present occupation: Postdoc at Maastricht University, Department of Toxicogenomics
Supervisors: Prof. Dr. J. Kleinjans, Dr. K. Wodzig
Thesis defence: 19 November
Title: In vitro Toxicogenomics; unravelling the Mechanisms Underlying Drug-Induced Hepatotoxicity
Although the current screening of new drugs relies heavily on animal testing, drugs considered to be safe based on the results of animal tests often turn out to be toxic to humans. The liver, which is the primary site of drug degradation and elimination, is particularly vulnerable to damage caused by drugs. The results of this study show that alternative methods instead of animal tests can be used to distinguish hepatotoxic from non-hepatotoxic substances. Furthermore, it is shown that more relevant information about underlying mechanisms of drug-induced hepatotoxicity can be obtained by combining several research techniques.
Danielle Boesten  
**Present occupation:** Teacher Applied Science at Fontys Hogeschool / University, Maastricht  
**Supervisors:** Prof. Dr. A. Bast, Dr. G.J. den Hartog  
**Thesis defence:** 1 December  
**Title:** Polyols and polyphenols against glucotoxicity  
This thesis shows that certain food substances can have therapeutic implications for patients suffering from diabetes. One of the substances we studied is erythritol, a naturally-occurring substance which is present in small amounts in some fruits as well as beer and wine. It is shown that erythritol protects blood vessel cells (the lining of our vascular system) and beta cells (cells which produce insulin) against harmful effects of glucose. The substances we studied often had several small effects which together produced a large positive effect on cells. This is beneficial in the management of chronic diseases, because a ‘gentle’ approach is preferable to a ‘harsh’ approach in which a blow is struck, as is often the case with drugs.

Marlon Jetten  
**Present occupation:** Postdoc at Maastricht UMC+, Department of Toxicogenomics  
**Supervisor:** Prof. Dr. J. Kleinjans  
**Thesis defence:** 5 December  
**Title:** Toxicogenomics responses in the in vitro liver; A view on human inter individual variation  
Toxicity for humans often is falsely predicted based on animal tests, possibly amongst others due to human inter individual variation. Human-based alternative screening methods are scarce. The liver, a primary site for toxicity, is a candidate for a human-based alternative model for safety screening. The aim of this study is to evaluate human inter individual variation in several liver-based in vitro cell models. The results show that these models indeed can be used to evaluate inter individual variation, especially when several research techniques are combined. Possibly these models can be used to relieve the burden on animal-testing in the future.

Erik Ruijters  
**Present occupation:** Product Development Manager at MagnaMedics Diagnostics BV, Maastricht  
**Supervisors:** Prof. Dr. A. Bast, Dr. G.R.M.M. Haenen, Dr. A.R. Weseler  
**Thesis defence:** 9 December  
**Title:** Health benefits of (-) - Epicatechin and other flavonoids  
Flavonoids are substances found in various food products. This study focusses on flavonols, a subgroup of the flavonoid family. Tea and cacao contain relatively high concentrations of one of these flavonols, epicatechin. The antioxidant and anti-inflammatory effects of epicatechin can have important implications for chronic inflammatory diseases such as rheumatoid arthritis, chronicenteritis, asthma and COPD. Our study results also show that flavonols have a positive effect on vascular health. During an eight-week period of flavonol intake from grape seeds vascular function in test subjects improved and blood markers of oxidative stress and inflammation were reduced. In addition, our findings suggest that epicatechin and other flavonoids counteract the effects of anti-inflammatory drugs. Therefore, it is conceivable that both will be prescribed simultaneously in the future.

Lieke Raaijmakers  
**Present occupation:** Researcher at IVO Institute for lifestyle and addiction  
**Supervisors:** Prof. Dr. N.K. de Vries, Prof. Dr. S.P.J. Kremers  
**Thesis defence:** 10 December  
**Title:** Diabetes care and the introduction of a new standard in the Netherlands; A closer look from the perspectives of health care professionals and patients  
This thesis shows that the introduction of the Care Standard for diabetes (supported by the National Diabetes Action Programme) has made a positive contribution to the improvement of care given to patients suffering from diabetes in the Netherlands. The National Diabetes Action Programme has resulted in the implementation of the Care Standard for diabetes into the Dutch health care. Studies on patients suffering from diabetes show that support of autonomy and strategies designed to improve perceived patient competencies are important factors in future interventions aimed at the improvement of self-management and quality of life. In the future, an integrated multidisciplinary patient-focused approach to chronic diseases is needed.

Eveline Martens  
**Present occupation:** Project Leader Clinical Studies at the Dutch Kidney Foundation, The Netherlands  
**Supervisors:** Prof. Dr. M. Westerterp-Plantenga, Prof. Dr. R.D. Mattes (Purdue Un. US)  
**Thesis defence:** 11 December  
**Title:** Interaction of dietary protein with energy balance  
This thesis studied the effects high-protein and low-protein diets have on food intake and energy consumption. In the laboratory restaurant, test subjects had daily low-protein, normal-protein or high-protein meals, each taken for
twelve days. They spontaneously ate less during high-protein meals than during low-protein and normal-protein meals. In a study which was carried out later, this satiating effect of proteins was reduced in test subjects who had high-protein or low-protein meals for twelve weeks while having to maintain their weight. The energy consumption was maintained in test subjects having high-protein meals, whereas it was reduced in test subjects having low-protein meals. Therefore, it was concluded that a high-protein diet may prevent weight gain due to its impact on satiation and food intake as well as energy consumption.

**Morteza Enajat**

**Present occupation**: Resident Plastic Reconstructive Surgery at VU Amsterdam, The Netherlands

**Supervisors**: Prof. R.R. van der Hulst, Dr. M.A.M. Mureau (Erasmus MC Rotterdam)

**Thesis defence**: 15 December

**Title**: Deep inferior epigastric artery perforator flap breast reconstruction: optimizing of technique, perioperative measures, and outcome

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**Hilda de Jong**

**Present occupation**: Postdoctoral research fellow at The University of British Columbia, Vancouver Canada

**Supervisors**: Prof. dr. H. van Loveren, Prof. Dr. J.W. Cohen Tervaert Dr. R.J. Vandebril (RIVM) & Dr. O.M. Klungel (RIVM)

**Thesis defence**: 18 December

**Title**: Cardiovascular drugs and the risk of systemic autoimmune diseases Pharmaco epidemiological and experimental approaches
**Tim Snijders**

**Present occupation:** Post-doctoral fellow at McMaster University, Department of Kinesiology, Hamilton, Canada  
**Supervisors:** Prof. Dr. L.J.C. van Loon, Dr. L. Verdijk  
**Thesis defence:** 18 December  
**Title:** Satellite cells in skeletal muscle atrophy and hypertrophy  
Ageing is accompanied by loss of muscle mass and muscle strength. This results in limitations in daily life, less independence and reduced quality of life. Muscle stem cells (also called satellite cells) are essential for muscle tissue growth and maintenance. This thesis shows that a reduction in the number of satellite cells and/or their function may play an important role in the loss of muscle mass associated with ageing. Long-term strength training helps increase muscle mass/muscle strength and is associated with an increase in the number of satellite cells. Strength training should be an important part of intervention programmes to prevent loss of muscle mass with ageing.

**Rutger Schols**

**Present occupation:** Resident Plastic Surgery, Maastricht UMC+  
**Supervisors:** Prof. Dr. L.P.S. Stassen, Prof. Dr. N.D. Bouvy, Dr. F.P. Wieringa (TNO)  
**Thesis defence:** 19 December  
**Title:** Innovative optical techniques for intraoperative anatomical guidance; Surgical navigation beyond the limits of the human eye.  
Innovative optical techniques can improve the intraoperative identification and characterisation of vital anatomical structures, such as nerves, ureters, arteries and bile ducts. This is crucial in all sorts of surgical procedures, as misidentification of these structures can lead to iatrogenic injury. This thesis focuses on two optical techniques: near-infrared fluorescence imaging using exogenic contrast for the identification of bile ducts, arteries and ureters; and diffuse reflection spectroscopy using endogenic contrast for the identification of new spectral contrasts of ureter, artery, parathyroid and nerve tissues that are invisible to the eye. While both techniques are subject to limitations, they have the potential to improve surgical care through better anatomical recognition. In addition, the newly discovered endogenic spectroscopic tissue contrasts provide insight into the development of a new generation of surgical cameras.
Education

The aims of our School specific PhD training programme is to cultivate research capabilities & broad understanding of human nutrition and metabolism, to provide PhD students with specific knowledge and skills needed for top-level research and to stimulate interdisciplinary training.

The goals are achieved by a mixture of professional and generic courses. To create more awareness among PhD students on the entire research portfolio of NUTRIM capita selecta are organised on a bi-weekly base during which leading institutional scientists provide state-of-the-art lectures on their area of expertise including their own data. All courses given are evaluated instantaneously and updated if appropriate on an annual basis.

Additionally participation in small scale journal clubs is stimulated, participation in ‘thematic meetings’ (e.g. training in knowledge transfer, valorisation and patent screening, career development) and NUTRIM supports participation in research management and/or board and council meetings (e.g. PhD council and departmental boards) Successful participation of the PhD training programme results in well-trained graduates who have developed an integrated view on most advanced and state-of-the-art topics in nutritional epidemiology and toxicology science, nutrition and metabolism in health and disease.

NUTRIM Lecture Series
In order to enhance the scientific standard of nutrition and to stimulate international exchange in this field, NUTRIM organizes five lectures yearly for which an international recognized expert in the field is invited to give a lecture and a Master class. The lectures cover all main research areas of NUTRIM and are not only aimed at a NUTRIM-wide audience but also at Dutch Universities and institutes within the field of nutrition, metabolism and toxicology, all food and pharma industry in the Netherlands and international universities and institutes within the EU region.

NUTRIM Capita Selecta
NUTRIM very much values the awareness among NUTRIM PhD Students on the entire research portfolio of NUTRIM. The Capita Selecta offer a wide range of subjects of that portfolio and aim to stimulate PhD Students to gain broader insights and interest in fields of research that are not necessarily their own field of expertise in order to stimulate and increase multi disciplinarity of our young researchers. Leading institutional scientists provide state-of-the-art lectures on the area of their expertise including their own data. The lectures are organized in two modules and comprise a total of approx. 20 lectures.

PhD Students’ Coordinator
Dr. Roger Godschalk, Assistant Professor, Department of Toxicology, is NUTRIM’s PhD Students Co-ordinator. The PhD-students Co-ordinator monitors the continuity of progress of each individual PhD-student using the NUTRIM progress monitoring procedure, approves the supervision and education plans within 3 months after appointment of a PhD-student and ensures their annual adaptation. He furthermore acts as a trust person for the PhD-Students, exercising a critical attitude towards all parties involved (PhD-student, mentor, supervisor, programme leader) and, if necessary, meeting with personnel consultants. He coordinates a programme of high-quality special courses, he represents the School in the Interfaculty PhD-students Committee (IPC) and he is a member of NUTRIM’s Council.

NUTRIM involvement in UM Master Programmes

Master ‘Biomedical Sciences’
Exploring human health and disease
The 21st century may well be called the century of molecular biology. Amid wide-scale investments in life sciences all over Europe, there is a growing demand for highly specialised professionals in a range of life science fields. Biomedical Sciences focuses on state of the art methodology and the skills that enable researchers to unravel the molecular mechanisms in health and disease. You explore the relationship between human beings and their environment from molecule, to gene, to cell and organ, to individual and to entire populations.

Master ‘Health Food Innovation Management’
Merging academia with industry
Health Food Innovation Management prepares you to understand the process of innovation in the food and beverage industry, with a specific focus on improving health and healthy eating behaviour by developing commercially relevant novel dietary intake concepts. Through a multidisciplinary learning approach, you will be prepared to help
transfer nutritional health science aspects into sound new product and marketing concepts. This programme thus fills the need for industry professionals who also have the expertise to properly interpret data and make food healthier in ways that are scientifically sound.

*Master 'Health Education and Promotion'
*Helping people be healthy

Health is one of the most important issues in our lives. Yet many people still do things that are risky for their health. And it's not easy to change this, since personal, environmental, social and political factors all influence individual behaviour. Health Education and Promotion focuses on the development, evaluation and implementation of health interventions at both the behavioural and environmental levels. The programme is interdisciplinary, training you as an expert in promoting health and well-being. Because after all, a gram of prevention is worth a kilo of cure!

*Master 'Human Movement Sciences'
*The biological basis of exercise

Human beings were designed for daily physical activity. But in the modern world our sedentary lifestyle has led to chronic diseases like obesity, cardiovascular disease and type 2 diabetes. Governments are increasingly recognising the importance of physical activity as a public health issue. This programme covers all aspects of the relationship between physical activity and health - from patients trying to get better, to individuals just trying to stay fit, to top athletes aiming for the pinnacle of their sport.

*MINT postgraduate educational institute

MINT aims at enlarging professional knowledge and understanding of nutritional problems and disease related metabolic aberrations in chronic disease prevention and management. In addition, the institute wants to promote the correct implementation of available and novel intervention strategies in this field. Medical and paramedical professionals and scientists. The composition of a target group varies between courses. MINT organizes high quality courses for medical and paramedical professionals and scientists about clinical topics not yet covered by others, but for which the target group addresses a clear demand.
## Lectures, master classes and courses 2014

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<th>Activity</th>
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<tr>
<td>8 January</td>
<td>NUTRIM Capita Selecta by Dr. Leo Köhler ‘Amino acid metabolism in the gut’</td>
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<td>29 January</td>
<td>NUTRIM Capita Selecta by Dr. Gijs Goossens ‘Adipose tissue dysfunction in obesity-related insulin resistance’</td>
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<tr>
<td>12 February</td>
<td>NUTRIM Capita Selecta by Dr. Ronit Shiri-Sverdlov ‘The traffic jam in NASH: OxLDL in lysosomes’</td>
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<td>26 February</td>
<td>NUTRIM Capita Selecta by Prof. Luc van Loon ‘Ageing and muscle mass loss’</td>
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<td>14 March</td>
<td>Gut &amp; Liver Meeting, lecture by Prof. Dr. Kristin Verbeke ‘Deciphering the impact of the gut microbiota in health and disease by analysing their metabolite’</td>
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<tr>
<td>26 March</td>
<td>NUTRIM Capita Selecta by Prof. Ellen Blaak ‘Adipose tissue-muscle cross-talk in insulin resistance and diabetes’</td>
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<td>2 April</td>
<td>NUTRIM Master Class by Prof. Dennis Bier ‘Nutrition science and the media’</td>
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<td>4 April</td>
<td>Valedictory lecture by Prof. Cor Baeten ‘The way out’</td>
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<tr>
<td>9 April</td>
<td>NUTRIM Capita Selecta by Dr. Freddy Troost ‘Gastrointestinal modulation of satiety’</td>
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<td>9 April</td>
<td>International Society of Indoor Air Quality and Climate - ISIAQ / NUTRIM Symposium (pré conference) ‘Counting the cost of comfort: beyond thermal comfort’</td>
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<td>11 April</td>
<td>Lecture ‘Mitochondrial protein homeostasis in the control of metabolism and aging’, lecture by Dr. Riekelt H. Houtkooper</td>
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<tr>
<td>30 April</td>
<td>NUTRIM Capita Selecta by Prof. C. Evelo ‘If haystacks get too big start looking for sewing machines instead of needles’</td>
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<td>14 May</td>
<td>NUTRIM Capita Selecta by Prof. Stef Kremers ‘Prevention of obesity’</td>
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<td>14 May</td>
<td>Introductory lunch meeting for new PhD Students</td>
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<td>16 May</td>
<td>Kick off meeting: MUMC+2020 project: ‘Synergy between experimental research and medical excellence to outweigh cancer cachexia’, incl. lecture by Prof. Ken Fearon ‘Surgeon and professor of mechanisms and treatment of cancer cachexia’</td>
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<tr>
<td>16 May</td>
<td>Lecture by Prof. A. van der Vliet ‘Dual oxidase in the respiratory epithelium. Role in injury responses and allergic inflammation’</td>
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<td>28 May</td>
<td>NUTRIM Capita Selecta by Prof. Aalt Bast ‘Nutritional Toxicology’</td>
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<td>6 June</td>
<td>Farewell Symposium ‘Nutritional Science in transition’ incl. valedictory lecture by Prof. Wim Saris ‘Something to chew on’</td>
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<td>11 June</td>
<td>NUTRIM Capita Selecta by Dr. Jogchum Plat ‘Towards understanding the pros and cons of plant sterols’</td>
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<tr>
<td>13 June</td>
<td>Gut &amp; Liver Meeting, lecture by Dr. Sven van IJzendoorn ‘Complicating gut-liver cross-talk in a rare congenital diarrheal disorder’</td>
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<td>23 June</td>
<td>Mini Symposium ‘Possibilities with imaging techniques in metabolic research’</td>
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<td>24 June</td>
<td>Symposium ‘Systems Biology for Food, Feed and Health’, at Wageningen University, cooperation with NUTRIM - Bioinformatics Department</td>
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<td>25 June</td>
<td>NUTRIM Capita Selecta by Dr. Steven Olde Damink ‘Interorgan perspective in (surgical) liver failure’</td>
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<td>3 September</td>
<td>NUTRIM Capita Selecta by Dr. Kaatje Lenaerts ‘Intestinal compromise, immunity and nutrition’</td>
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<td>17 September</td>
<td>NUTRIM Capita Selecta by Prof. Edwin Mariman ‘Cellular and molecular aspects of weight regain: the adipose tissue’</td>
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<td>19 September</td>
<td>Inaugural lecture by Prof. Wouter van Marken Lichtenbelt: ‘Light my fire’</td>
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<td>8 and 22 October</td>
<td>Workshop ‘Presentation and Pitching for PhD Students’</td>
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<td>15 October</td>
<td>NUTRIM Capita Selecta by Prof. F.J. van Schooten ‘Biomarkers of health and disease’</td>
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<td>17 October</td>
<td>Inaugural Lecture by Prof. Stef Kremers: ‘Obesitaspreventie met pieken en dalen’</td>
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<td>29 October</td>
<td>NUTRIM Capita Selecta by Prof. Margriet Westerterp-Plantenga ‘Food intake regulation: Energy- and reward-homeostasis’</td>
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<tr>
<td>5 and 19 November</td>
<td>Workshop ‘Presentation and Pitching for PhD Students’</td>
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<td>12 November</td>
<td>NUTRIM Capita Selecta by Dr. Kenneth Meijer ‘Economics of human locomotion’</td>
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<td>21 November</td>
<td>Inaugural Lecture by Prof. Jogchum Plat: ‘Voedingswetenschappen; Vereeuwigd met de erfenis van Hippocrates’</td>
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<td>26 November</td>
<td>NUTRIM Capita Selecta by Prof. Wouter van Marken Lichtenbelt ‘Energy metabolism, thermo regulation, brown fat activity and ageing’</td>
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<tr>
<td>3 December</td>
<td>NUTRIM Capita Selecta by Prof. Maurice Zeegers ‘Unlock your secret to a healthy life’</td>
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<tr>
<td>12 December</td>
<td>NUTRIM Symposium ‘Adipose tissue dysfunction in obesity’, incl. valedictory Lecture by Prof. Marleen van Baak: ‘Over gewichtige zaken’</td>
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<tr>
<td>17 December</td>
<td>Annual NUTRIM Symposium, theme ‘Connect. Engage. Inspire’</td>
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Translational research infrastructure

NUTRIM research achievements are made possible by collaboration of open-minded basic scientists and clinical opinion leaders and an excellent infrastructure.

Examples

*Human surgical models

Human intestinal ischemia-reperfusion model
A segment of healthy jejunum 01 is usually resected in patients undergoing pylorus-preserving pancreatico-duodenectomy. After isolation of a small part 02, ischemia is induced by placing two vascular clamps 03, which results in discoloration of the jejunal wall 04. By removing clamps, reperfusion is initiated. Histological assessment of intestinal tissue (05-A, control) reveals damage after ischemia (05-B), and reperfusion (05-C+05-D).

*Obesity treatment 06. Endobarrier duodenaljejunal bypass liner (DJBL). This device constitutes a 60 cm open teflon sleeve, which is placed endoscopically in the proximal small intestine, effectively excluding this part of the gut from exposure to food.

Human tissue analysis

* Brown Adipose Tissue
Figure 1 07: Brown adipose in adult man. FDG-PET-CT image of lean young adult man after cold exposure showing BAT activity in supraclavicular and paravertebral areas. A HE-stained slide showing typical multivacuolar brown adipocytes (BAT) and univacuolar white adipocytes (WAT).
B Immunofluorescence stained slide showing the BAT-unique protein UCP1 that facilitates heat production in BAT (UCP1 in green).
Figure 2 08: Brown adipose tissue (BAT) activity before and after weight loss. Figure 3 09: Brown adipose tissue activity during ISO infusion and cold.

* In vitro research 10: 3D cell culture. In this model intestinal epithelial cells form a 3-dimensional spheres structure, enabling the investigation of nutritional components on intestinal barrier function foto 3D cell culture.
Translational research infrastructure

* Muscle fibre typing of human skeletal muscle: Red cells represent slow oxidative type 1 fibres, green cells represent fast glycolytic type 2 fibres. In blue the basal membrane protein laminin is visualised.

**Imaging - non-invasive investigation of metabolism**

* Ectopic fat content in skeletal muscle, the heart or liver can be measured by 1H-MRS, an example of the liver is shown in figure 12. High-energy metabolites, such as ATP or Phosphocreatine can also be quantified by 31P-MRS in these organs (example of a skeletal muscle spectrum in figure 13). These techniques are valuable tools in evaluating the effects of physiological interventions.

* Muscle Function and “In-Vivo” Anatomy

Muscle capacity is determined from dynamometry experiments. The HPL has a BIODEX III dynamometer is used to characterize the force and power capacities of muscle groups.

* Developing Non-Invasive Imaging of Liver Inflammation

Figure 15: Microscope view of cultured bone marrow derived Macrophages and an ultrasound view of a mouse liver.
Translational research infrastructure

Figure 2 16: VisualSonics Vevo2100 High-Frequency, High resolution digital imaging platform.
Figure 3 17: Electron Microscopy and Light Microscopy photos from a mouse liver. A+C EM photos of a Kupffer cell loaded with fat B+D Light microscopy photos of the liver stained for a Kupffer cell marker.

* In vivo Research 18: Fully automated liquid chromatography mass spectrometry systems together with stand-alone HPLC systems and surrounding equipment, for metabolic research.

Modelling
* In collaboration with the Netherlands Consortium for Systems Biology applications are developed that can be used to see results from modelling studies and genomics experiments next to each other 19.

* 3D Capture and Muscle-Skeletal Modelling 20: Muscle-skeletal performance of specific activities of daily life (e.g. walking, stair climbing, etc.) offering important information on coordination patterns and the stability and economy of the activity. (Meijer picture marker set, Glasgow/Maastricht foot model, movies stair climbing.)
Proof of concept: human experiment. Subjects undergoing various types of measuring, examples of research projects

* Metabolic Research Unit Maastricht (MRUM) 21: The Metabolic Research Unit Maastricht (MRUM) is a facility with highly sensitive equipment for the studies in the field of energy expenditure, substrate utilization and other in-vivo metabolism.

* The Human Performance Laboratory 22: Muscle dysfunction due to chronic disease, (e.g. suffering from Diabetes, COPD, Osteoarthritis, Osteoporosis, Obesity and Frailty) and or disuse, important determinants of adverse muscle skeletal loading, poor movement performance and reduced mobility in daily life.

* Stable Isotope Methodology 23: Stable isotope tracers provide a safe and powerful tool to investigate carbohydrate, fat, and protein metabolism in vivo in humans. A stable isotope tracer is made by labelling a molecule (e.g., glucose, free fatty acid, or amino acids) with one or more atoms to make it distinct from the naturally occurring molecule (tracee) to allow its detection.

* Serotonergic modulation of intestinal permeability and visceral perception 24.

* Ileal brake 25: A 200 cm long catheter is introduced into the small intestine of healthy volunteers. Nutrients are directly infused through this catheter and are delivered in different parts of the small intestine in order to expose ileum to different amounts of carbohydrates and proteins to see whether carbohydrates or proteins activate the ileal brake.

* Gluten digestion 26: A triple-lumen feeding catheter is inserted under intermittent fluoroscopic control, with the tube tip located in the duodenum to administer test meals and enzyme directly into the stomach, and for the aspiration of fluid samples from the stomach and the duodenum.
Translational research infrastructure

Ambulatory Monitoring of muscle (dys)function
* The MMAAS 27 is a sophisticated monitoring system. It can capture 3D muscle-skeletal motion and muscle activity for a whole day and has been developed for a more detailed analysis of limitations in movement performance during ADL.

* The CAM 28 is an activity monitor that discriminates between non-weight bearing and weight bearing postures as well as physical activities (e.g. walking, cycling). It is used to monitor time spent on sedentary and physical activities in humans.

Biomarker development
* Diagnosis by exhaled breath 29:
Exhaled breath contains thousands of so-called volatile organic compounds (VOCs) of which the composition varies depending on health status.

* Protein research
Proteins are the major regulators of life processes and as such they are important for the balance between health and disease. They function as diagnostic and prognostic biomarkers of crucial health sustaining processes in the body and are major drug targets for medication.

Protein separation
30 1st dimension separation
31 2nd dimension separation
32 Protein staining
33 Detection and Image analysis

Protein identification
34 Automated spot cutting
35 Digestion and spotting
36 Mass spectrometry
## Large collaborative research projects at the national and international level

### Large research projects in the Netherlands

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<td>Microbiota, energy balance and metabolism</td>
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<td>Effects of decontamination</td>
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<td>Nocturnal protein supply during sleep as a dietary strategy to improve muscle mass in elderly</td>
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<td>Muscle mass preservation</td>
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<td>The impact of the macronutrient composition and energy content of a nutritional supplement on post-prandial muscle protein synthesis in the elderly</td>
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<td>Cardiovascular health - HDL functionality</td>
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<td>Using metabolomic analysis of volatile organic compounds (VOCs) in breath as biomarkers for healthy and disturbed gut Insulin-related metabolic disorders</td>
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<td>Diet, insulin-resistance and chronic inflammation</td>
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<td>Microbe-mediated gut metabolism / Microbial functionality and safety</td>
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<td>Relevance of vascular function markers</td>
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<td>Oral perception and metabolic effect of proteins</td>
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<td>Sensory satiety, metabolic satiety and food intake regulation</td>
<td>Prof. M. Westerterp-Plantenga</td>
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<td>Cardiac lipotoxicity</td>
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<td>Evaluation and validation of cathepsins as a biomarker for NASH</td>
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### Large collaborative EU research projects

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<td>Flaviola: Targeted delivery of dietary flavonols for optimal human cell function: Effects on cardiovascular health</td>
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<td>AnastomoSEAL: Development of a resorbable sealing patch for the prevention of anastomotic leakage after colorectal cancer surgical treatment</td>
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<td>An open, integrated and sustainable chemistry, biology and pharmacology knowledge resource for drug discovery</td>
<td>Prof. C. Evelo</td>
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<td>Eurodish, Study on the need for food and health research infrastructures in Europe</td>
<td>Prof. C. Evelo</td>
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<tr>
<td>Microgennet: Extension, enhancement and strengthening of established collaborations for the purpose of a community-driven knowledge base for micronutrient genomics</td>
<td>Prof. C. Evelo</td>
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<td>Recruitment and activation of brown adipocytes as preventive and curative therapy for type 2 diabetes</td>
<td>Prof. W.D. van Marken Lichtenbelt</td>
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<td>Diagnostic and prognostic biomarkers for inflammatory bowel disease</td>
<td>Dr. M. Pierik</td>
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<td>SysmedIBD: Systems medicine of chronic inflammatory bowel disease</td>
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<td>Food4Me: Personalised nutrition: An integrated analysis of opportunities and challenges</td>
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<td>Sarcopenia and Physical fRality IN older people: multi-component Treatment strategies - SPRiNTT</td>
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<td>Full4Health: Understanding food-gut-brain mechanisms across the lifespan in the regulation of hunger and satiety for health</td>
<td>Prof. M. Westerterp-Plantenga</td>
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<td>PREVention of diabetes through lifestyle intervention and population studies in Europe and around the world</td>
<td>Prof. M. Westerterp-Plantenga</td>
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<td>e-NanoMapper - A database and ontology framework for Nanomaterials design and safety assessment</td>
<td>Dr. E. Willighagen</td>
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<td>Bladder Cancer Epidemiology</td>
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### Other EC initiatives / projects

- Innovation and standardisation
- European Strategic Research Agenda (SRA) of the European Technology Platform ETP Food for life, theme ‘Nutrition and Health’
International collaborations

University of Vermont, Burlington, USA
Topic: Respiratory Biology and oxidant-antioxidant metabolism
Contact person: Prof. Y. Janssen-Heininger, Department of Pathology
NUTRIM departments: Respiratory Medicine, Medical Microbiology, Toxicology
Collaboration since 1997
• Faculty exchange (Visiting professorships for Prof. Janssen-Heininger (NUTRIM) and Prof. E. Wouters (UVM))
• Joint PhD projects (4 PhD theses since 2003; 3 ongoing PhD projects)
• Joint laboratory facilities (NUTRIM: human tissue; UVM: transgenic animal models)
• Joint symposia, for example the Lecture and Master Class by Prof. B. Suratt ‘Obesity and the inflammation paradox’
• Master classes

University of Birmingham, UK
Topic: Genetic epidemiology & evidence based medicine
Contact person: Prof. M. Zeegers
NUTRIM departments: Complex Genetics, Internal Medicine, Paediatrics, Respiratory Medicine, Ophthalmology, Toxicology
Collaboration started in 2008

University College London, UK
Topic: Gut-liver homeostasis
Contact person: Prof. R Jalan, Institute of Liver and Digestive Health
NUTRIM departments: Surgery, Molecular Genetics
Collaboration since 1997
• Faculty exchange (Part time position for Dr. S. Olde Damink
• Joint PhD projects (joint NUTRIM thesis of S. Olde Damink and R. Jalan; 3 ongoing PhD projects)

RWTH Aachen, Germany
Topic: Liver inflammation and failure
Contact persons: Prof U. Neumann (Dept of Surgery) and Prof. C. Trautwein (Dept of Hepatology)
NUTRIM departments: Surgery, Hepatology and Molecular Genetics
Collaboration since: 2010
Development of Euregional HPB centre (since 2010 joint weekly HPB multi-disciplinary-team meetings and joint cross border operations)
Faculty exchange (Post-doc position of Dr. Veerle Bieghs)
• Joint PhD projects.

German Diabetes Centre, Germany
Topic: Metabolism and Diabetes, Düsseldorf
Contact: Prof. M. Roden
NUTRIM departments: Human Biology, Movement Sciences, Internal Medicine
Collaboration started in: 2010
• Joint research projects on ectopic fat accumulation, insulin sensitivity, mitochondrial function & BAT
• Organize yearly diabetes day

École Polytechnique Fédérale de Lausanne, Laboratory of Integrative Systems Physiology
Topic: Mitochondrial metabolism
Contact: Prof. J. Auwerx
NUTRIM departments: Human Biology
Collaboration started in 2011
• Faculty exchange

National Institute of Ageing, USA
Topic: Skeletal muscle weakness in chronic disease and aging
Contact person: Dr. R. de Cabo, Lab of Experimental Gerontology
Dr. T. Harris, Laboratory of Epidemiology, Demography, and Biometry
NUTRIM departments: Respiratory Medicine
Collaboration started in 2009
• Exchange at PhD and post-doc level
• Joint research projects
• Master classes

**St John’s Research Institute and National Academy, Bangalore, India**
Topic: Nutrition and metabolism
Contact: Prof. A. Kurpad
NUTRIM departments: Human Biology, Toxicology, Respiratory Medicine, Internal Medicine
Collaboration started in 2009
• Joint PhD projects
• Faculty exchange

**European “Biohealth computing” network**
Topic: Systems biology and chronic disease
Key partners: Grenoble, Barcelona, Torino
Contact person: Prof. Ph. Sabatier (Grenoble) and Prof. J. Roca (Barcelona)
NUTRIM departments: Bioinformatics, Toxicology, Respiratory Medicine, Molecular Genetics
• Joint MSc education and Summer school
• Faculty exchange

**Richardson Centre for Functional foods and Neutraceuticals, Manitoba, Canada**
Topic: functional foods and neutraceuticals
Contact: Prof. P.J. Jones
NUTRIM departments: Human Biology, Toxicology
Collaboration started in 2011
• Joint research projects on plant sterol metabolism
• Organized international symposium on plant sterols and health
## Appendix 3 List of abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ALD</td>
<td>Alcoholic Liver Disease</td>
</tr>
<tr>
<td>azM</td>
<td>Academic Hospital Maastricht</td>
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<tr>
<td>BAT</td>
<td>Brown Adipose Tissue</td>
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<tr>
<td>BBMRI-NL</td>
<td>Biobanking and Biomolecular Research Infrastructure</td>
</tr>
<tr>
<td>CARIM</td>
<td>School for Cardiovascular Disease</td>
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<tr>
<td>CEFIC</td>
<td>The European Chemical Industry Council</td>
</tr>
<tr>
<td>CIRO</td>
<td>Centre for Integrated care and Chronic Organ Failure</td>
</tr>
<tr>
<td>COPD</td>
<td>Chronic Obstructive Pulmonary Disease</td>
</tr>
<tr>
<td>CTMM</td>
<td>Centre of Translational Molecular Medicine</td>
</tr>
<tr>
<td>DFN</td>
<td>Dutch Heart Foundation</td>
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<tr>
<td>DJBL</td>
<td>Duodenal-Jejunal Bypass Liner</td>
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<tr>
<td>ECNIS</td>
<td>European Centre of Excellence on Environmental Carcinogenesis, Nutrition and Individual Susceptibility</td>
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<tr>
<td>ECO</td>
<td>European Congress on Obesity</td>
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<tr>
<td>ECPI</td>
<td>The European Council for Plasticisers and Intermediates</td>
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<tr>
<td>ECSS</td>
<td>European College of Sport Science</td>
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<tr>
<td>EFSD</td>
<td>European Foundation for the Study of Diabetes</td>
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<tr>
<td>ET</td>
<td>Enabling Technologies</td>
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<td>EU</td>
<td>European Union</td>
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<tr>
<td>FAEEs</td>
<td>Fatty acid ethyl esters</td>
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<tr>
<td>FDG</td>
<td>Fluoro-deoxy-glucose</td>
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<tr>
<td>FHML</td>
<td>Faculty of Health, Medicine and Life Sciences</td>
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<tr>
<td>FIND</td>
<td>Foundation for Innovative New Diagnostics</td>
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<tr>
<td>IBD</td>
<td>Inflammatory Bowel Disease</td>
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<td>IBS</td>
<td>Irritable Bowel Syndrome</td>
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<tr>
<td>I-FABP</td>
<td>Intestinal fatty acid binding protein</td>
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<tr>
<td>ILD</td>
<td>Interstitial Lung Diseases</td>
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<tr>
<td>IMI</td>
<td>Innovative Medicine Initiative</td>
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<tr>
<td>KNAW</td>
<td>Royal Dutch Academy of Arts and Sciences</td>
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<tr>
<td>KNGF</td>
<td>Royal Dutch Society for Physical Therapy</td>
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<tr>
<td>MLDS</td>
<td>Dutch Digestive Foundation</td>
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<tr>
<td>MUMC</td>
<td>Maastricht University Medical Centre</td>
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<tr>
<td>NAFLD</td>
<td>Non-alcoholic fatty liver disease</td>
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<tr>
<td>NASH</td>
<td>Non-alcoholic Steatohepatitis</td>
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<tr>
<td>NBIC</td>
<td>Netherlands Bioinformatics Centre</td>
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<tr>
<td>NCSB</td>
<td>Netherlands Centre for Systems Biology</td>
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<tr>
<td>NFU</td>
<td>Netherlands Federation of University Medical Centres</td>
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<td>NGI</td>
<td>Netherlands Genomics Initiative</td>
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<td>NRF</td>
<td>Nutricia Research Foundation</td>
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<tr>
<td>NuGo</td>
<td>European Nutrigenomics Organisation</td>
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<tr>
<td>NWO</td>
<td>Netherlands Foundation for Scientific Research</td>
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<tr>
<td>OPZuid</td>
<td>Operational Programme South Netherlands (European Innovation Programme)</td>
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<tr>
<td>OTC</td>
<td>Osteosynthesis and trauma care</td>
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<tr>
<td>PET</td>
<td>Position emission tomography</td>
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<tr>
<td>PI</td>
<td>Prime Investigator</td>
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<tr>
<td>RCO NL</td>
<td>Netherlands Enterprise Agency</td>
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<tr>
<td>RIVM</td>
<td>National Institute of Public Health &amp; Environmental Protection</td>
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<tr>
<td>RVO-NL</td>
<td>Netherlands Enterprise Agency</td>
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<tr>
<td>SSIB</td>
<td>Society for the Studies of Ingestive Behaviour</td>
</tr>
<tr>
<td>STW</td>
<td>Technology Foundation</td>
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<tr>
<td>SWOL / NRF</td>
<td>University Fund Limburg</td>
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<tr>
<td>TIPharma</td>
<td>Top Institute Pharma</td>
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<tr>
<td>TIFN</td>
<td>Top Institute Food and Nutrition</td>
</tr>
<tr>
<td>TNO</td>
<td>Netherlands Organisation for Applied Scientific Research</td>
</tr>
<tr>
<td>UCP</td>
<td>UnCoupling Proteins</td>
</tr>
<tr>
<td>Veni/Vidi/Vici</td>
<td>Prestigious personal grants from NWO</td>
</tr>
<tr>
<td>VLAG</td>
<td>Graduate School of Food Technology, Agro biotechnology, Nutrition and Health Sciences</td>
</tr>
<tr>
<td>VOC</td>
<td>Volatile organic compounds</td>
</tr>
<tr>
<td>WAT</td>
<td>White Adipose Tissue</td>
</tr>
<tr>
<td>WCRF</td>
<td>World Cancer Research Fund</td>
</tr>
<tr>
<td>ZonMw</td>
<td>Netherlands Organisation for Health Research &amp; Development</td>
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