ANNUAL REPORT 2021

Department of Biomedical Sciences of Cells and Systems (BSCS)

UMCG
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UMCG

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1. Foreword

2021 in review

Hereby we present to you our second Annual Report of the Department of Biomedical Sciences of Cells and Systems (BSCS). The 2021 report will again provide you with a quantitative overview of all our activities and achievements, in science, education, business development and outreach.

The risks of such overviews is that they may be (mis)used as numerical indicators to score quality and progress or (even worse) as failures, especially when evaluating individual contributions. So, whereas we do consider and value the quantitative data in this report as our “medals”, we also like to emphasize that they are the result of collaborative efforts of many (not always mentioned by name) and that many other non-quantitative events have enlightened 2021. The latter, despite the remaining, often frustrating restrictions related to the Covid-19 pandemic, forcing people to work in (unpleasant) shifts or to work at home and execute their work behind square screens. Our deep respect goes to all the young people, especially those from abroad, who were so often deprived of social contacts and yet, mostly managed to still do their work with dedication and the highest quality possible, given the circumstances.

Even in 2022, we are still fighting the pandemic; but, maybe there is some light at the end of that tunnel now, such that we may go back to our normal lives soon and share exciting research discoveries in-person and inspire and mentor students face-to-face.
This annual report of course will also give you an overview of the focus of our research and education. It is not only the quantitative part, the numbers that count. I am proud that we have a department where curiosity and creativity brings us to achievements that are seen by a wide audience. I am proud of a team that cooperates under difficult circumstances and we can present these nice 2021 outcomes.

Harrie Kampinga
Head of the department, BSCS
February 2022
2. Research at BSCS

Our mission is to contribute significant advancements to the understanding of the fundamentals of functional and dysfunctional human biology at the molecular, cellular and systems level that ultimately will be applicable to combat diseases and increase human health span.

In BSCS, research and education are intertwined.

- With our research, we aim to discover and transfer knowledge to medical applications
- With our education, we teach cutting-edge biology to the doctors and scientist of the future

This way, we strive to advance the cycle of bench-to-bed-to-bench for human well-being.
The societal relevance of this mission is considered to be comprised of the following 3 main items:

1. **Understanding basic mechanism of the function of cells & systems drive advances in Medicare**
   
   Nearly all current medical treatments are based on discoveries, often done long before the related application, on detailed insights in how molecules, cells and systems function and how they are derailed in disease.

   * Our early analysis on how precision radiotherapy can be targeted to avoid radiation side effects has been the basis for proton therapy.
   * Our screens in Drosophila melanogaster have led to the discovery of therapeutic compounds now explored for the treatment of PKAN.

2. **We connect state-of-the-art Research with Innovative Education**
   
   Academic education requires role models and modern teaching.

   * BSCS takes pride in intense training and careful supervision of its PhD students.
   * We support problem-based, curiosity-driven learning programs (such as in flipped classrooms), provide basic and advanced courses in science technologies and strategies, and practical courses.
   * We develop novel digital education tools (e-learning).

3. **Collaborations drive discoveries**
   
   The progress of science is based on specialized expertise for discoveries, but requires intense collaborations amongst experts for driving such discoveries all the way to utilization.

   BSCS strives for a great team spirit not only to nurture internal collaboration but also strongly supports collaborations with external partners in and outside the UMCG.
3. Research groups at BSCS

Research in the Department of Biomedical Sciences of Cells and Systems is divided into the following four sections:

3.1 Section Anatomy and Medical Physiology

The section Anatomy and Medical Physiologyy perform basic research on human motivational processes using different motivational contexts and research techniques. Human motivational process in biomedical education and training also underly the development of several digital applications by our group that support undergraduate and postgraduate anatomy and physiology teaching. These applications can also be implemented in applied research on teaching efficacy. The two facilities of the Section – Dissection Room and Medical Physiology Lab – offer possibilities to collaborate in external research programs.

Groups:
- The research group of Janniko Georgiadis mainly focuses on human motivational processes in i) biomedical education and training, integrating educational science with gaming-psychology, and ii) sexual behavior, focusing on predictive coding theory.
3.2 Section Cognitive Neuroscience

The section Cognitive Neuroscience does research into symptoms and treatment of different psychiatric disorders and of age-related cognitive impairment.

Groups:

- **André Aleman** focuses on three lines of investigation: i) Psychiatric symptoms and vulnerability, with a focus on cognitive-emotional interactions, ii) Cognitive aging, with a focus on mild cognitive impairment and iii) Treatment and prevention, with a focus on non-invasive neuro-stimulation.

- **Branislava Ćurčić-Blake** focuses on brain connectivity analysis and improving cognitive functioning in patients with multiple sclerosis and elderly people with mild cognitive impairment (MCI), as well as auditory verbal hallucinations.

- **Sander Martens** focuses on individual differences in temporal attention within and across sensory modalities.

- **Iris Sommer** aims to improve future perspectives for patients with schizophrenia and other complex brain disorders. Special emphasis is put on biomarkers and personalized medicine. Her group has a broad interest in methods such as imaging, post-mortem analysis, epidemiology and treatment studies.

- **Marie-José van Tol** focuses on the interaction between mood and cognition in major depressive disorders, and especially factors that promote a prolonged course of these disorders and prevent relapse.
3.3 Section Molecular Cell Biology

The research mission of this section is to study basic processes in molecular cell biology to generate novel, fundamental insights related to cellular and organismal fitness. Through high-quality research, we aim at identifying and, where possible, at exploiting cellular targets to promote healthy aging and/or treat human disease.

- **Steven Bergink** aims to understand how DNA damage is linked to disturbances of protein homeostasis. (Steven resigned from our Department on 01-08-2021).

- **Ben Giepmans** aims to better visualize how molecules, organelles and cells act in concert to organize life, and how this may be affected in diseases. Focus is on developing and improving large-scale multimodal microscopy approaches that allow better identification of targets with new probes. Special interest is in uncovering the trigger that leads to Type 1 diabetes.

- **Lara Barazzuol** (Seconded from the department of Radiation Oncology) focuses on assessing the effect of DNA damage (as caused by radiation and chemotherapy) on the brain and aims to achieve an improved biological and molecular understanding of cancer treatment-induced neurocognitive dysfunction.

- **Rob Coppes** (Seconded from the department of Radiation Oncology) focuses on the role, mechanism and regenerative potential of normal tissue stem cells in the response of tissues to different radiation qualities, such as photons and protons.
• **Mark Hipp** studies the cellular quality control machinery to identify the mechanisms that healthy cells use to prevent toxic protein aggregation, and to help cells to use these mechanisms to prevent diseases associated with protein aggregation.

• **Harrie Kampinga** studies how cells maintain a healthy proteome, which is not only crucial for protein function and hence functionality of cells, but also essential to prevent accumulation of protein damage (protein aggregates) that can lead to a cascade of toxic events that threaten cellular health span. To ensure a proper protein homeostasis, an intricate protein quality control (PQC) network exists in cells in which Heat Shock Proteins (HSP), the central research topic in his group, play a central role.

• **Muriel Mari** focuses on i) Investigation of the membrane rearrangements underlying the biogenesis of the autophagosomes, the vesicular carriers that are the hallmark of autophagy, and ii) Improvement and development of new electron microscopy approaches to increase the number of biological questions that can be addressed with these techniques.

• **Catherine Rabouille** focuses on i) how cellular stress remodels the secretory pathway into a phase separated stress assembly in cell culture and ii) how cells initiate unconventional secretion through the Golgi protein GRASP in organoids.
• Fulvio Reggiori aims at unveiling the regulation and molecular mechanism of autophagy using yeast as the model system. As the long-term objective is to understand the exact contribution of autophagy in specific physiological and pathological contexts, the group is also investigating the interaction between autophagy-related proteins and pathogens, in particular viruses, and the role of autophagy in preventing neurodegeneration.

• Ody Sibon aims to understand molecular mechanisms behind neurodegenerative diseases presenting with movement disorders. Obtained fundamental insights are used to design treatment strategies which are currently tested in clinical settings.

• Sven van Ijzendoorn aims to understand the molecular mechanisms that control the intracellular dynamics of proteins, lipids and membranes in the context of the functional organization of cells, and to understand how these mechanisms contribute to health or, when disrupted, to human disease. In this context our focus is also on rare congenital disorders caused by disrupted intracellular protein dynamics and cellular organization, which includes elucidating their pathogenesis, development of patient-specific iPSC-based cell models and lead identification for novel therapeutic strategies.
3.4 Section Molecular Neurobiology

The mission of the Section Molecular Neurobiology is to study the central nervous system (CNS) during healthy ageing and neurodegenerative diseases using state of the art techniques.

Groups:

- **Wia Baron**'s research interests lie in the area of myelin biogenesis and myelin repair with emphasis on the disease multiple sclerosis (MS). Currently, her research aims at revealing and overcoming environmental restrictions in MS lesions that underlie remyelination failure.

- **Bart Eggen** focuses on neuron-glia signaling and on the epigenetic regulation of different glial cell phenotypes and associated functionalities. This research is focused on brain development, ageing and perturbed functions of cells of the central nervous system cell in neurodegenerative conditions.

- **Inge Holtman** focuses on the effect of natural genetic variation on susceptibility to brain diseases using state-of-the-art computational and machine learning approaches.

- **Inge Zijdewind** investigates mechanisms – at the level of muscles, spinal cord, and cortex – responsible for increased levels of fatigue and fatigability in different groups of subjects (including multiple sclerosis). Additionally, associated effects of fatigue and fatigability on physical and cognitive performance, and quality of life are studied.

- **Susanne Kooistra** focuses on how the epigenome regulates glial cell identity and function under neuroinflammatory conditions like multiple sclerosis, using single cell-omics approaches.
# Awarded Research Proposals

**Projects awarded to the PIs:**

<table>
<thead>
<tr>
<th>#</th>
<th>Research Group</th>
<th>Funding body</th>
<th>Project Title</th>
<th>Budget</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>H.Kampinga</td>
<td>Huntington DNJB6</td>
<td>Inhibition of the aggregation of mutant huntingtin by activating DNAJB6 – fase 2</td>
<td>€ 264,000</td>
</tr>
<tr>
<td>2</td>
<td>F.Reggiori/M.Mari/L.Barazzuol/M.Mauthe</td>
<td>Million Dollar Bike Ride</td>
<td>Deciphering the causes of mitochondrial network disruption in WDR45-defective cells and their contribution to the BPAN pathology</td>
<td>€ 58,000</td>
</tr>
<tr>
<td>3</td>
<td>B.N.G.Giepmans</td>
<td>NWO</td>
<td>NL-Biomaging Advanced Microscopy bridging grant</td>
<td>€ 71,475</td>
</tr>
<tr>
<td>4</td>
<td>B.N.G.Giepmans</td>
<td>ZonMw</td>
<td>Pancreatic exocrine malfunction may trigger beta cell stress</td>
<td>€ 749,990</td>
</tr>
<tr>
<td>5</td>
<td>B.N.G.Giepmans</td>
<td>EU EFRO IMDAP</td>
<td>Imaging Data Platform (IMDAP)</td>
<td>€ 224,778</td>
</tr>
<tr>
<td>6</td>
<td>B.N.G.Giepmans</td>
<td>ZonMW ARMED</td>
<td>Antioxidant treatment as a novel therapeutic option for microvillus inclusion disease - ARMED</td>
<td>€ 246,227</td>
</tr>
<tr>
<td>7</td>
<td>B.J.L.Eggen/ S Kooistra/ I.R. Holtman</td>
<td>Alzheimer NL</td>
<td>Understanding the role of microglia subpopulations in AD</td>
<td>€ 300,000</td>
</tr>
<tr>
<td>8</td>
<td>B.J.L.Eggen/ S Kooistra</td>
<td>MS Research</td>
<td>Delineating altered cell-cell interactions in MS lesion development and progression: an integrative single-cell and spatial transcriptomics approach</td>
<td>€ 290,000</td>
</tr>
<tr>
<td>9</td>
<td>B.J.L.Eggen/ N.Brouwer</td>
<td>MS Research</td>
<td>Coordinator MS-Center North</td>
<td>€ 12,500</td>
</tr>
<tr>
<td>10</td>
<td>B.J.L.Eggen</td>
<td>MS Research</td>
<td>spatial gene expression analysis of de- and remyelinating/ryemylinated lesions in a cuprizone mouse model, niet te honeren</td>
<td>€ 20,000</td>
</tr>
<tr>
<td>11</td>
<td>W.Baron</td>
<td>MS Research</td>
<td>Targeting extracellular HSP90b as a novel therapeutic intervention to overcome remyelination failure in multiple sclerosis</td>
<td>€ 287,482</td>
</tr>
<tr>
<td>12</td>
<td>A.Aleman</td>
<td>GPS Chugai</td>
<td>MR scans for pharmaceutical development</td>
<td>€ 143,200</td>
</tr>
<tr>
<td>13</td>
<td>A.Aleman</td>
<td>GPS GH Res</td>
<td>Cognitive performance changes due to a psilocybin-like compound</td>
<td>€ 12,000</td>
</tr>
<tr>
<td>14</td>
<td>I.E.C.Sommer</td>
<td>ZonMw</td>
<td>Fewer cognitive sideeffects of electroconvulsive therapy with rivastigmine patches</td>
<td>€ 589,300</td>
</tr>
<tr>
<td>15</td>
<td>I.E.C.Sommer</td>
<td>Hersenstichting</td>
<td>No Guts No Glory</td>
<td>€ 999,956</td>
</tr>
<tr>
<td>16</td>
<td>I.E.C.Sommer</td>
<td>HAMAD Qatar Nat.Res.Fund</td>
<td>Early detection of psychotic disorders</td>
<td>€ 10,632</td>
</tr>
<tr>
<td>17</td>
<td>I.E.C.Sommer</td>
<td>Boehringer</td>
<td>A phase III randomized, double-blind, placebo-controlled, parallel group trial to examine the efficacy and safety of BI 425809 once daily over 26 week treatment period in patients with schizophrenia (CONNEX-2)</td>
<td>€ 211,560</td>
</tr>
<tr>
<td>18</td>
<td>I.E.C.Sommer</td>
<td>SUFFUGIUM</td>
<td>Elke stem telt</td>
<td>€ 24,953</td>
</tr>
<tr>
<td>19</td>
<td>M.J.van Tol</td>
<td>Pilotfonds KNAW</td>
<td>Marvelous Mind</td>
<td>€ 10,000</td>
</tr>
<tr>
<td>20</td>
<td>M.S.Hipp</td>
<td>Alzheimer Nederland</td>
<td>Modulating Intracellular Quality Control to Prevent Spreading of Aggregated Tau</td>
<td>€ 50,000</td>
</tr>
<tr>
<td>#</td>
<td>PhD/Postdoc</td>
<td>Research Group</td>
<td>Funding body</td>
<td>Project Title</td>
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<tr>
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<td>------------------</td>
<td>-------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Jouke Jan Wedman</td>
<td>Ody Sibon/Hein Schepers</td>
<td>De Cock-Hadders</td>
<td>Elucidating the remarkable property of vitamin derivatives to enter the brain and rescue neurodegeneration</td>
</tr>
<tr>
<td>2</td>
<td>Yingyong Cong</td>
<td>F. Reggiori</td>
<td>Swiss IBSA</td>
<td>Killing coronaviruses by striking at their heart</td>
</tr>
<tr>
<td>3</td>
<td>Noura Faraj</td>
<td>B.N.G.Giepmans</td>
<td>De Cock-Hadders</td>
<td>An in vivo model to define the effect of exocrine ablation on pancreatic β-cell stress</td>
</tr>
<tr>
<td>4</td>
<td>Qinghong Li</td>
<td>Svan Uzendoorn</td>
<td>De Cock-Hadders</td>
<td>Identifying repurposeable drugs that stimulate intestinal absorption in microvillus inclusion disease</td>
</tr>
<tr>
<td>5</td>
<td>Alejandro Marmolejo</td>
<td>Erik Boddeke/Amalia Dolga</td>
<td>De Cock-Hadders</td>
<td>Studying microglia in Alzheimer’s Disease: an organoid system.</td>
</tr>
<tr>
<td>6</td>
<td>Jody de Jong</td>
<td>W.Baron</td>
<td>De Cock-Hadders</td>
<td>Remyelination failure in multiple sclerosis exploring the net effect of the extracellular matrix of distinct MS lesions on glial cell behavior</td>
</tr>
<tr>
<td>7</td>
<td>Jody de Jong</td>
<td>W.Baron</td>
<td>MS Research</td>
<td>Consequences of the extracellular matrix architecture in white matter multiple sclerosis lesions to glial cell behaviour relevant for remyelination</td>
</tr>
<tr>
<td>8</td>
<td>Jody de Jong</td>
<td>W/Baron / Bart Eggen</td>
<td>Monique-Blom de Wagt grant</td>
<td>Overcoming remyelination failure in MS: the effect of the extracellular matrix on remyelination-relevant behaviour of glia cells in white matter MS lesions</td>
</tr>
<tr>
<td>9</td>
<td>Wendy Oost</td>
<td>W.Baron</td>
<td>De Cock-Hadders</td>
<td>Large-scale electron microscopy for multiple sclerosis</td>
</tr>
<tr>
<td>10</td>
<td>Janna de Boer, Dr.</td>
<td>I.E.C.Sommer</td>
<td>CLARIAH Say No More!</td>
<td>Say no more! Natural Language Processing for diagnosis and screening in psychiatry</td>
</tr>
<tr>
<td>11</td>
<td>B.Brand</td>
<td>I.E.C.Sommer</td>
<td>De Cock-Hadders</td>
<td>Predicting treatment response to raloxifene augmentation in patients with a schizophrenia spectrum disorder</td>
</tr>
<tr>
<td>12</td>
<td>Shiral Gangadin</td>
<td>I.E.C.Sommer</td>
<td>De Cock-Hadders</td>
<td>Identification and treatment of immune dysregulation in schizophrenia spectrum disorders</td>
</tr>
<tr>
<td>13</td>
<td>Sofia Puvogel</td>
<td>I.E.C.Sommer / Bart Eggen</td>
<td>De Cock-Hadders</td>
<td>Alterations within vascular and neuronal cross-talk in Schizophrenia</td>
</tr>
<tr>
<td>14</td>
<td>Mirjam Koster</td>
<td>Bart Eggen / Wia Baron</td>
<td>De Cock-Hadders</td>
<td>A pilot study to identify distinct cell populations in multiple sclerosis lesions using single-nucleus RNA-sequencing</td>
</tr>
<tr>
<td>15</td>
<td>Marion Wijering</td>
<td>Bart Eggen / Wia Baron</td>
<td>Monique-Blom de Wagt grant</td>
<td>Spatial gene expression analysis of de- and remyelinated lesions in the cuprizone mouse model</td>
</tr>
<tr>
<td>16</td>
<td>Marion Wijering</td>
<td>Bart Eggen / Wia Baron</td>
<td>De Cock-Hadders</td>
<td>Functional analysis of MS-associated astrocyte genes in iPSC-derived astrocytes from relapsing-remitting multiple sclerosis patients</td>
</tr>
<tr>
<td>17</td>
<td>Tiago Medeiros Furquim</td>
<td>Bart Eggen / Erik Boddeke</td>
<td>De Cock-Hadders</td>
<td>Single-cell epigenomics of microglia from multiple sclerosis brain</td>
</tr>
<tr>
<td>18</td>
<td>Rianne Gorter</td>
<td>Wia Baron</td>
<td>De Cock-Hadders</td>
<td>Unraveling an unexpected role for MMP7 in remyelination</td>
</tr>
<tr>
<td>19</td>
<td>Tiago Furquim, Alejandro Garza and Prajit Dhar (Faculty of Arts)</td>
<td>Bart Eggen / Erik Boddeke</td>
<td>BCN Seed Grant 2021</td>
<td>Deciphering the grammar and morphology of the protein language in Alzheimer’s Disease</td>
</tr>
<tr>
<td>20</td>
<td>Rianne Gorter</td>
<td>Wia Baron</td>
<td>Network Glia</td>
<td>‘young investigator’ stipend for the virtual Euroglia Meeting 2021</td>
</tr>
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</table>
5. Facts and Figures

5.1 Funding received/ Projects awarded

<table>
<thead>
<tr>
<th>Projects and Funding</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget awarded projects</td>
<td>€ 4,068,420</td>
<td>€ 4,710,069</td>
</tr>
<tr>
<td>Number of projects awarded</td>
<td>23</td>
<td>39*</td>
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</table>

*See the previous section for a list of awarded projects.

5.2 PhD Graduations

<table>
<thead>
<tr>
<th>Number of PhDs Graduated per section</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>Section Cognitive Neuroscience</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Section Molecular Cellbiology</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Section Molecular Neurobiology</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>12</strong></td>
<td><strong>13</strong>*</td>
</tr>
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</table>

*See the Appendix-1 for a list of all PhD theses defended per section at the end of the report.

5.3 Scientific Publications

<table>
<thead>
<tr>
<th>Number of publications per section</th>
<th>2020</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td>Section Anatomy and Medical Physiology</td>
<td>3</td>
<td>00</td>
</tr>
<tr>
<td>Section Cognitive Neuroscience</td>
<td>63</td>
<td>97</td>
</tr>
<tr>
<td>Section Molecular Cellbiology</td>
<td>43</td>
<td>52</td>
</tr>
<tr>
<td>Section Molecular Neurobiology</td>
<td>25</td>
<td>25</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>134</strong></td>
<td><strong>174</strong>*</td>
</tr>
</tbody>
</table>

*See the Appendix-2 for a list of all publications published per section at the end of the report.

“Our department has achieved a balanced gender ratio and welcomed a number of new PhD students.”
5.4 People

<table>
<thead>
<tr>
<th>Gender</th>
<th>2021</th>
<th>2021</th>
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</thead>
<tbody>
<tr>
<td>Men</td>
<td>62 (41%)</td>
<td>83 (50%)</td>
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<tr>
<td>Women</td>
<td>91 (59%)</td>
<td>84 (50%)</td>
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<tr>
<td>Total</td>
<td>153</td>
<td>167</td>
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<table>
<thead>
<tr>
<th>PhDs students</th>
<th>2020</th>
<th>2021</th>
</tr>
</thead>
<tbody>
<tr>
<td>PhD regular</td>
<td>38</td>
<td>48</td>
</tr>
<tr>
<td>PhD bursaries</td>
<td>4</td>
<td>12</td>
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<tr>
<td>Total</td>
<td>42</td>
<td>60</td>
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<table>
<thead>
<tr>
<th>Employees</th>
<th>2020</th>
<th>2021</th>
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<tbody>
<tr>
<td>Total FTE</td>
<td>113.15</td>
<td>122.85</td>
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<tr>
<td>Total number of employees</td>
<td>153</td>
<td>167</td>
</tr>
<tr>
<td>No. of employees moved out</td>
<td>7</td>
<td>6</td>
</tr>
<tr>
<td>No. of employees joined</td>
<td>23</td>
<td>13</td>
</tr>
<tr>
<td>Transferred employees</td>
<td>-</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Internationals</th>
<th>2020</th>
<th>2021</th>
</tr>
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<tbody>
<tr>
<td>No. of Dutch employees</td>
<td>89 (58%)</td>
<td>135 (81%)</td>
</tr>
<tr>
<td>No. of International employees</td>
<td>64 (42%)</td>
<td>32 (19%)</td>
</tr>
<tr>
<td>No. of nationalities</td>
<td>22</td>
<td>16</td>
</tr>
<tr>
<td>USA</td>
<td>1</td>
<td>Italy</td>
</tr>
<tr>
<td>Brazil</td>
<td>2</td>
<td>Japan</td>
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<tr>
<td>Canada</td>
<td>1</td>
<td>Mexico</td>
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<td>China</td>
<td>2</td>
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<tr>
<td>Germany</td>
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<td>Slovenia</td>
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<tr>
<td>France</td>
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<tr>
<td>India</td>
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</tr>
<tr>
<td>Iraq</td>
<td>1</td>
<td>Switzerland</td>
</tr>
</tbody>
</table>

Management team BSCS

- Harrie Kampinga: Head of the Department
- Janniko Georgiadis: Head of the Section Anatomy and Medical Physiology
- André Aleman: Head of the Section Cognitive Neuroscience
- Fulvio Reggiori: Head of the Section Molecular Cellbiology
- Bart Eggen: Head of the Section Molecular Neurobiology
- Henk Heidekamp: Managing Director
- Arnoud Rozema: Financial Controller and Staff Advisor
- Mallikarjuna Gunnam: Research Coordinator
- Wytse Hogewerf: Staff Assistant
- Harry Moes: Housing, HRM, Finance and Quality Assurance
- Greetje Hollander: Secretary Anatomy & Medical Physiology
- Hedwig van Oosten: Secretary Cognitive Neuroscience Center
- Greetje Noppert: Secretary Molecular Cellbiology
- Trix van der Sluis-Rozema: Secretary Molecular Neurobiology

Samen verleggen we grenzen voor een duurzame toekomst van gezondheid
6. Facilities

6.1 Dissection Room facility

The Dissection Room facility is a modern facility where real human anatomy can be studied extensively and in considerable detail. The facility strongly supports life-long learning, offering both basic undergraduate courses and specialistic post-graduate trainings across a great variety of teaching and training programs, locally, regionally, nationally and internationally. This irreplaceable form of learning is afforded by human body donors, who generously give their body to the University of Groningen to stimulate, support and improve biomedical education and research. The facility has a close collaboration with the Wenckebach Skills Center for the optimization of resident training and surgical approaches, for simulating skills needed in the operation room, and for research on clinically relevant anatomy.

Specific services:
- 3 different embalming methods to optimally cater to a range of education or research requests.
- Partnership with Wenckebach Skills Center enables very wide range of education, training, and research activities with donated bodies, great expertise in organizing international specialistic surgical courses.

People involved in the facility and their roles:
Janniko R. Georgiadis – Head of the facility
Steve Oosterhoff – Manager of the facility
Peter Veldman – Prosector
Ronald Meijer - Prosector

Contact:
Department of Biomedical Sciences of Cells and Systems
University Medical Center Groningen
Antonius Deusinglaan, 1
Section Anatomy and Medical Physiology
Internal Zipcode FB42
9700 AD Groningen
The Netherlands
https://bscs.umcg.nl/en/facilities/dissection-room
Our high quality facilities and laboratories provide excellent opportunities for education, research and development to our collaborators and partners.
6.2 Medical Physiology Lab facility

The Medical Physiology Lab is used to teach the basic concepts of physiology to 700-1000 students per year of medicine, human movement sciences, dentistry, pharmacy, biomedical sciences and the University College Groningen. Via experiential learning, these students master the concepts in respiratory physiology, cardiovascular physiology, exercise physiology and neurophysiology: the students experience the tests themselves and they perform those tests on fellow students, and learn to interpret the results. For medical students, this is also their first experience in physical examination and additional measurements, such as electrocardiography, blood pressure measurements, and lung function tests.

In 2020, we received a financial investment from the UMCG to update, upgrade, and increase the numbers of our equipment, to be able to match the practice in the clinic, to deal with larger numbers of students per practical, and to be able to offer high-end courses in physiology for medical residents and specialists. The first investments were used to update (and upgrade) one of the set-ups of exercise physiology, to renew the set-up for continuous blood pressure measurements, and to replace the stethoscopes for the cardiovascular function tests.

People involved in the facility and their roles.
Janniko R. Georgiadis – Head of the facility
Ruby Otter-Drost – Manager of the facility
Annelies van der Molen – Coordinator of the facility

Contact:
Department of Biomedical Sciences of Cells and Systems
University Medical Center Groningen
Antonius Deusinglaan, 1
Section Anatomy and Medical Physiology
Internal Zipcode FB42
9700 AD Groningen
The Netherlands
https://bscs.umcg.nl/en/facilities/medphyslab
6.3 Cognitive Neuroscience Center (CNC) facility

We provide high-quality measurements and analyses of brain structure and activity using a diversity of cutting-edge technologies. Founded in 2002, the CNC is a research facility where people from the UMCG, the RUG, and external users collaborate, combining a variety of disciplines including medicine, psychology, linguistics, biology, and artificial intelligence.

The main aim of our center is to understand the neural basis of cognitive and emotional functioning during development and ageing using different modalities including fMRI, EEG, NIRS, and neurostimulation.

We focus on different research topics:

- Diverse psychiatric disorders including depression and schizophrenia
- Cognitive Aging
- Attentional and emotional control
- Visual perception
- Food perception
- Language acquisition
- Neurofeedback
- Motor control
- Drug development

We are uniquely placed for a wide variety of (brain) studies. We collaborate with the Department of Nuclear Medicine and Radiology to support integration of PET and MR studies. Besides data acquisition, the CNC supports researchers with analyses and statistics and can provide a workplace environment with its own servers for (guest) researchers. Furthermore, the CNC offers commercial partners a complete brain research ‘package’ encompassing acquisition, analysis and reporting.

People involved in the facility and their roles:
Prof. André Aleman – Head of the facility

Contact:
Cognitive Neuroscience Center
Internal Zipcode FA32,
Antonius Deusinglaan 2,
9713 AW Groningen

For information, you can contact
Hedwig van Oosten at h.w.p.m.van.oosten@umcg.nl,
Telephone +31 50 361 64 44.
https://umcgresearch.org/w/cognitive-neuroscience-center
6.4 Drosophila melanogaster facility

Drosophila melanogaster (fruit fly) is one of the most well studied animals to answer biological research questions in various fields, including ecology, evolution, behaviour, genetics, biomedical research, development and more.

The Drosophila facility at the UMCG is using a wealth of advanced genetic tools to design fly models to understand biological processes underlying age-related diseases. These models are used to investigate novel treatments for human diseases.

In collaboration with interested parties (researchers, educational organisations) we can design, and assist in generating and providing the requested Drosophila models.

We provide the following services:

1. Assist in the design of a suitable Drosophila model for research questions
2. Infrastructure for interested parties to generate the Drosophila model
3. Deliver fruit flies for small scale (genetic) teaching courses

People involved in the facility and their roles:
Prof. Ody Sibon -- Head of the facility
Ellie Eggens-Meijer -- Technician: logistics Drosophila service unit
Bart Kanon -- Technician: Drosophila handling
Erika Geubel -- Technician: Drosophila handling

Contact:
Drosophila melanogaster – facility
Department of Biomedical Sciences of Cells and Systems
University Medical Center Groningen
Antonius Deusinglaan, 1
Section Molecular Cellbiology Internal Zipcode FB32
9700 AD Groningen
The Netherlands
https://umcgresearch.org/w/drosophila-melanogaster
6.5 UMCG Microscopy & Imaging Center (UMIC) facility

Microscopy is a longstanding great enabling technology to help to understand how molecules regulate, or affect, live. UMIC offers training and access to advanced microscopes and image processing aimed at cellular imaging.

UMIC staff is highly enthusiastic because it is again a fantastic time to be a microscopist! Recent developments that already routinely can be used at UMIC include:

I. intravital microscopy to study molecules and cells in living organism using
   a. single-photon confocal laser scanning microscopy (CLSM)
   b. two-photon CLSM
   c. light sheet microscopy
II. Robotics allow live-cell imaging plates at high throughput

Special niches at UMIC, including custom-built microscopes and expert assistance that attract international researchers include

III. correlated light and electron microscopy (CLEM);
IV. ‘nanotomy’ to analyze molecules and organelles in tissues in a Google earth-like manner with nanometer range resolution
V. Identification using ‘Color’ electron microscopy

In 2021 several new techniques are available by a major upgrade of the instruments. UMIC is very dynamic and has many more approaches for cellular imaging, with several new investments planned. Do you want to apply seemingly impossible microscopic approaches in your research, feel free to contact us (www.umic.info).

Fig. 6.5a: Multimodal microscopy: Different signals are obtained from the electron microscope that allows ‘nanotomy’ and ‘ColorEM’. Samples are sent from other regions in the Netherlands/world to use these niche techniques in biomedical research.
Fig 6.5b: Tarzan (top) and Jane (bottom), zebrafish larvae to study the pancreas in context of Type 1 diabetes. UMIC optogenetics and imaging of living larvae, including using multi-photon, single plane illumination microscopy and FAST-EM.

People involved in the facility and their roles:
Ben Giepmans – Director
Klaas Sjollema – Managing Director Light Microscopy
Jeroen Kuipers – Managing Director Electron Microscopy
UMIC participates in the NVvM, NL-BioImaging, NEMI, is a DTL-hotel and nPOD core facility

Contact:
UMCG Microscopy & Imaging Center (UMIC)
Antonius Deusinglaan 1 (FB32)
9700 AD Groningen
The Netherlands

EM-dbase: nanotomy.org
UMIC core: umic.info
https://umcgresearch.org/w/umic
6.6 Cesium-137 γ-ray facility

The Cesium-137 γ-ray machine is to be used by authorized researchers to irradiate cells, Drosophila larvae, mice and rats and other samples.

People involved in the facility and their roles:
RPO (Radiation Protection Officer): Rob Coppes
RPE (Radiation Protection Expert): Rick Havinga
Contact person radiation worker (level 5): Uilke Brouwer

Contact:
https://bscs.umcg.nl/en/facilities/cesium-137%CE%B3-ray-facility/
ubrouwer@umcg.nl
Department of Biomedical Sciences of Cells and Systems
University Medical Center Groningen
Antonius Deusinglaan, 1
Section Molecular Cellbiology Internal Zipcode FB32
9700 AD Groningen
The Netherlands
# 7. Education

Teaching and training is also a core activity within the BSCS department. The research staff from BSCS is involved in a wide range of educational activities spanning across multiple faculties and institutions. Below we provide a list of courses that are being coordinated by the research staff from the BSCS. This list does not include the activities where the BSCS members were not the coordinators.

<table>
<thead>
<tr>
<th>Faculty/ Institute</th>
<th>Course</th>
<th>Coordinator</th>
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<tbody>
<tr>
<td>Medicine</td>
<td>G2020 Course Semester 1.2</td>
<td>Hiske van Duinen</td>
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<tr>
<td></td>
<td>G2020 Course Semester 2.1</td>
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</tr>
<tr>
<td></td>
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<td>Janniko Georgiadis</td>
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<td></td>
<td>G2020 PreMaster</td>
<td>Rob Bakels</td>
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<td></td>
<td>G2020 chair TBP (toetsbeoordelingspanel)</td>
<td>Rob Bakels</td>
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<tr>
<td></td>
<td>European Medical School Oldenburg-Groningen</td>
<td>Janniko Georgiadis</td>
</tr>
<tr>
<td></td>
<td>Psychiatry and Neuroscience (2nd year)</td>
<td>Branislava Ćurčić-Blake</td>
</tr>
<tr>
<td>Dentistry</td>
<td>Bachelor. year 1</td>
<td>Anne-Marijke Kosta</td>
</tr>
<tr>
<td></td>
<td>Coordinator Medische lijn</td>
<td>Inge Zijdewind</td>
</tr>
<tr>
<td>Science and Engineering (FSE)</td>
<td>Master BCN: Human neuroanatomy</td>
<td>Janniko Georgiadis</td>
</tr>
<tr>
<td></td>
<td>Bachelor Life Sciences &amp; Technology / Biology: Medical Physiology</td>
<td>Hiske van Duinen</td>
</tr>
<tr>
<td></td>
<td>Master BCN: Membrane Biology and Disease</td>
<td>Wia Baron</td>
</tr>
<tr>
<td></td>
<td>Medical Cell Biology</td>
<td>Muriel Mari</td>
</tr>
<tr>
<td></td>
<td>Functional Neuroscience</td>
<td>Susanne Kooistra</td>
</tr>
<tr>
<td></td>
<td>Glia and Stem Cell Biology</td>
<td>Bart Eggen</td>
</tr>
<tr>
<td>Human Movement Science</td>
<td>Bachelor BW: Neuroanatomie 1</td>
<td>Janniko Georgiadis</td>
</tr>
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<td>Bachelor BW: Algemene fysiologie</td>
<td>Ruby Otter-Drost</td>
</tr>
<tr>
<td></td>
<td>Bachelor BW: Neurofysiologie</td>
<td>Rob Bakels</td>
</tr>
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<td></td>
<td>Bachelor BW: Inspanningsfysiologie</td>
<td>Hiske van Duinen</td>
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<tr>
<td>University College Groningen</td>
<td>Anatomy &amp; Histology</td>
<td>Cyril Luman</td>
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<tr>
<td></td>
<td>Human Physiology</td>
<td>Pepijn Schoonen</td>
</tr>
<tr>
<td></td>
<td>Clinical Psychology: mental health and illness</td>
<td>André Aleman</td>
</tr>
<tr>
<td>Hanze</td>
<td>Anatomie van de mens(Master Physician Assistant)</td>
<td>Carola Haven</td>
</tr>
<tr>
<td>Post-graduate teaching and training</td>
<td>Common Trunk surgery residency training program</td>
<td>Janniko Georgiadis</td>
</tr>
<tr>
<td>BSCS/UMIC, UMCG</td>
<td>Cellular Imaging Light</td>
<td>Ben Giepmans</td>
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<tr>
<td>BCN, UMCG</td>
<td>Cognitive Neuro-psychiatry, Research Masters</td>
<td>Marie-José van Tol</td>
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<td>BCN</td>
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<td>Susanne Kooistra</td>
</tr>
<tr>
<td>BCN,UMCG</td>
<td>BCN Mathematics for neuroscientists</td>
<td>Branislava Ćurčić-Blake</td>
</tr>
</tbody>
</table>
8. Scientific dissemination & Business development

At BSCS, we encourage and support researchers to share our know-how, drive discoveries towards applications and (in doing so) collaborate with industries. We welcome collaborations to generate access to our scientific ideas and state-of-the-art facilities. Below we list out results from our recent efforts to connect science with business.

8.1 PKAN
The Sibon group discovered and developed a potential treatment for the neurodegenerative disease Pantothenate Kinase-Associated Neurodegeneration (PKAN) (Srinivasan et al., Nat. Chem Biol 2015; Jeong et al., EMBO MOL. MED 2019). Currently, financed by the Stichting Zeldzame Ziekte Fonds, Stichting Kans voor PKAN kinderen, de Stichting Lepelaar, ZonMW and the Hersenstichting, an investigator driven clinical trial started (September 2021) for PKAN patients in close collaboration with the Expertise Centre for Movement Disorders, at the UMCG. The product under investigation was designed, developed and produced (clinical usage grade) by prof. Sibon and her collaborators. The product is proven to be effective in Drosophila and mouse models for PKAN and the aim of the clinical study is to test our developed product in the clinic.

8.2 Enatom
Enatom is a joint initiative by the Section Anatomy & Medical Physiology and the 360 degree visualization company VIEMR to visualize in exquisite detail human anatomical specimens for use in distance learning applications and solutions. Thanks to considerable investments over the past few years, Enatom has made substantial progress in anatomic content and image quality.

8.3 Anatomy Gym
Anatomy Gym is a game-like App for smartphone and tablet to learn anatomical facts. It was launched in 2020. Anatomy Gym has seen considerable interest from users as well as from teaching parties that want to include specific modules. Anatomy Gym is scalable to a very large and diverse audience, and progress has been made to stimulate its further development and sustainability.

8.4 Stem cell therapy
Radiotherapy of head and neck cancer is often accompanied with dysfunction of the salivary glands leading to xerostomia (dry mouth syndrome). Basic science by the Coppes’ lab linked this to identification of a salivary gland cell stem compartment that is depleted by radiation. This has now developed into a stem cell therapy in which stem cells from the patient are collected before and give back after radiation for the treatment of this side effect. After pre-clinical testing and development of a protocol for safe clinical use, a first in man Phase I/II trial will start this summer at the UMCG.
9. Outreach & Dissemination

Besides research and education, all scientific staff members from BSCS, including PhD students, postdocs, and group leaders, have been actively involved in the scientific outreach and dissemination activities. Below we list out the notable activities by BSCS during the year 2021.

Outreach by the PIs:

1. Mario Mauthe, Fulvio Reggiori, Muriel Mari and Lara Barazzuol received a grant from the 2020 Million Dollar Bike Ride Grant Program.

2. Rob Coppes in an article on UMCGresearch.org: For the very first time, the UMCG starts offering tissue-specific stem cell transplants to cancer patients who are at risk of a dry mouth after radiotherapy. umcgresearch.org, stemcellpodcast.com, longfonds.nl, umcgkankerresearchfonds.nl, omroephetogeland.nl, longevity.technology, academictimes.com, reuma-amhemo.nl, svt.se, dvhn.nl, rd.nl, rtvnoord.nl-1 and rtvnoord.nl-2.


4. Iris Sommer on Brainwash talks (NPO2) gives a glimpse into the woman’s brain. https://www.tvgids.nl/tv/brainwash-talks

5. Marvelous Mind receives € 10,000 from KNAW science communication fund https://www.rug.nl/research/bcn-brain/marvelousmind/

6. Muriel Mari and Mario Mauthe on “Teaching from Bench to Bedside – A bachelor course at the crossroads of research, care and patient involvement” https://umcgresearch.org/w/teaching-from-bench-to-bedside


9. Rob Coppes in an article on UMCG KennisinZicht - Growing a working mini-organ with thyroid tissue https://kennisinzicht.umcg.nl/Paginas/schildklier-kweken.aspx


11. MS researcher Susanne Kooistra has been appointed as Assistant Professor https://bscs.umcg.nl/en/2021/08/23/appointment-susanne-kooistra-as-assistant-professor/

12. Susanne Kooistra received Rogier Hintzen Award https://bscs.umcg.nl/en/2021/10/04/susanne-kooistra-received-rogier-hintzen-award/

13. Marie-José van Tol is the new chair of De Jonge Akademie https://www.dejongeakademie.nl/nieuws/2106122.aspx

14. Iris Sommer has been awarded the Distinguished Lorentz Fellowship https://bscs.umcg.nl/en/2021/12/16/6006/

15. Iris Sommer was one of the speakers at 2021 Gala of Science https://ita.nl/nl/voorstellingen/gala-van-de-wetenschap-2021/1655706/


17. BSCS researchers Bart Eggen, Inge Zijdewind and Wia Baron are MT members of the MS Center Noord Nederland (MSCNN, www.mscnn.nl). As MSCNN coordinator Nieske Brouwer distributes a monthly electronic newsletter to inform subscribers (130) on timely topics (e.g., COVID-19 and MS), and MSCNN activities (e.g., MS seminars, PhD defenses) and MSCNN news (e.g., new employees, publications, grants), among others, via interviews.

18. Inge Zijdewind and Liesbeth Simmelink presented a research proposal during patient group meeting for the MS-vereniging regio Groningen/Noord Drenthe.
Outreach by the PhDs/Postdocs:

1. Dr. Yingying Cong from the group of Prof. Fulvio Reggiori received a 30,000 euros fellowship from Swiss IBSA Foundation to work on a research project entitled “Killing coronaviruses by striking at their heart” for 1 year. https://www.ibsafoundation.org/en/activities/fellowships/ibsa-foundation-fellowships-2020.

2. Mario Mauthe, from the group of Fulvio Reggiori, was elected as a new board member of the Nordic Autophagy Society (NAS). https://nordicautophagy.org/board-members/

3. Abel Soto Gamez, from the group of Prof. Rob Coppes, received the “Tekke Huizinga Funds” Scholarship for a study visit to two labs in Tokyo for improving skills in stem cell technologies.”

4. Shiral Gangadin, from the group of Iris Sommer, is one of the 12 new faces of science (KNAW) (Info)

5. Shiral Gangadin as Blogger Faces of Science 2021 https://www.nemokennislink.nl/facesofscience/wetenschappers/shiral-gangadin/

6. Janna de Boer and Alban Voppel, from the group of Iris Sommer, received the NWO Open Mind Award https://www.nwo.nl/nieuws/vijf-out-box-ideeengrijpen-open-mind-beurs

7. Three BSCS PhD students from the Section Molecular Neurobiology write an alternating blog (https://www.grunnmoves.nl/blog-mscnn) on their MS research and their experience as PhD students for the website of Grunn MoveS.

8. Tiago Medeiros Furquim and Alejandro Marmolejo Garza from BSCS, together with Prajit Dhar (Faculty of Arts) received a BCN Seed Grant 2021 for their project titled “Deciphering the grammar and morphology of the protein language in Alzheimer’s Disease”. https://www.rug.nl/research/behavioural-cognitive-neurosciences/information/bcn-seed-grants-2021.pdf

9. Rianne Gorter received a Network Glia ‘Young Investigator’ Stipend for the virtual Euroglia Meeting 2021.
## 10. Appendix 1: PhD graduations

More details about the PhD graduations can be found on the university research portal.

### Section Cognitive Neuroscience

<table>
<thead>
<tr>
<th></th>
<th>Student Name</th>
<th>Supervisor(s)</th>
<th>Thesis Title</th>
<th>DOI Link</th>
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<tbody>
<tr>
<td>1</td>
<td>Jasper Nuninga</td>
<td>Iris Sommer</td>
<td>Electrically induced neuroplasticity: Exploring the effects of electroconvulsive therapy for depression using high field MRI</td>
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<td>2</td>
<td>Mascha Linsen</td>
<td>Iris Sommer</td>
<td>Understanding hallucinations outside the context of psychotic disorders</td>
<td><a href="https://doi.org/10.33612/diss.18277500">https://doi.org/10.33612/diss.18277500</a></td>
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<td>3</td>
<td>Maya Schutte</td>
<td>Iris Sommer</td>
<td>A Transdiagnostic Comparison of Hallucinations</td>
<td><a href="https://doi.org/10.33612/diss.193691966">https://doi.org/10.33612/diss.193691966</a></td>
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<td>4</td>
<td>Shereif A.M.M. Haykal</td>
<td>Iris Sommer, Branislava Ćurčić-Blake</td>
<td>Visual pathway white matter alterations in glaucoma</td>
<td><a href="https://doi.org/10.33612/diss.183967255">https://doi.org/10.33612/diss.183967255</a></td>
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### Section Molecular Cellbiology

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<th>Thesis Title</th>
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<tr>
<td>5</td>
<td>Cecilia Rocchi</td>
<td>Coppes, R.P; Barazzuol, L</td>
<td>Exploring the Regeneration Potential of Salivary Glands using Organoids as a Model</td>
<td><a href="https://doi.org/10.33612/diss.168896082">https://doi.org/10.33612/diss.168896082</a></td>
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<td>6</td>
<td>Wouter Huiting</td>
<td>Kampinga, H.H., Bergink, S</td>
<td>The impact of genotoxic stress on protein homeostasis</td>
<td><a href="https://doi.org/10.33612/diss.168249330">https://doi.org/10.33612/diss.168249330</a></td>
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<tr>
<td>7</td>
<td>Yi Yu</td>
<td>Sibon, O.C.M., Schepers, H</td>
<td>Exploring novel strategies to rescue Coenzyme A deficiency-related diseases in Drosophila melanogaster models</td>
<td><a href="https://doi.org/10.33612/diss.177562111">https://doi.org/10.33612/diss.177562111</a></td>
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<tr>
<td>8</td>
<td>Marit de Beer</td>
<td>Giepmans, B.N.G., Sven Ijzendoorn</td>
<td>Development and application of protein-based probes for correlated microscopy.</td>
<td><a href="https://doi.org/10.33612/diss.147586577">https://doi.org/10.33612/diss.147586577</a></td>
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### Section Molecular Neurobiology

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<tr>
<td>9</td>
<td>Yang Heng</td>
<td>Bart Eggen, Jon Laman, Susanne Kooistra</td>
<td>Innate Immune memory and Transcriptional profiling of Microglia</td>
<td><a href="https://doi.org/10.33612/diss.151944032">https://doi.org/10.33612/diss.151944032</a></td>
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<td>10</td>
<td>Malte Borggrewe</td>
<td>Jon Laman, Bart Eggen, Susanne Kooistra</td>
<td>Exploring the VISTA of glial cells</td>
<td><a href="https://doi.org/10.33612/diss.168886037">https://doi.org/10.33612/diss.168886037</a></td>
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<tr>
<td>11</td>
<td>Clarissa Branco Haas</td>
<td>Bart Eggen, Jon Laman</td>
<td>Insulin signaling and microglia in the young and aged brain</td>
<td><a href="https://doi.org/10.33612/diss.183132348">https://doi.org/10.33612/diss.183132348</a></td>
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<td>12</td>
<td>Dennis Lentferink</td>
<td>Wia Baron, Bart Eggen</td>
<td>Regional diversity in oligodendrocyte progenitor cells: implications for remyelination in grey and white matter</td>
<td><a href="https://doi.org/10.33612/diss.165785285">https://doi.org/10.33612/diss.165785285</a></td>
</tr>
<tr>
<td>13</td>
<td>Charlotte de Jong</td>
<td>Wia Baron, Dick Hoekstra</td>
<td>On the role of galectin-2 in remyelination and multiple sclerosis</td>
<td><a href="https://doi.org/10.33612/diss.183761740">https://doi.org/10.33612/diss.183761740</a></td>
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11. Appendix 2: Publications

More details about these publications can be found on the university research portal.

Section Cognitive Neuroscience:


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Section Molecular Cellbiology:


Section Molecular Neurobiology:


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**Design and Illustrations:**
PuBliss | [www.publiss.nl](http://www.publiss.nl)  

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