



**NETHERLANDS
BRAIN BANK**

Progress Report

2015 – 2016



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The cover photo shows sections of brain areas, embedded in paraffin, cut at 8 µm thickness, and stained with Hematoxylin and Eosin staining. The image was adjusted from a photograph taken by Marieke de Lorijn.

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Introduction

It is with great pleasure that I present the 2015-2016 progress report of the Netherlands Brain Bank in which you can find numbers of registrations, societal outreach, autopsies and scientific output.

2015-2016 were important years for the NBB, when our extensive national brain donor program for psychiatric diseases was unrolled and we organized a national donor campaign for psychiatric diseases with poster boards at train stations and radio commercials. The campaign significantly increased the awareness of the necessity of brain donation for research in general and psychiatric diseases specifically. The attention for brain human brain tissue research in the media increased numbers of brain donor registrations of subjects with psychiatric diseases considerably. Currently, their numbers equal numbers of brain donor registrations of subjects with neurological diseases.

To note, the annual numbers of registration, autopsies and tissue applications all increased in 2015-2016. The increase in work load was reason to expand our NBB team with two employees to assist with registrations and with communication with researchers that apply for tissue.

We started a pipeline for post mortem MRI in tight collaboration with the neighbouring Spinoza Institute for Neuroimaging that has a 3T and 7T MRI available day and night. Post in situ mortem imaging will bridge the mesoscale image data with the microscale histological data for brain function and brain disease.

More than 500 papers were published with tissue provided by the NBB 2013- 2016 reporting important scientific break troughs in human brain tissue research and are listed in this annual report. In addition, the NBB was included as corporate co-author on several papers. NBB also published 'Brain Net Europe's Ethical Code of Conduct for Brain Banking'. This Code of Conduct covers basic legal rules and the bioethical principles involved in brain banking. Sources include laws, regulations and guidelines (Declarations, Conventions, Recommendations, Guidelines and Directives) issued by international key organizations.

I am greatly indebted to the Netherlands Institute for Neuroscience, the Royal Netherlands Academy for Arts and Sciences, Stichting MS Research, Stichting ParkinsonFonds, Hersenstichting, stichting Zabawas and de Vriendenloterij, as well as to private backers, for their financial support, which is indispensable for the continuation of the NBB.

I also thank the members of the autopsy team for their guidance and round-the-clock help with the autopsies. Many of them are (PhD) students and technicians who have volunteered to help us out despite their own busy programs and work commitments. Equally indispensable are the autopsy assistants and pathologists at VUmc, to whom I would like to express my gratitude for their unstinting willingness to perform the autopsies.

Last but not least, a heartfelt thank you to all our donors and their families, without whom worldwide scientific research of the brain and brain disease would not be possible.

Inge Huitinga
Director Netherlands Brain Bank

Vision and mission

The vision of the Netherlands Brain Bank

The human brain forms one of the main scientific puzzles and many aspects of its functioning are still waiting to be understood. Innovative research using human brain tissue may lead to major scientific breakthroughs regarding the understanding of the human brain in health and disease and yield novel therapeutic strategies to treat brain disorders.

The mission of the Netherlands Brain Bank

The Netherlands Brain Bank (NBB) facilitates cutting edge human brain research by providing the scientific community with the highest quality post mortem tissue of patients and matched controls in combination with cliniconeuropathological documentation. The NBB adheres to strict ethical guidelines such as informed consent, open access, non-profit policy as stated in Brain Net Europe's Ethical Code of Conduct for brain banking.

Donor Program

The Netherlands Brain Bank (NBB) has a prospective donor program, recruiting donors during life. In 2015-2016 the diagnoses that were explicitly welcomed were: Multiple Sclerosis, Alzheimer's disease (only via VUmc Alzheimer center), Parkinson's disease, Lewy Body Dementia, Frontotemporal Dementia and heritable neurodevelopmental disorders. In addition, the NBB has a separate donor program for psychiatric diagnoses, NBB-Psy. This program is described in more detail from page Finally, there is always the focus on registering control donors. Despite these focusses, every registration request of a person with another diagnoses is still reviewed on an individual basis. The donors register at the NBB via informed consent and registration forms in line with regulations and guidelines issued by international key organizations, such as the Council of Europe, the European Commission, the World Medical Association and the World Health Organization.

Registrations

On December 31, 2016, 4237 living donors were registered at the NBB, more than in any previous year. Figure 1 shows these registrations broken down by diagnosis.

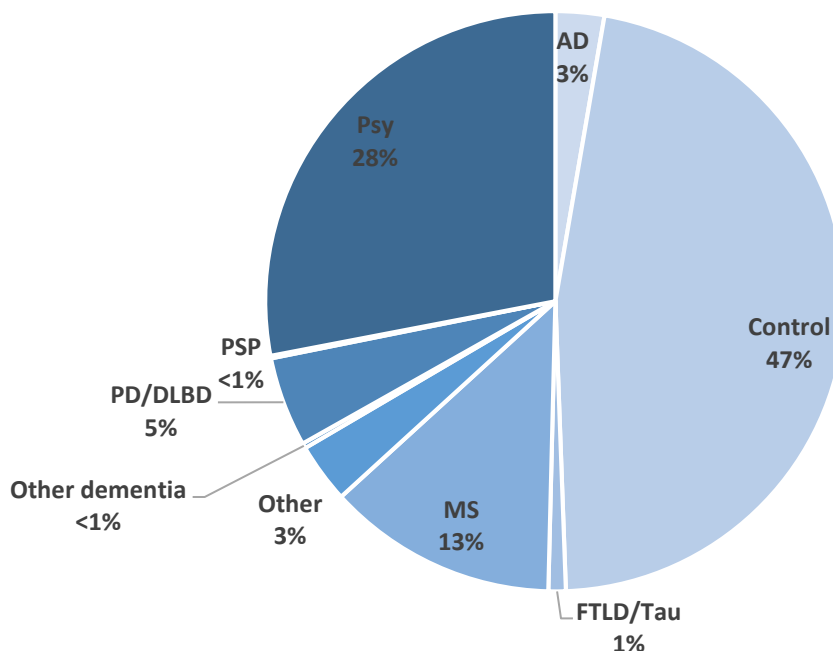


Figure 1: Registered donors on December 31, 2016 (total: 4237). Abbreviations: Control; Non-demented control, AD; Alzheimer's disease, FTLD/Tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PSP; Progressive supranuclear palsy, PD/DLBD; Parkinson's disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses.

In 2015 and 2016, a total number of 1507 new donors registered at the NBB. The distribution of new registrations across different diagnoses, compared with new registrations in earlier years, is shown in figure 2. The notable increase of both control donors and donors with a psychiatric diagnosis can be explained by

the active donor program of the NBB-Psy project, and specifically the launch of the national campaign for NBB-Psy in 2016.

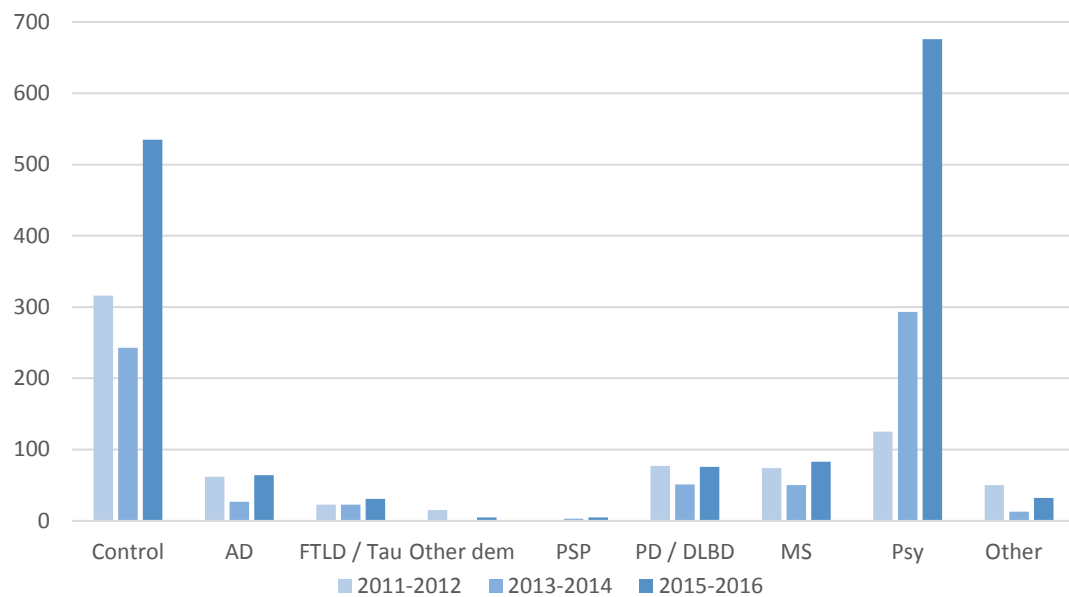


Figure 2: New donor registrations in 2011-2016. Abbreviations: Control; Non-demented control, AD; Alzheimer's disease, FTLD/Tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PSP; Progressive supranuclear palsy, PD/DLBD; Parkinson's disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses.

The distribution of new registrations across different diagnoses in 2015 and 2016 are shown in figure 3.

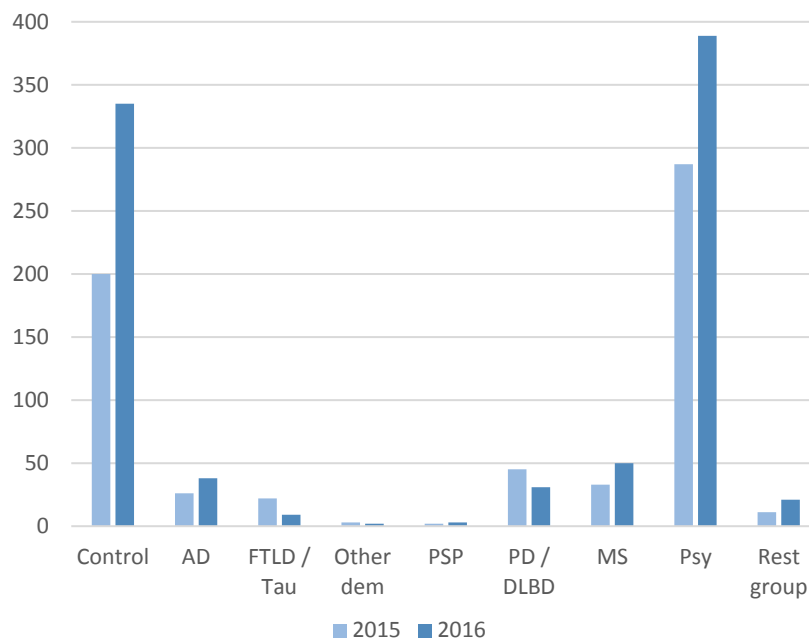


Figure 3: New donor registrations in 2015 and 2016. Abbreviations: Control; Non-demented control, AD; Alzheimer's disease, FTLD/Tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PSP; Progressive supranuclear palsy, PD/DLBD; Parkinson's disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses.

The Netherlands Brain Bank for Psychiatry (NBB-Psy)

Aim of NBB-Psy

The project 'The Netherlands Brain Bank for Psychiatry' (NBB-Psy) was launched in 2012. The aim of the project is to recruit brain donors diagnoses with one or more of the following psychiatric disorders: Schizophrenia or psychoses, bipolar disorder, major depression, obsessive-compulsive disorder, post-traumatic stress disorder, autism spectrum disorder, and attention-deficit hyperactivity disorder.

The NBB-Psy project is funded by the Netherlands Organisation for Scientific Research (NWO) with €3,450,000 for five years starting in 2012. The NBB-Psy project is a collaborative effort of the NBB and five University Medical Centers:

- University Medical Center Utrecht (UMC Utrecht)
- Academic Medical Center Amsterdam (AMC)
- VU University Medical Center (VUmc)
- Radboud University Medical Center (Radboudumc)
- Erasmus University Medical Center (Erasmus MC).

NBB-Psy donor program

Potential donors are approached both actively and passively. Mainly, participants of clinical research cohorts of the University Medical Centers participating in NBB-Psy are actively approached. In addition, NBB-Psy set up a network with relevant patient and family associations as well, in order to inform their members about NBB-Psy (Tables 2 and 3).

In march 2016, a national NBB-Psy donor campaign was launched concerning, posters, brochures and radio commercials to inform the Dutch public on the necessity of human brain tissue research to solve brain diseases and the need for brain donors, specifically those with psychiatric diseases and control donors. The campaign resulted increased awareness of the necessity of brain donation and increase in numbers of psychiatric and control donor registrations in 2016.



Figure 4: NBB-Psy poster on a train station.

After registration of a donor with a psychiatric diagnosis, this diagnosis is confirmed by requesting the official DSM-classification. In addition, all newly registered psychiatric and control donors are once interviewed by NBB-Psy research assistants. They perform the M.I.N.I. plus interview (Mini International Neuropsychiatric Interview, a diagnostic tool). Finally, information on the development and course of possible diseases during life is gathered via medical questionnaires. All donors answer the questions in this questionnaire at registration. Donors with a psychiatric diagnosis are asked to repeat this questionnaire yearly, and control donors are asked to repeat it 5-yearly, but this is not compulsory.

NBB-Psy registrations

On December 31, 2016, 1187 living donors with a psychiatric diagnosis were registered at the NBB. Figure 4 shows these registrations broken down by diagnosis. When a donor registers with two or more different diagnoses, only the main diagnosis is shown in the figures 5 and 6.

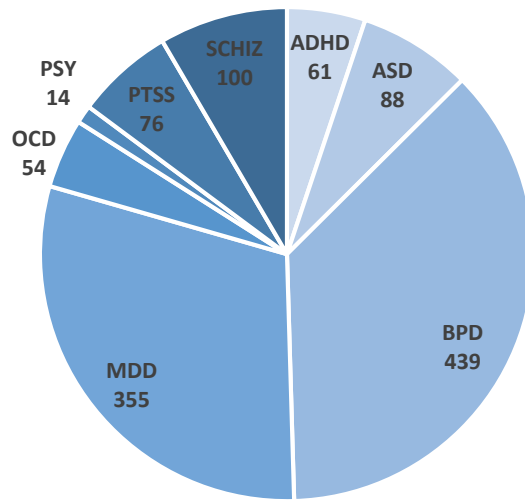


Figure 5: Registered psychiatric donors on December 31, 2016 (total: 1187). Abbreviations: ADHD; Attention deficit hyperactivity disorder, ASD; Autism spectrum disorder, BPD; Bipolar disorder, MDD; Major depressive disorder, OCD; Obsessive compulsive disorder, PSY; Psychiatric disorders (unspecified), PTSS; Post-traumatic stress disorder, SCHIZ; Schizophrenia.

On In 2015 and 2016, a total number of 676 new donors with one or more psychiatric disorder registered at the NBB. These new registrations, broken down by diagnoses are shown in figure 6.

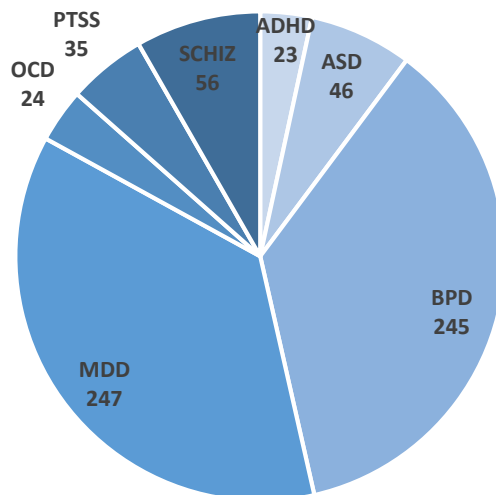


Figure 6: New registrations of psychiatric donors in 2015 and 2016 (total 676). Abbreviations: ADHD; Attention deficit hyperactivity disorder, ASD; Autism spectrum disorder, BPD; Bipolar disorder, MDD; Major depressive disorder, OCD; Obsessive compulsive disorder, PSYCH; Psychiatric disorders (unspecified), PTSS; Post-traumatic stress disorder, SCHIZ; Schizophrenia.

Collaboration with cohorts

In 2015-2016, the NBB has continued her collaborations with several clinical research cohorts. The people participating in such cohorts, are usually studied longitudinally during life and will be available for post mortem brain research after registration with the NBB, providing a valuable set of research data. The research cohorts with which the NBB participates are:

VUmc Alzheimer Center

All patients of the VUmc Alzheimer Centre informed about the possibility to register as brain donor at the NBB. In the Alzheimer Centre there are two specific brain donor programs for two specific patient groups:

- 100-plus study (project leader Dr. H. Holstege, VUmc): the 100-plus study researches non-demented centenarians during life and, since 2013, offers them the possibility to become a brain donor. The autopsy is then performed by the NBB and the brain is donated to VUmc. In total 74 100-plus participants are registered as a brain donor (December 31, 2016), and a total of 22 brain donations have taken place, of which 5 in 2015 and 13 in 2016.
- Pathological substrate of clinical variability in Alzheimer's disease (PAGE-AD) study (project leader Dr. RF. Bouwman): the PAGE-AD study researches the parietal type of Alzheimer's disease (AD), compared to typical AD patients and healthy controls since 2014. Participants are asked to register as a brain donor at the NBB, upon which their brain tissue will be available for research by the PAGE-AD study after their death. In total 60 PAGE-AD participants are registered at the NBB as a brain donor (December 31, 2016), and 7 brain donations have taken place, all of which in 2016.

Other cohorts

- Prevention of dementia by intensive vascular care (PreDIVA, project leader prof. P. van Gool, AMC, Amsterdam): The PreDIVA study researches cardiovascular intervention in relation to dementia, and collaborates with the NBB since 2014. So far (December 31, 2016) one PreDIVA participant has registered at the NBB as a brain donor.
- Collaborations with specialized nursing homes, who inform their residents about the NBB.
 - Dijk en Duin: Ederly persons with psychiatric symptoms and/or cognitive behavioral problems
 - Nieuw Unicum: multiple sclerosis

Donor communication

Like previous years, our websites www.hersensbank.nl, www.brainbank.nl, www.nhb-psy.nl and www.nbb-psy.nl were available to inform both donors and researchers. The NBB also has brochures, both for with general information about the NBB, and specifically about NBB-Psy.

NBB-Psy

The website www.wehebbenhersensnodig.nl was launched for the national campaign of NBB-Psy in 2016. Donors with a psychiatric diagnosis and control donors also received the NBB-Psy newsletter in both 2015 and 2016, to inform them about developments within the project.

Public relations

The NBB has continued to raise awareness for the NBB and the importance of brain research through several activities and media, including presentations, magazine articles, and tv and radio items. Tables 1-3 provide an overview of all these activities, articles/items. Due to the national campaign of NBB-Psy, there has been a

particular focus in PR activities focused on potential psychiatric donors. These articles/items and activities are therefore described separately in table 2 and 3 respectively.

Table 1: Overview of public relations activities and articles on the work of the NBB in 2015 and 2016 (general PR activities and activities focused on non-psychiatric diagnoses).

Date	Title*/description	Medium/information
January 2015	“Wife of Ab Janssen (1933-2013) pleas for the Netherlands Brain Bank”	Parkinson Magazine
January 2015	“Brain research: the only way to really get ahead”	PreDIVA Magazine
January 2015	“On a state visit? Me? That can’t be true!”, article about Inge Huitinga joining the state visit of King Willem-Alexander and Queen Maxima to South Korea	Rondom MS (magazine)
March 2015	“Much potency is fixed – we know more and more about the brain, brain diseases and possible treatments”	Volkskrant (daily newspaper)
March 2015	King Willem-Alexander visits the Netherlands Institute for Neuroscience	Event
April 2015	“The faces behind MS-research – Many new answers, but also many new questions”	MS Mensen (magazine)
May 2015	Online article and video about the NBB, including a conversation between Inge Huitinga and Liesbeth Kooij and MS-patients	Nieuwunicum.nl
May 2015	Inge Huitinga is present on an event for MS patients on World MS Day	Event
June 2015	Interview with Perta Brom about the NBB	NPO 1 (radio)
June 2015	“World MS day 2015”, report on the Wolrd MS Day event where Inge Huitinga was present	MS Mensen (magazine)
August 2015	Interview with Michiel Kooreman about the NBB	NPO 1 (radio)
September 2015	“Alzheimer protein is potentially contagious”, article including comments of Annemieke Rozemuller, neuropathologist NBB	NRC Handelsblad (daily newspaper)
October 2015	Inge Huitinga is present on the MS information day in VU University Medical Center	Event
October- November 2015	Recurrent radio commercial about MS featuring Inge Huitinga	Radio 1, 2, 4 and Classic FM
October 2015	The NBB is present on a public event of the Dutch Brain Foundation	Event
October 2015	Bonnie van Huik and Petra Brom (NBB) give a presentation at the Parkinson Café	Event
October 2015	“The Netherlands knows many stars in MS research”, article featuring, amongst others, Inge Huitinga	Rondom MS (magazine)
November 2015	“The Netherlands Brain Bank is looking for donors”, article about the NBB	Jong (Dutch Brain Foundation magazine)
December 2015	“Thinking outside the box is also of great importance in MS research”, interview with Inge Huitinga about the NBB	VOZ (magazine)
December 2015	“About the Brain Bank”	Het Klavier (magazine)
January 2016	“Always looking for donors: the Netherlands Brain Bank”, online article	http://www.biobanken.nl/

Table 1 NBB PR activities (continued)

Date	Title*/description	Medium/information
February 2016	Bonnie van Huik and Petra Brom (NBB) give a presentation at the Parkinson Café	Event
March 2016	Pictures of the NBB are included in the database of photo agency Hollandse Hoogte	www.hollandse-hoogte.nl
September 2016	“Severe shortage of donor brains”, interview with Inge Huitinga about the NBB	De Telegraaf (daily newspaper)
September 2016	“Brainwalk”, people with acquired brain injury walk/run for the NBB, organized by the Rotary of Leudal	Event
October 2016	Bonnie van Huik and Petra Brom (NBB) give a presentation at the ParkinsonNet congress region South-East	Event
October 2016	Petra Brom and Sophie Kuijpers (NBB) were present with an information stand at a public event of the Dutch Brain Foundation	Event

*Original Dutch titles were translated in English

Table 2: PR NBB-Psy - overview of public relations activities and articles in 2015 and 2016, focused on psychiatric diagnoses

Date	Title*/description	Medium/information
January 2015	“We just know too little” (subtitle: “Brain bank investigates brains of deceased with a psychiatric disease”), Interview with Inge Huitinga and Saskia Palmen on NBB-Psy	Relevant (magazine)
March 2015	“Why is Hannie Boumans brain donor” Interview with mother of schizophrenia patient, by Geertje de Lange	Ypsilon News (patient magazine)
March 2015	“The Netherlands Brain Bank for Psychiatry is looking for brain donors”, article by Geertje de Lange	Open Geest, Anoiksis (patient magazine)
March 2015	Interview with a bipolar patient contemplating brain donation, by Geertje de Lange	PlusMinus (patient magazine)
May 2015	“About Brains and Death”, by Menno Oosterhoff	Online article OCD Netwerk, dwang.eu
June 2015	Interview with Henk Driessen, schizophrenia patient and brain donor, by Geertje de Lange	Open Geest, Anoiksis (patient magazine)
June 2015	NBB-Psy digital newsletter	Nhb-psy.nl and by email to registered control and psychiatric donors
June 2015	Launch of animated NBB-Psy short movie	Nhb-psy.nl
June 2015	Interview with bipolar patient who is cohort study participant and brain donor, by Geertje de Lange	PlusMinus (patient magazine)
September 2015	“I gladly make my vulnerable genes available”, interview with director of schizophrenia family association Ypsilon who is brain donor, by Geertje de Lange	Ypsilon News (patient magazine)

Table 2 PR NBB-Psy (continued)

Date	Title*/description	Medium/information
December 2015	“NBB-Psy, what is that exactly?”, article about NBB-Psy and interview with Nel Hooiveld research assistant NBB-Psy	Netherlands Study of Depression and Anxiety (magazine)
February, 2016	“Brain donors wanted for research”, online article about NBB-Psy	Nedkad.nl
14-3-2016	“Wanted: a piece of your brain”, online article	Gezondheid.eenvandaag.nl
14-3-2016	“Wanted: a piece of your brain”	EenVandaag (daily television show)
14-3-2016	“Wanted: a piece of your brain. Watch back”	EenVandaag Twitter
15-3-2016	“Call: donate brain after death”	EenVandaag radio
15-3-2016	“The Netherlands Brain Bank started a campaign to recruit donors amongst psychiatric patients for research”	NOS, Twitter
15-3-2016	“Brain bank is looking for donors amongst psychiatric patients”, online article	Nos.nl
15-3-2016	“Shortage of donated brains from psychiatric patients”, online article	www.nu.nl
15-3-2016	“Brain Bank is looking for Brains”, interview with Inge Huitinga	NPO radio 1 – 3FM
15-3-2016	“Brain bank recruits donors amongst psychiatric patients”, interview with Myrthe van der Meer, initiation of national campaign for NBB-Psy	Trouw (daily newspaper)
15-3-2016	“Wanted: brains from psychiatric patients”, online article	www.telegraaf.nl (website of daily newspaper)
15-3-2016	“The Netherlands Brain Bank is looking for brains”, online article	www.skipr.nl
15-3-2016	“Netherlands Brain Bank starts campagne for donors amongst psychiatric patients”, online article	www.nationalezorggids.nl
16-3-2016	“Myrthe donates her brain to research”	NOS op 3 Facebook
16-3-2016	“The Netherlands Brain Bank is looking for brains”, video	NOS op 3 YouTube
16-3-2016	“Brain Bank is looking for donors amongst psychiatric patients. @MyrthevdMeer in #eenvandaag”	NPO Radio1 Twitter
16-3-2016	“Brain bank urgently needs brains from psychiatric patients”, online article	www.blikopnieuws.nl
16-3-2016	“Brains wanted”	MaxVandaag (television)
16-3-2016	“Share your brain for research”	AmsterdamFM (radio)
16-3-2016	“Brain Bank is looking for donors”	EO Radio5 (radio)
17-3-2016	“The NBB needs brains”, online article	www.nvvp.net
March 2016	“Netherlands Brain Bank starts campaign ‘We need brains’”, article about the start of the NBB-Psy campaign	Nedkad.nl
March 2016	“Netherlands Brain Bank for Psychiatry: unraveling the human brain to understand psychiatric disorders”, article about the presentation of Saskia Palmen at the annual day of Anoiksis	Open Geest, Anoiksis (patient magazine)
March 2016	“Brain bank is looking for brain donors with depression”, online article about NBB-Psy and the start of the campaign	Depressievereniging.nl

Table 2 PR NBB-Psy (continued)

Date	Title*/description	Medium/information
March 2016	“Brain bank is looking for brain donors with depression”, short article about the campaign with a link to the longer article about the website of depressievereniging	Newsletter depressievereniging
June 2016	“News from the Brain Bank”, article about NBB-Psy national campagne	Open Geest, Anoiksis (patient magazine)
02-07-2016	Advertisement for NBB-Psy	Trouw and Volkskrant (daily newspapers)
July 2016	Description of the Netherlands Brain Bank and the project NBB-Psy on Wikipedia	nl.wikipedia.org/wiki/Nederlands_Hersenbank
July 2016	Launch of a Facebook page of the NBB	Facebook.com/Hersenbank
August 2016	“The Netherlands Brain Bank for Psychiatry”, article about NBB-Psy including the motivation of a GGZ Oost Brabant patient to become a donor	De Horizon (patient magazine of GGZ Oost Brabant)
September 2016	“Understanding ASD better through postmortem brain research”, article about NBB-Psy	Engagement met autism (magazine)
October 2016	“Message from the NBB”, article about NBB-Psy	Newsletter 22Q11
October 2016	Description of NBB-Psy on the NESDA website	nesda.nl/over-nesda/nesda-deelstudies/
December 2016	“Brain tissue for research”	De Reinier, magazine

*Original Dutch titles were translated in English

Table 3: Presence of NBB-Psy team members at congresses and events in 2015 and 2016

Date	Venue (diagnosis of focus*)	Additional information
March 2015	ADHD women conference, Utrecht (ADHD)	Present with information stand
March 2015	Visit Munich Brain Bank, Germany (all)	Visit by Saskia Palmen and Marleen Rademaker
March 2015	Reinier van Arkel – departement of Psychiatry (all)	Presentation by Saskia Palmesn and Marleen Rademaker
March 2015	Kenniscentrum Depressie en Angst (MDD)	Presentation by Lisette Kuijper and Marleen Rademaker
March 2015	Autism Congress (ASD)	Presentation by Saskia Palmen
April 2015	Symposium ASD & Science, Brainbank Amsterdam (ASD)	Presentations by Saskia Palmen, Marleen Rademaker and guest speaker
May 2015	Huiskamergroep (Schizophrenia)	Presentation on NBB-Psy for peer get together
May 2015	Rotary Gouda (all)	Presentation by Saskia Palmesn and Marleen Rademaker
June 2015	GGNet Apeldoorn (all)	Presentation by Marleen Rademaker

Table 3 Presence of NBB-Psy team members at congresses and events (continued)

Date	Venue (diagnosis of focus*)	Additional information
June 2015	GGz inGeest, locatie Zuiderpoort (all)	Presentation by Mark Mizee and Marleen Rademaker
June 2015	Symposium KJP/KP Karakter, Arnhem (ASD and ADHD)	Presentation by Marleen Rademaker
June 2015	Academic Hour Karakter, Nijmegen (ASD and ADHD)	Presentation by research assistant
June 2015	Annual Dutch depression association day (MDD)	Present with information stand
June 2015	National VMDB day (BPD)	Present with information stand
June 2015	Annual day for the Dutch Study of Depression and Anxiety (MDD)	Presentation by Marleen Rademaker and Mark Mizee for researchers and poster presentation
June 2015	Regional meeting of Anoiksis Nijmegen (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
July 2015	GGZ Centraal, locatie Amersfoort (all)	Presentation by Marleen Rademaker (for central client advice board)
July 2015	Information afternoon NBB-Psy, PsyQ Den Haag (all)	Present with information stand
August 2015	Regional meeting of Anoiksis Utrecht (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
September 2015	Regional meeting of Anoiksis Eindhoven (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
September 2015	National VMDB day, Utrecht (BPD)	Present with information stand
September 2015	Research meeting RadboudUMC Psychiatry, Nijmegen (ASD and ADHD)	Presentation by Saskia Palmen
September 2015	Regional Anoiksis meeting, Noord-Brabant Oost (Schizophrenia)	Presentation by Lisette Kuijper
Oktober 2015	Information afternoon NBB-psy, PsyQ Rotterdam (ADHD)	Present with information stand
Oktober 2015	National Anoiksis day (Schizophrenia)	Presentation by Saskia Palmen and information stand
Oktober 2015	Symposium 'The flexible brain', Hersenstichting Utrecht (all)	Present with information stand
Oktober 2015	PAOH course for physicians at Radboudumc (all)	Presentation by Saskia Palmesn and Marleen Rademaker
Oktober 2015	Annual congress of 'Professionals in NAH' (all)	Presentation by Saskia Palmen, Marleen Rademaker and Mark Mizee
Oktober 2015	Centrum '45, Oegstgeest (PTSD)	Presentation for policemen, by Kim van Dijk
Oktober 2015	Centrum '45, Oegstgeest (PTSD)	Presentation for veterans, by Kim van Dijk
November 2015	Annual Autism congress, Utrecht (ASD)	Present with information stand

Table 3 Presence of NBB-Psy team members at congresses and events (continued)

Date	Venue (diagnosis of focus*)	Additional information
December 2015	National VMDB day (BPD)	Present with information stand
December 2015	Trajectum (all)	Presentation by Saskia Palmen and Mark Mizee
March 2016	National VMDB day (BPD)	Presentation by Saskia Palmen and information stand
April 2016	Regional meeting of Anoiksis Leeuwarden (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
June 2016	ADHD vrouw-dag (ADHD)	Present with information stand
June 2016	Regional meeting of Anoiksis Amsterdam (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
June 2016	Regional meeting of Anoiksis Rijswijk (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
July 2016	Advocacy day Conference of International society of Bipolar and Affective Disorders (BPD)	Stand of NBB-Psy with brochures
August 2016	PsyQ Utrecht (ADHD)	Presentation of the NBB
September 2016	Regional meeting of Anoiksis Overijssel/Gelderland (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
September 2016	Regional meeting of Anoiksis Rotterdam (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
September 2016	Regional meeting of Anoiksis Deventer (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
September 2016	National VMDB day (BPD)	Present with information stand
September 2016	Valerius Symposium (oration Odile van der Heuvel) (All)	Handing out brochures at the Valerius Symposium
Oktober 2016	Regional meeting of Anoiksis Leiden (Schizophrenia)	Presentation of the NBB at Anoiksis meeting
Oktober 2016	Lunchmeeting AMC, team Miranda Olf (PTSS)	Presentation NHB-psy and update PTSS-registrations
December 2016	PDC politiepoli	Cooperation PDC-politiepoli NHB Psy (Chantal)
december 2016	Psychiater meeting Dijk en Duin	Presentation by research assistant
december 2016	National VMDB day, Utrecht	Stand of NBB-Psy with brochures

* Diagnosis abbreviations are listed in the List of Abbreviations (page 71)

Autopsies and diagnostics

On December 31, 2016 a total number of 4121 brain donations had taken place via the NBB. In 2015 and 2016, 114 and 139 autopsies were performed by the NBB respectively. The numbers of autopsies in the years 2009 – 2016 are shown in figure 7.

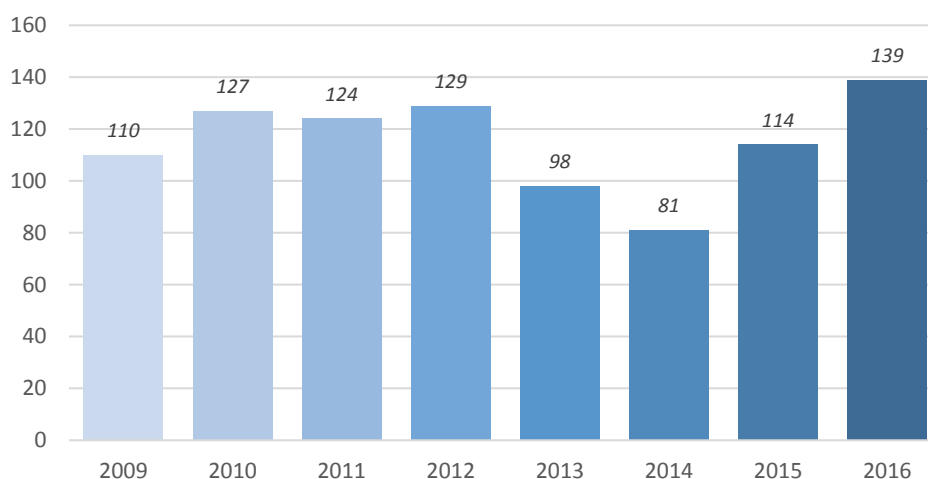


Figure 7: Total numbers of autopsies in 2009 – 2016.

The numbers of autopsies in 2009 – 2016 and broken down per diagnosis, are shown in figure 8. In cases where the donor had two or more diagnoses, only the main diagnosis is shown.

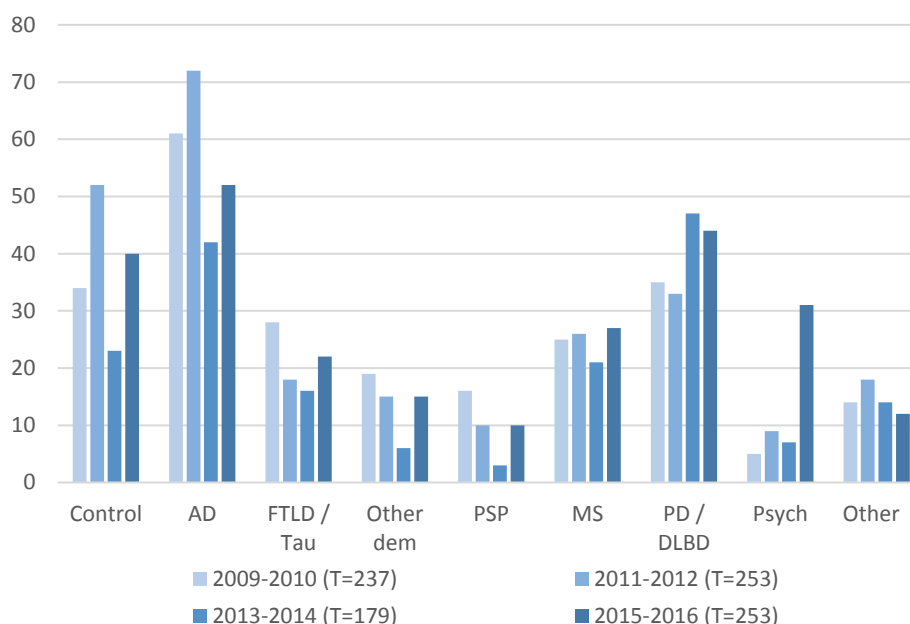


Figure 8: Numbers of autopsies in 2009 – 2016, broken down by diagnosis. Abbreviations: Control; Non-demented control, AD; Alzheimer's disease, FTLD/Tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PSP; Progressive supranuclear palsy, PD/DLBD; Parkinson's disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses.

Figure 9 shows the total number of brain donors (4142) from which the NBB has obtained brain material from 1985 – 2016, broken down by diagnosis. The same side notes concerning the clinical diagnoses and the main diagnoses as described above apply.

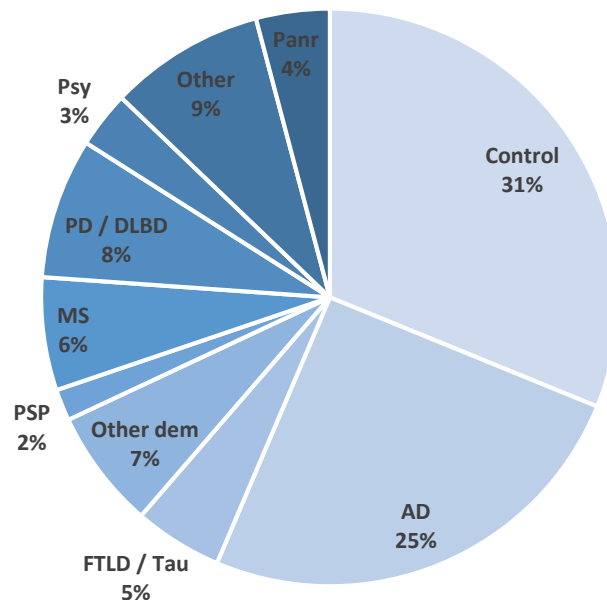


Figure 9: Brain donation since 1985, broken down by diagnosis (4142 on December 31, 2016). Abbreviations: Control; Non-demented control, AD; Alzheimer's disease, FTLD/Tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PSP; Progressive supranuclear palsy, PD/DLBD; Parkinson's disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses.

Post mortem delay

The NBB aims to collect brain tissue as soon as possible after death, to ensure a short post mortem delay and high quality tissue. In this, the NBB has a stable yearly average between 6 and 7 hours. This relatively short post mortem delay is achieved by: the NBB's prospective donor registration policy, the NBB's ability to perform autopsies 24/7, and the relatively small size of the Netherlands.

Figure 10 shows the average post mortem delay in the years 2012 – 2016.

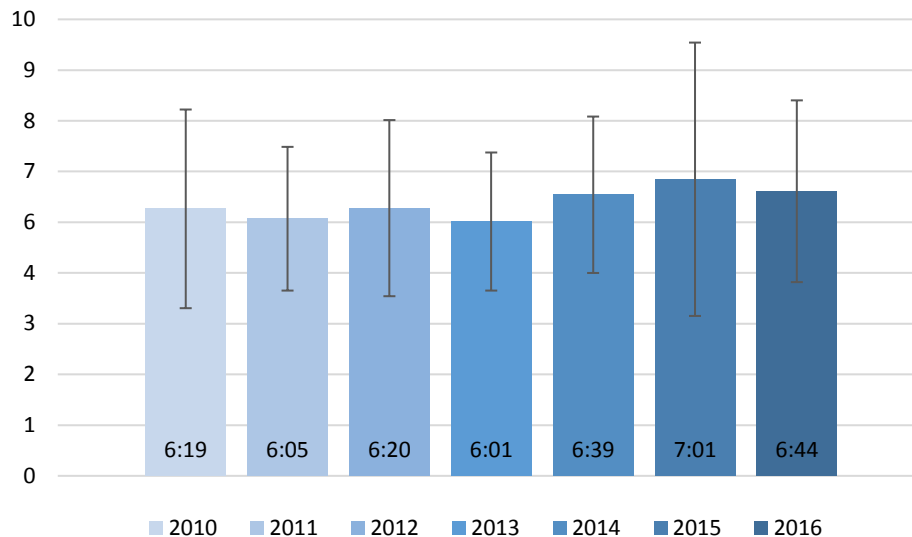


Figure 10: Annual mean post mortem delay in hours \pm standard deviation

Autopsy procedures

In 2015 and 2016 the NBB has continued its autopsy procedures as developed over previous years. The NBB uses different autopsy protocols for different diagnoses, because the affected brain regions differ per diagnosis and dissects up to 200 different brain regions for researchers. In all protocols, one hemisphere is fixed in formalin and used for the post-mortem diagnosis. From the other hemisphere, samples are taken for both frozen and FFPE storage as well as fresh for culture or immediate analysis.

Eye dissection

In addition to donating their brain, donors can also choose to give permission for the donation of their eyes. In 2009, initiated by Professor Arthur a. Bergen, the NBB included eyes in its donor program. Researchers can request these eyes either frozen, or fresh in medium in which case they will be collected from future autopsies. So far a total of 256 eyes, have been collected of which 34 eyes in 2015 and 2016. Whether these additional tissues are actually collected during an autopsy where there is permission to do so, will depend on the demand for these tissues from the research community.

NBB-Psy

The autopsy protocol for psychiatric donors differs from that for other donors in three ways:

- The left and right hemispheres are used alternatingly for diagnostics and storage respectively. This is because the neuropathological make-up for various psychiatric disorders is not yet fully mapped, and may be unilateral.
- A small piece of skin is collected from the back of the head, from which iPSCs are generated by the Erasmus Stem Cell Centre (headed by Prof. Joost Gribnau and Dr. Mehrnaz Ghazvini, ErasmusMC, Rotterdam) for dissemination by NBB-Psy.
- Pure microglia are isolated from the occipital cortex and corpus callosum, for dissemination by NBB-Psy.

Post mortem diagnosis

After the autopsy, the tissue from one hemisphere is fixed in formalin for four weeks and subsequently divided in approximately eighteen standard regions, embedded in paraffin, cut and (immuno) histochemically stained. The sections are then evaluated by one of three neuropathologists, who use their evaluation along with the clinical medical information about the donor, to provide the final diagnosis.

Because it can differ from the clinical diagnosis, brain tissue is only available for dissemination after this final diagnosis has been set, so the NBB is sure of what tissue she provides to researchers. The exception is fresh tissue provided to researchers for purposes of cell culture.

Tissue supply

The NBB transfers tissue to researchers of both for-profit and non-profit organizations, given that their tissue application was approved by the NBB's tissue advisory board, and a Material Transfer Agreement (MTA) is signed between the NBB and said organization. A template of the MTA used by the NBB can be found on ...

On December 31, 2016, MTA's between the NBB and a total of 167 different organizations are in place. 142 of which are universities or research institutes and 25 are pharmaceutical companies. 23 of the MTA's with universities and research institutes, and 10 of the MTA's with pharmaceutical companies were signed in 2015 and 2016.

In 2015 and 2016, the NBB received 158 tissue requests for new projects. 115 from universities and/or research institutes and 43 from pharmaceutical companies. In addition, there were 192 follow-up requests for additional tissue for previously approved projects, 166 from universities and/or research institutes and 26 from pharmaceutical companies. Finally, there are continuous applications. These are typically requests for fresh tissue, collected prospectively during autopsies. In 2015 and 2016, 60 new continuous applications were accepted, of which 55 from universities and/or research institutes and 5 from pharmaceutical companies.

Figure 11 shows all tissue applications in 2015 and 2016, broken down for the previously described categories: new applications, supplementary applications and continuous applications.

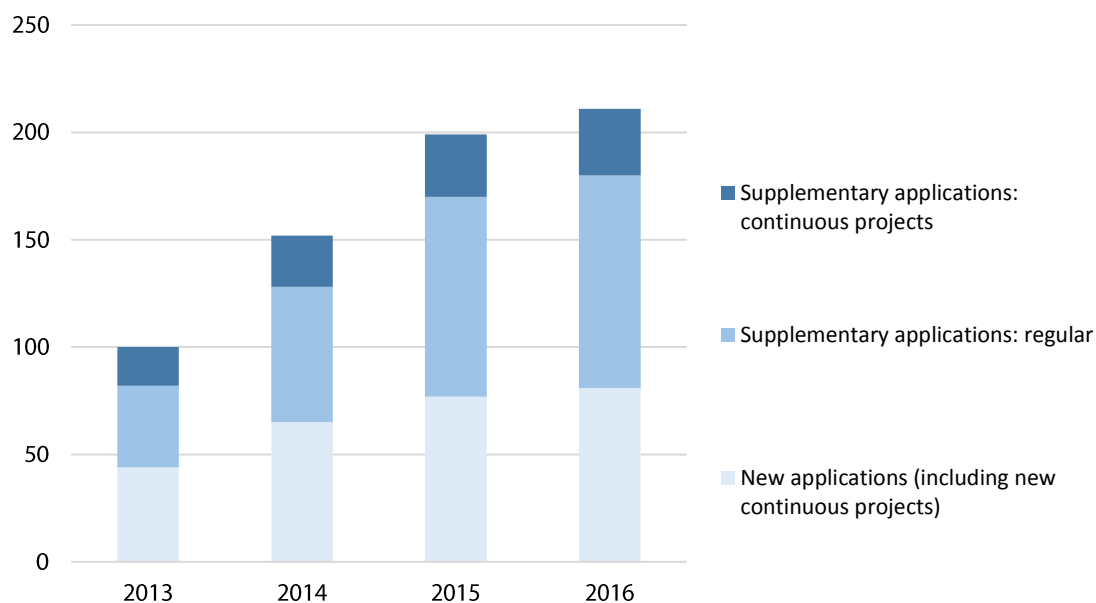


Figure 11: All tissue requests in 2015 and 2016, compared with 2013 and 2014.

Number of samples supplied to research projects

In 2015 and 2016 a total of 9835 samples were supplied to researchers, of which 5466 in 2015 and 4368 in 2016. Figure 12 shows the supplied tissue samples per diagnosis in 2009 - 2016.

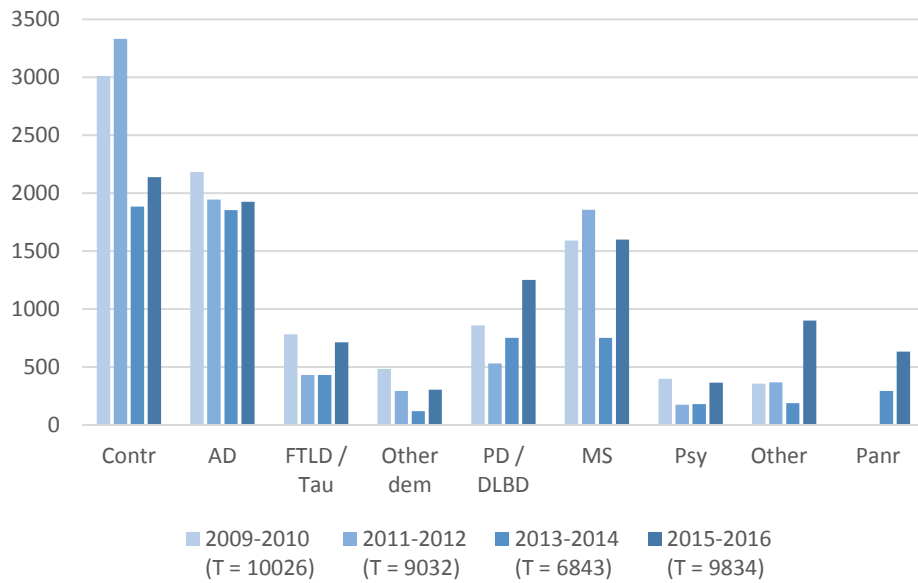


Figure 12: Supplied tissue samples in 2009 – 2016, broken down by diagnosis. Abbreviations: Contr; Non-demented control, AD; Alzheimer’s disease, FTLD/tau; Frontotemporal lobar degeneration/Tauopathy, Other dem; Other types of dementia, PD/DLBD; Parkinson’s disease/Diffuse Lewy body dementia, MS; Multiple Sclerosis, Psy; Psychiatric disorders, Other; Other diagnoses, Panr; Pathological report not ready yet.

Figure 13 shows the supplied tissue samples per type of storage in 2009 – 2016, showing an increase in supplied fresh tissue samples in 2015 and 2016 compared to previous years.

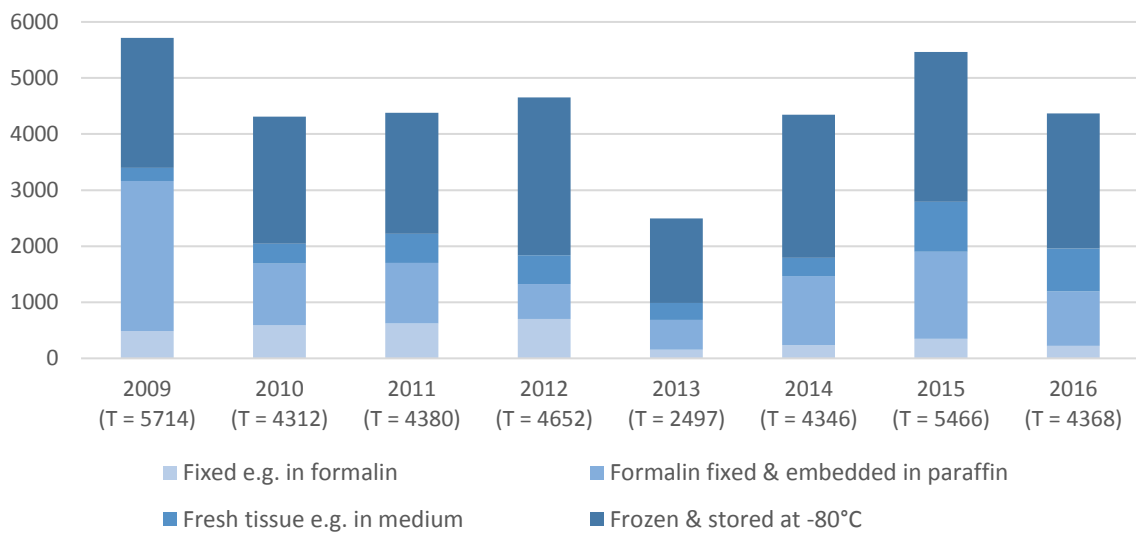


Figure 13: Supplied tissue samples in 2009 – 2016, broken down by type of storage.

Finances

The NBB is a department of the Netherlands Institute for Neuroscience (NIN), which is an institute of the Royal Netherlands Academy of Arts and Sciences (KNAW). As such, the NBB receives structural financial support from both the NIN and the KNAW. Besides this structural support, the NBB is entirely dependent on grants, donations and the financial contributions from the researchers who apply for tissue at the NBB.

General grants

Grant	2015	2016
Structural contribution from NIN	€324,144	€324,144
Stichting MS Research	€111,096	€111,096
Stichting ParkinsonFonds	€43,500	€10,875
Hersenstichting	€15,000	€15,000
Stichting Zabawas	€16,430	€0

Project based grants

Funding organization	Project	Period	Amount
NWO ¹ (Netherlands Organisation for Scientific Research)	The Netherlands Brain Bank for Psychiatry (NBB-Psy)	15-9-2012 - 15-9-2020	€3,450,000
Vriendenloterij ²	Neuropathological subtypes and gender difference in MS	15-5-2015 - 1-9-2019	€295,000

The grant for NBB-Psy was granted to the NBB and the five participating Dutch university medical centers, University Medical Center Utrecht (UMC Utrecht), Academic Medical Center Amsterdam (AMC), VU University Medical Center (VUmc), Radboud University Medical Center (Radboudumc), and Erasmus University Medical Center (Erasmus MC). The project and its budget are coordinated by the NBB.

The necessity of grants

The costs to make tissue available for research are approximately €800,000 per year. Without the help of patient organizations and other funding agencies, the NBB would not be able to maintain its high standards, and it is only thanks to the received funding that the NBB is able to continue brain banking.

Stichting MS Research³ (MS Research Foundation) has been funding the NBB for many years, resulting in an increase of the number of MS donors and in the availability of MS tissue. Due to the special MRI-guided

¹ <https://www.nwo.nl/>

² <https://www.vriendenloterij.nl/>

³ <https://msresearch.nl/>

dissection protocol, the autopsy costs for MS are higher than for other autopsies. Moreover, the clinical history of MS patients is often more extensive and the summarization of the medical information requires a greater effort. Lastly, in-depth neuropathological diagnostics of the MS plaques is time-consuming, but indispensable for good tissue dissemination. MS Research covers the costs of all MS autopsies and of some control autopsies.

The grants of **Stichting ParkinsonFonds**⁴ (Parkinson Fund Foundation) cover the costs of some of the Parkinson autopsies and some donor recruitment activities, which would not be possible without this additional funding.

Funding by **Hersenstichting**⁵ (Brain Foundation) and **Stichting Zabawas**⁶ (Zabawas Foundation) is used to cover costs for donor recruitment, autopsies and administration.

Private donations

Stichting Vrienden van het Herseninstituut (Friends of the Netherlands Institute for Neuroscience Foundation) helps the NBB to reach its objectives by giving financial support.

In 2015, we received €11,601.88 in donations through this foundation, and in 2016 we received €1,769.11. Financial donations remain vital to the continued existence of the NBB and are thus very welcome. If you wish to help, please make your donation to: Stichting Vrienden van het Herseninstituut, IBAN: NL76INGB0002167378; BIC: INGBNL2A), mentioning “NBB”.

Because the foundation also raises money for the Netherlands Institute for Neuroscience in general, mentioning “NBB” ensures that your donation reaches us. The Foundation is registered at the Dutch Chamber of Commerce under registration no. 41205869.

We are very grateful for all grants and donations. The work of the NBB would not be possible without the support of numerous foundations and patient organizations, and the enthusiastic dedication of individuals.

⁴ <https://www.parkinsonfonds.nl/>

⁵ <https://www.hersenstichting.nl/>

⁶ <https://www.zabawas.nl/>

Research projects 2015 – 2016

An overview of the projects, both national and international, which received tissue from the Netherlands brain bank. For all projects, the primary applicant(s), their affiliation, and the project title as submitted in the NBB-application form is listed, unless specified otherwise by the researcher.

- Aguila Benitez**, J., Nichterwitz, S., Nijssen, J., Allodi, I., Comley, L.H., Hedlund, E. Karolinska Institutet, Department of Neuroscience, Retzius v. 8, 171 77 Stockholm, Sweden. Identification of protective and degenerative pathways in motor neuron disorders.
- Albrecht**, S., Ghelman, J., Kemming, C., Kuhlmann, T. Institute of Neuropathology, University Hospital Münster, Pottkamp 2, 48149 Münster. Extent of remyelination in spinal cord lesions compared to brain lesions.
- Amor**, S., Kipp, M., van der Valk, P. Vrije Universiteit Medical Center, Amsterdam, The Netherlands. Pre-active MS lesions hold clues for reversal of inflammation. Stichting MS Research.
- Amor**, S. Vrije Universiteit Medical Center, Amsterdam, The Netherlands. Pentraxin 3 - a novel anti-inflammatory agent in MS?
- Azpiazu**, M., Svedberg, P., Varnäs, K., Halldin, C., Sunnemark, D., Schou, M., Varrone, A. Department of Clinical Neuroscience, Centre for Psychiatry Research, Karolinska Institutet and Stockholm City Council, Stockholm, Sweden; Offspring Biosciences, Södertälje, Sweden; Personalised Healthcare and Biomarkers, AstraZeneca, PET Science Centre, Karolinska Institutet, Sweden. Identification and validation of transcripts and proteins as well as PET radioligand development in neurodegenerative disorders with special emphasis to Parkinsons disease (PD) and Alzheimer's disease (AD).
- Baas**, F., Drosu, N. Academic Medical Center, Department of Genetics, Meibergdreef 9, 1105 AZ, Amsterdam; MIT, 77 Massachusetts Ave, Cambridge MA 02139, USA. In search of new epitopes relevant for MS.
- Baron**, W. et. Al. University Medical Center Groningen, Department of Cellular Biology, A. Deusinglaan 1, 9713 AV, Groningen, The Netherlands. Reshaping the ECM landscape in MS lesions to promote remyelination.
- Boddeke**, H.W.G.M. University Medical Centre Groningen, Dept. Neuroscience, A. Deusinglaan 1, 9713AV Groningen. Analysis of age-related changes in gene expression in human microglia.
- Boland**, B. University College Cork, Department of Pharmacology and Therapeutics, Western Gateway Building, Western Road, Cork, Ireland. Novel profiling of multiple amyloid precursor protein (APP) metabolites in Human brain tissue – potential biomarkers for Alzheimer's disease.
- Bordone**, M., Morais, N. Instituto de Medicina Molecular, Faculdade de Medicina, Universidade de Lisboa, Lisboa, Portugal. Alternative splicing: an etiological factor and a novel therapeutic target in Parkinson's disease.
- Bossoni**, L., Grand Moursel, L., Bulk, M., Simon, B.G., Webb, A., van der Weerd, L., Huber, M., Carretta, P., Lascialfari, A., Oosterkamp, T.H. Huygens-Kamerlingh Onnes Laboratory, Leiden University, 2333 CA Leiden, The Netherlands; Department of Human Genetics, Leiden University Medical Center, Leiden, The Netherlands; Department of Radiology, Leiden University Medical Center, Leiden, The Netherlands; Percuros BV, Leiden, The Netherlands; Department of Physics, Pavia University, Pavia, Italy; Dipartimento di Fisica, Universit`a Degli Studi di Milano, Milano, Italy. Human-brain ferritin studied by muon Spin Rotation: a pilot study.

- Bouwman**, F., Scheltens, P., Van de Berg, W., Voorn, P., Geurts, J., Hoozemans, J., Rozemuller, J., Van de Weerd, L., Huitinga, I. VUMC Alzheimer Center, Amsterdam, The Netherlands; VUMC dept of Anatomy & Neurosciences, Amsterdam, The Netherlands; VUMC dept of Neuropathology, Amsterdam, The Netherlands; LUMC dept of Radiology, Leiden, The Netherlands; Netherlands Brain Bank, Amsterdam, The Netherlands. Pathological substrate of clinical variability in Alzheimer's disease.
- Bras**, J. University College of London, Department of Molecular Neuroscience, 8-11 Queen Square, WC1N3AR, London, United Kingdom; National Institutes on Aging, National Institutes of Health, USA. Understanding the genetic basis of Dementia with Lewy Bodies.
- Breuer**, J., Schneider-Hohendorf, T., Schwab, N., and Wiendl, H. Department of Neurology, University of Münster, Münster, Germany. Analysis of the expression of laminin alpha-4 on choroid plexus tissue.
- Bridel**, C., Jimenez, C.R., Smit, A.B., van Swieten, J.C., van der Flier, W.M.H., van der Vlies, S., Visser, P.J., Teunissen, C.E. Department of Clinical Chemistry, Neurochemistry Lab and Biobank, VU Medical Centre, Amsterdam, The Netherlands; Department of Medical Oncology, OncoProteomics Laboratory, VU Medical Centre, Amsterdam, The Netherlands; Department of Molecular and Cellular Neurobiology, Center for Neurogenomics and Cognitive Research, Neuroscience Campus Amsterdam, VU University, Amsterdam, the Netherlands; Department of Neurology, Erasmus MC - University Medical Centre Rotterdam, The Netherlands; Department of Neurology, Alzheimer Center, VU University Medical Centre Amsterdam, Amsterdam, The Netherlands; Alzheimer Center and Department of Neurology, VUmc, Amsterdam Neuroscience, Amsterdam, the Netherlands; Department of Psychiatry and Neuropsychology, School for Mental Health and Neuroscience, Maastricht University, Maastricht. PRODIA: Development of biomarkers enabling early and accurate differential diagnosis of dementia.
- Brophy**, P. University of Edinburgh, Centre for Neuroregeneration, 49 Little France Crescent, Edinburgh, Scotland. Aberrant ion channel expression and nodal disruption within dorsal root ganglia in multiple sclerosis: implications for neuropathic pain.
- Butovsky**, O. Brigham and Women's Hospital, Center for Neurologic Diseases, 77 Avenue Louis Pasteur, HIM 614, Boston, MA 02115, USA; Massachusetts General Hospital, 55 Fruit St, Boston, MA 02114, USA. Mechanism of regulation of microglia in Multiple Sclerosis.
- Chakraborty**, A. VU University Medical Center, Department of Molecular Cell Biology and Immunology, Van der Boerhorststraat 7, 1081 BT Amsterdam, The Netherlands. Targetting the alterations in vasculature during progression of Alzheimer's : A therapeutic approach.
- Chen**, W. The Max Delbrück Center for Molecular Medicine in the Helmholtz Association (MDC), Berlin Institute of Health (BIH), Department of System Biology, Robert-Rössle-Straße 10. (H87, 1.55), 13125, Berlin, Germany. The transcriptomic landscape of human dorsal root ganglions.
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- Creyghton**, M.P. Hubrecht Institute, Uppsalalaan 8, 3508 AD, Utrecht, The Netherlands. The human epigenomic landscape of distal enhancers in development and disease.
- Das Neves Carvalho**, A.M.G. iMED.Ulisboa – Research Institute for Medicines, Faculty of Pharmacy, University of Lisbon, Department of Cellular Function and Therapeutic Targeting Group, Av. Prof. Gama Pinto, 1649-003 Lisbon, Portugal. S-Glutathionylation in Parkinson's Disease: Endoplasmic reticulum stress modulation by S-Glutathionylation in Parkinson's Disease.

- De Wit**, N. Vumc, Department of Molecular cell biology and Immunology, De Boelelaan 1108, 1081HZ Amsterdam, The Netherlands. Altered shingolipid balance in Alzheimer's disease: a new therapeutic approach?
- Den Haan**, J., Morrema, T., Ten Brink, J., Hoozemans, J., Bergen, A., Bouwman, F. VU University Medical Center Alzheimer Center, Neurology, Amsterdam, The Netherlands; Dept. of Pathology, VU University Medical Center, Amsterdam, The Netherlands; Department of Clinical Genetics, Academic Medical Center, Amsterdam, the Netherlands. AD pathological hallmarks in post mortem retinas of AD patients.
- Dekker**, A.D., Vermeiren, Y., Gelpi, E., Aerts, T., Van Dam, D., Jean-Jacques Martin, J., De Deyn, P.P. Department of Neurology and Alzheimer Research Center, University of Groningen, University Medical Center Groningen, Groningen, The Netherlands; Laboratory of Neurochemistry and Behaviour, Institute Born-Bunge, University of Antwerp, Wilrijk, Antwerp, Belgium; Neurological Tissue Bank – Biobanc, Hospital Clinic Barcelona, Institut d'Investigacions Biomediques August Pi i Sunyer (IDIBAPS), Barcelona, Spain; Department of Neurology and Memory Clinic, Hospital Network Antwerp (ZNA) Middelheim and Hoge Beuken, Antwerp, Belgium. Alzheimer neuropathology in Down syndrome: ABC scoring and assessment of the monoaminergic neurotransmitter system.
- Deutch**, L. Karolinska Institutet, Department of Neuroscience, Tomtebodavägen 23B, Stockholm, Sweden 171 65; National Institute of Mental Health, NIH. ABC Transporter and Inflammatory Marker Expression in Drug-Resistant Epilepsy.
- Dewachter**, I. Institute of Neuroscience, Université catholique de Louvain (UCL), Department of Cellular and Molecular Neuroscience (CEMO), Avenue Emmanuel Mounier 53, Tour Pasteur 53+3, 1200 Brussels, Belgium. Analysis of the cross-seeding mechanism between A β and Tau and its relevance in Alzheimer's disease.
- Dijkstra**, A. VU Medical Center, Department of Pathology, De Boelelaan 1117, 1081 HV Amsterdam, The Netherlands. Identifying the role and mechanisms of a novel projection neuron in frontotemporal dementia and other cognitive disorders.
- Dobson**, R. Kings College London, NIHR Biomedical Research Centre for Mental Health South London, De Crespigny Park London SE5 8AF, London Box P092, United Kingdom; Erasmus MC, 's-Gravendijkwal 230, 3015 CE Rotterdam, The Netherlands. RNA-sequencing of AD cases who carry Trem2 risk alleles.
- Doorenweerd**, N. Leiden University Medical Center, the C.J. Gorter Center for high field MRI, the Department of Human Genetics, and the Department of Radiology, Albinusdreef 2, 9600 Leiden, The Netherlands. Dystrophin expression in the healthy human brain – related to Duchenne muscular dystrophy.
- Doshina**, A., Gourgue, F., Onizuka, M., Opsomer, R., Wang, P., Roussel-Ando, R., Tasiaux, B., Dewachter, I., Kienlen-Campard, P., Brion, J.P., Gailly, P., Octave, J.N., Pierrot, N. Université catholique de Louvain / Institute of Neuroscience, Departement of SSS/IONS/CEMO, Avenue Hippocrate 54, bte B1.54.10 1200 Brussels, Belgium. Regulation of Neuronal GABAergic Response by the Amyloid Precursor Protein of Alzheimer Disease.
- Dupree**, J.L., Oh, U., Sato-Bigbee, C., De Vries G.H., Fuss, B. Department of Anatomy and Neurobiology, Virginia Commonwealth University School of Medicine, Richmond, VA, USA; Department of Neurology, Virginia Commonwealth University School of Medicine, Richmond, VA, USA; Department of Biochemistry and Molecular Biology, Virginia Commonwealth University School of Medicine, Richmond, VA, USA; Hunter Holmes McGuire VA Medical

- Center, Richmond, VA, USA. Characterization of molecular differences between relapsing-remitting, primary-progressive and secondary progressive Multiple Sclerosis.
- Ederra**, J.R. Biodonostia Research Institute, Department of Neuroscience, Paseo Dr. Begiristain s/n, 20014-San Sebastián, Spain. Functional characterization of a novel candidate gen for retinosis pigmentaria, identified by whole exome sequencing.
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- Ettle**, B., Kerman, B. E., Reiprich, S., Rockenstein, E., Wegner, M., Masliah, E., Gage, F.H., Winkler, J. Department of Molecular Neurology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg, Germany; Laboratory of Genetics, The Salk Institute for Biological Studies, La Jolla, CA, USA; Research Center for Regenerative and Restorative Medicine, Istanbul Medipol University, Istanbul, Turkey; Institute of Biochemistry, Friedrich-Alexander-Universität Erlangen-Nürnberg, Erlangen, Germany; Department of Neurosciences, University of California San Diego, La Jolla, CA, USA; Division of Neuroscience, National Institute of Aging, Bethesda, USA4; Department of Molecular Neurology, University Hospital Erlangen, Friedrich-Alexander-Universität Erlangen-Nürnberg, Schwabachanlage 6, 91054, Erlangen, Germany. The impact of α -synuclein accumulation on oligodendrocyte maturation and myelination in Multiple System Atrophy.
- Farajnia**, S., Arietti, M., Holzel, M.B., Howlett, M., Kamermans, M. Netherlands Institute for Neuroscience, Meibergdreef 47, 1105 BA, Amsterdam, The Netherlands. Restoration of high acuity human vision.
- Fasano**, M. Department of Structural & Functional Biology, University of Insubria, via Alberto da Giussano 12, I-21052 Busto Arsizio (VA), Italy. Analysis of proteasomal and autophagic function in post-mortem Parkinson's disease tissues.
- Ferretti**, M.T., Merlini, M., Kulic, L., Gericke, C., Nitsch, R.M. Institute for Regenerative Medicine (IREM), University of Zurich, Zurich, Switzerland. Immune surveillance alterations in choroid plexus of Alzheimer's disease patients.
- Fliers**, E., Boelen, A. Dept. of Endocrinology and Metabolism, Academic Medical Center, University of Amsterdam, Netherlands. Expression of TBL1X, TBL1XR1 and IRS4 in human hypothalamus.
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- Fransen**, N. Netherlands Institute for Neuroscience, Department of Neuroimmunology, Meibergdreef 47, 1105 BA, Amsterdam, The Netherlands. Characterization of neuropathological subtypes of MS in the NBB tissue collection.
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- Fritsche**, L., Harnisch, K., Teuber-Hanselmann, S., Keyvani, K., Junker, A. Institute of Neuropathology, University Hospital Essen, Essen, Germany. MicroRNA profiles and microRNA target identification in grey matter lesions of multiple sclerosis.

- Frykman**, S. Karolinska Institutet, Department of Neurobiology, Care Sciences and Society (NVS), Blickagången 6, Novum, Level 5, Elevator D, 11147 Huddinge, Sweden. Studies on the mechanisms of synaptic degeneration in Alzheimer disease and Dementia with Lewy bodies.
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- Gao**, S.F. Institute of Nervous System Diseases, Xuzhou Medical College, Department of Neurosurgery, 84 West Huai-Hai Road, 221002, Xuzhou, China P.R. The role of CAPON-mediated hypothalamic nNOS-NO system in the pathogenesis of depression.
- Gatti**, A. National Council of Research of Italy, Istituto di Scienza e Tecnologia Materiali Ceramici, Via Granarolo 64, I-48018 FAENZA (RA), Italy. Prototypal approach to the study of brain samples affected by Fronto Temporal Disorder and Motoneuron Disease.
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- Glatzel**, M. Institute of Neuropathology, Center of Diagnostics, University Medical Center Hamburg-Eppendorf, Martinistraße 52, 20246 Hamburg, Germany. Improving the role of learning in older individual by non-invasive brain stimulation.
Subproject: The role of intracortical GABAergic inhibition for neuroplasticity and learning during ageing.
- Gorgels**, T.G.M.F., Webers, C.A.B. University Eye Clinic Maastricht, MUMC+, Maastricht; The Netherlands Institute for Neurosciences (NIN-KNAW), Amsterdam, the Netherlands. From genes to glaucoma: identifying glaucoma pathways.
- Grand Moursel**, L., Munting, L.P., van der Graaf, L.M., van Duinen, S.G., Goumans, M.J.T.H., Ueberham U., Natté R., van Buchem M.A., van Roon-Mom W.M.C., van der Weerd L. Department of Human Genetics, Department of Radiology, Department of Pathology, and Department of Molecular Cell Biology, Leiden University Medical Center, Leiden, Netherlands; Paul Flechsig Institute of Brain Research, University of Leipzig, Leipzig, Germany. TGF β pathway deregulation and abnormal phospho-SMAD2/3 staining in hereditary cerebral hemorrhage with amyloidosis-Dutch type.
- Guo**, L., Balesar, R., Bao, A., and Swaab, D. Department of Neurobiology, Key Laboratory of Medical Neurobiology of Ministry of Health of China, Zhejiang Province Key Laboratory of Mental Disorder's Management, Zhejiang Province Key Laboratory of Neurobiology, Zhejiang University School of Medicine, Hangzhou, Zhejiang, P.R. China; and Netherlands Institute for Neuroscience, an Institute of the Royal Netherlands Academy of Arts and Sciences, The Netherlands. CRH immunocytochemistry in human hypothalamic paraventricular nucleus (PVN).
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Netherlands Academy of Arts and Sciences, Amsterdam, The Netherlands; and department of Mental Health, Zhejiang Province Key Laboratory of Mental Disorder's Management, National Clinical Research Center for Mental Health Disorders, First Affiliated Hospital, Zhejiang University School of Medicine, Hangzhou, China. The development of a rat depression model based upon an aromatase disorder: validation on the postmortem human brain.

Xicoy, H., Brouwers, J.F., Helms, J.B., Wieringa, B., Martens, G.J.M. Dept. of Molecular Animal Physiology, Donders Institute for Brain, Cognition and Behaviour, Faculty of Science, Radboud University, Nijmegen, The Netherlands; Dept. of Cell Biology, Radboud Institute for Molecular Life Sciences (RIMLS), Radboudumc, Nijmegen, The Netherlands; Dept. of Biochemistry and Cell Biology, Faculty of Veterinary Medicine, Utrecht University, Utrecht, The Netherlands. Transcriptomic, proteomic and lipidomic analysis of substantia nigra and striatum of Parkinson's disease patients and control individuals.

Xu, Y. Zhejiang Province Key Laboratory of Mental Disorder's Management, Department of Mental Health, 79 Qingchun Road, Hangzhou, Zhejiang, 310058, China PR. Hypocretin/orexin and melanin-concentrating hormone changes in the basolateral amygdala, hypothalamus and cortex: a postmortem study.

Xu, Y. Zhejiang Province Key Laboratory of Mental Disorder's Management, Department of Mental Health, 79 Qingchun Road, Hangzhou, Zhejiang, 310058, China PR. A neural circuit in Schizophrenia: a postmortem study.

Zhou, Y. Zhejiang University School of Medicine, Department of Neurobiology, 866 Yuhangtang Rd, Hangzhou, Zhejiang, 310058, China P.R. Molecular mechanisms underlying the pathophysiology of Alzheimer's disease.

Zhu, S., Viejo-Borbolla, A. Institute of Virology, Hannover Medical School, Hannover, Germany. Derivation of human peripheral neurons from inducible pluripotent stem cells suggests the existence of a novel neuronal population.

Zhu, Q.B., Unmehopa, U., Bossers K., Hu Y.T., Verwer, R., Balesar, R., Zhao, J., Bao, A.M., Swaab, D. Department of Neurobiology, Key Laboratory of Medical Neurobiology of Ministry of Health of China, Zhejiang Province Key Laboratory of Neurobiology, Zhejiang University School of Medicine, Hangzhou, Zhejiang 310058, P.R. China; and Netherlands Institute for Neuroscience, an Institute of the Royal Netherlands Academy of Arts and Sciences, Amsterdam, The Netherlands. MicroRNA-132 and early growth response-1 in Nucleus Basalis of Meynert during the course of Alzheimer's disease.

Pharmaceutical companies

In 2015 and 2016, NBB tissue was supplied to the following pharmaceutical companies:

AbbVie Deutschland GmbH & Co KG

AC Immune S.A.

Actelion Pharmaceuticals Ltd.

Apodemus AB

Asterand UK Acquisition Limited

AstraZeneca

Bioarctic

Biogen Inc

Charles River Nederland BV

EMD Millipore

Evotec AG

GlaxoSmithKline

Janssen Vaccines & Prevention B.V.

Lysosomal Therapeutics Inc

Novartis Pharma AG

Roche

UCB Pharma SA

Publications 2013 – 2016

This chapter lists the publications that have resulted from research involving tissue from the NBB.

There have been several projects in which the NBB was actively involved and therefore listed as corporate co-author, requested occasionally since 2013.

Corporate co-authorship of the NBB

Bergen, A. A., Kaing, S., ten Brink, J. B., Netherlands Brain Bank, Gorgels, T. G., & Janssen, S. F. (2015). Gene expression and functional annotation of human choroid plexus epithelium failure in Alzheimer's disease. *BMC Genomics*, *16*(1), 1–15. <https://doi.org/10.1186/s12864-015-2159-z>

Dijkstra, A. A., Voorn, P., Berendse, H. W., Groenewegen, H. J., Netherlands Brain Bank, Rozemuller, A. J. M., & van de Berg, W. D. J. (2014). Stage-dependent nigral neuronal loss in incidental Lewy body and Parkinson's disease. *Movement Disorders*, *29*(10), 1244–1251.

Krudop, W. A., Bosman, S., Geurts, J. J., Sikkes, S. A., Verwey, N. A., Stek, M. L., ... Netherlands Brain Bank (2015). Clinico-pathological correlations of the frontal lobe syndrome: results of a large brain bank study. *Dementia and geriatric cognitive disorders*, *40*(3–4), 121–129.

Nielsen, H. M., Ek, D., Avdic, U., Orbjörn, C., Hansson, O., Netherlands Brain Bank, ... Wennström, M. (2013). NG2 cells, a new trail for Alzheimer's disease mechanisms? *Acta Neuropathologica Communications*, *1*, 7. <https://doi.org/10.1186/2051-5960-1-7>

Schottlaender, L. V., Houlden, H., & Multiple-System Atrophy (MSA) Brain Bank Collaboration. (2014). Mutant COQ2 in Multiple-System Atrophy. *New England Journal of Medicine*, *371*(1), 80–83. <https://doi.org/10.1056/NEJMc1311763>

Vermunt, M. W., Tan, S. C., Castelijns, B., Geeven, G., Reinink, P., de Bruijn, E., ... Creyghton, M. P. (2016). Epigenomic annotation of gene regulatory alterations during evolution of the primate brain. *Nature neuroscience*.

Wong, T. H., Chiu, W. Z., Breedveld, G. J., Li, K. W., Verkerk, A. J. M. H., Hondius, D., ... van Swieten, J. (2014). PRKAR1B mutation associated with a new neurodegenerative disorder with unique pathology. *Brain*, *137*(5), 1361–1373. <https://doi.org/10.1093/brain/awu067>

There has also been a publication in which NBB-employees were individually listed as co-author:

Klioueva, N. M., Rademaker, M. C., Dexter, D. T., Al-Sarraj, S., Seilhean, D., Streichenberger, N., ... Huitinga, I. (2015). BrainNet Europe's Code of Conduct for brain banking. *Journal of Neural Transmission*, *122*(7), 937–940. <https://doi.org/10.1007/s00702-014-1353-5>

Publication list

Acquarelli, J., Brain Bank, T. N., Bianchini, M., & Marchiori, E. (2016). Discovering Potential Clinical Profiles of Multiple Sclerosis from Clinical and Pathological Free Text Data with Constrained Non-negative Matrix Factorization. In *Applications of Evolutionary Computation* (pp. 169–183). Springer, Cham. https://doi.org/10.1007/978-3-319-31204-0_12

Adams, S. L., Tilton, K., Kozubek, J. A., Seshadri, S., & Delalle, I. (2016). Subcellular Changes in Bridging Integrator 1 Protein Expression in the Cerebral Cortex During the Progression of Alzheimer Disease Pathology. *Journal of Neuropathology & Experimental Neurology*, 75(8), 779–790. <https://doi.org/10.1093/jnen/nlw056>

Ádori, C., Glück, L., Barde, S., Yoshitake, T., Kovacs, G. G., Mulder, J., ... Mitsios, N. (2015). Critical role of somatostatin receptor 2 in the vulnerability of the central noradrenergic system: new aspects on Alzheimer's disease. *Acta neuropathologica*, 129(4), 541–563.

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Anand, U., Facer, P., Yiangou, Y., Sinisi, M., Fox, M., McCarthy, T., ... Anand, P. (2013). Angiotensin II type 2 receptor (AT2R) localization and antagonist-mediated inhibition of capsaicin responses and neurite outgrowth in human and rat sensory neurons. *European Journal of Pain*, 17(7), 1012–1026. <https://doi.org/10.1002/j.1532-2149.2012.00269.x>

Anand, U., Yiangou, Y., Sinisi, M., Fox, M., MacQuillan, A., Quick, T., ... Anand, P. (2015). Mechanisms underlying clinical efficacy of Angiotensin II type 2 receptor (AT2R) antagonist EMA401 in neuropathic pain: clinical tissue and in vitro studies. *Molecular Pain*, 11(1), 1–12. <https://doi.org/10.1186/s12990-015-0038-x>

Andersson, R., Gebhard, C., Miguel-Escalada, I., Hoof, I., Bornholdt, J., Boyd, M., ... Sandelin, A. (2014). An atlas of active enhancers across human cell types and tissues. *Nature*, 507(7493), 455–461.

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List of abbreviations

AD	Alzheimer's disease
ADHD	Attention deficit hyperactivity disorder
ASD	Autism spectrum disorder
BPD	Bipolar disorder
Contr	Non-demented control donors
DEPMA	Bipolar disorder
FTLD/tau	Frontotemporal lobar degeneration/Tauopathy
MDD	Major depressive disorder
MS	Multiple sclerosis
OCD	Obsessive compulsive disorder
Other	Other diagnoses
Other dem	Other types of dementia
PANR	Pathological report not ready yet
PD/DLBD	Parkinson's disease/Diffuse Lewy body dementia
PSP	Progressive supranuclear palsy
Psych	Psychiatric disorders (unspecified)
PTSD	Posttraumatic stress disorder
SCHIZO	Schizophrenia
Trans	Transsexuality