# Dyslexia, Motor Control, and the Cerebellum

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The objectives of the present study are:1. To demonstrate that adult subjects with developmental dyslexia have abnormal cerebellar volume;2. To demonstrate that abnormal cerebellar volume is associated with language and motor difficulties.

Ethical review	Approved WMO
Status	Recruitment stopped
Health condition type	Other condition
Study type	Observational invasive

# Summary

### ID

NL-OMON36419

**Source** ToetsingOnline

**Brief title** Dyslexia Motor Control Cerebellum

## Condition

• Other condition

Synonym Developmental dyslexia, language disorder

#### **Health condition**

Developmental dyslexia

# Research involving

Human

## **Sponsors and support**

Primary sponsor: Universitair Medisch Centrum Utrecht Source(s) of monetary or material Support: Ministerie van OC&W

### Intervention

Keyword: Cerebellum, Dyslexia, Language, Motor control

### **Outcome measures**

#### **Primary outcome**

(a) Subjects\* cerebellar volume; (b) subjects\* scores on language and motor

tasks.

#### Secondary outcome

Subjects\* scores on timing, visuo-spatial, and verbal working memory tasks.

# **Study description**

#### **Background summary**

Developmental Dyslexia (DD) is defined as a learning disorder that is neurological in origin and is characterized by difficulties in accurate and fluent written word recognition and by poor spelling and reading abilities, despite normal intelligence, normal hearing, adequate classroom exposure, and absence of physical, emotional and socioeconomic problems [International Dyslexia Association 2002]. DD is regarded as a deficit in the acquisition of written language (reading, spelling), which is most likely the result from a deficiency in the recognition and processing of speech sounds (\*phonological deficit\*; cf. Snowling 2000). However, recent studies have uncovered a number of problems in the motor domain as well. Several studies report that compared to the controls subjects with DD are less stable during a variety of balancing tasks [Fawcett 1999; Getchell 2007; Moe-Nilssen 2003; Nicolson 1990; Stoodley 2005; Yap and van der Leij 1994] and slower on peg moving [Stoodley 2006a] and rapid pointing [Stoodley 2006b; Velay 2002]. Implicit motor learning is also impaired in DD [Howard 2006; Molinari 1997]. In addition, subjects with DD show disturbances in binocular control, both in tasks that do involve reading [Eden 1994; Stein 1985] and in those that do not [Bucci 2008a,b; Fisher 2000a,b; Fowler 1991], and they may have abnormal control of saccadic eye movements [Biscaldi 1998].

The motor abilities tested in the studies mentioned above are known to be supported, at the neuro-anatomical level, by the cerebellum and are often regarded as clinical hallmarks of cerebellar disorder [Beldarrain 1999; Gerwing 2005; Ito 2005; Molinari 1997; Petrosini 1996; Yeo 1998]. On the basis of these facts, researchers have proposed the Cerebellar Deficit Hypothesis (CDH), according to which DD is associated with a cerebellar deficit [Stoodley 2009a]. The CDH is supported by some structural imaging studies showing that children and adults with DD have reduced grey matter volume in the anterior cerebellum, anomalies in metabolite distribution in the right Cerebellum, and diminished connectivity [Brambati 2004, Brown 2001, Brunswick 1999, Eckert 2003, 2004, Finch 2002, Laycock 2008, Rae 1998, 2002, Stoodley 2009b,c]. One functional imaging study reports that implicit motor learning activates different cerebellar areas in children with DD as compared to control subjects [Menghini 2006]. Two volumetric studies with children / adolescents [Eckert 2003. Kronbichler 2008] have shown that cerebellar volume is associated with measures of reading and spelling proficiency. However, no study has tested the association between cerebellar volume, motor abilities and written as well as oral language abilities in the same young adults with DD. If the CDH is correct, it is expected that volumetric cerebellar measures be associated with the measures of motor and language proficiency in adult subjects with DD.

#### **Study objective**

The objectives of the present study are:

1. To demonstrate that adult subjects with developmental dyslexia have abnormal cerebellar volume;

2. To demonstrate that abnormal cerebellar volume is associated with language and motor difficulties.

#### Study design

One part of the study is an observational case-control study. Two groups of subjects will be tested: a group of 15 young adults with Developmental Dyslexia (DD) and a group of 15 controls matched for age, sex, and education level. Both groups will undergo structural MRI, volumetric measurements specifically, and a battery of behavioral language and motor tests (described in detail in section 4.2). The cerebellar morphometric measures will be compared in the two groups. The other part of the study is a correlational study, where subjects\* individual cerebellar morphometric measures will be correlated to their performance on the behavioral language and motor tests.

The study is expected to be carried out within approximately 10 months. Preparation of MRI facilities and language and motor tasks will take approximately 2 months. Conducting the experiments will cost 5 months. Analyzing the data will be completed within 3 months.

#### Study burden and risks

There is no burden associated with this investigation. Subjects have to visit the Utrecht University Medical Center once and lie motionless in the MRI-scanner for a short amount of time (approximately 30 minutes).

# Contacts

Public Universitair Medisch Centrum Utrecht

Heidelberglaan 100 3584 CX, Utrecht NL **Scientific** Universitair Medisch Centrum Utrecht

Heidelberglaan 100 3584 CX, Utrecht NL

# **Trial sites**

## **Listed location countries**

Netherlands

# **Eligibility criteria**

Age Adults (18-64 years) Elderly (65 years and older)

## **Inclusion criteria**

For subjects with DD:

• Official diagnosis of developmental dyslexia For all participants:

• Right handedness;

- Dutch as native language;
- Modified Rankin scale score 0;
- Normal or corrected to normal vision.

## **Exclusion criteria**

• Non-MRI compatible prostheses, claustrophobia or pregnancy;

• Neurological or psychiatric conditions other than being investigated (specifically cerebrovascular accidents and ADHD);

- Inability to visit the Utrecht University Medical Center or the UiL-OTS lab;
- Cluttering or stuttering.

# Study design

## Design

Study type:	Observational invasive
Intervention model:	Other
Allocation:	Non-randomized controlled trial
Masking:	Open (masking not used)
Control:	Active
Primary purpose:	Basic science

## Recruitment

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NL	
Recruitment status:	Recruitment stopped
Start date (anticipated):	15-10-2011
Enrollment:	30
Туре:	Anticipated

# **Ethics review**

Approved WMO	
Date:	14-12-2011
Application type:	First submission

# **Study registrations**

## Followed up by the following (possibly more current) registration

No registrations found.

## Other (possibly less up-to-date) registrations in this register

No registrations found.

## In other registers

 Register
 ID

 CCMO
 NL34973.041.11