

China Scholarship Council – University Maastricht
PhD Programme Application form

Basic information

1. Information on prospective UM supervisors and Promotor

1a. First Supervisor/promoter:

Dr. T.T.J.M. Berendschot
University Eye Clinic Maastricht, Maastricht University
PO Box 5800, 6202 AZ Maastricht, the Netherlands
t +31 43 3877345
e t.berendschot@maastrichtuniversity.nl

1b. Second Supervisor/copromoter:

Prof. dr. C.A.B. Webers
University Eye Clinic Maastricht, Maastricht University
PO Box 5800, 6202 AZ Maastricht, the Netherlands
t +31 43 3877808
e c.webers@mumc.nl

2. Information on UM Faculty/ Department/ Institute/ School contact person:

Dr. T.T.J.M. Berendschot
University Eye Clinic Maastricht, Maastricht University
PO Box 5800, 6202 AZ Maastricht, the Netherlands
t +31 43 3877345
e t.berendschot@maastrichtuniversity.nl

- To be filled in by the applicant if already known -

1. Information on the applicant

- Initial(s), first name, surname:
- Male/female:
- Current work address:

- Telephone:
- E-mail: WeChat:
- Private address:

2. Details of applicant's home university

Note! A separate letter of recommendation by the supervisor or faculty dean of the home university is required.

- Name of home university:
- Address:
- Telephone:
- E-mail:
- Website (if available):

3. Applicant's home university Master Thesis supervisor:

- Title(s), initial(s), first name, surname:
- Address for correspondence:

- Telephone:
- E-mail: WeChat:

4. Research field(s)

重大专项 / Major Special Projects

前沿技术 / Frontier Technologies

基础研究 / Basic Research

5. Title of research plan for CSC-UM PhD Programme

Multi-spectral imaging for in vivo imaging of oxygen tension and β -amyloid

6. Short summary of research plan

Background: The retina has an important property that makes it a sensitive biomarker for diseases: Owing to the responsiveness to light, it has high demands for energy and thus the oxygen consumption is one of the highest in the body. As a result, the retina is extremely sensitive to metabolic changes that can display structural and functional alterations at early stages of diseases by affecting blood supply and oxygen consumption. On the basis of these considerations, it can be expected that the retina is highly vulnerable to pathologic metabolic changes. These disorders may be restricted to the retina (such as glaucoma or age-related macular degeneration) but can also be the result of systemic diseases (e.g. diabetes often leading to diabetic retinopathy) or of pathological processes that primarily affect other parts of the brain (e.g. Alzheimer's disease or Parkinson's disease). Indeed there are brain disorders, such as Alzheimer's disease, that are also known to have effects on the retina. The prevalence of Alzheimer's disease is correlated with the prevalence of glaucoma. A positive correlation between age-related retinal diseases such as glaucoma and AMD and cognitive deficits in elderly subjects was established. Visual impairments are also correlated with depression and anxiety disorders in elderly subjects. As such, the retina can be a good biomarker for Alzheimer's disease and other brain disorders.

Oxygenated and deoxygenated blood have different absorption characteristics. This makes it possible to determine the oxygen tension by spectral analysis of the light that is reflected at the retina. The possibility of the usage of retinal oximetry in Alzheimer's disease has only been explored recently with promising results.

However, there are severe flaws in existing setups using only two wavelengths which give rise to oxygen saturations going way above 100% in disease, large intra-eye and inter-eye variations and in some diseases results that cannot be trusted at all. Multispectral imaging will overcome these problems.

Accumulation of β -amyloid leads to neuronal dysfunction and neuro-degeneration. In the brain this has implications in Alzheimer's disease. In the human eye it has been reported to be implicated in Glaucoma and Age-related Macular Degeneration. Using curcumin, β -amyloid in postmortem retinal samples from Alzheimer's disease patients could be stained and allowed the identification of the plaques. Based on these findings it has been shown that direct optical imaging of β -amyloid retinal plaques may be obtained by using multispectral imaging and retinal fluorochrome-staining.

Study objective and Expected Results: The aim of this project is to build and clinically test a reliable multi-spectral imaging device, that allows in vivo imaging of oxygen tension and β -amyloid in human eyes. Maps showing the possible existence and distribution of β -amyloid plaques will be obtained in glaucoma patients and possibly patients with (early) Alzheimer's disease. A second goal is to develop software for hyperspectral image analysis for early detection and diagnosis of these diseases, based on existing models developed in our laboratory.

Requirements: optics / physics / biomedical engineering.

Group's performance:

Web of Science October 6, 2022

Tos Berendschot: Publications: 344; H-Index: 43; number of citations 6545

Carroll Webers: Publications: 306; H-Index: 34; number of citations 4539

7. Motivation for CSC-UM PhD application

Dr. Tos Berendschot will be the daily supervisor for this project. He studies the functional morphology of the human retina by non-invasive optical techniques and has developed devices for quickly and easily measuring Macular Pigment in the human eye, based on the objective technique of fundus reflectance spectroscopy. He further has used time resolved spectroscopy, including the development of femtosecond laser systems.

Prof. Dr. Carroll Webers is director of the University Eye Clinic Maastricht. He is a leading expert on fundamental and applied research in glaucoma and has been involved in a number of intervention trials.

Under the guidance of Dr. Berendschot four other PhD students from the CSC program successfully enrolled a PhD project. Yuan Tian has obtained her PhD degree September 17, 2015 and Shuo Zhang his July 7, 2021. Shuhe Zhang, who started September 2019, already has papers several published and in review. Yu Yu started January 2022. Prof. Webers is guiding yet another student, Wenting You, who started October 2018 and also has already papers published.

Applicant's Curriculum Vitae (if available)

8. Personal details

Applicant

- Title(s), initial(s), first name, surname:

CSC-UM PhD programme start 1-9-2021

- Surname:

- Nationality: Chinese

- Date of Birth:

- Country and place of birth:

9. Master's degree (if applicable)

Note! Add a copy of your Master's degree to your application

University (211 or 985 if available):

Faculty/discipline:

City and country:

Date:

Grade average:

Title Master's thesis (if applicable):

Thesis grade: