



Mark Bitsch Vestergaard

Postdoc, M.Sc., Ph.d.



28th December 1986, Copenhagen, Denmark.



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Key research interests

Human cerebral metabolism and perfusion during metabolic and hypoxic stress.

Age-related changes of cerebral metabolism.

Alteration of cerebral metabolism from vascular disease.

Development of MR-imaging, MR-spectroscopy and PET techniques for studying cerebral physiology.

Expert on data analysis and statistical modelling.

Experience

November 2017

March 2017 -

Postdoc

Department of Clinical Physiology and Nuclear Medicine and PET, Rigshospitalet, Copenhagen, Denmark.

Projects: Human cerebral perfusion, oxygen consumption and energy metabolism during hypoxic exposure. Age-related changes in cerebral energy metabolism. Validation of MRI perfusion methods. Measurement of cerebrovascular activity using MRI techniques. Robust computation of image-derived input function from combined PET and MR-imaging.

September 2013 - February 2017

Ph.D. Student

University of Copenhagen and Functional Imaging Unit, Department of Clinical Physiology and Nuclear Medicine and PET, Rigshospitalet, Glostrup, Denmark.

Projects: Human cerebral perfusion, oxygen consumption and energy metabolism during hypoxic exposure. Cerebrovascular reactivity and oxygen consumption during extended breath holding in freedivers. Examination of pathophysiology in patients with migraine using MR-imaging.

September 2012 - August 2013

Research Assistant

Functional Imaging Unit, Department of Clinical Physiology and Nuclear Medicine and PET, Rigshospitalet, Glostrup, Denmark.

Projects: Acquisition of cerebral oxygen metabolism, blood perfusion and cerebrovascular reactivity using non-invasive MRI-techniques.

September 2012 - August 2013

Research Assistant

Danish Research Centre for Magnetic Resonance, Hvidovre Hospital, Hvidovre, Denmark.

Projects: Motion tracking during MR-imaging.

Education

2013-2017 **Ph.D.** Graduate Programme in Neuroscience, University of Copenhagen.

Thesis: *Energy Metabolism of the Hypoxic Brain in Healthy Humans and Freedivers.*

2008-2011 **Master degree.** Biomedical Engineering, University of Copenhagen and the Technical University of Denmark.

Master thesis: *Motion Tracking During Magnetic Resonance Imaging based on Gradient Induced Signals.*

2005-2008 **Bachelor degree.** Biomedical Engineering, University of Copenhagen and the Technical University of Denmark.

Thesis: *Changes in the electroencephalogram during hypoglycaemia.* In collaboration with Novo Nordisk.

Key skills

Magnetic resonance imaging: Quantitative measurements, cerebral perfusion, cerebral metabolism, arterial spin labelling, phase contrast velocity mapping, susceptibility based imaging, magnetic resonance spectroscopy, fMRI.

Positron emission tomography: Perfusion measurements (¹⁵O-H₂O PET). Image-derived input function.

Data analysis: Matlab, r, FSL, mrVista, Freesurfer, PMOD.

Brain metabolism: Perfusion, oxygen consumption, lactate, hypoxia.

Awards

May 2013

Full Ph.D. scholarship.

Publications (updated November 2017)

1. Jensen MLF, **Vestergaard MB**, Tønnesen P, Larsson HBW, Jennum PJ.
Cerebral blood flow, oxygen metabolism and lactate during hypoxia in patients with obstructive sleep apnea. *Sleep*. November 2017. [Epub ahead of print]
2. **Vestergaard MB**, Larsson HBW.
Cerebrovascular reactivity and oxygen consumption during breath-hold and hypoxic challenge in freedivers and healthy controls. *Journal of Cerebral Blood Flow and Metabolism*. September 2017 [Epub ahead of print], doi: 10.1177/0271678X17737909.
3. Arngrim N, Hougaard A, Ahmadi K, **Vestergaard MB**, Schytz HW, Amin FM, Larsson HBW, Olesen J, Hoffmann MB, Ashina M.
Heterogenous migraine aura symptoms correlate with visual cortex fMRI responses. *Annals of Neurology*. November 2017 [Epub ahead of print], doi: 10.1002/ana.25096.
4. Arngrim N, Hougaard A, Schytz HW, **Vestergaard MB**, Britze J, Faisal AM, Skovgaard KO, Larsson HBW, Olesen J, Messoud A.
Effect of hypoxia on BOLD fMRI response and total cerebral blood flow in migraine with aura patients and healthy volunteers. *Journal of Cerebral Blood Flow and Metabolism*. May 2017 [Epub ahead of print], doi: 10.1177/0271678X17719430.
5. Arngrim N, Schytz HW, Britze J, **Vestergaard MB**, Sander M, Olsen KS, Olesen J, Messoud A.
Carbon monoxide inhalation induces headache in human headache model. *Cephalgia*. 2017 January [Epub ahead of print], doi: 10.1177/0333102417708768.
6. Younis S, Hougaard A, **Vestergaard MB**, Larsson HBW, Ashina M.
Migraine and magnetic resonance spectroscopy: A systematic review. *Current Opinion in Neurology*. 2017 June, 30(3); 246-262.
7. **Vestergaard MB**, Lindberg U, Aachmann-Andersen NJ, Lisbjerg K, Christensen SJ, Rasmussen P, Olsen NV, Law I, Larsson HBW, Henriksen OM.
Comparison of global cerebral blood flow measured by phase-mapping magnetic resonance imaging and ¹⁵O-H₂O positron emission tomography. *Journal of Magnetic Resonance Imaging*. 2017 March, 45(3); 692-699.
8. **Vestergaard MB**, Lindberg U, Aachmann-Andersen NJ, Lisbjerg K, Christensen SJ, Law I, Rasmussen P, Olsen NV, Larsson HBW.
Acute hypoxia increases the cerebral metabolic rate - a magnetic resonance imaging study. *Journal of Cerebral Blood Flow and Metabolism*. 2016 December, 36(6); 1046-1058.
9. Larsson HBW, **Vestergaard MB**, Lindberg U, Iversen HK, Cramer SP.
Brain capillary transit time heterogeneity measured by dynamic contrast-enhanced T1-weighted perfusion Magnetic Resonance Imaging. *Journal of Magnetic Resonance Imaging*. 2016 June, 45(6):1809-1820.
10. Arngrim N, Schytz HW, Britze J, Amin FM, **Vestergaard MB**, Hougaard A, Wolfram F, de Koning PJ, Olsen KS, Secher NH, Larsson HBW, Olesen J, Ashina M.
Migraine induced by hypoxia: a MRI spectroscopy and angiography study. *Brain*. 2016 March, 139; 723-737.

Conference Contributions

1. Arngrim N, Hougaard A, Schytz HW, **Vestergaard MB**, Britze J, Faisal AM, Skovgaard KO, Larsson HBW, Olesen J, Messoud A. Effect of hypoxia on BOLD fMRI response and total cerebral blood flow in migraine with aura patients and healthy volunteers 18th Congress of the International Headache Society. Oral presentation. Vancouver, Canada. September 2017.

2. Arnglim N, Schytz HW, Britze J, **Vestergaard MB**, Sander M, Olsen KS, Olesen J, Messoud A. Carbon monoxide inhalation induces headache in human headache model. 18th Congress of the International Headache Society. Oral presentation. Vancouver, Canada. September 2017.
3. Henriksen, OM, **Vestergaard MB**, Lindberg U, Aachmann-Andersen NJ, Lisbjerg K, Christensen SJ, Olsen NV, Rasmussen P, Larsson HBW, Law I. Interindividual and regional variations in coupling of cerebral blood flow and metabolism measured by PET and MRI. 28th Symposium on Cerebral Blood Flow, Metabolism and Function and 13th Conference on Quantification of Brain Function with PET. Oral presentation. Berlin, Germany. April 2017.
4. Jensen MLF, **Vestergaard MB**, Smith MN, Tønnesen P, Larsson HBW, Jennum PJ. Cerebral blood flow, cerebral metabolism and metabolites during hypoxia in patients with obstructive sleep apnea. 23rd Congress of the European Sleep Research Society. Oral presentation. Bologna, Italy. September 2016.
5. **Vestergaard MB**, Larsson HBW. Measurement of total brain oxygen consumption using sagittal phase information. The International Society for Magnetic Resonance in Medicine 2016 Nordic Chapter Meeting. Oral presentation. Uppsala, Sweden. June 2016.
6. **Vestergaard MB**, Lindberg U, Aachmann-Andersen NJ, Lisbjerg K, Christensen SJ, Rasmussen P, Olsen NV, Law I, Larsson HBW, Henriksen OM. Comparison of measurements of total cerebral blood flow by MRI phase-mapping techniques and H₂¹⁵O Positron Emission Tomography. European Society for Magnetic Resonance in Medicine and Biology 2015 conference. Oral presentation. Edinburgh, United Kingdom. September 2015.
7. **Vestergaard MB**, Grüner JM, Andersen U, Iversen H, Larsson HBW. Ny MR-metode til vurdering af hjernens blodgennemstrømning hos patienter med forsnævring af halspulsåren. (In Danish). Dansk Selskab for Klinisk fysiologi og Nuklearmedicins 2014 Årsmøde. Oral presentation. Kolding, Denmark. September 2014.
8. **Vestergaard MB**, Schultz J, Turner R, Hanson LG. Motion Tracking from Gradient Induced Signals in Electrode Recordings. European Society for Magnetic Resonance in Medicine and Biology 2011 conference. Oral presentation. Leipzig, Germany. September 2012.