

# Muhammad Abul Hasan

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## Academic Qualifications

Oct 2010-Oct 2014	<b>PhD</b>	BioMedical Engineering	University of Glasgow (UK)
June2008-May2010	<b>MEng</b>	Industrial Electronics	NED University (Pakistan)
Jan2004-Dec2007	<b>BEng</b>	Electronics	NED University (Pakistan)

## Work Experience

- **NED University of Engineering & Technology** (Dept of Biomedical Engineering)

**Assistant Professor**  
Dec2014-till date

### **Teaching undergraduate and postgraduate students**

- Basic electronics
- Biomedical Electronics
- Biomedical Instrumentation & Measurement (I and II)
- Digital Signal Processing
- Instrumentation and Measurement for food engineers
- Neuroscience & Neural Networks
- Advance Biomedical Instrumentation
- Advance Digital Signal Processing

**Lecturer**  
Jun2008-Nov2014

### **Class Advisor**

Act as a bridge between the students and the University administration for handling scholarships, timetable coordination and attendance record.

- **University of Glasgow** (Dept of Biomedical Engineering)

**Mentor**  
(Oct2011-Mar 2014)

- Mentoring students in 'Integrated system design project'. (*Students from management and different engineering disciplines work on one project*).
- Demonstrator in Signal Processing for BioSignatures.
- Assist students in the final year projects (MEng and Beng).

## Research Experience/ Interest

Muhammad Abul Hasan has been doing research in the field of EEG signal processing and its application since October 2010. He is experienced in analysing and recording EEG with 61

channels to investigate the cortical changes following central neuropathic pain in paraplegic patients. Furthermore, he designed EEG-based neurofeedback system for the treatment of central neuropathic pain. A neurofeedback system was made by integrating EEG device named g.usb amplifier (biosignal amplifier) with Simulink and LABVIEW. A Neurofeedback system that was designed by us included five channels and can also be used to provide information in laplacian. He has also developed a neurofeedback and BCI system using a single channel neurosky device. To design both systems, he has used Arduino microcontroller and C-sharp. Regarding EEG data processing, he has applied wavelet transformation to study time-frequency dynamics of EEG, fourier transform to study spectral analysis of EEG, coherence analysis to study connectivity analysis, and inverse solution techniques to study deep cortical structure.

### **Research Skills**

- Experienced in clinical work with patients suffering from chronic pain
- Experienced in EEG recording using 'Neuroscan' and 'g.usb amplifier' EEG devices
- Familiar with Neurosky EEG device
- Experienced in 'MATLAB' and 'EEGLAB' softwares for EEG data processing
- Experienced in sLORETA for EEG source localization
- Experienced in SIFT for Granger-Causality
- Experienced in EEG, EMG and ECG (3 leads) recordings using 'Power Lab' device
- Signal Processing including EEG time-frequency analysis, ERP, ICA and connectivity analysis
- Good presentation skills
- Able to work independently and in a group
- Statistical analysis using MATLAB
- Familiar with LABVIEW

### **Trainings/Meetings**

- Apr 2011 Course on EEG Neurofeedback in London
- Jun 2012 Course on ERP in Birmingham
- Dec 2012 Attended 'Scottish Intercollegiate Guidelines Network 'meeting on Chronic Pain
- Oct 2015 International workshop on OBE system organized by HEC at NEDUET
- Dec 2015 Seminar on Intellectual Property organized by HEC in collaboration with IPO and UNIDO
- May 2016 Student Centre Learning organized by NED University at NED University

## **Honors**

- 2010 PhD Scholarship- NED University of Engineering & Technology
- 2012 GU68 award ([http://www.guengtrust.org.uk/awards\\_history](http://www.guengtrust.org.uk/awards_history) )
- 2015 HEC approved PhD supervisor
- 2015 Won first prize in DICE-DUHS
- 2015 Organized an event PIBE (Project & Ideas of Biomedical engineering)

## **Members**

- 2014-till date Member of Board of Studies, Department of Biomedical Engineering, NED University of Engineering & Technology, Karachi
- 2014-till date Member of Board of Faculty, Department of Biomedical Engineering, NED University of Engineering & Technology, Karachi
- 2015-till date Member BME research group, Department of Biomedical Engineering, Riphah International University, Islamabad

## **Public Awareness Articles**

- Mar-2012 *'Easing the pain'* is published in University of Glasgow website Headlines. This article describes the effect of Neurofeedback Training for treatment of chronic central neuropathic pain. ([http://www.gla.ac.uk/research/infocus/projects/headline\\_281501\\_en.html](http://www.gla.ac.uk/research/infocus/projects/headline_281501_en.html) )
- 2012 *'Easing the Pain'* is published in Spinal Cord Injury Scotland magazine. This article reports the patient perspective after getting Neurofeedback Training for managing chronic central neuropathic pain. ([http://www.sisonline.org/images/content\\_files/FINAL\\_APPROVED\\_VERSION\\_Summer\\_2012\\_SIS\\_News\\_A4\\_36pp.pdf](http://www.sisonline.org/images/content_files/FINAL_APPROVED_VERSION_Summer_2012_SIS_News_A4_36pp.pdf) , page 12)
- Nov 2013 *'The Power of the Mind'* is broadcasted on Internet radio program 'Airing Pain' Episode 47. <http://painconcern.org.uk/how-we-help/airing-pain/>
- April 2014 *'Training the Brain' under 'Exploring pathways of Pain'* is published in Horizons Magazine at University of Glasgow. ([http://www.gla.ac.uk/research/horizons/spring2014/exploringpathwaysofpain/?utm\\_source=newsletter](http://www.gla.ac.uk/research/horizons/spring2014/exploringpathwaysofpain/?utm_source=newsletter))

## **Technical Presentations**

- Feb 2012 'Neurofeedback for treatment of central neuropathic pain following Spinal Cord injury' in 'Technologies of the mind' meeting held in University of Glasgow. ([http://web.eng.gla.ac.uk/frm\\_tmp/techofmind\\_reg.html](http://web.eng.gla.ac.uk/frm_tmp/techofmind_reg.html) )
- Sep 2012 'Voluntarily modulation of EEG rhythms reduces Neuropathic pain in patients with Spinal Cord Injury' in the 51<sup>st</sup> annual scientific meeting on advances in spinal cord injury management, London.
- Sep 2014 'Quantitative EEG analysis and Neuromodulation for Treatment of Central Neuroapthic Pain in Paraplegics Patients' in 43<sup>rd</sup> SCISCI clinical research meeting held at Queens Elizabeth National Spinal Injuries unit, Glasgow. (<http://www.gla.ac.uk/departments/scisci/> )
- Sep 2014 'Reduced Activation at Cortical Level Following Neurofeedback Treatment is Associated with Reduction in Central Neuropathic Pain Intensity' in 6<sup>th</sup> International BCI conference, Austria (Skype presentation).
- Apr 2015 'Brain computer interfacing' in the Hamdard Institute of Engineering & Technology, Hamdard University.

## **Publications** (Impact points=12.247, H-index=3, i10index=1, citations=30)

- 1- Vuckovic A, Muhammad Abul Hasan, Bahman Nasseroleslami, Bernard A. Conway, David B. Allan, Matthew Fraser. Motor imagery in spinal cord injury with neuropathic pain: a component clustering method. *Proceedings of the 4th International Symposium on Applied Sciences in Biomedical and Communication Technologies*. ISABEL 2011, October 26-29, Barcelona, Spain. ACM New York, NY, USA. (<http://dl.acm.org/citation.cfm?id=2093866> ). ISBN: 978-1-4503-0913-4. DOI: 10.1145/2093698.2093866.
- 2- Vuckovic, A., Hasan, M.A., Conway, B.A., Allan, D.B., and Fraser, M. (2011) Neurofeedback for treatment of neuropathic pain in SCI patients. *SCIENCE Research Update*, 1 . p. 18.
- 3- Vuckovic A, Muhammad Abul Hasan, Matthew Fraser, David B. Allan. Effects of Neurofeedback Treatment on Neuropathic Pain Following Spinal Cord injury. *14<sup>th</sup> world congress on pain, IASP 2012 Milan*. 27<sup>th</sup>-31<sup>st</sup> Aug 2012. Abstract PW544. ([http://www.abstracts2view.com/iasp/lookup\\_view.php?word=Hasan&where=authors&return=%2Fiasp%2Fauthorindex.php%3Fnum%3DH%26page%3D2%26start%3D51](http://www.abstracts2view.com/iasp/lookup_view.php?word=Hasan&where=authors&return=%2Fiasp%2Fauthorindex.php%3Fnum%3DH%26page%3D2%26start%3D51) )
- 4- Muhammad Abul Hasan, Vuckovic A, David B. Allan, Matthew Fraser. Voluntarily modulation of EEG rhythms reduces Neuropathic pain in patients with Spinal Cord Injury. *51st Annual Scientific Meeting ISCOS 2012 London- Advances in Spinal Cord Injury*

- 5- Vuckovic A, Muhammad Abul Hasan, Matthew Fraser, David B. Allan. Design and experimental evaluation of Neurofeedback system for treatment of Central Neuropathic Pain. *National Health Informatics Scotland*, Glasgow. 20<sup>th</sup>-21<sup>st</sup> Sep 2012.
- 6- Muhammad Abul Hasan, Vuckovic A, David B. Allan, Matthew Fraser. On-line EEG Training Reduces Central Neuropathic Pain. *GRPe Conference 2013* Glasgow. June 2013.
- 7- A Vuckovic, B. Conway, M.A. Hasan, B. Kalman. Source Information Flow study on EEG data during Motor Imagery. Pg 67-68. *Bioengineering conference 2013*. Glasgow UK. 6<sup>th</sup> -7<sup>th</sup> September 2013.
- 8- A Vuckovic, M A Hasan, M Fraser, B A Conway, B Nasserolelessami, D B Allan. Dynamic Oscillatory Signatures of Central Neuropathic Pain in Spinal Cord Injury. 2014. *The Journal of Pain*, 15(6), 645-655.
- 9- Ren Xu, Ning Jiang, Aleksandra Vuckovic, Muhammad Abul Hasan, Natalie Mrachacz Kersting, David Allan, Matthew Fraser, Bahman Nasserolelessami, B A Conway, Kim Dremstrup, Dario Farina. Movement-related cortical potentials in paraplegic patients: abnormal patterns and considerations for BCI-rehabilitation. *Frontiers in Neuroengineering*, vol 7, 1-9.
- 10- Aleksandra Vuckovic, Muhammad Abul Hasan, Matthew Fraser, D B Allan, B A Conway. A pilot study on clinical and neurological Effects of Neurofeedback Training for Treatment of Central Neuropathic Pain. In *proceedings of ICNR conference 2014 Denmark*, 823-831. *Book Title: Replace, Repair, Restore, Relieve—Bridging Clinical and Engineering Solutions in Neurorehabilitation*. DOI: 10.1007/978-3-319-08072-7\_113.
- 11- Muhammad Abul Hasan, Aleksandra Vuckovic, Matthew Fraser, D B Allan, B A Conway. Reduced Activation at Cortical Level Following Neurofeedback Treatment is Associated with Reduction in Central Neuropathic Pain Intensity. In *Proceedings of the 6th International BCI conference 16-19<sup>th</sup> September 2014, Graz, Austria*. *Book Title: The Future of Brain Computer Interaction: Basics, shortcomings, users*. DOI: 10.3217/978-3-85125-378-8. ISBN: 978-3-85125-378-8.
- 12- Aleksandra Vuckovic, Muhammad Abul Hasan, Bethel Osuguwa, Matthew Fraser, D B Allan, B A Conway. The Influence of Central Neuropathic Pain in Paraplegic Patients on Performance of Motor Imagery Based Brain Computer Interface. 2015. *Clinical Neurophysiology*.
- 13- Muhammad Abul Hassan, Matthew Fraser, Bernard A Conway, David B Allan, Aleksandra Vuckovic. The mechanism of neurofeedback training for treatment of central neuropathic pain in paraplegia: a pilot study. 2015. *BMC Neurology*, 15:200, 1-13.

- 14- Hasan, M.A., Fraser, M., Conway, B.A., Allan, D.B., Vučković, A., Reversed cortical over-activity during movement imagination following neurofeedback treatment for central neuropathic pain, *Clinical Neurophysiology* (2016), doi: <http://dx.doi.org/10.1016/j.clinph.2016.06.012>

## **Ongoing Projects**

- 1- Design and develop a graphical user interface to provide neurofeedback in order to control concentration using integration of 1 EEG channel neurosky device and arduino.
- 2- Develop software to process biosignal data in realtime and in online.
- 3- Compute difference in EEG coherence between able-bodied and patients with spinal cord injury.
- 4- Study the differences in the activity of the deep cortical structures between able-bodied and patients with spinal cord injury.
- 5- Study non-contact video based techniques for vital sign monitoring.
- 6- Design of a fixed mode pacemaker

## **References**

Will be provided upon request.