



Unit of Functional Neurosurgery

Professor Marwan I Hariz
Chair of Functional Neurosurgery
Tel: +44 (0) 20 7419 1860
Email: m.hariz@ion.ucl.ac.uk

Dr Patricia Limousin, Senior Lecturer
Consultant Neurologist
Tel: +44 (0) 20 7837 3611 Ext 3040
Email: p.limousin@ion.ucl.ac.uk

Mr Keyoumars Ashkan, Senior Lecturer
Consultant Neurosurgeon
Tel: +44 (0) 20 7837 3611 Ext 3054
Email: k.ashkan@ion.ucl.ac.uk

Professor Marjan Jahanshahi
Consultant Neuropsychologist
Tel: +44 (0) 20 7837 3611 Ext 3055
Email: m.jahanshahi@ion.ucl.ac.uk

PARKINSON'S APPEAL: Unit of Functional Neurosurgery

Progress Report June 2006

The Unit of Functional Neurosurgery at the Institute of Neurology (IoN), Queen Square, was established in October 2002 when Professor Marwan Hariz was appointed to the first established University Chair of Functional Neurosurgery (The Edmond J. Safra Chair), and also to the position of Consultant Neurosurgeon at the National Hospital for Neurology and Neurosurgery (NHNN). The Unit of Functional Neurosurgery was established through the generous support of The Parkinson's Appeal, led by Mrs Lyn Rothman. The Unit is dedicated to the treatment of patients with Parkinson's disease and other movement disorders using the technique of Deep Brain Stimulation (DBS), a new technique for correcting abnormal function in brain circuits that control movement.

The mission for the Unit is both to provide a first-rate treatment for patients with Parkinson's disease and other movement disorders, and to carry out extensive research at the Institute of Neurology aimed at understanding, improving and extending the use of DBS as a treatment.

Recent Developments in the Unit

Clinical Activity in the Unit

As at May 2006, a total of 93 patients have been treated with DBS in the Unit. 32 patients are part of the MRC PD Surgery Trial. 27 patients suffer from dystonia, for which DBS is also a very effective treatment. 2 patients with chronic deafferentation pain also benefited from DBS. The success rate of the Unit remains extremely high.

Current Staff Members in the Unit

Professor M Hariz (*Edmond J. Safra Chair of Functional Neurosurgery*)
Mrs P Forsdick (*PA to Professor Hariz*)
Dr P Limousin (*Consultant Neurologist and Senior Lecturer*)
Professor M Jahanshahi (*Consultant Neuropsychologist*)
Mr K Ashkan (*Consultant Neurosurgeon and Senior Lecturer*)
Dr S Tisch (*Clinical Research Fellow, PhD student*)
Mr L Zrinzo (*Specialist Registrar and Clinical Research Fellow*)
Dr L Wilkinson (*Postdoctoral Research Fellow*)
Ms E Tripoliti (*Speech Therapist, PhD student*)
Ms E Borrell (*Specialist Movement Disorder Nurse*)

Major International Meeting held by the Unit

UCL Institute of Neurology • National Hospital for Neurology & Neurosurgery • Unit of Functional Neurosurgery (Box 146), Sobell Department, Queen Square • London WC1N 3BG

Secretary: Ms Patricia Forsdick ☎ +44 (0)20 7837 3611 Ext 3656 • Fax: +44 (0)20 7278 9836 • Email: p.forsdick@ion.ucl.ac.uk
Movement Disorder Specialist Nurse: Ms Ellie Borrell ☎ +44 (0)20 7837 3611 Ext 4459 • Email: ellie.borrell@uclh.nhs.uk

On November 18th and 19th 2004, the Unit of Functional Neurosurgery, Institute of Neurology, hosted an international meeting “**Functional Neurosurgery for Movement Disorders, Pain and Psychiatric Illness**”. This meeting was attended by 120 in all, including all the major international figures in the field of DBS. It was a superb opportunity for the Unit to demonstrate the great progress made by the Unit in both clinical service and research. Another international meeting is being planned for February 2007.

New accommodation for the Unit in a new Clinical Neurosciences building, 33 Queen Square

In September 2006, work will commence on a new £9m Clinical Neuroscience Centre on the site of 33 Queen Square. The new building is a joint development between the National Hospital and the Institute of Neurology. It will accommodate the Unit and its patients on the east side of Queen Square, in close proximity to hospital wards, imaging facilities, operating theatre and the intensive care unit. The Wolfson Foundation has awarded a grant of £1m towards the cost of the new building.

National Specialist Advisory Service (NSCAG) Report on the work of the Unit

The NHS National Specialist Advisory Service (NSCAG) for Deep Brain Stimulation visited Queen Square in September last year to make their assessment of the DBS service here. The Unit subsequently received an excellent report, which endorsed both the quality of the surgical facilities here and the lack of severe complication in the patients treated to date. Our Unit is one of the foremost in the UK in terms of numbers of patients treated with DBS for movement disorders. This report is an excellent commendation of the Unit, coming as it does within two years of the Unit's first operation.

DBS Support Group

With the increasing number of operated patients, and increasing demands on the Unit's personnel, it has been considered helpful to set up a DBS Support Group, to provide patients and their families with extra psychological and emotional support in the immediate pre- and post-operative periods. Professor Jahanshahi and Ms Ellie Borrell are in the process of setting up such a DBS Support Group. Initially, the Support Group will be run from Queen Square, with Professor Jahanshahi and Ms Ellie Borrell having a major input. It is envisaged that, over time, one or more of the patients operated in the Unit of Functional Neurosurgery would take over the running of the Support Group. Membership of the Group will be open to any patient who has been operated in the Unit of Functional Neurosurgery.

BBC – “City Hospital” and DANA Centre Event

Two of our patients, one of whom is a neurologist, featured in the BBC programme, “City Hospital”. This programme followed their progress before, during and after DBS. Our patients also featured in a major event on DBS during Brain Awareness Week 2006 at the DANA Centre in London.

Website

With the enormous help of Martin Westall, the Parkinson's Appeal website has just been completely redesigned and updated: please visit it at <http://www.parkinsonsappeal.com>

Roger Lemon
Director
Institute of Neurology

Marwan Hariz
Edmond J Safra Chair of Functional Neurosurgery
Institute of Neurology

June 2006

Research Grants/Awards

Professor Hariz

- 2005-2007 Improving the Accuracy and Efficiency of Surgical Implantation of Therapeutic DBS Electrodes: Intra-operative Use of Local Field Potentials to Identify the Subthalamic Nucleus
DANA Foundation Clinical Neuroscience Research Grant: Prof P Brown
Co-Applicants: Prof M Hariz and Dr P Magill.
\$136,000
- 2006-2008 Effective target volume from DBS and RF electrodes for functional neurosurgery – theoretical and experimental analysis.
The Swedish Research Council
Co-Applicants: Prof M Hariz and Prof Karin Waardell (Univ of Linköping, Sweden)
1,800,000 SEK
- 2005- 2010 Functional Connectivity of the motor system in healthy subjects and in patients with Movement disorders or stroke – to test if surgery changes the pattern of functional connectivity in the motor system using transcranial magnetic stimulation methods to detect connections from premotor and parietal areas to the motor cortex
Medical Research Council: Prof J Rothwell, in collaboration with the Unit
£1,031,803

Professor Jahanshahi

- 2005-2007 Does provision of visual cues through virtual reality glasses improve mobility in Parkinson's disease? A controlled study
Project Grant from the Parkinson's Disease Society
Co-applicants: Dr R Greenlaw, Professor N Quinn
£98,193
- 2004-2006 ESRC/MRC Postdoctoral Fellowship for Dr Leonora Wilkinson
£61,860
- 2005-2007 ParkService – Telematics application service for people with Parkinson's disease. A market validation proposal.
European Commission eTen (Trans-European Telecommunications Networks)
Co-applicant with OCC, MESTOR, ICCS, PROMITHEAS, PARKAID, GRIGIONI, SCHENECKENHAUS
€640,000

Dr Limousin

- 2005-2010 STN Stimulation – Neural Control of Movement and Posture
Medtronic
Co-applicant: Prof Rothwell
\$175,000
- 2006-2009 A therapeutic approach to freezing in Parkinson Disease
Medical Research Council.
Co-applicant: Dr Day
£309,570
- 2005-2008 Impact of Deep Brain Stimulation on speech in patients with Parkinson's disease
Project Grant from the Parkinson's Disease Society
£99,698

2004-2005	Pump priming grant for the position of specialist PD Nurse Parkinson's Disease Society	£40,000
2004-2005	Effect of DBS on speech in Parkinson's disease and dystonia Federation Francaise des Groupements Parkinsoniens	£12,000
2005-2006	Mechanisms by which effective subthalamic nucleus stimulation alters spatial and temporal patterns of motor cortical activity based on the following terms and conditions. NIH/Medtronic Co-applicants: J Rothwell, D Corcos, E Tripoliti	\$175,000
2003-2005	Study of Brain Plasticity following GPi stimulation for dystonia Brain Research Trust.	£55,194
Mr K Ashkan		
2006	Funds from Medtronic to secure equipment for motor cortex stimulation project	200,000 Euros

Research Publications from the Unit 2004-2006

Hariz MI, Krack P, Melville R, Jorgensen JV, Hamel W, Hirabayashi H, Lenders M, Wesslen N, Tengvar M, Yousry TA: A Quick, and Universal Method for Stereotactic Visualization of the Subthalamic Nucleus Before and After Implantation of Deep Brain Stimulation Electrodes. *Stereotact Funct Neurosurg*, 2003;80:96-101 (released Feb. 2004)

Kühn AA, Williams D, Kupsch A, **Limousin P**, **Hariz M**, Schneider GH, Yarrow K, Brown P: Event-related beta desynchronization in human subthalamic nucleus correlates with motor performance, *Brain* 2004;127:735-46.

Hariz MI, Blomstedt P, **Limousin P**: The myth of microelectrode recording in ensuring a precise location of the deep brain stimulation electrode within the sensorimotor part of the subthalamic nucleus: The illustration contradicts the text, or: a picture says more than a thousand words. Letter to the Editor, *Mov Disord*, 2004;19:863-864.

Hariz MI: Is Microelectrode recording necessary in movement disorder surgery? The case against. Chapter 21, in: Israel Z and Burchiel KJ (eds): Microelectrode recording in movement disorder surgery, *Thieme*, New York, 2004, pp 197-207

Vergouwen MDI, Lenders MWPM, Jansen ENH, Steur, Kölling P, **Hariz M**: Long term results of unilateral posteroventral pallidotomy for antipsychotic drug-induced tardive dyskinesia, *J Neurol Neurosurg Psychiatr* 2005;76:1039

Thobois S, **Tisch S**, Xie-Brustolin J, Mertens P, **Hariz M**, Benatru M, Broussolle E, **Limousin-Dowsey P**: Can chronic subthalamic nucleus stimulation induce de novo tremor in Parkinson's disease? *Mov Disord* 2005;20:1066-1069.

Blomstedt P, **Hariz MI**: Hardware-related complications of DBS: A Ten Year experience. *Acta Neurochir* 2005;147:1061-1064

Fogelson N, Kühn AA, Silberstein P, **Limousin P, Hariz M**, Trottenberg T, Kupsch A, Brown P: Frequency dependent effects of subthalamic nucleus stimulation in Parkinson's disease. *Neurosci Lett* 2005; 382:5-9.

Kühn AA, **Hariz MI**, Silberstein P, **Tisch S**, Kupsch A, Schneider GH, **Limousin-Dowsey P**, Yarrow K, Brown P. Activation of the subthalamic region during emotional processing in Parkinson's disease. *Neurology* 2005;65:707-713

Doyle LM, Kühn AA, **Hariz M**, Kupsch A, Schneider GH, Brown P. Levodopa-induced modulation of subthalamic beta oscillations during self-paced movements in patients with Parkinson's disease. *Eur J Neuroscience*, 2005;21:1403-12

Silberstein P, Pogosyan A, Kühn AA, Hotton G, **Tisch S**, Kupsch A, **Dowsey-Limousin P, Hariz M**, Brown P. Cortico-cortical coupling in Parkinson's Disease and its modulation by therapy. *Brain*, 2005; 128:1277-1291.

Nowak DA, Topka H, **Tisch S, Hariz M, Limousin P**, Rothwell JC: The beneficial effects of subthalamic nucleus stimulation on manipulative finger force control in Parkinson's disease. *Exp Neurol* 2005;193:427-436.

Rodriguez-Oroz MC, Obeso JA, Lang AE, Houeto J-L, Pollak P, Rehncrona S, Kulisevsky A, Albanese A, Volkmann, **Hariz MI**, NP Quinn, JD Speelman, J Guridi, I Zamarbide, A Gironell, J Molet, B Pascual-Sedano, B Pidoux, AM Bonne, Y Agid, J Xie, A-L Benabid, AM Lozano, J Saint Cyr, L Romito, F Contarino, M Scerrati, V Fraix, N Van Blercom; Bilateral deep brain stimulation in Parkinson's disease: A multicentre study with 4 years follow-up. *Brain* 2005;128:2240-2249.

Nowak DA, Tisch S, **Hariz M**, Limousin P, Topka H, Rothwell JC: Sensory timing cues improve akinesia of grasping movements in Parkinson's disease: a comparison to the effects of subthalamic nucleus stimulation. *Mov Disord*. 2006 21:166-172.

Hariz MI: Management of referred Deep Brain Stimulation failures: What is DBS "failure" and how about management of own DBS failures? Letter to the Editor, *Arch Neurol*, 2005;62:1938

Hariz MI, Vayssière N. Stereotactic surgery without microelectrode recording, Chapter; In Press.

Blomstedt P, Hariz G-M, **Hariz MI**: Pallidotomy versus pallidal stimulation. *Parkinsonism and Related Disorders*, Published online, March 2006.

Blomstedt P, **Hariz MI**: Are complications less common in deep brain stimulation than in ablative procedures for movement disorders. *Stereotact Funct Neurosurg*, in press.

Kuhn AA, Doyle L, Pogosyan A, Yarrow K, Kupsch A, Schneider GH, **Hariz MI**, Trottenberg T, Brown P: Modulation of beta oscillations in the subthalamic area during motor imagery in Parkinson's disease. *Brain*. 2006 Mar;129(Pt 3):695-706.

Chen CC, Pogosyan A, Zrinzo LU, Tisch S, Limousin P, Ashkan K, Yousry T, **Hariz MI**, Brown P: Intra-operative recordings of local field potentials can help localize the subthalamic nucleus in Parkinson's disease surgery. *Exp Neurol*. 2006 Mar;198(1):214-21.

Kühn, A.A., Silberstein, P., Loukas, C., Trottenberg, T., Kupsch, A., **Limousin, P., Hariz, MI**, Schneider, G.-H., Brown, P. Subthalamic beta activity correlates with therapy-induced motor improvement in PD. *Mov Disord*, SUBMITTED.

Tisch S, Limousin P, Rothwell JC, Asselman P, Zrinzo L, Jahanshahi M, Bhatia KP, **Hariz MI**. Changes in forearm reciprocal inhibition following pallidal stimulation for dystonia. *Neurology*. 2006 Apr 11;66(7):1091-1093.

Lenders MW, Vergouwen MD, Hageman G, van der Hoek JA, Ippel EF, Jansen Steur EN, Buschman HP, **Hariz M**: Two cases of autosomal recessive generalized dystonia in childhood: 5 year follow-up and bilateral globus pallidus stimulation results. *Eur J Paediatr Neurol*. 2006;10(1):5-9.

Åström M, Johansson JD, **Hariz MI**, Eriksson O, Wårdell K: The effect of cystic cavities on deep brain stimulation in the basal ganglia: a simulation-based study. *J Neural Engineering* 2006;3:132-138.

Lenders MW, Buschman HP, Vergouwen MD, Steur EN, Kolling P, **Hariz M**: Long term results of unilateral posteroventral pallidotomy for antipsychotic drug induced tardive dyskinesia. *J Neurol Neurosurg Psychiatry*. 2005;76:1039.

Harald Fodstad and **Marwan Hariz**: Electricity in the treatment of nervous system disease. SUBMITTED

Kühn A, Williams D, Kupsch A, **Limousin P, Hariz M**, Schneider G-H, Yarrow K, Brown P: Event related beta desynchronization in human subthalamic nucleus correlates with motor performance. SUBMITTED

Blomstedt P, Olivecrona M, Sailer A, **Hariz MI**: Dittmar and the History of Stereotaxy or Rats, Rabbits and References. *Neurosurgery*, SUBMITTED

Brücke C, Kupsch A, Schneider G-H, **Hariz MI**, Nuttin B, Kopp UA, Kempf F, Doyle L, Chen CC, Yarrow K, Brown P, Kühn AA: The subthalamic region is activated during valence-related emotional processing in PD patients. SUBMITTED

Tisch S, Limousin P, Rothwell JC, Asselman P, Quinn N, **Jahanshahi M**, Bhatia KP, **Hariz MI**: Changes in blink reflex excitability after Globus Pallidus internus Deep Brain Stimulation for dystonia. SUBMITTED

Blomstedt P, Olivecrona M, Sailer A, **Hariz MI**: Dittmar and the History of Stereotaxy or Rats, Rabbits and References. SUBMITTED

Yardley L, **Jahanshahi M**, Hallam R. (2004) Psychosocial aspects of disorders affecting balance and gait. In A Bronstein, T Brandt, MH Woollacott, JG Nutt (eds) *Clinical Disorders of Balance, Posture and Gait*, Arnold, London, pp. 360-384.

Schrag A, Morley D, Quinn N, **Jahanshahi M**. (2004) Development of a measure of the impact of chronic parental illness on adolescent and adult children: The parental illness impact scale (Parkinson's disease). *Parkinsonism & Related Disorders*; 10:399-405.

Schrag A, Morley D, Quinn N, **Jahanshahi M**. (2004) Impact of Parkinson's disease on the patients' adolescent and adult children. *Parkinsonism & Related Disorders*; 10:391-397.

Papathanasiou I, Filipovic SR, Whurr R, Rothwell JC, **Jahanshahi M**. (2004) Changes in corticospinal motor excitability induced by non- motor linguistic tasks. *Exp Brain Research*; 154:218-225.

Kelly SW, **Jahanshahi M**, Dirnberger G. (2004) Learning of ambiguous and hybrid sequences in patients with Parkinson's disease. *Neuropsychologia*; 42:1350-1357.

Jones CRG, Rosenkranz K, Rothwell JC, **Jahanshahi M**. (2004) The right dorsolateral prefrontal cortex is essential in time reproduction: an investigation with repetitive transcranial magnetic stimulation. *Exp Brain Res*; 158(3):366-372.

Thobois S, **Jahanshahi M**, Pinto S, Frackowiak RSJ, **Limousin-Dowsey P**. (2004) PET and SPECT functional imaging studies in Parkinson's disease: from the lesion to its consequences. *NeuroImage*; 23(1):1-16.

Tisch S, Silberstein P, **Limousin-Dowsey P**, **Jahanshahi M**. (2004) The Basal Ganglia: Anatomy, Pharmacology and Physiology. *Psychiatric Clinics of North America*; 27:757-799.

Kuoppamäki M, Rothwell JC, Brown RG, Quinn N, Bhatia KP, **Jahanshahi M**. (2005) Motor performance following isolated bilateral lesions of the globus pallidus shows many similarities with Parkinson's disease. *J Neurol Neurosurg Psychiatr*; 76:482-490.

Jahanshahi M. (2005) TMS and cognitive function. In M Hallett & S Chokroverty (eds) *Magnetic stimulation in Clinical Neurophysiology*, 2nd Edition, Butterworth-Heinemann, Woburn, MA, pp. 281-302.

Jahanshahi M. (2005) Behavioural and psychiatric manifestations in Dystonia. In K Anderson, W Weiner, A Lang (eds) *Behavioural Neurology of Movement Disorders*, 2nd Edition, Advances in Neurology Series, Lippincott, Williams & Wilkins; pp291-319..

Jahanshahi M. (2005) Parkinson's disease. In A. Baum, C. McManus, S. Newman, J. Weinman and R. West (eds) *Cambridge Handbook of Psychology, Health and Medicine*. Second edition; In Press.

Dirnberger G, Frith CD, **Jahanshahi M**. (2005) Excessive inhibitory outflow from the globus pallidus and failure to modulate frontal activation with task demands in Parkinson's Disease. *NeuroImage*; 25, 588-599.

Paviour DC, Winterburn D, Simmonds S, Burgess G, **Wilkinson L**, Fox NC, Lees AJ, **Jahanshahi M**. (2005) Can the FAB bedside test of cognitive function differentiate bradykinetic rigid syndromes? Relation of the FAB with formal neuropsychological testing. *Neurocase*; 11, 275-282.

Schrag A, Morley D, Quinn N, **Jahanshahi M** (2005) Caregiver burden in Parkinson's disease is closely linked to psychiatric symptoms, falls and disability in the patient. *Parkinsonism & Related Disorders*, 12, 35-41

Paviour D, Price S, **Jahanshahi M**, Lees A, Fox N (2006) Longitudinal MRI in progressive supranuclear palsy and multiple systems atrophy: rates and regions of Atrophy. *Brain*, 129, 1040-9

Jahanshahi M, Saleem T, Ho AK, Dirnberger G, Fuller R (2005). Random Number Generation as an Index of Controlled Processing. *Neuropsychology*, In Press

Paviour D, Price S, **Jahanshahi M**, Lees A, Fox N, (2006) Regional Brain Volumes Distinguish PSP, MSA and PD: MRI based Clinico-radiological Correlations. *Movement Disorders*, IN PRESS

Paviour DC, Jager, H R **Wilkinson L**, **Jahanshahi M**, Lees AJ (2006) Holmes Tremor: Application of Modern Neuroimaging Techniques. *Movement Disorders* IN PRESS

Mondolo F, **Jahanshahi M**, Grana A, Biasutti E, Cacciatori E, Di Benedetto P (2006) The validity of the Hospital Anxiety and Depression Scale and the Geriatric Depression Scale in Parkinson's disease. *Behavioural Neurology* IN PRESS

Page D, Butler A, **Jahanshahi M** (2006) Quality of Life in focal, segmental and generalised Dystonia. SUBMITTED

- Limousin, P.** (2004) Thalamic stimulation in essential tremor. *Lancet Neurology*; 3:80.
- Pinto S**, Ozsancak C, **Tripoliti E**, Thobois S, **Limousin-Dowsey P**, Auzou P. (2004) Parkinson's disease treatments and dysarthria: an updating of thought. *Lancet Neurology*; 3:547-556.
- Bakker M, Esselink RAJ, Renooij J, **Limousin-Dowsey P**, Speelman JD, Bloem BR. (2004) Effects of stereotactic neurosurgery on postural instability and gait in Parkinson's disease. *Mov Disord*; 19:1092-9.
- Mackinnon CD, Webb RM, Silberstein P, **Tisch S**, Asselman P, **Limousin P**, & Rothwell J.C. (2005). Stimulation through subthalamic electrodes implanted near the subthalamic nucleus activates projections to motor areas of cerebral cortex in patients with Parkinson's disease. *European Journal of Neuroscience* 21, 1394-1402.
- Nowak DA, **Tisch S**, **Hariz M**, **Limousin P**, Topka H, Rothwell JC: Sensory timing cues improve akinesia of grasping movements in Parkinson's disease: A comparison to the effects of STN stimulation. *Mov Disord*, IN PRESS
- Silberstein P, Pogosyan A, Kühn A, Hotton G, **Tisch S**, Kupsch A, **Dowsey-Limousin P**, **Hariz M**, Brown P. Cortico-cortical coupling in Parkinson's Disease and its modulation by therapy. *Brain*, 2005, 128: 1277-91
- Nowak D, **Tisch S**, **Limousin P**, **Hariz M**, Topka H, Rothwell JC: The beneficial effects of subthalamic nucleus stimulation on manipulative finger force control in Parkinson's disease. *Experimental Neurology*, 2005 193 427-36
- Fogelson N, Kühn A, Silberstein P, **Dowsey Limousin P**, **Hariz M**, Trottenberg T, Kupsch A, Brown P: Frequency dependent effects of subthalamic nucleus stimulation in Parkinson's disease. *Neuroscience Letters*, 2005 382: 5-9
- Thobois S, **Tisch S**, Xie-Brustolin J, Mertens P, **Hariz M**, Benatru , Broussolle E, **Limousin-Dowsey P**: Can chronic subthalamic nucleus stimulation induce de novo tremor in Parkinson's disease? *Mov Disord* 2005; 20: 1066-9
- Fogelson N, Pogosyan A, Kuhn A, Kupsch A, van Bruggen G, Speelman H, Tijssen M, Quarterone A, Insola A, Mazzone P, Di Lazzaro V, **Limousin P**, Brown P. Reciprocal interactions between oscillatory activities of different frequencies in the subthalamic region of patients with Parkinson's disease. *Eur J Neurosci* 2005; 22: 257-266.
- Kuhn A, **Hariz M**, Silberstein P, **Tisch S**, Kupsch A, Schneider G, **Limousin-Dowsey P**, Yarrow K, Brown P. Activation of the subthalamic region during emotional processing in Parkinson disease. *Neurology* 2005; 65: 707-713.
- Limousin-Dowsey P**, **Tisch S**. Surgery for movement disorders: new applications? *J Neurol Neurosurg Psychiatry* 2005; 76: 904.
- Tisch S**, **Limousin P**, Rothwell JC, Asselman P, Quinn N, **Jahanshahi M**, Bhatia K, **Hariz M**. Changes in blink reflex excitability after globus pallidus internus stimulation for dystonia. *Movement Disorders* (Accepted with revisions)

Tisch S, Limousin P, Rothwell JC, Asselman P, Zrinzo L, Jahanshahi M, Bhatia K, Hariz M. Changes in forearm reciprocal inhibition following pallidal stimulation for dystonia. *Neurology* (Accepted with revisions)

Heise CE, Teo ZC, Wallace BA, **Ashkan K**, Benabid AL, Mitrofanis J. Cell survival patterns in the pedunculo-pontine tegmental nucleus of methyl-4-phenyl-1,2,3,6-tetrahydropyridine-treated monkeys and 6OHDA-lesioned rats: evidence for differences to idiopathic Parkinson disease patients? *Anat Embryol (Berl)*. 2005 Nov; 210: 287-302

Fitzpatrick E, **Ashkan K**, Wallace BA, Benabid AL, Mitrofanis J. Differential survival patterns among midbrain dopaminergic cells of MPTP-treated monkeys and 6OHDA-lesioned rats. *Anat Embryol (Berl)* 2005 Sep; 210 (2): 101-123.