



**THE SIGNALS AND SYSTEMS AREA SEMINAR
(EE 500 GRADUATE COLLOQUIUM)
Fall 2009**

*You are cordially invited to
The Signals and Systems Area Seminar
Entitled*

**“Electrophysiology of the basal ganglia: can new
treatments come from correcting errors in signal
processing?”**

By

Prof. Thyagarajan Subramanian

Penn State Milton S. Hershey College of Medicine

The talk will take place on

**October 15, 2009
4:00 pm**

At

225 EE West Building

Talk Abstract:

Over 100 years of electrophysiological recordings from the basal ganglia have suggested some unique connectivity and signal processing characteristics. The dogma in the field has been that these signals are entirely mediated by chemical neurotransmitters and that disorders of the basal ganglia can be corrected by replacing these neurotransmitters. While vast majority of patients benefit from neurotransmitter replenishment in the short run, they continue to suffer numerous complications of treatment and unsatisfactory side effects. Electrical therapy using implanted electrodes also do not completely ameliorate disease. New treatment strategies that provide both electrical and neurochemical solutions at the same time may correct signal processing errors. This presentation will demonstrate the clinical aspects of PD, the known electrical and chemical dysfunction and methods currently employed in research.

Speaker's CV:**CURRENT TITLES AND AFFILIATIONS**

Director, Movement Disorders Program

Professor with Tenure, Departments of Neurology and Neural and Behavioral Sciences, Milton S. Hershey College of Medicine, Penn State University, Hershey, PA 17033

ADDRESS FOR CORRESPONDENCE

Penn State Milton S. Hershey Medical Center
Mail Code H109, Room C2846,
500 University Drive
Hershey, PA 17033
Phone: (717) 531-4449
Cell: 717-599-8785
E-mail: tsubram@yahoo.com (preferred)
Or tsubramanian@hmc.psu.edu

LICENSURE/SPECIALITYBOARD CERTIFICATION

June 1989	Educational Council for Foreign Medical Graduates (ECFMG) Permanent Certification
January 1996	American Board of Psychiatry and Neurology (Neurology)

State and International Medical License

Pennsylvania (active); Ohio (active); Georgia (inactive); TC Medical Council, India (active)

PERMANENT RESIDENT OF USA (green card holder)

EDUCATION

- 1978 Secondary School leaving certificate (SSLC), St. Joseph's Boy's High School, Calicut, India, Graduated with first class (honors)
- 1980 College (Pre-Med): Malabar Christian College/Calicut University, Calicut, India, Graduated with first class and distinction (honors with distinction)
- 1985 Medical School: M.B.B.S. (M.D.): Calicut Medical College, Calicut University, Calicut, India, Class Rank 8/200

POSTDOCTORAL EXPERIENCE (all full-time)

- 03/86-07/88 Internship and General Surgery Residency, Calicut Medical College, Calicut, India
- 08/88-06/90 Graduate Research Fellow, Department of Neurobiology, Anatomy and Cell Science, University of Pittsburgh, Pittsburgh, PA, USA.
- 07/90-06/91 Internship, Internal Medicine, Shadyside Hospital, Pittsburgh, PA, USA
- 07/91-06/94 Neurology Resident and Teaching Fellow, Department of Neurology, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
- 07/94-10/97 Neurology Postdoctoral Clinical & Research Fellowship (Movement Disorders/Experimental Therapeutics/Neural Transplantation), Emory University School of Medicine, Atlanta, GA, USA

PROFESSIONAL EXPERIENCE AND AFFILIATIONS

- 1997-2000 Attending Physician (Neurology), Grady Memorial Hospital, Atlanta, GA, USA
- 1997-2000 Attending Physician (Neurology), Emory University Hospital, Atlanta, GA, USA
- 1997-2000 Assistant Professor of Neurology, Department of Neurology, Emory University School of Medicine, Atlanta, Georgia 30322
- 1995-2000 Affiliate Scientist, Yerkes Regional Primate Research Center, Atlanta, GA 30322
- 1997-2000 Director, Neural Transplantation Laboratory, Department of Neurology, Emory University School of Medicine, Atlanta, GA 30322
- 8/00-3/01 Clinical Associate Staff, Department of Neurology, Cleveland Clinic Foundation, Cleveland, OH 44195
- 3/01-10/05 Full Staff, Department of Neurology, Neurosciences and Physical Medicine and Rehabilitation, Cleveland Clinic Foundation, Cleveland, OH 44195
- 10/05-12/05 Adjunct Full Staff, Department of Neurology, Neurosciences and Physical Medicine and Rehabilitation, Cleveland Clinic Foundation, Cleveland, OH 44195
- 12/05-present Professor of Neurology and Neural and Behavioral Sciences, Staff Physician, Penn State Milton S. Hershey Medical Center, Hershey, PA 17033
- 6/2008 Professor with Tenure, Penn State University, PA
- 6/2008 Director, Division of Movement Disorders, Department of Neurology, Penn State University Hershey Medical Center, Hershey, PA 17033

GRANT REVIEWER

2001-03: Natural Sciences and Engineering Research Council of Canada
2001 Scotland Science and Technology Grants Commission
2006-2008 Member, Institutional Review Board A, PSUHMC, Hershey, PA
2008- Member, Scientific Review Committee, PSUHMC, Hershey, PA
2008- Member, Biosafety Committee, PSUHMC, Hershey, PA

AD-HOC MANUSCRIPT REVIEWER

Experimental Neurology, Journal of Comparative Neurology, Journal of Neuroscience Methods, Brain Research, Pharmacology, Biochemistry and Behavior, Neuroscience and Behavioral Reviews, Brain, Neurology, Experimental Eye Research

HONORS AND AWARDS

Elected Fellow, American Society for Neural Transplantation and Repair, 1997
International Research Award, Parkinson's Disease Foundation, 1999
Member, Parkinson Study Group, 2000-current.
First Dr. S. Kalyanaraman Oration Award, Neurological Institute of Madras Medical College, Chennai, India, Dec, 27, 2002
Elected member, World Federation of Neurology, 2005
Tenured Professorship, Penn State University, 2008

SOCIETY MEMBERSHIPS

Society for Neuroscience, American Academy of Neurology, American Society for Neural Transplantation and Repair, Movement Disorders Society, American Society for Gene Therapy

ELECTED OR NOMINATED POSITIONS

2005-2009 Executive Committee Member, Interventional Neurology Section, American Academy of Neurology (AAN) (reelected 2007)

- 2004-2006 Educational Committee Member, American Society for Neural Therapy and Repair (ASNTR)
- 2006-2008 Chairman, Educational Committee American Society for Neural Therapy and Repair (ASNTR)
- 2004-2005 Executive Committee Member, Association of Indian Neurologists in America (AINA)
- 2006- Scientific Advisory Board Member, Penn State Neuroscience Institute, Hershey, PA
- 2006-2008 President, Central Pennsylvania Chapter of the Society for Neuroscience
- 2006-2008 Member, Institutional Review Board A, Penn State Hershey Medical Center, Hershey, PA
- 2007-present Member, Institutional Biosafety Committee, Penn State Hershey Medical Center
- 2008- Member, Scientific Review Committee, PSUHMC, Penn State College of Medicine, Hershey, PA, 17033

GRANT SUPPORT

a. Active support

Federally-funded

1. Intranigral transplantation in parkinsonian monkeys, 2001-2011 (National Institutes of Health (NINDS) **RO1** NS42402 PI: **Thyagarajan Subramanian, grant competitively renewed in 2006**
This grant will evaluate the effects of dual transplants into the striatum and into the nigra on parkinsonism and to understand the pathophysiology of cell transplants using neurophysiological assessments in the basal ganglia circuits. This grant was initially funded from 2001-2006 competitively renewed for 5 additional years of funding in 2006.
2. *Macuna pruriens* endocarp for dyskinesias, 2005-2007, National Institutes of Health (NCCAM) **R21** AT001607, PI: **Thyagarajan Subramanian**
No cost extension 2007-2010
This grant will test the effects of the Indian aurvedic plant product, mucuna pruriens in animal models of Parkinson's disease using behavioral tests, electrophysiology and

microdialysis. These experiments will test the notion that mucuna pruriens has additional anti-dyskinetic properties besides anti-parkinsonian properties.

3. Human Retinal Pigment Epithelial Cell (hRPEC) Mediated ex-vivo Gene Therapy in Parkinson's Disease, Jan 2006 to July 2010, Pennsylvania Department of Health Tobacco Settlement Funds Biomedical Research Grant, PI: **Thyagarajan Subramanian**
This competitive PA State Grant will test the effectiveness of ex-vivo gene therapy using modified RPE cells in animal models of Parkinson's disease. Using gene transfer techniques we seek to modify RPE cells such that they produce enhanced quantities of dopamine and dopamine precursors. These modified cells will be evaluated for their efficacy to ameliorate parkinsonism and to prevent the onset of drug induced dyskinesias.
4. Use of MRI to detect progression of PD, Dana Foundation application, PI: Jianli Wang, Col: Thyagarajan Subramanian

Contracts

5. PostCEPT: A long term follow up study of PRECEPT study patients. Parkinson's disease study group (PSG) and Cephalon Pharmaceuticals Penn State Milton S. Hershey College of Medicine-PI: **Thyagarajan Subramanian**
6. **Patient Registry Outcomes in Spasticity (PROS) Care**, Penn State Milton S. Hershey College of Medicine-PI: **Thyagarajan Subramanian**
7. Effects of Coenzyme Q10 in Parkinson's disease-Phase 3 (QE3), PSG and NIH, Penn State Milton S. Hershey College of Medicine-PI: **Thyagarajan Subramanian**

Investigator Initiated Studies

8. A prospective, single-blind, randomized comparison study of the effects of Wellbutrin XL (bupropion extended release formulation) and Lexapro (citalopram) on parkinsonism in patients with Parkinson's disease (PD) and comorbid depression, PI: **Thyagarajan Subramanian**
9. Impact of Parkinson's disease on problem solving ability. PI: Amanda Price, Elizabethtown College, Co Investigators: Paul Eslinger and **Thyagarajan Subramanian**

b. Previous support

1. Federally-Funded

ASNTR Student Travel Fellowship: National Institutes of Health NINDS R13NS059304-01

Thyagarajan Subramanian (PI) 05/01/07-05/31/07 and 2008

This conference grant supported graduate students and post doctoral fellow travel and per diems to attend the ASNTR annual meeting 2007 and 2008 and the short grantsmanship course

Intranigral transplantation in parkinsonian monkeys, 2001-2005 National Institutes of Health (NINDS) RO1 NS42402 PI: Thyagarajan Subramanian

Functional MRI evaluation of Parkinson's Disease, 2001-2005, National Institutes of Health (NINDS) **R01** NS039841, PI: Michael Phillips, MD, **Co-I: Thyagarajan Subramanian**

Spheramine: A cell-based therapy for Parkinson's disease, 4 R44 NS9211-02, 1999-2000. NIH accelerated SBIR Phase I. Emory University Co-I: **Thyagarajan Subramanian**

CNS Grafting for Parkinsonism, 1993-1999. NIH RO1-NS-24340 PI: RAE Bakay. Co-investigator: **Thyagarajan Subramanian**

2. Private Foundation Funded

Effect of Glial Derived Neurotrophic Factor (GDNF) in Parkinsonian Monkeys, Emory University Research Committee Grant. 1996-1997. PI: **Thyagarajan Subramanian**

Assessment of the neuroprotective effect of pretreatment with intranigral Glial Derived Neurotrophic Factor (GDNF) in MPTP parkinsonian monkeys, American Parkinson Disease Association Research Atlanta Chapter Grant, 1996-1998, PI: **Thyagarajan Subramanian**

Characterization of the role of dopamine in the primate substantia nigra
Parkinson Disease Foundation International Grant, 4/1/99-4/30/01
Principal-Investigator: **Thyagarajan Subramanian**

"The Efficacy of Terazosin in Treatment of Multiple System Atrophy Symptoms", CCF-RPC, PI: **Thyagarajan Subramanian**

"Intranigral transplantation of RPE cells for parkinsonism" American Parkinson Disease Foundation (APDA) postdoctoral research grant. PI: Brigitte Piallat, Co-I: Kala Venkiteswaran, **Mentor: Thyagarajan Subramanian**

3. Investigator Initiated Research Contracts

Assessment of the Effect of Intrastratial Implantation of Retinal Pigmented Epithelial Cells (RPE) in Parkinsonian Monkeys, 1996-2000, Theracell, Inc., Somerville, NJ, PI: **Thyagarajan Subramanian**

Characterization of dopaminergic function of human retinal pigmented cells (hRPE) and in hRPE attached to gelatin microcarriers (hRPE-GM) transplanted into the brain, 11/25/98-04/30/00 Titan Pharmaceuticals, Inc., Somerville, NJ. PI: **Thyagarajan Subramanian**

Assessment of Dopamine Transporter in Retinal Pigmented Epithelial (RPE) Cells and Immunological Consequences of Intrastratial Implantation of Xenogenic (RPE) Cells in Hemiparkinsonian Rats, 1997-98. Theracell, Inc., Somerville, NJ, PI: **Thyagarajan Subramanian**

4. Contracts

A Multi-Center, Double-Blind, Placebo-Controlled, Parallel Group Safety Study of Pulmonary Function in Patients with Reduced Lung Function Treated with BOTOX®

(Botulinum Toxin Type A) Purified Neurotoxin Complex for Focal Upper Limb Spasticity Due to Upper Motor Neuron Syndrome. Allergan. Penn State Milton S. Hershey College of Medicine-PI: **Thyagarajan Subramanian**

A randomized, double-blind, active (pramipexole 0.5mg tid) and placebo controlled efficacy study of pramipexole, given 0.5 mg and 0.75 mg bid over a 12-week treatment phase in early Parkinson's disease patients (PramiBID) Penn State Milton S. Hershey College of Medicine-PI: **Thyagarajan Subramanian**

A Randomized, Double-Blind, Placebo-Controlled, Dose-Finding Study to Assess the Efficacy and Safety of CEP-1347 in Patients with Early Parkinson's Disease. Parkinson's disease study group (PSG) and Cephalon Pharmaceuticals Cleveland Clinic Foundation - PI: **Thyagarajan Subramanian**

"Observational study of BOTOX use in cervical dystonia", Allergan, Inc. Cleveland Clinic Foundation PI: **Thyagarajan Subramanian, MD**

A Multicenter, Open-Label Study of the Safety of Repeated Doses of BOTOX® (Botulinum Toxin Type A) Purified Neurotoxin Complex for the Treatment of Focal Limb Poststroke Spasticity, Allergan, Inc. Cleveland Clinic Foundation -PI: **Thyagarajan Subramanian**

"Investigation of the administration of lioresal intrathecal (baclofen injection) for the management of spasticity associated with stroke", Medtronic, Inc. Cleveland Clinic Foundation PI: **Thyagarajan Subramanian**

A Phase III, Multi-center, Randomized, Double-blind, Placebo-controlled, Fixed Dose Response Study Comparing the Efficacy and Safety of Sumanitrolol versus Placebo in Patients with Early Parkinson's Disease, Pfizer Corporation
Cleveland Clinic Foundation -PI: **Thyagarajan Subramanian**

A Survey to Assess the Incidence and Characteristics of melanoma in Parkinson's disease Patients Protocol EP002, Teva Pharmaceuticals
Cleveland Clinic Foundation -PI: **Thyagarajan Subramanian**

A multicenter, US and Canada, Double-blind, Randomized, Placebo-controlled, Parallel Group Study for the Efficacy, Tolerability and Safety of Rasagiline Mesylate in Parkinson's Disease Patients with Motor Fluctuations (PRESTO) study: Teva Pharmaceuticals. Cleveland Clinic Foundation PI: **Thyagarajan Subramanian**

Safety and Efficacy of Botox purified neurotoxin complex in the treatment of upper limb spasticity post stroke, 1/12/99-12/31/00, Allergan, Inc. Emory University PI: **Thyagarajan Subramanian**

A double-blind, controlled, multicenter clinical trial of the safety and efficacy of transplanted fetal porcine cells in patients with Parkinson's disease, Diacrin/Genzyme, LLC, Charlestown MA 02129. Emory University PI: RL Watts, Co-I: **T Subramanian**

COMT Inhibitors in Parkinson's Disease: Open label, randomized, parallel group comparison of talcapone and pergolide given in combination with Medopar (levodopa/benserazide) or Sinemet (levodopa/carbidopa) in Parkinsonian patients who exhibit end-of-dose 'wearing-off', with follow up extension of talcapone #NR15175/M35001, Hoffmann-La Roche Laboratories, Natley, NJ. Emory University Co-PI: RL Watts. Sub PI's: **T Subramanian**, M Evatt.

A long-term double-blind comparison of talcapone versus placebo given in combination with levodopa/AADC-I in delaying the onset of motor fluctuations in PD patients naive to levodopa therapy. Hoffmann-La Roche Laboratories, Natley, NJ. Emory University Co-PI: RL Watts. Sub PI: **T Subramanian**.

Two-period Crossover Comparison of Rizatriptan to Sumatriptan in the Acute Treatment of Migraine, Merck Research Laboratories, West Point, PA 19486. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

A Single-dose, Randomized, Double-blind, Placebo-controlled Study Evaluating the Safety and Efficacy of Ibuprofen 200 mg and 400 mg for the Treatment of Migraine Headache Pain, McNeil Consumer Products Co. Fort Washington, PA 19034. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

Dose Comparison of LY334370 Hydrochloride in the Treatment of Acute Migraine, Lilly Research Laboratories, Indianapolis, IN 46285. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

A Randomized, Double-blind, Placebo-controlled Study of Oral Sumatriptan in the Acute Treatment of Disabling, Primary Headaches (Migraine, Migrainous Headache, and Episodic Tension-type Headache), Innovative Medical Research, Inc., Baltimore, MD. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

An Open, Randomized, Parallel-group, Multicenter Trial to Compare the Efficacy of a Stratified Treatment Regimen for Acute Migraine Attacks in Which Patients Receive Therapy According to the Grade of Their Migraine Disability at Baseline, Assessed by the MIDAS Questionnaire, With That of Two Other Treatment Regimens in Which Patients Receive Standard Therapy That May Be Altered After Three Attacks (Stepped Care) or Within Individual Attacks (Staged Care), Geneca Pharmaceuticals, Wilmington, DE 19850-5437. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

Double-blind, Single-dose Multicenter, Parallel Group Randomized, Placebo-controlled, Outpatient Study, Whitehall-Robins Healthcare, Madison, NJ 07940. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

A Multicenter, Double-blind, Placebo-controlled, Parallel Group Study of Two Dose Levels of Oral Eletripton and Two Dose Levels of Oral Sumatriptan Given for the Acute Treatment of Migraine, Quintiles, Inc., Grafton, CT 06340. PI: **Thyagarajan Subramanian** (IMR, Atlanta)

FORMAL TEACHING

Medical Student and Graduate Teaching

- 1989-1990 Graduate Teaching Fellow, Gross Anatomy (medical and graduate students), University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
- 1993 Teaching Fellow, Neuropathology section (medical and graduate students), University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
- 1996 Instructor, Clinical Neuroscience, Emory University School of Medicine, Atlanta, GA, USA
- 2006- Professor of Neurology and Neural and Behavioral Sciences (Second yr medical student class and graduate student class didactic and lab instruction), Penn State Milton S. Hershey College of Medicine

SUPERVISORY TEACHING

Teaching: Post-doctoral fellows

- 1997 Rowena Johnston, Ph.D.
- 1999-2000 Chandrika Garg, MD
- 8/00-3/01 Anwar Ahmed, MD, Currently Movement Disorders Staff, Cleveland Clinic Foundation, Cleveland, OH
- 7/01-9/15/01 Kanwaljit Ahuja, MD, Currently in private practice, Maryland, USA
- 9/01-9/02 Jennifer Nelms, Ph.D.
- 4/02-4/03 Jai Perumal, MD.
- 06/02-12/02 Manoj Malhotra, MD, Currently Clinical Director, Novartis Corp., Morristown, NJ
- 09/03-09/04 Brigitte Piallat, Ph.D. Currently Associate Professor, INSERM Research Unit, Grenoble, France
- 09/03-03/05 Babak Tousi, MD. Currently Associate Staff, Geriatrics, Cleveland Clinic Foundation (Regional Medical Practice), Cleveland, OH
- 02/04-06/05 Milind Deogaonkar, MD, Clinical Faculty, Department of Neurosurgery, Cleveland Clinic Foundation, Cleveland, OH
- 09/06-06/07 Laxmathy Sukumaran, MD
- 12/06- Renuka Ramachandra, PhD
- 1/07-4/09 Kumaraswamy Gutalu, PhD

Teaching: Residency program

- 1991-1994 Teaching Fellow, Neurology Junior Residents, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
- 1994-1997 Teaching Fellow, Movement Disorders and Neurology, Emory University School of Medicine, Atlanta, GA, USA
- 1997-2000 Assistant Professor, Neurology, Psychiatry and Internal Medicine residents and Movement Disorders Fellow, Emory University School of Medicine, Atlanta, GA, USA
- 8/00-2004 Supervisor, Movement Disorders Clinical Rotation, Neurology (7 residents each year, 1-2 month rotation, 2 days/week) and Psychiatry Residents (8 residents/year, 1 month rotation, two full days per week in outpatient clinical rotation), Geriatric Medicine Fellows (3 fellows/year, 2 days week), Cleveland Clinic Foundation, Cleveland, OH 44145
- 2005-2007 Professor of Neurology (2 residents each year, supervise rotations and outpatient clinical rotations). Penn State Milton S. Hershey Medical Center, Hershey, PA

2007-2009 Professor of Neurology (4 neurology residents each year, supervise rotations and outpatient clinical rotations). Penn State Milton S. Hershey Medical Center, Hershey, PA

Teaching: Clinical Instruction Bedside for Medical Students

1991-1994 Teaching Fellow, Neurology Rotation for MS3 and 4, University of Pittsburgh School of Medicine, Pittsburgh, PA, USA
1994-1997 Teaching Fellow, Neurology Rotation for MS3 and 4, Emory University School of Medicine, Atlanta, GA, USA
1997-2000 Assistant Professor, Neurology Rotation for MS3 and 4, Emory University School of Medicine, Atlanta, GA, USA
2006- Professor of Neurology and Neural and Behavioral Sciences, MS 3 and 4 Neurology elective supervision. Penn State Milton S. Hershey College of Medicine, Hershey, PA, USA

Teaching: Medical Students-Didactic

1997-2000 Instructor, Neurology core didactic course for medical students, Emory University School of Medicine. Taught 1 module each year consisting of 3 lectures/ demonstrations
1988-1990 Teaching Assistant, Gross Anatomy Course and Dissection, MS1 year, University of Pittsburgh School of Medicine, Pittsburgh, PA
2006-2007 Professor of Neurology and Neural and Behavioral Sciences, Penn State M.S. Hershey College of Medicine, Neuroscience course, MS2 year, lecture, neuroscience lab, case based learning and PBL modules
2006-2008 Course co-director (understudy to Dr. Richard Tenser), Neural and Behavioral Sciences core medical school course
2008- Course co-director, Neural and Behavioral Sciences core medical school course

Teaching: Medical Student Summer Research Program (3 months)

1998 Mohammed Kooshkabadi, Emory Medical School MS1
2001 Marcel Heers, German exchange student, Freiberg University School of Medicine, Germany
2006-08 Neena Marupudi, Penn State Milton S. Hershey College of Medicine, MS I and II years. **Parkinson Disease Foundation Summer Fellowship Awardee 2006, ASNTR travel award winner 2007, Central PA SfN Chapter Award winner 2007, APDA summer student fellowship 2008 winner**
2007 Snehal Patel, Penn State Milton S. Hershey College of Medicine, MS1. **Parkinson Disease Foundation Summer Fellowship Awardee 2007**
2008 Elizabeth Luccasen, Penn State Milton S. Hershey College of Medicine, MS1.
2009 Amanda Rowlands, Penn State Milton S. Hershey College of Medicine, MS1. **APDA summer student fellowship 2009 winner**
2009 Jonathan Wu, Penn State Milton S. Hershey College of Medicine, MS1.

Graduate Students

2006-2007 Jennifer Nyland, Penn State Milton S. Hershey College of Medicine, Neuroscience Graduate Student Rotator
2006-2007 Nicholas Wiley, Penn State Milton S. Hershey College of Medicine, Neuroscience Graduate Student Rotator

- 2007 Carolina Guzman, Penn State Milton S. Hershey College of Medicine, Neuroscience MD-PhD Student Rotator
- 2007- Timothy Gilmour, Penn State University PhD Student (**Thesis Co-Advisor: Thyagarajan Subramanian**)
- 2007- Christopher Lieu, Penn State Milton S. Hershey College of Medicine, Neuroscience PhD Student (**Thesis Advisor: Thyagarajan Subramanian**)

Graduate Student Didactic Classes taught by Thyagarajan Subramanian

- 2006-2008 "Synapse I and II" lectures, taught as part of Molecular and Cellular Neuroscience, PSU Course # 520, Course director: R. Milner, PhD
- 2006-2008 MD-PhD Seminar Course, PSU Course #, Course Director: R. Levenson, PhD
- 2007-2008 "Pharmacology of Movement Disorders" in Pharmacology PSU course #502, Course director: Leo Fritzpatrick, PhD
- "Pathophysiology of drug induced dyskinesias" in Pharmacology PSU course #502, Course director: Leo Fritzpatrick, PhD

Teaching: Undergraduate Research Students (3 month)

- 1999-2000 Shankar Unnikrishnan, Emory University Sophomore
- 2000 Samita Sharma, Emory University Sophomore
- 2000 Ashu Verma, Emory University Sophomore
- 1999-2000 Chris Gebert, Emory University Sophomore
- 2000-2003 Shalini Garg, Duke University Junior
- 2002-2004 Samar Shah, John Carroll University Junior
- 2003-2004 Maria Minadeo, Miami University of Ohio Junior
- 2003 Stasha Rezak, Case Western Reserve University Freshman
- 2004 Supriya Mahajan, Harvard University Junior
- 2004 Nick Nayak, George Washington University Sophomore
- 2004 Swetha Suresh, Case Western Reserve University Freshman
- 2003-2005 Jamie Watkins, Miami University of Ohio Junior
- 2006 Abigail Harris, Albright College, Junior
- 2009 Sheerin W, Johns Hopkins University Freshman

Teaching: Lab Technicians who have gone on to graduate school

- 1994-2000 Walt Hubert, tech 2, completed PhD in Neuroscience at Emory University and currently post-doc at Emory University, Atlanta, GA
- 1995-2000 Deanna Marchionini, tech 2, completed PhD in Neuroscience at Rush Presbyterian University, Chicago in 2005, currently post-doc at Columbia University, New York, NY
- 2001-2005 Patrick T. Redman, tech 2, currently PhD student in Neuroscience at University of Pittsburgh, Pittsburgh, PA
- 2002-2005 Erin V. Gilbert, tech 2, currently PhD student at Kent State University School of Biological Sciences, Kent, OH

BIBLIOGRAPHY

Papers

1. **Subramanian T**, IF Pollack and RD Lund, Rejection of mesencephalic retinal xenografts in the rat induced by the systemic administration of recombinant interferon-gamma, *Exp. Neurol.*, 131:157-162, 1995
2. **Subramanian T**, DF Emerich, RAE Bakay, JM Hoffman, MM Goodman, TM Shoup, GW Miller, AI Levey, GW Hubert, S Batchelor, SR Winn and RL Watts, Polymer encapsulated PC-12 cells demonstrate high-affinity uptake of dopamine in vitro and ¹⁸F-dopa uptake and metabolism after intracerebral implantation in nonhuman primates. *Cell Transp.*, 6 (5): 469-477, 1997
3. Watts RL, **T Subramanian**, A Freeman, CG Goetz, GT Stebbins, RD Penn, JH Kordower and RAE Bakay, Effect of stereotaxic intrastriatal cografts of autologous adrenal medulla and peripheral nerve in Parkinson's Disease: 2 year follow -up study. *Exp. Neurol*, 147: 510-517, 1997
4. Wichmann T, H Bergman, PA Starr, **T Subramanian**, RL Watts, and MR DeLong. Comparison of MPTP-induced changes in spontaneous neuronal discharge in the internal pallidal segment and in the substantia nigra pars reticulata in primates. *Exp. Brain Res.*, 125 (4): 397-409, 1999
5. Xing D, P Chen, R Keil, CD Kilts, B Shi, VM Camp, G Malveaux, T Ely, MJ Ovens, J Votow, M Davis, JM Hoffmann, **T Subramanian**, RAE Bakay , RL Watts, MM Goodman. Synthesis, Biodistribution and Primate Imaging of Flourine-18 labeled 2b-carb0-1-flouro-2-propoxy-3b□□4□chlorphenyl)tropanes, Ligands for the imaging of dopamine transporters by positron emission tomography *J Biol Chem*, 43 (4): 639-648, 2000.
6. Kellstein DE, Lipton RB, Geetha R, Koronkiewicz K, Evans FT, Stewart WF, Wilkes K, Furey SA, **Subramanian T**, Cooper SA. Evaluation of a novel solubilized formulation of ibuprofen in the treatment of migraine headache; a randomized, double-blind, placebo controlled, dose-ranging study. *Cephalalgia* 20(4): 233-243, 2000
7. Starr, P, **T Subramanian**, RAE Bakay, T Wichmann. Electrophysiological localization of the substantia nigra in the parkinsonian primate. *J Neurosurg.* 93:704-710, 2000
8. **Subramanian T**. Cell transplantation for the treatment of Parkinson's disease: an update. (Review article) *Seminars in Neurology* 21 (1): 103-115, 2001
9. Fowler, KA, MJ Huerkemp, JK Pulliam, **T Subramanian**, Anesthetic protocol: Propofol use in Rhesus macaques (*Macaca mulatta*) during magnetic resonance imaging with stereotactic head frame application. *Brain Research Protocols* 7: 87-93, 2001
10. Okun, MS, Stover, NP, **Subramanian, T**, Gearing, M, Wainer, BH, Holder, C, Watts, RL, Juncos, JL, Freeman, A, Evatt, ML, Vitek, JL., and DeLong, MR. Complications of Gamma Knife Surgery for Parkinson's Disease. *Archives of Neurology.* 58(12): 1995-2002, 2001
11. **Subramanian T**, D Marchionini, E Potter, M Cornfeldt, Striatal xenotransplantation of human retinal pigment epithelial cells attached to microcarriers in hemiparkinsonian rats ameliorates behavior deficits without provoking a host immune response. *Cell Transplantation*, 11 (3): 207-14, 2002
12. **Subramanian T**, HO Luders, Commentary: Botulinium toxin injections for hemifacial spasm, *Neurologia medico-chirurgia*, 42 (6): 248-250, 2002
13. Brashear, A., Gordon, AR., Elovic, E., Kassicieh, VD., Marciniak, C., Do, M., Lee, C-H., Jenkins, S., Turkel, C for the Botox Post-Stroke Spasticity Study Group * (**includes Subramanian, T.**) Intramuscular Injection of Botulinum Toxin For The Treatment of Wrist And Finger Spasticity After A Stroke. *N Engl J Med*, 347(6): 395-400, 2002
14. Watts, RL, Raiser, CD, Stover, NP, Cornfeldt, ML, Schweikert, AW, Allen, RC, **Subramanian, T**, Doudet, D, Honey, CR, Bakay, RAE, Stereotaxic intrastriatal implantation of human retinal pigment epithelial (hRPE) cells attached to gelatin microcarriers: a potential new cell therapy for Parkinson's disease. *Journal of Neural Transmission. Supplementum.* (65): 215-27, 2003.

15. Bakay, RAE, Stover, NP, Raiser, CD, **Subramanian, T.**, Cornfeldt, ML, Schweikert. AW., Allen, RC, Watts, RL, Implantation of Spheramine in advanced Parkinson's disease (PD). *Frontiers in Bioscience* 9:592-602, 2004
16. Tousi B., **Subramanian T.**: Hallucinations in Parkinson's disease; Approach and Management. *Clinical Geriatrics*, 12 (10): 19-24, 2004
17. Tousi B., Ahuja K., Perumal JS., **Subramanian T.**, Effects of botulinum toxin –B (BTX-B) for hemifacial spasm. *Parkinsonism and Related Disorders*, 10 (7): 455-456, 2004
18. Tousi, B., Schuele, SU., **Subramanian T.**, 46 year old woman with rigidity and frequent falls: Approach to patient with parkinsonian symptoms. *Cleveland Clinic Journal of Medicine*, 72 (1): 57-66, 2005
19. Parkinson Study Group (Includes **Subramanian, T.**) A randomized placebo controlled trial of rasagiline in Parkinson's disease patients with levodopa-related motor fluctuations, *Archives of Neurology*, 62:241-248, 2005
20. **Subramanian T.**, Deogaonkar MS., Brummer ME, Bakay RAE. MRI guidance improves accuracy of stereotaxic targeting of cell transplantation in parkinsonian monkeys *Exp. Neurology*, 193 (1): 172-180, 2005
21. Tousi B., **Subramanian, T.**, The effect of levetiracetam on levodopa induced dyskinesias in patients with Parkinson's disease. *Parkinsonism and Related Disorders*, 11 (5): 333-4, 2005
22. Deogaonkar, MS., Heers, M., Mahajan, S., Brummer, M., **Subramanian, T.**, Methods of construction of a MRI based 3D tabular database of 3D stereotactic coordinates for individual structures in the basal ganglia of *Macaca mulatta*. *Journal of Neuroscience Methods*, 149 (2): 154-63, 2005
23. Deogaonkar, MS., **Subramanian, T.**, Pathophysiological basis of treatment strategies for drug-induced dyskinesias in Parkinson's disease, *Brain Research Reviews*, 50 (1): 156-68, 2005
24. Stover SP, Bakay RAE, **Subramanian T**, Raiser CD, Cornfeldt ML, Schweikert AW, Allen, RC, Watts, RL, Intrastriatal Implantation of human retinal pigment epithelial cells attached to microcarriers in advanced Parkinson's Disease, *Archives of Neurology* 62 (12): 1833-1837, 2005
25. Parkinson Study Group (Includes **Subramanian, T.**) A Randomized Placebo-Controlled Trial of Rasagiline in Levodopa-Treated Patients With Parkinson Disease and Motor Fluctuations. The PRESTO Study, *Arch Neurol.* 2005; 62:241-248
26. Goetz CG, Schwid SR, Eberly SW, Oakes D, Shoulson I, and the Parkinson Study Group TEMPO and PRESTO Investigators (Includes **Subramanian, T.**) Safety of rasagiline in elderly Parkinson's disease patients, *Neurology* 66 (9): 1427-9, 2006
27. Zhao, Z, Krishnaney, A, Teng, Q, Garrity-Moses, M, Tanase, D, Liu, JK, Venkiteswaran, K, **Subramanian, T**, Davis, M, Boulis, NM, Anatomically discrete functional effects of adenoviral clostridial light chain gene-based synaptic inhibition in the deep layers of the superior colliculus/deep mesencephalic nucleus of the midbrain, *Gene Therapy*, 13 (12): 942-952, 2006
28. Ivanhoe, CB, Francisco, GE, McGuire, J, **Subramanian, T**, Grissom, S, Intrathecal Baclofen (ITB) Management of Spastic Hypertonia Following Stroke: Implications for Function and Quality of Life, *Archives of Physical Medicine and Rehabilitation*, 2006; 87(11):1509-1515
29. Elmer L, Schwid S, Eberly S, Goetz C, Fahn S, Kieburtz K, Oakes D, Blindauer K, Salzman P, Oren S, Prisco UL, Stern M, Shoulson I; Parkinson Study Group TEMPO and PRESTO Investigators (includes **Subramanian T**). Rasagiline-associated motor improvement in PD occurs without worsening of cognitive and behavioral symptoms. *J Neurol Sci* 2006; 248(1-2): 78-83

30. The Parkinson Study Group PRECEPT Investigators* (includes **Subramanian T**), The Mixed Lineage Kinase Inhibitor CEP-1347 Fails to Delay Disability in Early Parkinson's Disease, *Neurology* 2007; 69 (15):1480-1490
31. Comella, CL, Jankovic, J, Lai, FM, Brin, MF, BoNTA Group (includes **Subramanian T**), Long term efficacy, immunogenicity and safety of botulinum toxin type A in the treatment of cervical dystonia: an observational study, *Movement Disorders* 2008; 23(10): 1353-1360
32. Michael A. Schwarzschild, M.D., Ph.D., Steven R. Schwid, M.D., Kenneth Marek, M.D., Arthur Watts, Ph.D., Anthony E. Lang, M.D., David Oakes, Ph.D., Ira Shoulson, M.D., and Alberto Ascherio, M.D. and the Parkinson Study Group PRECEPT Investigators, (includes **Subramanian T**), Serum Urate as a Predictor of Clinical and Radiographic Progression in Parkinson Disease. *Arch Neurol*, Jun 2008; 65: 716 - 723.

Book Chapters

1. **Subramanian, T.**, "The Basal ganglia: an overview" In Hans O Luders, editor. "Deep Brain Stimulation and Epilepsy", Martin Dunitz Publishers, pp 21-28, 2004
2. **Subramanian T.**, Deogaonkar M: 'Cell transplantation and Gene therapy for the treatment of Parkinson's disease'. In Galvez-Jimenez N., Editor: 'Scientific Basis for Treatment of Parkinson's Disease,' Taylor & Francis Medical books, London, UK, pp 233-250, 2005
3. Tousi B., **Subramanian, T.** MSA-P presenting as stridor. *Movement Disorders: 100 Instructive Cases* by Stephen G. Reich (Editor), # Taylor & Francis, Inc. November 2008 ISBN-13: 9781841845241, 304pp

Peer-reviewed Journal Abstracts

- 1 **Subramanian T**, J Vitek, RL Watts, C Maier, RAE Bakay, MR DeLong, Microelectrode-guided stereotactic selective thalamotomy improves tremor but not bradykinesia in a young Parkinson disease patient. *Neurology*, 45 (3):38, 1995
- 2 **Subramanian T**, RL Watts, RAE. Bakay, AH Freeman, CG Goetz, GT Stebbins, RD Penn, and JH Kordower, Stereotactic intrastriatal cogafts of autologous adrenal medulla (AM) and peripheral nerve (PN) improves motor performance in Parkinson's Disease (PD). *Experimental Neurology*, 135 (2): 170, 1995
- 3 **Subramanian T**, RL Watts, DF Emerich, RAE Bakay, TM Shoup, MM Goodman, JM Hoffman, Polymer encapsulated PC-12 cells demonstrate ¹⁸F-dopa uptake *in vivo* by Positron Emission Tomography (PET) after intracerebral implantation in nonhuman primates. *Neurology*, 46(2): A417, 1996
- 4 **Subramanian T**, RL Watts, DF Emerich, RAE Bakay, TM Shoup, MM Goodman, JM Hoffman, Preliminary results of intracerebral implantation of polymer encapsulated PC-12 cells (PEPC) in nonhuman primates. *Movement Disorders*, 11, Suppl. 1, 250, 1996
- 5 **Subramanian T**, RL Watts, RAE Bakay, GW Miller, AI Levey, S Batchelor, GW Hubert, SR Winn, TM Shoup, MM Goodman, JM Hoffman, and DF Emerich, Polymer encapsulated PC-12 cells (PEPC) demonstrate high-affinity uptake of dopamine *in vitro* and ¹⁸F-dopa uptake and metabolism after intracerebral implantation in nonhuman primates. 6th International Neural Transplantation Meeting Abs., 1:30, 1997
- 6 Watts, RL, **T Subramanian**, GW Hubert, JM Hoffman, and RAE Bakay, Stereotactic intrastriatal allogenic fetal mesencephalic tissue implants compared to sham surgery in MPTP-induced hemiparkinsonian (HP) monkeys. 6th International Neural Transplantation Meeting, Abs., 1:30, 1997

- 7 Bakay, RAE, RL Watts, LD Byrd, K Boyer, GW Miller, AI Levey, JM Hoffman, JM Klemm, **T Subramanian**, GW Hubert, and PA Starr. Morphological comparisons of primate fetal mesencephalic grafts using cell suspension or mechanical dispersion in MPTP-induced parkinsonian monkeys. 6th International Neural Transplantation Meeting, Abs., 1:29, 1997
- 8 **T Subramanian**, GW Miller, RAE Bakay, RL Watts and AI Levey, Quantitative immunochemical analysis of striatal dopamine transporter in MPTP-induced hemiparkinsonian monkeys, *Neurology*, 48 (3): A324, 1997
- 9 JM Hoffman, B Shi, MM Goodman, **T Subramanian**, AI Levey and RL Watts, Correlation of *in vivo* and *in vitro* dopamine transporter function. *Neurology*, 48 (3): A62, 1997
- 10 **T Subramanian**, RL Watts, GW Hubert, and RAE Bakay, Striatal allogenic fetal mesencephalic (FM) tissue transplants compared to sham surgery in hemiparkinsonian (HP) nonhuman primates. *Journal of the Neurological Sciences*, 150: S183, 1997
- 11 RE Johnston, **T Subramanian**, B Burnette, GW Hubert, ML Cornfeldt, and RL Watts, Intrastratial xenotransplantation of microcarrier bound human retinal pigmented epithelial (hRPE) cells in hemiparkinsonian (HP) rats. *Exp. Neurol.*, 153, 367–392, 1998
- 12 **T Subramanian**, RAE Bakay, B Burnette, GW Hubert, ML Cornfeldt, and RL Watts, Effects of stereotactic intrastratial transplantation of human retinal pigmented epithelial (hRPE) cells attached to gelatin microcarriers on parkinsonian motor symptoms in hemiparkinsonian (HP) monkeys. *Exp. Neurol.*, 153, 367–392, 1998
- 13 **T Subramanian**, B Burnette, RAE Bakay, JM Hoffman, J Votow, ML Cornfeldt, and RL Watts, Intrastratial transplantation of human retinal pigmented epithelial cells attached to gelatin microcarriers (hRPE-GM) improves on parkinsonian motor signs in hemiparkinsonian (HP) monkeys. *Mov. Dis.*, 13 (2): 268, 1998
- 14 D Marchionini, **T Subramanian**, B Burnette, G Miller, M Iuvonne, E Potter and M Cornfeldt. Dopaminergic properties of retinal epithelial cells attached to gelatin microcarriers (RPE-GM) transplanted into parkinsonian animals. *Exp. Neurol.*, 159 (2): 608, 1999
- 15 **T Subramanian**, RAE Bakay, ML Cornfeldt and RL Watts, Blinded placebo-controlled trial to assess the effects of striatal transplantation of human retinal pigmented epithelial cells attached to microcarriers (hRPE-M) in parkinsonian monkeys. *Parkinsonism and Related Dis.*, 5: S111, 1999
- 16 **T Subramanian**, AI Levey, GW Hubert, GW Miller, DD Shoepf, RL Watts, Noncompetitive AMPA glutamate receptor antagonist (LY300164) potentiates the behavioral effects of levodopa in hemiparkinsonian monkeys, *Neurology* 52: A216, 1999
- 17 **T Subramanian**, D Marchionini, SE Leff, Preventive effects of intranigral glial derived neurotrophic factor (GDNF) gene therapy, *Exp. Neurol.*, 164 (2): 448, 2000
- 18 **T Subramanian**, Bakay, RAE, Brummer, M., Marchionini, D, Cornfeldt, ML, and Watts, RL, The effects of striatal transplantation of human retinal pigmented epithelial cells attached to microcarriers (hRPE-M) in parkinsonian monkeys. Presented at the 7th International Neural Transplantation Meeting, O'dense, DK, 1999. *Exp. Neurol.*, 2000.
- 19 Ray L. Watts, Cathy D. Raiser, Natividad P. Stover, Michael L. Cornfeldt, Alfred W. Schweikert, **Thyagarajan Subramanian**, Roy A.E. Bakay. Stereotaxic Intrastratial Implantation of Retinal Pigment Epithelial Cells Attached to Microcarriers in Advanced Parkinson Disease (PD) Patients: A Pilot Study, *Neurology*, 56 (Suppl. 3), P04.102. 2001
- 20 Watts, R.L., Raiser, C.D., Stover, N.P., Cornfeldt, M. L., Schweikert, A. W., Allen, R. C., **Subramanian, T.**, Bakay, R.A.E., Stereotaxic Intrastratial Implantation of Retinal Pigment Epithelial Cells Attached to Microcarriers in Advanced Parkinson Disease (PD) Patients: A Pilot Study in Six Patients, *Parkinsonism & Related Disorders*, 7 (Suppl.), S87, P-TU-305, 2001

- 21 Kala Venkiteswaran, Shalini Garg, **Thyagarajan Subramanian**, Recombinant lentiviral mediated stable transgene expression in retinal pigment epithelial (ARPE-19) cells. *Exp. Neurol.* 175 (2): 440, 2002
- 22 K. Venkiteswaran, JL Nelms, N Tidwell, **T Subramanian**, Dopaminergic properties of retinal pigment epithelial (RPE) cells. *Exp. Neurol.* 175 (2): 446, 2002
- 23 Redman P.T., Perumal J.S., Shah S., Watkins J., Venkiteswaran K., **Subramanian T.**, Growth and immunological characteristics of intrastriatal and intranigral transplantation of fetal ventral mesencephalic tissue from GFP expressing transgenic mice into parkinsonian rats. *Experimental Neurology* 181(1): 103, 2003
- 24 Venkiteswaran K., Perumal J.S., Redman P.T., Shah S., Watkins J., Razack S., **Subramanian T.**, Xenotransplantation of green fluorescent protein expressing retinal pigment epithelial cells into hemiparkinsonian rats. *Experimental Neurology* 181(1): 108, 2003
- 25 Venkiteswaran K., Perumal J., Redman P., Watkins J., and **Subramanian T.**, Safety of recombinant lentiviral mediated ex-vivo gene therapy using retinal pigment epithelial cells in hemiparkinsonian rats. *Molecular Therapy* 7(5): 659, 2003
- 26 Tousi, B., **Subramanian, T.**, Effects of Levetiracetam in the management of drug-induced dyskinesias in patients with Parkinson's disease, *Movement Disorders*, 19 suppl 9: S175, 2004
- 27 Jain S., **Subramanian, T.**, Assessing subjective improvement and disability in patients with dystonia of the neck in focal and generalized syndromes treated with botulinum toxin followed by deep brain stimulation, *Movement Disorders*, 19 suppl 9: S326, 2004
- 28 Gilbert, EV., Redman, PT, Venkiteswaran, K., **Subramanian, T.**, Fetal dorsal mesencephalic (FDM) tissue as a possible "control" transplant for nigral fetal ventral mesencephalic (FVM) tissue transplants, *Experimental Neurology*, 187 (1): 225, 2004
- 29 **Subramanian T.**, Venkiteswaran K., Redman P., Gilbert EV., Ex-vivo gene therapy with modified retinal pigment epithelial cells without attachment to microcarriers for parkinsonism, *Movement Disorders*, 19 suppl 9: S325, 2004
- 30 Deogaonkar, M., Piallat, B., **Subramanian, T.**, Effect of L-dopa on neuronal activity of Subthalamic Nucleus (STN) and Substantia Nigra (SN) in hemiparkinsonian monkeys. *Movement Disorders*, 20 suppl 10: S75, 2005
- 31 **Subramanian, T.**, Deogaonkar, M, Brummer, ME, Wichmann, T., Leff, SE, Bakay, RAE, Comparison of accuracy of stereotaxic targeting for cell transplantation and gene therapy in parkinsonian monkeys using multi-modality guidance, *Neurology*, 64 (6) suppl 1: A279, 2005
- 32 Venkiteswaran, K., Deogaonkar, M., **Subramanian, T.**, Striatal transplantation of genetically modified human retinal pigment epithelial cells (hRPEC) demonstrate stable long-term transgene expression, improve parkinsonism and ameliorate electrophysiological changes in parkinsonian rats, *Experimental Neurology*, 193 (1): 262, 2005
- 33 **Subramanian, T.**, Piallat, B., Deogaonkar, M., Redman, P., Gilbert, EV., Venkiteswaran, K., Electrophysiological consequences of dopaminergic transplantation in parkinsonian animals, *Experimental Neurology*, 193 (1): 261, 2005
- 34 Deogaonkar, M., Piallat, B., Gilbert, EV., Venkiteswaran, K., **Subramanian, T.**, Role of fetal dorsal mesencephalon as a 'control' for intranigral grafts in hemiparkinsonian rats with dual transplants, *Experimental Neurology*, 193 (1): 243, 2005
- 35 K. Venkiteswaran, M. Deogaonkar, D. Dluzen, **T. Subramanian**, Xenotransplantation of human retinal pigment epithelial (RPE) cells into the striatum of 6-OHDA lesioned hemiparkinsonian rats causes a 10 fold increase in dopamine level, *Experimental Neurology*, 198 (2): 592, 2006

- 36 Ira Shoulson, Parkinson Study Group (PSG), and PRECEPT Investigators (Includes **T. Subramanian**) CEP-1347 Treatment Fails to Favorably Modify the Progression of Parkinson's Disease (PRECEPT) Study: S61.003 *Neurology* 67: 185, 2006
- 37 Christopher A. Lieu, Jennifer E. Nyland, Nicholas J. Wiley, Ashley M. Stull, Bala V. Manyam, Thyagarajan Subramanian, Effects Of *Mucuna Pruriens* Extract On Drug-Induced Dyskinesias In Hemiparkinsonian Rats, *Cell Transplantation*, 16 (3): 333, 2007
- 38 Neena I. Marupudi, Abigail Harris, Michelle M. Shankar, Ashley M. Stull, Periasamy Selvaraj, Thyagarajan Subramanian, Kala Venkiteswaran, Putative Mechanisms Of Immune Tolerance Of Human Retinal Pigment Epithelial Cells (hRPEC) In CNS Xenotransplantation, *Cell Transplantation*, 16 (3): 337, 2007
- 39 Renuka Ramachandra, Carolina Pinzon-Guzmon, Kala Venkiteswaran, Keith Elmslie, Thyagarajan Subramanian, Invitro transplantation studies of human retinal pigment epithelial cell (hRPEC) transdifferentiated neurons into basal ganglia slice culture. American Society for Neural Therapy and Repair Annual Meeting, May 1-4, 2008 Peer Reviewed Abstract, **Cell Transplantation 17 (4): 479, 2008**. NINDS funded Travel award winning poster.
- 40 Kumaraswamy GK, Mathers RC, Krady JK, Venkiteswaran K, and Subramanian T, Human Retinal Pigment Epithelial Cells Secreted Factors Downregulate Cytokine Expression In Activated Murine Microglial Cells, American Society for Neural Therapy and Repair Annual Meeting, May 1-4, 2008 Peer Reviewed Abstract, **Cell Transplantation 17 (4): 469, 2008**. NINDS funded Travel award winning poster.
- 41 Neena I. Marupudi, M.S.; **Kala Venkiteswaran, Ph.D.**; Ashley M. Stull, B.S.; Thyagarajan Subramanian, M.D. Human Retinal Pigment Epithelial Cells (HRPECs) are Critical to Protect Ocular Xenografts in the CNS against Immune Rejection. American Society for Neural Therapy and Repair Annual Meeting, May 1-4, 2008 Peer Reviewed Abstract, **Cell Transplantation 17 (4): 474, 2008**. NINDS funded Travel award winning poster
- 42 Lieu, CA., Stull, AM, Petticoffer, AC, Manyam, BV, Subramanian, T., Drug induced dyskinesias and the involvement of DARPP-32 in hemiparkinsonism rat. American Society for Neural Therapy and Repair Annual Meeting, May 1-4, 2008 Peer Reviewed Abstract, **Cell Transplantation 17 (4): 471, 2008**. NINDS funded Travel award winning poster.
- 43 Venkiteswaran K. and **Subramanian T.**, Human retinal pigment epithelial cell (hRPEC) cotransplants protect mouse fetal ventral mesencephalic striatal xenografts from immune rejection, Presented at the 10th International Neural Transplantation and Repair Meeting, Freiberg, Germany, September 11-14, 2008.
- 44 MA Berk, U Salli, R Ramachandra, K Venkiteswaran and **T Subramanian**, Cografts of Human Retinal Pigment Epithelial (HRPE) Cells Prevent Immune Rejection and Promote Survival of Striatal Xenografts of Human Embryonic Stem Cells (HES) (Travel Award Winner)
- 45 CA Lieu, NI Marupudi, MA Berk, R Ramachandra and **T Subramanian**, Interhemispheric Nigrostriatal Connections and Their Potential Role in the Genesis of Drug-Induced Dyskinesias in Parkinson's Disease (Travel Award Winner)
- 46 NI Marupudj, C Lieu, J Tombran-Tink, R Ramachandra and **T Subramanian**. Intrastratial Administration of Pigment Epithelium-Derived Growth Factor (PEDF) Ameliorates 6-OHDA-Mediated Neurotoxicity in Hemiparkinsonian Rats (Travel Award Winner and Platform presentation)

Other Published Abstracts

1. **Subramanian T**, IF Pollack and RD Lund, Rejection of mesencephalic retinal xenografts in the rat induced by the systemic administration of recombinant interferon-gamma, *Neurosc. Abs.*, 16(2): 1208, 1990

2. **Subramanian T**, IF Pollack and RD Lund, The effect of Cyclosporine A on eye-removal induced rejection of mesencephalic retinal xenografts, *Neurosc. Abs.*, 17(2): 1137, 1991
3. **Subramanian T**, RL Watts, RAE Bakay, GW Miller, AI Levey, B Shi, D Eshima, JT Greenamyre, GW Hubert, MM Goodman, and JM Hoffman, ¹⁸F-labeled WIN Positron Emission Tomography (PET) in a nonhuman primate: a novel radioisotope to study dopamine transporter. *Neurosc. Abs.*, 22(3): 1787, 1996
4. GW Hubert, **T Subramanian**, RL Watts and RAE Bakay, Correlation of dopaminergic cell survival to motor behavioral improvement following intrastriatal transplantation of fetal mesencephalic (FM) tissue from a single donor. *Neurosc. Abs.*, 23 (2): 1998, 1997
5. T Wichmann, P Starr, **T Subramanian**, RAE Bakay, RL Watts and MR DeLong, Effects of experimental parkinsonism on neuronal discharge in the substantia nigra pars reticulata (SNr) in primates. *Neurosc. Abs.*, 23 (2): 2430, 1997
6. **T Subramanian**, T Wichmann, GW Hubert and RL Watts, Neuroprotective effect of intranigral injections of glial derived neurotrophic factor (GDNF) on MPTP-induced parkinsonism in monkeys. *Neurosc. Abs.*, 24 (2): 1466, 1998
7. **T. Subramanian**, K. Venkiteswaran, D. Marchionini, M. Brummer, MRI guidance improves accuracy of stereotactic targeting of cell transplantation and gene therapy in parkinsonian monkeys, *Neurosc.Abs.*, 27, 245.3, 2001
8. J.L. Nelms, K. Venkiteswaran, S.E. Leff, **T. Subramanian**. USE OF RECOMBINANT LENTI VIRAL VECTOR EXPRESSING GREEN FLUORESCENT PROTEIN (RLV-GFP) TO PRELABEL FETAL VENTRAL MESENCEPHALIC (FVM) TISSUE TRANSPLANTS. Program No. 34.15. 2002.SFN Online.
9. **T. Subramanian**, N.E. Tidwell, S. Garg, S. Razack, J. Jacobs, K. Venkiteswaran, N. Boulis, B.V. Manyam. MUCUNA PRURIENS SEED EXTRACT AMELIORATES PARKINSONIAN DISABILITY IN HEMIPARKINSONIAN (HP) MONKEYS Program No. 326.9. 2002,SFN Online.
10. K. Venkiteswaran, J.L. Nelms, J.S. Perumal, **T. Subramanian**. COMPARISON OF DOPAMINERGIC PROPERTIES OF RETINAL PIGMENT EPITHELIAL (RPE) CELLS WITH FETAL VENTRAL MESENCEPHALIC (FVM) TISSUE Program No. 429.18. 2002 SFN Online.
11. P.T. Redman, K. Venkiteswaran, J.S. Perumal, E.V. Gilbert, S. Shah, **T. Subramanian**. BEHAVIORAL EFFECTS OF DUAL XENOTRANSPLANTATION OF FETAL VENTRAL MESENCEPHALIC (FVM) TISSUE FROM GFP EXPRESSING MICE INTO HEMIPARKINSONIAN (HP) RATS. Program No. 788.17. 2003 SFNOnline.
12. M.S.Deogaonkar, M.Heers, M.Brummer, **T. Subramanian**. MRI based 3 - D stereotaxic atlas of Macaca mulatta brain: Consideration in the MPTP treated parkinsonian monkey Program No. 676.15. 2004 *Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience
13. E.V.Gilbert, J.K.Leszczyński, **T. Subramanian**, J.Zhang. Methods to provide enrichment to MPTP - treated hemiparkinsonian (HP) monkeys without interfering with operant conditioned behavioral testing Program No. 676.16. 2004 *Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience
14. B.Piallat, P.Redman, K.Venkiteswaran, E. Gilbert, M. Deogaonkar, **T. Subramanian**. Electrophysiological evidence for recovery of neural circuitry in hemiparkinsonian (HP) rats treated by FVM transplantation Program No. 791.5. 2004 *Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience
15. Venkiteswaran, K., Deogaonkar, M., **Subramanian, T.**, Long term transgene (GFP) and dopa generating enzyme expression *in vivo* following transplantation of genetically engineered hRPE cells in parkinsonian rats, Program No. 258.7. 2005 *Abstract Viewer/Itinerary Planner*. Washington, DC: Society for Neuroscience, 2005. Online.
16. Deogaonkar, MS., **Subramanian, T.**, Electrophysiology guided unilateral 6-hydroxydopamine lesioning of substantia nigra compacta to induce hemiparkinsonism,

Program No. 424.16. 2005 Abstract Viewer/Itinerary Planner. Washington, DC: Society for Neuroscience, 2005. Online.

17. Stull, AM., Petticoffer, A., Ramachandra, R., Marupudi, N., Venkiteswaran, K., **Subramanian, T.**, Human retinal pigment epithelial (hRPE) cells cotransplants protect fetal ventral mesencephalic (FVM) striatal xenotransplants from immune rejection, Program No. 779.19. 2007 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2007. Online
18. Pinzon-Guzman, C., Stull, AM., Elmslie, KS., Venkiteswaran, K., **Subramanian, T.**, Can human retinal pigmented epithelial (hRPE) cells be transdifferentiated into dopaminergic neurons? Program No. 778.20. 2007 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2007. Online.
19. **Subramanian, T.**, Nyland, JE., Wiley, NJ., Lieu, CA., Fink, ML., Petticoffer, AC., Manyam, BV., Comparison between mucuna pruriens endocarp and levodopa in parkinsonian animals, Program No.883.2. 2007 Neuroscience Meeting Planner. San Diego, CA: Society for Neuroscience, 2007.
20. R. C. MATHERS, A. M. STULL, G. K. KUMARASWAMY, J. K. KRADY, K. VENKITESWARAN, T. SUBRAMANIAN; Striatal immune response in rats to cogafts of human retinal pigment epithelial (hRPE) cells and mouse fetal ventral mesencephalic (FVM) cells. Program#/Poster#: 527.7/B59 2008 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2008. Online.
21. R. RAMACHANDRA, K. VENKITESWARAN, K. S. ELMSLIE, T. SUBRAMANIAN; Striatal immune response in rats to cogafts of human retinal pigment epithelial (hRPE) cells and mouse fetal ventral mesencephalic (FVM) cells. Program#/Poster#: 741.8/S12 2008 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2008. Online.
22. G. KUMARASWAMY, T. SUBRAMANIAN, C. LIEU, D. BERG; Transcranial ultrasound detection of MPTP induced substantia nigra hyperechogenicity in rhesus monkeys. Program#/Poster#: 743.4/V8 2008 Neuroscience Meeting Planner. Washington, DC: Society for Neuroscience, 2008. Online.

SPECIAL TEACHING COURSES

“New Advances in the Management of Spasticity and Muscle Overactivity”, Professional Postgraduate Services Course. Held at St. Louis, MO, October 7, 2000
Course Co-Director: Thyagarajan Subramanian, MD

“Interventional Neurology: Deep Brain Stimulation”, American Academy of Neurology 53rd Annual Meeting Course, Philadelphia, PA, (6PC.002), 2001. Invited speaker, Thyagarajan Subramanian, MD

Management of Dystonia, Multidisciplinary approach to the treatment of children with cerebral palsy, Cleveland Clinic Center for Continuing Education Symposium at Landerhaven, Mayfield Heights, OH, May 3, 2002. Invited speaker: Thyagarajan Subramanian

“Treatment of Spasticity and Dystonia” in Comprehensive management in stroke rehabilitation, CME course for physicians and health care providers, Medical College of Ohio, Toledo, OH, April 20, 2002, Invited Speaker: Thyagarajan Subramanian

Neurotoxins for the treatment of neurological disorders, A teaching course for residents and fellows, 2004. Cleveland Clinic Center for Continuing Education Symposium, MBNA

Intercontinental Conference Center at the Cleveland Clinic Foundation, Cleveland, OH.
Course Director: Thyagarajan Subramanian

“Clinical experience of Botulinum toxin in non-GU applications” in Pharmacological Neuromodulation Therapies for Voiding Dysfunction, December 4, 2004, Cleveland Clinic Center for Continuing Education Symposium, MBNA Intercontinental Conference Center at the Cleveland Clinic Foundation, Cleveland, OH. Invited Speaker: Thyagarajan Subramanian

Second Annual Cleveland Residents and Fellows Educational Training Program in the use of Neurotoxin Therapies, May 7, 2005. W.O. Walker Center, Cleveland, OH. Course Director: Thyagarajan Subramanian

“Interventional Neurology: Office Procedures for the Management of Spasticity” in Hot topics: Update in Neurology, May 6, 2005. Medical College of Ohio Symposium, Toledo, OH Invited Speaker: Thyagarajan Subramanian

American Academy of Neurology /Movement Disorders Society Advanced Workshop on the treatment of Spasticity and Dystonia, Cleveland, OH, July 23, 2005. Course Director: Thyagarajan Subramanian, MD

“Advanced Parkinson’s Disease: Medical Management to Experimental Therapeutics” in Advanced Neuromodulation: Experimental Therapeutics to Deep Brain Stimulation, Second Annual Penn State Neuroscience Institute Conference, Hershey, PA, June 16-17, 2006

Pharmacy Forum: Penn State Hershey Medical Center Teaching Conference, “Recent Advances in PD Treatments”, Grantville, PA, April 20, 2007

Neurology for the Non-neurologist, “Tremor and Parkinson’s disease”, Penn State Hershey Medical Center Teaching Conference, Harrisburg, PA, May 17, 2007

1st Penn State Hershey Movement Disorders Resident Teaching Course, Nov, 2006
Course Director: Thyagarajan Subramanian, MD

2nd Penn State Hershey Movement Disorders Resident Teaching Course, Oct 12, 2007
Course Director: Thyagarajan Subramanian, MD

3rd Penn State Hershey Movement Disorders Resident Teaching Course, Nov, 2008
Course Director: Thyagarajan Subramanian, MD

INVITED LECTURES/GRAND ROUNDS

1. “Recent advances in Neural Transplantation”, Invited Lecture, National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India, 1998
2. “Parkinson’s disease: molecular approaches to experimental therapeutics”, Invited Lecture, Jawaharlal Nehru Center for Advanced Scientific Research and Indian Institute of Science, Bangalore, India, 1998
3. "Restorative treatments for Parkinsonism: Fetal Transplantation", in Annual Update in Movement Disorders and General Neurology, Cleveland Clinic Florida, January 16, 1999
4. "Viral vector and liposome based gene transfer for the treatment of Parkinson's disease", Indian Institute of Science, Bangalore, India, September 3, 1999

5. "Recent advances in neural transplantation and gene therapy for Parkinson's disease", Neuroscience Grand Rounds Invited Speaker, Cleveland Clinic Foundation, Cleveland, OH, Jan 10, 2000
6. Recent advances in neural transplantation and gene therapy for Parkinson's disease", Neurology-Neurosurgery Combined Grand Rounds Invited Speaker, University of Mississippi Medical Center, Jackson, MS, Jan 25, 2000
7. "Neural transplantation and gene therapy for the treatment of Parkinson's disease", Neurology Grand Rounds Invited Speaker, Southern Illinois University School of Medicine (SIU), Springfield, IL, Feb 8, 2000
8. "Retinal Pigment Epithelium Cell Transplantation for Parkinsonism", Mayo Clinic Neuroscience Grand Rounds, Jacksonville, FL, Feb 2, 2001
9. "Gene Therapy for Movement Disorders", in Cleveland Clinic International Symposium: Neuromodulation, defining the future, June 8-11, 2001
10. "Cell Transplantation and Gene Therapy for Parkinsonism", Johns Hopkins University Invited Lecture, October 19, 2001
11. "Cell Transplantation and Gene Therapy for Parkinsonism: lessons in basal ganglia function", Kent State University Graduate Program Invited Lecture, October 25, 2001
12. Retinal Pigment Epithelial Cell Transplantation for Parkinson's Disease", Oregon Health Sciences University, Portland, OR., Invited lecture, November 16, 2001
13. "Recent advances in the treatment of Parkinson's disease: role of continuous dopaminergic stimulation", Cleveland Veterans Affairs (VA) Medical Center: GCRC grand rounds, Cleveland, OH, January 11, 2002
14. Pediatric Movement Disorders: Focus on Dystonia and Spasticity, Cleveland Clinic Foundation Department of Pediatrics, Cleveland, OH. Invited Grand Round Speaker, January 22, 2002
15. Recent advances in the treatment of Parkinson's disease, UNC, Chapel Hill, Invited lecture, July 15, 2002
16. Frontiers in Neuroscience; Cell Transplantation, Gene Therapy and DBS, Baylor College of Medicine, Houston, TX, 2002
17. Basal Ganglia: An Overview, In "Deep Brain Stimulation For Epilepsy" Cleveland Clinic Symposium, May 2002
18. Recent Advances in the Management of Spasticity, Association of Indian Physicians of North East Ohio Annual Symposium, Cleveland, OH, 2002
19. Frontiers in Neuroscience; Cell Transplantation, Gene Therapy and DBS, Association of Indian Physicians of North East Ohio Annual Symposium, Cleveland, OH, 2002
20. Recent Advances in the Management of Spasticity, National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India, Dec 18, 2002
21. Frontiers in Neuroscience; Cell Transplantation, Gene Therapy and DBS, National Institute of Mental Health and Neurosciences (NIMHANS), Bangalore, India, Dec 19, 2002
22. Frontiers in Neuroscience; Cell Transplantation, Gene Therapy and DBS, All India Institute of Medical Sciences, New Delhi, India, Dec 31, 2002
23. Frontiers in Neuroscience: Cell Transplantation, Gene Therapy and DBS, Appolo Hospital Stereotactic and Functional Surgery Symposium, New Delhi, India, Dec 20, 2002
24. Frontiers in Neuroscience: Cell Transplantation, Gene Therapy and DBS, Dr. S. Kalyanaraman Oration, Neurological Institute of Madras Medical College, Chennai, India, Dec 27, 2002
25. Parkinson's disease update: Cell Transplantation, Gene Therapy and DBS, Grand Rounds Presentation, Department of Neurology, University of Western Ontario, London, Ontario, Canada, March 25, 2003

26. Parkinson's disease: New Developments, Grand Rounds Presentation, Fairview Hospital, Fairview, OH, March 24, 2003
27. Recent Advances in Spasticity Management, Grand Rounds Presentation, Medical College of Ohio, Toledo, OH, January, 2004
28. Recent Advances in Parkinson's disease, Grand Rounds Presentation, University of Texas Medical Branch, Galveston, TX, Sept 2004.
29. Pathophysiology of Parkinson's disease: lessons learned from cell transplantation and gene therapy experiments, Grand Rounds Presentation, University of Colorado Health Sciences Center, Denver, CO, Sept 2004.
30. Understanding Basal Ganglia Function: Lessons from Cell Transplantation, Grand Rounds Presentation, University of Minnesota School of Medicine, Minneapolis, MN. November 2004.
31. Recent advances in translational research for Parkinson's disease, Grand Rounds Presentation, UCLA Cedar Sinai Hospital, Department of Neurology, Los Angeles, CA, January 23, 2005.
32. Basal ganglia pathophysiology: lessons from stem cell transplantation, gene therapy and DBS, Grand Rounds Presentation, Parkinson's Institute, Sunnyvale, CA, March 11, 2005
33. Basal ganglia pathophysiology: lessons from cell transplantation, gene therapy and DBS, Invited Scientific Presentation, University of Kentucky, Lexington, KY, April 2, 2005
34. What is new in the treatment of Parkinson's disease and Parkinsonism, Association of Indian Physicians of North East Ohio Annual Symposium, Cleveland, OH, April 30, 2005
35. Basal ganglia pathophysiology: lessons from cell transplantation, gene therapy and DBS, Invited Scientific Presentation, Northeast Ohio University College of Medicine, Rootstown, OH, June 7, 2005
36. Basal ganglia pathophysiology: lessons from cell transplantation, Johns Hopkins University Institute for Cell Engineering Special Invited Lecture, Baltimore, MD, June 21, 2005
37. Basal ganglia pathophysiology: lessons from cell transplantation, gene therapy and DBS, University of Louisville Neurology Invited Lecture, Louisville, KY, September 13, 2005
38. Neuropsychiatric aspects of hyperkinetic movement disorders, Psychiatry Grand Rounds, Penn State Milton S. Hershey College of Medicine, Feb 2, 2006
39. Bench to bedside: translational research in Parkinson's disease, Neuroscience Grand Rounds, Penn State Milton S. Hershey College of Medicine, Feb 3, 2006
40. Interventional Neurology: Outpatient Office Procedures To Treat Dystonia and Spasticity, Neurology Grand Rounds, Penn State Milton S. Hershey College of Medicine, August 11, 2006
41. International Congress on Neurology and Rehabilitation, India Habitat Center, New Delhi, India, Invited Speaker on "Neurorehabilitation and repair strategies for Parkinson's disease: stem cells, gene therapy and deep brain stimulation", March 9-11, 2007
42. Satellite Symposium on Neuro-rehabilitation, "Botulinum toxin therapy for spasticity", Invited speaker, Mumbai, India, March 12, 2007.
43. Neurology Grand Rounds, "Experimental Therapeutics in PD", Neurology Grand Rounds, Penn State Milton S. Hershey College of Medicine, August 10, 2007
44. Neurology Invited Special Lecture, "Recent advances in PD: cell transplantation and gene therapy", Indiana University School of Medicine, Indianapolis, IN, August 17, 2007

45. Invited Visiting Professor, University of Tübingen, Germany, September 9, 2009. Neurology Grand Rounds Special Lecture: "Cell transplantation for PD: eye to the rescue of the brain".
46. Invited special lecture, DBS satellite session. 20th Annual American Society for Neurophysiological Monitoring (ASNM), Vancouver, BC, Canada, April 23-26, 2009. "Bench to bedside: lessons for intraoperative recording in DBS"

PUBLIC LECTURES

1. Stem cells, cell transplantation and gene therapy for Parkinson's disease, CCF Public lecture, Cleveland, OH, June 2001
2. Cell transplantation for Parkinson's disease, Parkinson's symposium, Northeast Ohio Parkinson's Support Group Symposium, Talmadge, OH, May 2001.
3. Spasticity management: recent advances, Cleveland Stroke Club, Cleveland, OH, April 2001
4. Recent advances in the treatment of Parkinson's disease: implications for the young patient, CCF Public Lecture, Cleveland, OH, January 2001.
5. Management of Dystonia in children with cerebral palsy, CCF Public Lecture, May 2, 2002
6. Experimental Therapeutics in Parkinson's disease: Opportunities for patients to help find a cure, Parkinson's Disease Support Group of Cleveland, Cleveland, OH, January 2004.
7. Experimental Therapeutics in Parkinson's disease: Opportunities for patients to help find a cure, Northeast Ohio Parkinson's Support Group Symposium, Talmadge, OH, April 2004.
8. Therapy update on Parkinson's disease. Erie Parkinson's Support Group Symposium, Erie, PA, April 24, 2005.
9. Treatment of Parkinson's disease, Penn State Milton S. Hershey Movement Disorders Program Patient Educational Symposium, April 29, 2006
10. Diagnosis of Parkinson's disease and how you can help find a cure for Parkinson's disease, Penn State Milton S. Hershey Movement Disorders Program Patient Educational Symposium, September 23, 2006
11. Brain Awareness Week 2007, Central PA Chapter of Society for Neuroscience, Lecture on "Parkinson's Disease", "Dystonia", and "Neural Plasticity" as part of the Neuroscience Film Festival at the Whitaker Science Center, Harrisburg, PA, March 16-18, 2007
12. Cell Transplantation and Gene Therapy, Invited Speaker, Indiana Parkinson Symposium, Indianapolis, IN, August 18, 2007

MEDIA WRITE UPS

Cover story; TAMING MY TREMOR; Parkinson's disease shook his life for 14 years. Brain surgery seven months ago promised both risk and relief. Was it worth it? By *Joel Havemann*. Los Angeles Times. Los Angeles, Calif.: Nov 14, 2004. pg. I.12

“Heady stuff planned for Brain Awareness Days”, Multiple media news stories about scientific outreach organized by Central PA Chapter of Society for Neuroscience led by Dr. Thyagarajan Subramanian, March 15-18, 2007

SPECIAL CLINICAL SKILLS AND EXPERTISE

1. Design, execution and analysis of clinical trials for movement disorders (pharmacological and surgical experimental therapeutics)
2. Certified Rater for the use of Unified Parkinson’s Disease Rating Scale (UPDRS) by the Parkinson Study Group (PSG)
3. Certified in good clinical practices (GCP) by the PSG
4. EMG guided chemodenervation (Botulinium Toxin and Phenol injections) for movement disorders, spasticity management, sialorrhea, excessive sweating and vocal cord disorders
5. Intraoperative interactive neurophysiological recording using microelectrodes and macrostimulation for functional stereotactic surgery in movement disorders patients
6. Programming of deep brain stimulators (DBS) and medication adjustments in DBS implanted patients to optimize outcome
7. Intrathecal baclofen (ITB) trial bolus and catheter trials, ITB pump refills and pump programming in movement disorders and spasticity patients
8. Certified to administer test dose and manage intrathecal baclofen (ITB) pumps by Medtronic, Inc. Physician Training Program