

# **GERHARD M. FRIEHS, M.D., M.A., FACGS, IFAANS**

**Former chairman of Dept. of Neurosurgery, Baylor Scott & White, Texas, USA**  
**Dep. Chairman of Neurosurgery Dept., Mitera Children's Hospital, Greece**  
**Professor of Neurosurgery, European University, Cyprus**  
**Associate Professor of Neurosurgery, Medical University of Graz, Austria**  
**Former Associate Professor, Neurosurgery, Texas A&M, Texas, USA**  
**Former Associate Professor, Clinical Neurosciences (Neurosurgery), Brown University, Rhode Island, USA**  
**Fellow American College of General Surgeons**  
**International Fellow American Association of Neurological Surgeons**  
**Board Member, American Board of General Surgery**

## ACADEMIC APPOINTMENTS AND ADMINISTRATIVE EXPERIENCE

2017 – present	Director, IMASA (International Medical and Surgical Associates), Nicosia, Cyprus Professor of Neurosurgery and Director of Neuroscience Program, European University, Nicosia, Cyprus
2010-2012	Chairman, Dept. of Neurosurgery, Baylor Scott&White hospital, Texas A&M University Director of the Neuroscience Institute at Scott&White, Temple, Texas Administrative Leadership for the entire institutional Neurosurgery program and Neuropsychology program Administrative leader for all clinical, educational and research responsibilities Administrative Leadership for the Children's hospital at Scott&White, Neurosurgery Administrative co-director for Finances, Neurosurgery clinic Co-director of the Movement Disorder Center at Scott&White Administrative and Clinical Neurosurgery appointee for Radiosurgery
2009 – 2010	Interim Chair, Department of Neurosurgery, Scott &White Memorial Hospital, Temple, TX
2009	Associate Professor of Surgery, Scott&White Memorial Hospital, Texas A&M University, Texas
2008 – 2009	Vice-Chairman, Department of Neurosurgery, Scott &White Memorial Hospital, Temple, TX
2008 – 2009	Assistant Professor of Surgery, Texas A&M University, Temple, TX
2002 – 2008	Associate Professor of Clinical Neurosciences (Neurosurgery), Brown University, Providence, Rhode Island Vice-Director of the New England Gamma Knife Center, Lifespan, Providence, Rhode Island Director of Pain and Functional Neurosurgery at Brown University Director of Functional Neurosurgery Fellowship, Brown University Quality Assurance Director, Neurosurgery Mentor: Masters of Medical Science Program at Brown University Clinical and Administrative Director for Neurosurgery at Memorial Hospital of Rhode Island
1996 - present	Associate Professor for Neurosurgery, Medical University Graz, Austria

#### Teaching Appointment in Neursurgery

1995-2002 Assistant Professor of Clinical Neurosciences (Neurosurgery), Brown University, Providence RI

#### POSTGRADUATE EDUCATION

Residency (Research): University of Minnesota, Minneapolis, MN, Dept. of Neurosurgery, 1/88-12/89

Internship: Karl-Franzens-Universität Graz, Department of Surgery, Graz, Austria, 1/90-12/90

Residency (Clinical): Karl-Franzen -University Graz, Department of Neurosurgery, Graz, Austria, 01/91 - 1/1/95

Fellowship: Endovascular and Cerebrovascular Intervention Fellowship at University of Alabama, Dept. of Neurosurgery, Birmingham, AL (Director: Mark Harrigan M.D., Ph.D.), 10/2012 – 12/2012

Pediatric Neurosurgery McLane Children's Hospital Baylor Scott & White Medical Center, Texas

#### GRADUATE EDUCATION

Medical School Karl-Franzens University, Graz, Austria, 1984-1988, Combined Pre-Med Program and Medical School; Graduation 12/1988: M.D.

Habilitation (Ph.D. equiv.) Karl-Franzens Univeristy, Graz, Austria, 1996  
(Thesis: Experimental Models of Parkinsonism; Chair: Prof. G. Pendl)

#### POSTGRADUATE HONORS & AWARDS

2007 Dean's Teaching Excellence Award, Brown University

2005 Rhode Island Top Doctor, Pain Management

2004 State of Rhode Island and Providence Plantations, Outstanding Doctor

2003 Brown University, M.A. honorary degree

1994 Honorable mention by the Austrian Medical Association for Ph.D. work on new neurosurgical approaches for the treatment of Parkinsonism

1993 Honorable mention by the Austrian Medical Association for work on Parkinsonism

1991 Birkmayer Award for Research on Parkinsonism

#### LEADERSHIP TRAINING

09/1997 Executive Physician Leadership program, VHA  
(certified executive leadership course provided by William&Mary University; 27.5 credit hours)

#### ADDITIONAL TRAINING

Kyphoplasty Balloon Kyphoplasty Training Program, 2006

Radiosurgery Karolinska Hospital, Department of Neurosurgery, 1993

## PROFESSIONAL LICENSES AND BOARD CERTIFICATIONS

2005 – present		ATLS instructor
03/03/08 – present	T	exas Faculty Temporary License (#42560)
3/1/95 - 2008		Board equivalent for Neurosurgery in State of RI
3/1/95 - 2008		Rhode Island Medical License (# 8827; then # LA 00005)
2/2/95		European Certification for Neurosurgery (EC countries)
2/2/95		Austrian Certification for Neurosurgery
12/15/88		Licensed Medical Doctor (Austrian Medical Council)

## HOSPITAL APPOINTMENTS

2018 – present		Hygeia Hospital, Athens, Greece
2020 – present		Dep. Chairman of Neurosurgery, Mitera Children’s Hospital
2013 - present		American Medical Center, Nicosia, Cyprus
2017 - present		Polyclinic Hygeia Limassol, Cyprus
2017 - 2020		Iaso Children's Hospital, Athens, Greece
2008 – 2012		Chief of Neurosurgery, Scott & White Memorial Hospital, Temple, Texas
2005 – 2008		Chief of Neurosurgery, Memorial Hospital of Rhode Island
1995 – 2008		Attending Neurosurgeon, Rhode Island Hospital, Department of Neurosurgery
		Attending Neurosurgeon, The Miriam Hospital, Department of Surgery, Division of Neurosurgery
		Attending Neurosurgeon, Memorial Hospital of Pawtucket, Department of Surgery, Division of Neurosurgery
		Attending Neurosurgeon, Butler Hospital, Department of Surgery

## OTHER APPOINTMENTS

1998 – 2003		Board member, MS Society
1998 – 2002		Chair, medical advisory board to MS society
1997 – present		Editorial board, Radiosurgery
1997 – 2008		Delegate for the Governor’s Brain Injury Advisory Committee

## HOSPITAL COMMITTEES

2009 – 2012		Chairman Committee, Scott&White Memorial Hospital, Texas
2008 – 2012		Tumor Board Review Committee, Scott & White Memorial Hospital
2008 – 2012		Trauma Peer Review Committee, Scott & White Memorial Hospital
2000 – 2008		Peer review committee, Lifespan, Rhode Island
1997 – 2008		Cancer committee, Lifespan, Rhode Island
1997 – 2008		Lifespan Laser Committee, Lifespan, Rhode Island
1995 – 1998		Morbidity and Mortality Conference, Lifespan, Rhode Island
1995 – 1998		QA coordinator for Neurosurgery, Lifespan, Rhode Island
1995 – 2004		Trauma Committee, Lifespan, Rhode Island

## PATENTS, PARTNERSHIPS

Co-Founder, Cyberkinetics Neurotechnology Systems, Inc. (CYKN); co-inventor on 3 patents on brain-machine interfaces

## MEMBERSHIP AND SOCIETIES

Österreichische Gesellschaft für Neurochirurgie (Austrian Neurosurgical Society)  
International Stereotactic Radiosurgery Society, 1993  
Leksell Gamma Knife Society, 1993  
International Neurotrauma Society, 1996  
CNS – Congress of Neurological Society, 2000  
AMA – American Medical Association, 1995  
Undersea and Hyperbaric Society  
Austrian/German Society for Hyperbaric Medicine

## ORIGINAL PUBLICATIONS IN PEER-REVIEWED JOURNALS

- 1) Friehs, G.M., Parker, R.G., He, L.S., Haines, S.J., Turner, D.A., Ebner, T.J., Lesioning of the Striatum Reverses Motor Asymmetry in the 6-Hydroxydopamine Rodent Model of Parkinsonism. *J Neural Transpl Plast* 2 (2), (1991), 141-156.
- 2) Friehs, I., Eber, B., Friehs, G.M., Langsteger, W., Koch, G., IgG-Anticardiolipin-Antibodies Are Markers for Cerebral and Peripheral Artery Disease. *VASA* 21 (2), (1992), 158-162.
- 3) Schröttner O, Friehs GM. Resultate perkutaner Chordotomie beim Lungen- und Mammakarzinom. *Der Schmerz*, 6 suppl 1, (1992), V. 5.4, 40.
- 4) Schröttner, O., Friehs, G.M., Pendl, G., Functional Neurosurgery with the Gamma Unit. *Acta Chir Austriaca Suppl* 102 (1993), 11-12.
- 5) Schröttner, O., Friehs, G.M., Pendl, G., Egger, J., Kreuzer, J., Bilateral anterior Gamma-Capsulotomies in Chronic Deafferentation Pain. *Acta Neurochir* 122 (1993), 177.
- 6) Friehs, G.M., Schröttner, O., Ojakangas, C.L., Pendl, G., Gamma Knife Treatment of Parkinsonism. *Acta Neurochir* 122 (1993), 178.
- 7) Friehs, I., Friehs, G.M., Friehs, G.B., Air embolism with bilateral pneumothorax after a five-meter dive. *Undersea & Hyperbaric Medicine* 20 (1993), 155-157.
- 8) Friehs, G.M., Schröttner, O., Indikationen für intraventrikuläre Morphinapplikation. *Der Schmerz*. 8 (1994); 65.
- 9) Schröttner O, Friehs GM. Der Stellenwert stereotaktischer Techniken in der Schmerzchirurgie. *Der Schmerz* 8 (1994), 63-64.
- 10) Langmann G, Pendl G, Schröttner O, Friehs GM, Mokry M, Papaethymiou G, Stücklschweiger G, Faulborn J. Die radiochirurgische Behandlung von Aderhautmelanomen mit der Grazer Leksell Gamma Einheit. *Ophthalmos* 5 (1994), 17.
- 11) Toro, C., Cox C, Friehs GM, Ojakangas C, Maxwell R, Gates JR, Gumnit RJ, Ebner TJ. 8-12 Hz rhythmic oscillations in human motor cortex during two-dimensional arm movements: Evidence for representation of kinematic parameters. *Electroenceph Clin Neurophysiol* 93 (1994), 390-403.
- 12) Pendl G, Schröttner O, Friehs GM, Stücklschweiger G. One year of experience at the first Austrian gamma knife unit. *Acta Neurochir* 127 (1994), 170-179.
- 13) Sutter BV, Friehs GM, Pendl G, Tölley E. Anterior cervical interbody fusion: Experience in 66 cases with a note on postoperative CT and MRI appearance. *Acta Neurochir*, 137 (1995), 192-198.
- 14) Friehs GM, Schröttner O, Pendl G. Intraventrikuläre Morphinapplikation. *Neuropsychiatrie* 8 (1994), 99-101.
- 15) Pendl G, Schrottner O, Friehs GM, Legat J, Leber K, Mokry M, Papaefthymiou G, Langmann G., Radiosurgery with the first Austrian cobalt-60 Gamma-unit. A one year experience. *Acta Neurochir (Wien)*. 1994;127(3-4):170-9.

- 16) Sutter B, Friehs G, Pendl G, Tolly E., Bovine dowels for anterior cervical fusion: experience in 66 patients with a note on postoperative CT and MRI appearance. *Acta Neurochir (Wien)*. 1995; 137(3-4):192-8.
- 17) Pendl G, Schrottner O, Friehs GM, Feichtinger H., Stereotactic radiosurgery of skull base meningiomas. *Stereotact Funct Neurosurg*. 1995; 64 Suppl 1:11-8.
- 18) Friehs GM, Schröttner O, Pendl G. Evidence for segregated pain and temperature conduction within the spinothalamic tract. *J Neurosurg*, (1995), 7-16.
- 19) Friehs GM, Ojakangas CL, Pachatz P, Schröttner O, Ott E, Pendl G. Thalamotomy and Caudatotomy with the Gamma Knife as a Treatment for Parkinsonism with a comment on Lesion Sizes. *J Stereotact Funct Neurosurg*, 64 (suppl 1) (1995), 209-221.
- 20) Friehs GM, G. Noren, C. Ohye, CM. Duma R. Marks, J. Plombon, R. Young, Lesion Size after Gamma Knife Treatment for Fuctional Disorders. *Stereotactic and Functional Neurosurgery (suppl 1):320-328*, 1996.
- 21) Larson DA., Gutin PH., McDermonntt M., Lamborn K., Sneed PK., Wara WM., Flickinger JC., Kondziolka D., Lunsford LD., Hudgins WR., Friehs GM., Haselsberger K., Leber K., Pendl G., Chung SS., Coffey RJ., Dinapoli R., Shaw EG., Vermeulen S., Young RF., Hirato M., Inoue HK., Ohye C., Shibazaki T. Gamma knife for glioma: selection factors and survival. *Internation Journal of Radiation Oncology, Biology, Physics*. 36(5):1045-53, Dec. 1, 1996.
- 22) Friehs GM, Ojakangas CL, Schrottner O, Ott E, Pendl G., Radiosurgical lesioning of the caudate nucleus as a treatment for parkinsonism: a preliminary report. *Neurol Res*. 1997 Feb; 19(1):97-103.
- 23) Friehs GM, Legat J, Zheng Z, Pendl G, Noren GC, Outcomes in patients treated with gamma knife radiosurgery for brain metastases from malignant melanoma. *Neurosurg Focus* 4 (6): Article 1, 1998.
- 24) Sutter, B., Arthur, A., Laurent, J., Chadduk, J., Friehs, G, Clarici, G., Pendl, G., Treatment options and time course for intramedullary spinal cord Metastasis. Report of three cases and review of the literature. *Neurosurg Focus*. 1998 May 15; 4(5):e3.
- 25) Rasmussen S, Greenberg BD, Friehs GM, Noren G, Neurosurgical approaches to intractable obsessive-compulsive disorder. *CNS Spectrum* 2000; 5(11):23-34.
- 26) Zheng Z, Shearer D, Noren G, Chougule P, Friehs GM., Comparison of geometric distortion in digital angiography with and without a correction program. Technical note. *J Neurosurg*. 2000 Dec; 93 Suppl 3:223-7.
- 27) Cobery ST, Noren G, Friehs GM, Chougule P, Zheng Z, Epstein MH, Taylor W. Gamma knife surgery for treatment of central neurocytomas. Report of four cases. *J Neurosurg*. 2001 Feb; 94(2):327-30.
- 28) Friedman JH, Sikirica M, Fernandez HH, Stopa E, Friehs, GM, Stroke Induced by Gamma Knife Pallidotomy: Autopsy Result. *Neurology* 2002; 58(11):1695-1697.
- 29) Zerris VA, Zheng Z, Noren G, Sungarian A, Friehs GM. Radiation and regeneration: behavioral improvement and GDNF expression after Gamma Knife radiosurgery in the 6-OHDA rodent model of hemiparkinsonism. *Acta Neurochir Suppl*. 2002: 84:99-105.
- 30) Nuttin B, Gybels J., Cosyns P, Gabriels L, Meyerson B, Andreewitch S, Rasmussen SA, Greenberg B, Friehs GM, Rezai AR, Montgomery E, Malone D, Fins JJ, Deep brain stimulation for psychiatric disorders. *Neurosurg Clin N Am* 2003: 14 (2); xv-xvi.
- 31) Greenberg BD, Price LH, Rauch SL, Friehs GM, Noren G, Malone D, Carpenter LL, Rezai AR, Rasmussen SA, Neurosurgery for intractable obsessive-compulsive disorder and depression: critical issues. *Neurosurg Clin N Am* 2003: 14(2), 199-212.
- 32) Carpenter LL, Friehs GM, Price LH, Cervical vagus nerve stimulation for treatment-resistant depression. *Neurosurg Clin N Am* 2003: 14(2), 275-82.
- 33) Okun MS, Fernandez HH, Pedraza P, Misra M, Lyons KE, Pahwa R, Tarsy D, Scollins L, Dorapi K, Friehs GM, Grace J, Romrell J, Foote KD, Development and initial validation of a screening tool for Parkinson disease surgical candidates. *Neurology* 2004: 63, 161-3.
- 34) Greenberg B, Friehs G, Carpenter LL, Tyrka A, Malone D, Rezai A, Shapira N, Foote K, Okun M, Goodman W, Rasmussen S, Price L. Deep Brain Stimulation: Clinical Findings in Intractable Depression and OCD. *Neuropsychopharmacology* (2004) 29; 532.

- 35) Donoghue JP, Nurmikko A, Friehs G, Black M. Development of neuromotor prostheses for humans in. *Suppl Clin Neurophysiol.* 2004; 57:592-606.
- 36) Friehs, G.M., Zerris, V.A., Ojakangas, C.L., Fellows, M.R., Donoghue, J. P. Brain-machine and brain-computer interfaces. *Stroke*, 2004 Nov; 35 (11 Suppl): 2702-05.
- 37) Okun, M.S., Fernandez, H.H., Pedraza O, Misra, M., Lyons, K.E., Pahwa, R., Tarsy, D., Scollins, L., Corapi, K., Friehs, G.M., Grace, J., Romrell, J., Foote, K.D. Developmental and initial validation of a screening tool for Parkinson disease surgical candidates. *Neurology*, 2004, Jul 13;63(1): 161-3.
- 38) Stearns, L., Boortz-Marx, R., Du Pen, S., Friehs, G.M., Gordon, M. Halyard, M., Herbst, L., Kiser, J., Intrathecal drug delivery for the management of cancer pain: a multidisciplinary consensus of best clinical practices. *J. Support Oncol* 2005, 3 (6), 399-408.
- 39) Zerris, V.A., Noren, G.C., Shucart, W.A., Rogg, J., Friehs, G.M., Targeting the cranial nerve: microradiosurgery for trigeminal neuralgia with CISS and 3D-flash MR imaging sequences. *J Neurosurg* 2005, 102 suppl, 107-10.
- 40) Hatsopoulos, N., Mukan, J., Polykoff, G., Friehs G., Donoghue, J., Cortically controlled brain-machine interface. *Conf Proc IEEE Eng Med Biol Soc.* 2005, 7 (1): 7660-7663.
- 41) Greenberg, B.D., Malone, D.A., Friehs, G.M., Rezai, A.R., Kubu, C.S., Malloy, P.F., Salloway, S.P. Okun, M.S., Goodman, W.K., Rasmussen, S.A., Three-year outcomes in deep brain stimulation for highly resistant obsessive-compulsive disorder. *Neuropsychopharmacology* 2006, 31(11), 2394. Epub 2006.
- 42) Carpenter, L.L., Friehs, G.M., Tyrka, A.R., Rasmussen, S., Price, L.H., Greenberg, B.D., Vagus nerve stimulation and deep brain stimulation for treatment of resistant depression. *Med Health RI*, 2006, 89 (4), 137, 140-1.
- 43) Friehs, G.M., Ojakangas, C., Carpenter, L.L., Greenberg, B., Chou, K.L., Surgical aspects of deep brain stimulation. *Med Health RI* 2006, 89 (4), 134-6.
- 44) Rauch, S.L., Dougherty, D.D., Malone, D., Rezai, A., Friehs, G.M., Fischman, A.J., Alpert, N.M., Haber, S.N., Stypulkowski, P.H., Rise, M.T., Rasmussen, S.A., Greenberg, B.D., A functional neuroimaging investigation of deep brain stimulation in patients with obsessive-compulsive disorder. *J Neurosurg.* 2006 Apr;104(4):558-65
- 45) Hochberg, L.R., Serruya, M.D., Friehs, G.M., Mukand, J.A., Saleh, M., Caplan, A.H., Branner, A., Chen, D., Penn, R.D., Donoghue, J.P., Direct Cortical Neural Ensemble Control of Prosthetic Devices by a Human with Tetraplegia. *Nature* 442 (7099), pp. xiii-222 (2006).
- 46) Greenberg, B.D., Malone, D.A., Friehs, G.M., Rezai, A.R., Kubu, C.S., Malloy, P.F., Salloway, S.P., Okun, M.S., Goodman, W.K., Rasmussen, S.A., Three-year outcomes in deep brain stimulation for highly resistant obsessive-compulsive disorder. *Neuropsychopharmacology.* 2006 Nov;31(11):2384-93.
- 47) Ojakangas, C.L., Shaikhouni, A., Friehs, G.M., Saleh, M., Morris, D.S., Donoghue, J.P., Decoding movement intent from human premotor cortex neurons for neural prosthetic applications. *J Clin Neurophysiol.* 2006 Dec; 23(6):577-84.
- 48) Park, M.C., Goldman, M.A., Carpenter, L.L., Price, L.H., Friehs, G.M., Vagus Nerve stimulation for depression: rationale, anatomical and physiological basis of efficacy and future prospects. *Acta Neurochir Suppl* (2007), 97: 1-10.
- 49) Park MC, Goldman MA, Park MJ, Friehs GM. Neuroanatomical localization of the "precentral knob" with computed tomography imaging. *Journal of Stereotactic and Functional Neurosurgery* 2007, 85:158-161.
- 50) Donoghue, J.P., Hochberg, L.R., Nurmikko, A.V., Black, M.J., Simeral, J.D., Friehs, G., Neuromotor prosthesis development. *Med Health RI* 2007, 90(1): 12-5.
- 51) Park M.C., Goldman M.A., Carpenter, L.L., Price, L.H., Friehs, G.M., Vagus nerve stimulation for depression: rationale, anatomical and physiological basis of efficacy and future prospects. *Acta Neurochir Suppl* 2007, 97: 407-16.
- 52) Friehs GM, Park MC, Goldman MA, Zerris VA, Noren G, Sampath P, Stereotactic radiosurgery for functional disorders. *Neurosurg Focus* 2007, 23.
- 53) Truccolo W, Friehs GM, Donoghue JP, Hochberg LR, Primary motor cortex tuning to intended movement kinematics in humans with tetraplegia. *J Neurosci* 2008, 28 (5): 1163-1178.

- 54) Greenberg BD, Gabriels LA, Malone DA, Rezai AR, Friehs GM, Okun MS, Shapira NA, Foote KD, Cosyns PR, Kubu CS, Malloy PF, Salloway SP, Giftakis JE, Rise MT, Machado AG, Baker KB, Stypulkowski PH, Goodman WK, Rasmussen SA, Nuttin BJ, Deep brain stimulation of the ventral internal capsule/ventral striatum for obsessive-compulsive disorder: worldwide experience. *Mol Psychiatry* 2008. Epub.
- 55) Malone DA, Dougherty DD, Rezai AR, Carpenter LL, Friehs GM, Eskandar EN, Rauch SL, Rasmussen SA, Machado AG, Kubu CS, Tyrka AR, Price LH, Stypulkowski PH, Giftakis JE, Rise MT, Malloy PF, Salloway SP, Greenberg BD. Deep brain stimulation of the ventral capsule/ventral striatum for treatment-resistant depression. *Biol Psychiatry* 2009; 15; 65: 267-275.
- 56) Kim SP, Simeral JD, Hochberg LR, Donoghue JP, Friehs GM, Black MJ, Point-and-click cursor control with an intracortical neural interface system by humans with tetraplegia. *IEEE Trans Neural Syst Rehabil Eng.* 2011; 19: 193-203.
- 57) Robinson JL, Laird AR, Glahn DC, Blangero J, Sanghera MK, Pessoa L, Fox PM, Uecker A, Friehs G, Young KA, Griffin JL, Lovullo WR, Fox PT, The functional connectivity of the human caudate: an application of meta-analytic connectivity modeling with behavioral filtering. *Neuroimage* 2012, 60: 117-129.
- 58) Kubu CS, Malone DA, Chelune G, Malloy P, Rezai AR, Frazier T, Machado A, Rasmussen S, Friehs G, Greenberg BD, Neuropsychological outcome after deep brain stimulation in the ventral capsule/ventral striatum for highly refractory obsessive-compulsive disorder or major depression. *Stereotact Funct Neurosurg* 2013; 91: 374-8.
- 59) Jarosiewicz B, Masse NY, Bacher D, Cash SS, Eskandar E, Friehs G, Donoghue LP, Hochberg LR, Advantages of closed-loop calibration in intracortical brain-computer interfaces for people with tetraplegia. *J Neural Eng* 2013; 10: 046012.
- 60) Perge JA, Homer ML, Malik WQ, Cash S, Eskandar E, Friehs G, Donoghue LP, Hochberg LR, Intra-day signal instabilities affect decoding performance in an intracortical neural interface system. *J Neural Eng* 2013, 10: 036004.
- 61) Perge JA, Zhang S, Malik WQ, Homer ML, Cash S, Friehs G, Eskandar EN, Donoghue JP, Hochberg LR, Reliability of directional information in unsorted spikes and local field potentials recorded in human motor cortex. *J Neural Eng* 2014, 11: 046007.
- 62) Masse NY, Jarosiewicz B, Simeral JD, Bacher D, Stavisky SD, Cash SS, Oakley EM, Berhanu E, Eskandar E, Friehs G, Hochberg LR, Donoghue JP, [Non-causal spike filtering improves decoding of movement intention for intracortical BCIs](#). *J Neurosci Methods.* 2014, 30: 236: 58-67.
- 63) Bacher D, Jarosiewicz B, Masse NY, Stavisky SD, Simeral JD, Newell K, Oakley EM, Cash SS, Friehs G, Hochberg LR, [Neural Point-and-Click Communication by a Person With Incomplete Locked-In Syndrome](#). *Neurorehabil Neural Repair.* 2015, 29: 462-71.
- 64) Masse NY, Jarosiewicz B, Simeral JD, Bacher D, Stavisky SD, Cash SS, Oakley EM, Berhanu E, Eskandar E, Friehs G, Hochberg LR, Donoghue JP, [Reprint of "Non-causal spike filtering improves decoding of movement intention for intracortical BCIs"](#). *J Neurosci Methods.* 2015, 15: 244:94-103.
- 65) Jarosiewicz B, Sarma AA, Bacher D, Masse NY, Simeral JD, Sorice B, Oakley EM, Blabe C, Pandarinath C, Gilja V, Cash SS, Eskandar EN, Friehs G, Henderson JM, Shenoy KV, Donoghue JP, Hochberg LR, [Virtual typing by people with tetraplegia using a self-calibrating intracortical brain-computer interface](#). *Sci Transl Med.* 2015, 11;7(313):

#### OTHER PUBLICATIONS

- 1) Friehs, G.M., Friehs, G.B., Jüttner, F.M., Kohek, P., Thorax Data - Einsatz eines Home-Computers in der Praxis. *Der Praktische Arzt*, 534 (1986), 338-344.
- 2) Schröttner, O., Friehs, G.M., Resultate perkutaner Chordotomie beim Lungen- und Mammakarzinom. *Der Schmerz*, 6 Suppl. 1, (1992), V 5.4., S40.
- 3) Friehs GM, Schröttner O. Levels of analgesia and thermesthesia after percutaneous and open cordotomies. In: *Pain - Clinical Aspects and Therapeutical Issues, Part II*. Keplinger B, Penak JM, Ray AL, Schmid H (eds.), Edition Verlag Selva (1993).

- 4) Schröttner O, Friehs GM. Place of stereotactic techniques in surgery for pain. In: Pain--Clinical Aspects and Therapeutical Issues, Part II. Keplinger B, Penak JM, Ray AL, Schmid H (eds.), Edition Verlag Selva (1993).
- 5) Friehs GM, Ojakangas CL, Pachatz P, Schröttner O, Ott E, Pendl G. Radiosurgical caudotomy as a possible treatment of Parkinsonism. *Mov Disorders* 9 suppl 1 (1994), 110.
- 6) Haselsberger K, Friehs GM, Schrottner O, Pendl G, Radiosurgery (gamma knife): an alternative adjuvant treatment for glioblastoma. In: Kogelnik HD (ed), *Progress in Radio-Oncology V*. Monduzzi editore, 1995.
- 7) Friehs GM. Treating the chronic pain of cancerous CNS Tumors. *Medicine & Health, Rhode Island* 79(6):218-23, 1996.
- 8) Walters BC, Friehs GM. Diagnosis and treatment of spinal stenosis. *Med Health R I*. 81(5):174-8, 1998. No abstract available.
- 9) Friehs GM, Friedman J, Epstein MH, Noren GC, Radiosurgical Pallidotomy for Parkinson's Disease. Krauss JK, Grossman G, Jankovich J (eds), *Pallidal Surgery for Parkinson's Disease and Movement Disorders*. Lippincott-Raven (1998).
- 10) Walters BC, Friehs GM, A surgical approach to low back pain. *Med Health R I*. 2000. Apr; 83(4):101-3.
- 11) Nakata GK, Friehs GM: Neurological Physiology. The brain and its response to injury. In: *The Practice of General Surgery*. Bland K (ed.). W.B. Saunder 2001, pp 192-195.
- 12) Friehs GM, Walters BC, Zerris V, Radiosurgical Treatment of Parkinson's Disease. In: *Surgery for Parkinson's Disease and Movement Disorders*. Krauss JK, Grossman G, Jankovich J (eds). Lippincott Williams & Wilkins, 2001, pp 258-267.
- 13) Donoghue JP, Nurmikko A, Friehs G, Black M. Development of neuromotor prostheses for humans. In: *Advances in Clinical Neurophysiology Supplements to Clinical Neurophysiology Vol 57* chapter 63; 588-602.
- 14) Park MC, Goldman MA, Carpenter LL, Price LH, Friehs GM. Vagus nerve stimulation for depression: rationale, anatomical and physiological basis of efficacy and future prospects. In: *Operative Neuromodulation. Volume II: Neural Networks Surgery*, Sakas DE, Simpson BA (eds). Springer Wien New York, NY, 2006.

#### ABSTRACTS

- 1) Friehs, G.M., He, L.S., Parker, R.G., Haines, S.J., Turner, D.A., Ebner, T.J., Elde, R.P., Chou, S.N., Stereotaxic Radiofrequency Lesioning of the Caudate Nucleus Without Transplantation Reduces Motor Asymmetry in a Rodent Model of Parkinson's Disease. *J. Neurosurg* 70 (1989), 330A.
- 2) Cox, C.M., Toro, C., Friehs, G.M., Ojakangas, C.L., Maxwell, R.E., Gates, J.G., Ebner, T.J., Topographical Analysis of Direct Cortical Potentials in Humans during Two Dimensional Movements. *American Association of Neurological Surgeons* (1989).
- 3) Friehs, G.M., He, L.S., Parker, R.G., Ojakangas, C.L., Turner, D.A., Haines, S.J., Ebner, T.J., Comparison of caudate lesioning and adrenal medulla grafting in 6-OHDA rats. *Soc. Neurosci. Abstr.*, 15 (1989), #200.4, p. 490.
- 4) Friehs, G.M., He, L.S., Parker, R.G., Haines, S.J., Turner, D.A., Ebner, T.J., Elde, R.P., Chou, S.N., Stereotaxic Radiofrequency Lesioning of the Caudate Nucleus Without Transplantation Reduces Motor Asymmetry in a Rodent Model of Parkinson's Disease. *American Association of Neurological Surgeons* (1989).
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- 6) Friehs, G.B., Ratzenhofer, B., Friehs, G.M., Smolle-Jüttner, F.-M., Beuster, W., Barotrauma beim Tauchunfall. *Ärztewoche* 1990.
- 7) Friehs, G.M., Friehs, I., Linck, G., Smolle-Jüttner, F.-M., Kohek, P., Pinter, H., Breinl, E., Friehs, G.B., Lasermatic Combolaser in Thoracic Surgery. *Combolaser Conference, Paris* (1990).
- 8) Beuster, W., Friehs, G.B., Friehs, G.M., Smolle-Jüttner, F.-M., Kohek, P., Ärztliche Analyse von Tauchunfällen. *Fortbildungsveranstaltung der Ärztekammer für Kärnten in Klagenfurt* (1990).

- 9) Friehs, G.B., Smolle-Jüttner, F.-M., Pinter, H., Friehs, G.M., Operationstaktische Aspekte der echten intrathorakalen Struma. 32. Tagung der Österreichischen Gesellschaft für Chirurgie (1990).
- 10) Friehs, G.B., Friehs, G.M., Beuster, W., Smolle-Jüttner, F.-M., Organisation der Rettungskette beim Tauchunfall in Österreich. Joint Meeting des American Diving Alert Meeting in Kiel (1991).
- 11) Friehs, G.M., Tilz, G.P., Friehs, I., Friehs, G.B., Interleukin-2-Rezeptoren beim Bronchuscarcinom. Jahrestagung der Österreichischen Gesellschaft für Lungenerkrankungen und Tuberkulose (1991).
- 12) Friehs, G.B., Friehs, G.M., Beuster, W., Smolle-Jüttner, F.-M., Der Tauchunfall in Österreich, Notfall Ärzte Seminar in Seggau (1991).
- 13) Friehs, G.M., Friehs, I., Friehs G.B., Der Tauchunfall I. Salzburger Rotkreuztage (1991).
- 14) Friehs, G.M., Friehs, I., Friehs G.B., Der Tauchunfall II. Salzburger Rotkreuztage (1991).
- 15) Friehs, G.M., Schröttner, O., Levels of Analgesia and Thermanesthesia after Open and Percutaneous Cordotomies. 3<sup>rd</sup> International Symposium on Advances in Pain Research, Lackenhof, Austria (1992).
- 16) Schröttner, O., Friehs, G.M., Place of Stereotactic Operations in Pain. 3<sup>rd</sup> International Symposium on Advances in Pain Research, Lackenhof, Austria (1992).
- 17) Mendez, A., Camarata, P.J., Friehs, G.M., Abtin, K., Ebner, T.J., Intraatrial Delivery of Nerve Growth Factor with Biodegradable Microspheres. Soc. Neurosci Abstr. 18 (1992), #36.8, p. 62.
- 18) Eder, H., Oberbauer, B., Friehs, G.M., Leber, K., Hydrocephalus - Klinische Ergebnisse mit "variable resistance valves". 16. Jahrestagung der Österreichischen Gesellschaft für Neurochirurgie (1992).
- 19) Sutter, B., Friehs, G.M., Bovine Knochendübel bei Fusionsoperation - Erfahrungsbericht. 16. Jahrestagung der Österreichischen Gesellschaft für Neurochirurgie (1992).
- 20) Schröttner, O., Friehs, G.M., Die Rolle des Neurochirurgen in der Therapie chronischer Schmerzen. Van Swieten Tagung (1992).
- 21) Schröttner, O., Friehs, G.M., Resultate perkutaner Chordotomie beim Lungen- und Mammakarzinom. 17. Jahrestagung der Deutschen Gesellschaft zum Studium des Schmerzes e.V., Bielefeld, Deutschland (1992).
- 22) Schröttner, O., Friehs, G.M., Der Stellenwert stereotaktischer Techniken in der Schmerzchirurgie. 2. Wissenschaftliche Tagung der Österreichischen Schmerzgesellschaft (1993).
- 23) Friehs, G.M., Schröttner, O., Indikationen für intraventrikuläre Morphinapplikation. 2. Wissenschaftliche Tagung der Österreichischen Schmerzgesellschaft (1993).
- 24) Pendl, G., Friehs, G.M., Schröttner, O., Radiochirurgie (Gamma Einheit) als Alternative zur Trepanation. 34. Tagung der Österreichischen Gesellschaft für Chirurgie (1993).
- 25) Eder, H.G., Oberbauer, R.W., Friehs, G.M., Hydrocephalus, clinical results with variable resistance valves. The International Society for Pediatric Neurosurgery (1993).
- 26) Hauer, A.Ch., Rosegger, H., Müller, W., Friehs, G.M., Fast, Ch., Lackner, H., Urban, Ch., Rh-Erythropoetin vs. Erythrocyte Transfusion in the Treatment of Hyporegenerative Anemia in Preterm Infants (1993). Pädiatrische Forschung mitteleuropäischer Länder in Wien, Austria.
- 27) Schröttner, O., Friehs, G.M., Pendl, G., Egger, J., Kreuzer, ., Bilateral anterior Gamma-Capsulotomies in Chronic Deafferentation Pain. 1<sup>st</sup> International Stereotactic Radiosurgery Society Meeting, Stockholm, Sweden (1993).
- 28) Friehs, G.M., Schröttner, O., Ojakangas, C.L., Pendl, G., Gamma Knife Treatment of Parkinsonism. 1<sup>st</sup> International Stereotactic Radiosurgery Society Meeting, Stockholm, Sweden (1993).
- 29) Schröttner, O., Friehs, G.M., Pendl, G., Functional Neurosurgery with the Gamma Unit. Symposium on Neurosciences, 3<sup>rd</sup> Indo-European Congress on Neurosciences, Salzburg, Austria (1993).
- 30) Schröttner, O., Friehs, G.M., Pendl, G., Stereotaktische Radiochirurgie von Meningeomen der Schädelbasis. Austrian-Czech-Slovakian Gamma Knife User Group Meeting, 1994.
- 31) Schröttner, O., Friehs, G.M., Pendl, G., Neurochirurgische Möglichkeiten beim chronifizierten Schmerz. 40. Ausseer Symposium 1994.
- 32) Pendl, G., Friehs, G.M., Schröttner, O., G.K.- Radiosurgery for Malignant Gliomas. Leksell Gamma Knife Satellite Symposia, Shanghai 1994.

- 33) Pendl, G., Friehs, G.M., Schröttner, O., Functional Neurosurgery with the Leksell Gamma Knife. Leksell Gamma Knife Satellite Symposia, Shanghai 1994.
- 34) Pendl, G., Friehs, G.M., Schröttner, O., Stereotactic Radiosurgery for Skull Base Meningeomas. Leksell Gamma Knife User Group Meeting, Kyoto 1994.
- 35) Langmann, G., Pendl, G., Schröttner, O., Friehs, G.M., Mokry, M., Papaefthymiou, G., Stücklschweiger, G., Faulborn, J., Radiosurgery for Uveal Melanomas with the Leksell Gamma Knife Graz. Leksell Gamma Knife User Group Meeting, Kyoto 1994.
- 36) Friehs, G.M., Ojakangas, C.L., Pachatz, P., Schröttner, O., Ott, E., Pendl, G., Treatment of Parkinsonism with the Gamma Knife. Leksell Gamma Knife User Group Meeting, Kyoto 1994.
- 37) Friehs GM, Smeaton S, Sungarian A, Zerris V, Huber R, Wojcik B, Stopa E. Evidence for Radiosurgery-Induced Regeneration in the Striatum of 6-OHDA Hemiparkinsonian Rats. Abstract for 8th International Leksell Gamma Knife Society Meeting, June 22-25, 1997 in Lyon, France.
- 38) Friehs GM, Zerris V, Sungarian A, Zheng Z, Radiation and Regeneration: Histochemical and Behavioral Effects in the Parkinsonian Mammalian CNS; Leksell Gamma Knife Meeting, Squa Valley, CA, April 14-17, 2000.
- 39) Chougule PC, Burton-Williams M, Saris SC, Friehs GM, Noren GC, Epstein MH, Wazer DE, Randozimed Treatment of Brain Metastases with Gamma Knife radiosurgery, XRT alone vs. both. ASTRO, 10/23/2000.
- 40) Williams S, Mukand J, Apple DF, Polykoff G, Friehs G, Donoghue J. Clinical Use of the BrainGate™ Neural Interface System in Individuals with Quadriplegia.

#### INVITED PRESENTATIONS:

- 1) Friehs, G.M., Spontane Regeneration im ZNS bei Hemiparkinsonismus der Ratte. Seminar für Neurobiologie, 1993. Karl Franzen University, Graz, Austria.
- 2) Creating Lesions in CNS Patients with Non-Invasive Methods, CNS meeting, New Orleans, October 1, 1997.
- 3) Head Injury, IAIABC 1997 Annual Convention, 1997.
- 4) Pain Treatment Course, Harvard University, Brigham and Women's Hospital; (co-director with Edgar Ross, M.D.); 1999
- 5) Friehs GM, Zerris V, Sungarian A, Effects of Striatal Gamma Knife Lesioning on Behavioral Testing and GDNF Expression in Hemi-Parkinsonian Rats; ISRS, December 12, 1999.
- 6) The Trials and Dangers of Neurological Localization, Kenney Day Program, The Memorial Hospital of R.I., 2001.
- 7) Implantable Therapies in Chronic Pain Management, Medtronic Seminar, New York, 2001.
- 8) Friehs GM, New Frontiers of Neuroaugmentation Therapies: The Human Neuroprosthesis Project. Cleveland Clinic Foundation Meeting, 2001.
- 9) Friehs, GM, Functional Radiosurgery: Pain; ISRS, Las Vegas, NV, June 10-13, 2001.
- 10) Friehs,GM, Spasticity Management: Focus on Rehabilitation; Medtronic Seminar, Providence, RI, February 5, 2002.
- 11) Friehs, GM, Intracranial Pressure; Brown University, Providence, RI, February 27, 2002.
- 12) Friehs, GM, Spinal Cord Stimulation and Intrathecal Analgesics for Chronic Pain: Assessment and Application, Boston, MA, February 27, 2002.
- 13) Friehs, GM, Spasticity Management: Focus on Rehabilitation, Medtronic Seminar, Providence, RI, February 5, 2002.
- 14) Friehs, GM, The Cost of Advanced Pain Therapies, Medtronic Seminar, Johnston, RI May 9, 2002.
- 15) Friehs, GM, Symposium: Frontiers of Organ and Tissue Replacement, Neuroprosthetics, New York, June 13, 2002.
- 16) Hochberg LR, Mukand JA, Williams, S, Polykoff G, Friehs GM and Donoghue JP. Brain-Computer Interfaces: Prospects for Neuro-Rehabilitation and Implications for Neurocritical Care. Neurocritical Care Society, 49 2005.

- 17) Hochberg LR, Mukand JA, Friehs GM and Donoghue JP. Brain-Gate Neural Interface System: Feasibility Study of a Human Neuromotor Prosthesis. American Academy of Neurology Annual Meeting, 2005.
- 18) Hochberg LR, Mukand JA, Friehs GM and Donoghue JP. Brain-Gate: Feasibility of a Human Neuromotor Prosthesis for Persons with Tetraplegia. Christopher Reeve Paralysis Foundation (2005).
- 19) Hochberg LR, Mukand JA, Polykoff GM, Friehs GM and Donoghue JP. Brain-Gate Neuromotor Prosthesis: Nature and use of neural control signals. Society for Neuroscience, 2005.
- 20) Zerris VA, Donoghue JP, Hochberg LR, and Friehs G. BRAINGATE: Turning Thought into Action: First experience with human neuro-motor prosthesis. Congress of Neurological Surgeons, 2005.
- 21) Park M, Zerris V, Hochberg LR, Donoghue JP, Mukand JA and Friehs GM. BrainGate – First experience with an implantable human neuro-motor prosthesis. North American Neuromodulation Society, 2005.
- 22) Hochberg LR, Suner S, Fellows MR, Friehs GM and Donoghue JP. Intracortical recordings from a 96-microelectrode array. Potential applications in Human Neurophysiology. 59<sup>th</sup> Annual Meeting of the American Epilepsy Society and the American Clinical Neurophysiology Society, Washington DC, 2005.

### GRANTS

- 1) Investigator, Birkmayer Award for Research in Parkinsonism (“Lesioning of the Striatum Reverse Motor Asymmetry in a 6-OHDA Rodent Model of Parkinsonism”); US \$ 6,000 (1993).
- 2) Investigator, Elekta Research Grant for Research in Parkinsonism (“Treatment of Parkinsonism with the Gamma Knife”), US \$ 100,000. (1994).
- 3) Co-Investigator, Österreichische Nationalbank, Research Grant (co-investigator with O. Schrötner, M.D.) for Research in Parkinsonism (“Radiochirurgische Behandlung des Parkinsonismus durch Zerstörung des Nucleus caudatus”), US \$ 40,000. (1994).
- 4) Investigator, Rhode Island Hospital research grant (“Radiosurgical lesioning of the striatum in 6-OHDA hemiparkinsonian rats”); US \$ 20,000 (1995).
- 5) Consultant, Static and Dynamic Organization of Primate Motor Cortex. NINDS grant R01 NS25074; Consultant (PI: John Donoghue, Ph.D.). 4/1/97 – 4/30/02.
- 6) Co-Investigator, Neuroprosthesis Project. Funded through Dept. of Neuroscience (Chairman: John Donoghue, Ph.D.); co-investigator; (1999 – present).
- 7) Co-Investigator, Vagus Nerve Stimulation Therapy for the Treatment of Intractable Depression. Funded by Cyberonics, Inc. Multi-Center Study Phase 2 Double-Blind Study. (Co-Investigator with Linda Carpenter, M.D. and Lawrence Price, M.D., Ph.D.). US\$ 100,000. (2000).
- 8) Co-Investigator, Deep Brain Stimulation Therapy for the Treatment of Obsessive-Compulsive Disorder. Funded by Medtronic, Inc. Multi-Center Phase 1 Study. (Co-Investigator with Ben Greenberg, M.D., Ph.D., and Steve Rasmussen, M.D.); \$150,000. (2001-2003).
- 9) Co-Investigator, Deep Brain Stimulation Therapy for the Treatment of Intractable Depression. Funded by Medtronic, Inc. Multi-Center Phase 1 Study. (Co-Investigator with Lawrence Price, M.D., Benjamin Greenberg, M.D., Ph.D., and Steven Rasmussen, M.D.); \$150,000. (2002 to 2005).
- 10) Co-Investigator, Deep Brain Stimulation for the Treatment of Intractable Depression, NIH RO1 application, 2003
- 11) Principal Investigator, A Randomized, Double-Blind, Placebo-Controlled Study of Intrathecal Ziconotide in Adults with Severe Chronic Pain. Funded by Elan Pharmaceuticals, Inc. Multicenter Phase III Study. Approx. \$140,000 (2003)

- 12) Co-Investigator: Implantation of Braingate (R) in Human Subjects who cannot move. (2 studies: for patients with stroke, high cervical injury or ALS). Funded by Cyberkinetics Neurotechnologies, Inc. Approx. \$ 700.000 (since 2004)
- 13) Principal Investigator: Development of a Tissue Bank for Neuroscience Research, Scott&White Institutional Grant: \$ 450.000 (2009-2012)

#### UNIVERSITY TEACHING ROLES

- 1) Head Injury and Spinal Cord Injury, Brown Medical School (surgery rotation), 1995 – present.
- 2) Director of Functional Neurosurgery (resident teaching program), 1995-present
- 3) Director of Neurosurgical Trauma, (resident teaching program), 1995-present
- 4) Head and Spinal Trauma, BTLS Program, Brown University, 1997.
- 5) Vasilios Zerris, M.D., MPH, M.MSc., Advisor for Masters of Medical Sciences degree, 1997-1999.
- 6) Neurosciences 262, Neurological Pathophysiology; 1998-present
- 7) Deep Brain Stimulation Therapy for Psychiatric Disease, Brown Medical School:
- 8) since 2000
- 9) Bio 370: Brain Machine Interfaces. Since 2000
- 10) Deep Brain Stimulation Therapy; Brown Medical School SC 295, 2001
- 11) Intracranial Pressure, Brown Medical School, (surgery rotation), since 2001
- 12) Advisor to PLME student Wendy Huang, Spring 2003.
- 13) Advisor and Mentor to Medical Student Jonathan Greenberg, M.D.
- 14) Advisor for Longitudinal to Undergraduate and Medical Student Anil Taner
- 15) Advisor for Longitudinal for Undergraduate and Medical Student Min Park

#### HOSPITAL TEACHING ROLES

- 1) Director of Resident Clinic for Neurosurgery, 1995-1999
- 2) Pain Management Techniques, Rhode Island Hospital Pain lectures 1996-2001.
- 3) Modern Management of Brain and Spine Injury, RIACEP Conference, Rhode Island, 1996.
- 4) Head and Spinal Cord Trauma, Paramedicine Refresher Course, 1996.
- 5) Neurosurgical Treatment of Cancer Pain, Miriam Hospital Grand Rounds, 1996.
- 6) The Baclofen Pump for Spasticity in Multiple Sclerosis”, Southern New England Rehabilitation Center, 1996.
- 7) Head Injury, RIH EMS Lecture Series, 1997.
- 8) Head and Spinal Cord Trauma, Paramedicine Refresher Course, 1997.

- 9) Neurosurgical Treatment of Pain, Neurology Grand Rounds, 1997
- 10) Deep Brain Stimulation Therapy, Neurology Grand Rounds, 1998
- 11) Intrathecal Medication Pumps, Neurology Grand Rounds, 1998