

Curriculum Vitae

PAUL LOUIS PENAR, M.D.

Professor of Surgery (Neurosurgery)
Secondary Faculty, Department of Pharmacology
The University of Vermont College of Medicine
Director, Functional Neurosurgery & Radiosurgery Program
Chair, Department of Surgery Quality Assurance Committee
Associate Director, Neurosurgery Residency Program

Birthdate: January 16, 1956
Birthplace: Mount Clemens, Michigan
Spouse: Dorothea Fraver Penar
Married October 26, 1979
Children: Peter (born 1986)
Geoffrey (born 1988)
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Education

University of Michigan, Ann Arbor, Michigan, with High Distinction B.S. 1973-77
Major: Microbiology
Regent's Alumni Scholarship

University of Michigan Medical School, with Distinction M.D. 1977-81
Medical Student Research Committee (1979-81)
Sandoz Award (1980-81)

Residency Training

Yale-New Haven Hospital, New Haven, Connecticut

Intern, Department of Surgery	7/81 - 6/82
Assistant Resident, Neurosurgery	7/82 - 12/85
Chief Resident, Neurosurgery	1/86 - 11/86
Associate - Surgery (Neurosurgery)	11/86 - 6/87

Professional Experience

Yale University School of Medicine:

Associate Research Scientist	7/84 - 6/85
Instructor in Surgery (Neurosurgery)	1/86 - 6/87

University of Illinois College of Medicine at Peoria:

Clinical Assistant Professor of Neurosurgery;	7/87 - 5/88
Attending Neurosurgeon, Associated University Neurosurgeons	

University of Vermont College of Medicine:

Assistant Professor of Surgery, Division of Neurosurgery	1988 - 1995
Attending Neurosurgeon, Fletcher Allen Health Care & Medical Center Hospital of Vermont	1988 - present
Associate Professor of Surgery, Division of Neurosurgery	1995 - 2004
Professor of Surgery, Division of Neurosurgery	2004 - present
Secondary Faculty, Department of Pharmacology	1996 - present
Neurosurgical Residency Program Director & Co-director	1998 - present

Honors and Awards

Alpha Omega Alpha Honor Medical Society, 1980
Sandoz Award for superior academic achievement, 1980-81
3rd prize poster abstract, American Association of Neurological Surgeons Annual Meeting, 1991
James Demeules Surgical Research Award, UVM Department of Surgery, 1997
H. Gordon Page Surgical Clinician Award, UVM Department of Surgery, 2002

Certification & Licensure

Medical licensure: Connecticut 1984 - 1987, Illinois 1987, Vermont 1988-present, New York 2006 - present
Diplomate, National Board of Medical Examiners, 1981
Diplomate, American Board of Neurological Surgery, 1989

Postgraduate Training Courses

ATLS Instructor Course, 1991; Recertification 1995
Automated Percutaneous Lumbar Discectomy Course, 1993
Review and Update in Neuroscience for Neurosurgeons, 1993
Medtronic Programmable Pump Certificate, 1994
Radiosurgery Training Course, Radionics Inc., 2000
Advanced Stereotactic & Functional Neurosurgery Course, Cleveland Clinic Foundation, 2002

Committees and Administrative Service (current service in **bold**)

University of Vermont

Research & Scholarship Committee, University Faculty Senate, Member 1990-94;
Chair, 1993-94

Executive Council of Faculty Senate, Member, 1993-94

University of Vermont College of Medicine

Review of Chairman of Anatomy & Neurobiology, Member, 1990

Search Committee for:

Neurobiology Faculty, 1995-96

Clinical Neurophysiologist / Neurologist, 1995-96

Neuro-Oncologist, 1997

Director of Surgical Pathology, 1997

Neurosurgery Division Chair, 1999

Confocal Microscope Users Advisory Group, 1995-1999

Institutional Animal Care and Use Committee, Member, 1994-2003

Committee on Human Research in the Medical Sciences (IRB), 2003-present

Fletcher Allen Health Care (Medical Center Hospital of Vermont)

Laser Committee, 1989-present; Chair, 1994 - 2001

Surgical Intensive Care Unit Committee, 1989 - 1994

Operating Room Scheduling Redevelopment Project, 1990-1992

Neurosurgery Service Line, Physician Representative, 1992-1995

Cancer Committee, 1993-1995

Protocol Review Committee of the Vermont Cancer Center, 1994-1996

Transfusion Committee, 1994 - 1999

Radiosurgery Task Force, 1997- 2000

Electronic Medical Record Committee, 2005 - present

Graduate Medical Education Committee, 1996 - present

Review of Neurology Residency Program, 2001

Review of Psychiatry Residency Program, 2002

Co-Director, Epilepsy & Functional Neuroscience Program, 1996 - present

Co-Director, Radiosurgery Program, 2000-present

Neurosurgical Residency Program Coordinator 1996-98; Program Director

1998 - 99; Associate Director, 2000 - present

Chair, Department of Surgery Quality Assurance Committee 2007

Neurosurgery Representative, 2000 - 2007

Professional Society Memberships & Committees

Alpha Omega Alpha Honor Medical Society, 1980
Congress of Neurological Surgeons, Resident Member 1984, Active Member 1987
American Association of Neurological Surgeons, Candidate 1988, Full Member 1990
Vermont State Medical Society, 1988
Joint Section (AANS/CNS) on Stereotactic and Functional Neurosurgery, 1989
American Society for Stereotactic and Functional Neurosurgery, 1989
World Society for Stereotactic and Functional Neurosurgery, 1989
New England Neurosurgical Society, 1989
Joint Section (AANS/CNS) on Tumors, 1991
Vermont Cancer Center, 1996
Society for Neuro-Oncology, 1997
Joint Committee on Digital Technology (AANS/CNS), 2003
Joint Committee on Education (AANS/CNS), Computer Subcommittee, 1989-90
AANS Technology Assessment Committee, 1993-1995
Vermont State Neurosurgical Society, Secretary, 2006 - present

Other Professional Activities

Reviewer, Journal of Trauma, 1988-present
Reviewer, Acta Neurochirurgica, the European Journal of Neurosurgery, 2002-present
Reviewer, Practical Reviews in Neurosurgery, Oakstone Publishing (2006 - present)
Editor, Emedicine textbook of Neurosurgery, 2000 - present

Visiting Professor, University of Massachusetts Medical Center, December 1996
Guest Examiner, American Board of Neurological Surgery, May 2000

Reviewer (ad hoc), Microvascular Research, 1999
Reviewer, Blood Vessel, 1988-1991
Continuing Education Award in Neurosurgery (AANS/CNS); 1990-92; 1996-98
Rhône-Poulenc Rorer Pharmaceuticals Inc., Gliadel study clinical consultant, 1997
Reviewer (ad hoc), Oncology Research, 1997
Course Faculty
Neurosurgical Laser Workshop, Yale University, July 1984
ATLS, University of Vermont, 1991-1997

Grants Awarded

Principal Investigator
Agency: American Cancer Society, Vermont Cancer Center, IN-156
Title: 1. Microvascular quantitation of an experimental intracranial tumor in the rat using computerized image processing
2. The role of the renin-angiotensin system in angiogenesis in the 9L intracranial gliosarcoma
Amount: \$ 7700
Term: 10-1-88 to 12-31-89

Principal Investigator
Agency: NINCDS, P20 NS30324-01
Title: Development of a Computerized Mathematical Model of the Intracranial Compartment
Amount: \$ 18,703
Term: 9/30/91 - 9/29/92 (renewed 9/92)

[Project III of "Pathogenesis of Secondary Brain Injury", Steven Shackford, Program Director]

Co-Investigator

Agency: NINCDS, P20 NS30324-01
Title: Cerebrovascular Endothelial Cell Dysfunction: Role of Trauma
Amount: \$ 159,430
Term: 9/30/91 - 9/29/94

[Project II of "Pathogenesis of Secondary Brain Injury", Steven Shackford, Program Director]

Principal Investigator

Agency: UVM College of Medicine, Cell Imaging Facility
Title: The Effect of EGFR-tyrosine kinase inhibitors on EGF receptor expression in Human Glioblastoma Cells as Assessed by Atomic Force Microscopy
Amount: \$ 1000
Term: 01/25/96

Principal Investigator

Agency: UVM College of Medicine, New Research Initiatives
Title: The role of PLC gamma inhibition in Epidermal Growth Factor Mediated Glioblastoma Invasion
Amount: \$7500
Term: 6/15/96 - 6/15/97

Co-Investigator

Agency: The McDonnell Foundation
Title: Evaluation of mitochondrial poisoning and Fas engagement in selective induction of apoptosis in human glioma cells
Amount: \$150,000
Term: 6/1/98 - 5/30/01

Principal Investigator for Center

Agency: Rhône-Poulenc-Rorer Pharmaceuticals, Inc.; RPR 132596-250MA
Title: Phase II Trial of Surgery with Gliadel Wafer and Radiation in Patients with Operable CNS Metastasis from Systemic Cancer
Amount: \$ 43,605
Term: September 1998 - 2000

Principal Investigator

Agency: Department of Surgery, UVM College of Medicine
Title: Treatment of medulloblastoma with genistein / cisplatin combination therapy in the nude mouse
Term: 1-1-01 to 06-30-02
Amount: \$22,100

Principal Investigator

Agency: Department of Surgery, UVM College of Medicine
Title: Treatment of glioblastoma with genistein and BCNU In The Nude Mouse
Term: 07-01-02 to 06-30-03
Amount: \$20,900

Principal Investigator

Agency: The Andy Fund

Title: Glioblastoma Research

Amount: ~\$ 300,000

Term: 1997 - 2004

(*The Andy Fund* is a private foundation initiated to support brain tumor research at the University of Vermont in my laboratory.)

Patents

A Whole-body Model for Intracranial Pressure Dynamics. WD Lakin, PL Penar, BI Tranmer, SA Stevens ; patent No. 7,182,602 granted 2-27-2007

Research Fellows

Sami Khoshyomn, M.D.; October 1994 - June 1997
Joseph DeMattia, M.D.; July 1997 - June 1998

Student Mentoring

Student Interest Group in Neurosciences, 2004-2007

Surgery Senior Major Faculty Mentor:

Gregory Murad
Myelomeningocele Repair Under Spinal Anesthesia
2001

Augustino Visoni
Surgical Treatment of Ilioinguinal Neuropathy
2003

Adam Polifka
Outcome Analysis of Ventriculoperitoneal Shunts
2006-07

Publications

- Penar PL:** Using Statistics on Your PC (A statistics program in basic). Soft Sector, June 1987, pp. 41-52.
- Penar PL:** A model of embolic cerebral ischemia in the rat. *Experimental Neurology* 96:393-405, 1987.
- Penar PL, Greer CA:** The effect of intravenous tissue-type plasminogen activator in a rat model of embolic cerebral ischemia. *Yale Journal of Biology & Medicine* 60:233-243, 1987.
- Penar PL, Prichard JW:** Jakob-Creutzfeldt disease associated with a cadaveric dural graft [letter]. *Journal of Neurosurgery* 67:149, 1987.
- Penar PL, Fischer DK, Goodrich I, Bloomgarden GM, Robinson F:** Spontaneous spinal epidural hematoma: Two case reports and literature review. *International Surgery* 72(4):218-221, 1987.
- Penar PL, Kim JH, Chyatte D:** Solitary eosinophilic granuloma of the frontal lobe. *Neurosurgery* 21:566-568, 1987.
- Penar PL, Kim JH, Chyatte D, Sabshin J:** Intraventricular cryptococcal granuloma: report of two cases. *Journal of Neurosurgery* 68:145-148, 1988.
- Thadani V, **Penar PL**, Partington J, Kalb R, Janssen R, Schonberger LB, Rabkin CS, Prichard JW: Creutzfeld-Jakob disease probably acquired from a cadaveric dura mater graft. *Journal of Neurosurgery* 69:766-769, 1988.
- Bereen JP, Vrabec MP, **Penar PL:** Intermittent pupillary dilatation associated with an astrocytoma. *American Journal of Ophthalmology* 109:237-239, 1990.
- Shatos MA, Orfeo T, Doherty J, **Penar P**, Collen D, Mann K: Thrombin regulates fibrinolysis and proliferation in cultured human cerebral microvascular endothelium. *Circulation* 88:1615, 1993
- Orfeo T, Doherty JM, Adey G, **Penar P**, Shatos MA: Percussion trauma alters human cerebral microvascular endothelial cell nonthrombogenicity in vitro. *Blood* 82:278a, 1993.
- Orfeo T, Doherty JM, Adey G, **Penar P**, Shatos MA: Sublethal percussion trauma in vitro causes a persisting derangement in the nonthrombogenicity of brain endothelial cells. *J Trauma* 37:347-357, 1994.
- Shatos MA, Orfeo T, Doherty JM, **Penar PL**, Collen DJ, Mann KG: A unique response of human cerebral microvascular endothelial cells to alpha-thrombin. *Fibrinolysis* 8 (Suppl. 1):96, 1994
- Bevan JA, Bevan RD, Klaasen A, **Penar P**, Poseno T, Walters C: Myogenic (stretch-induced) and flow-regulated tone of human pial arteries. In *Human Brain Circulation*, JA Bevan, (ed), Chapter 14, 1994. Humana Press, pages 179-193.
- Penar PL, Wilson JT:** Cost and survival analysis of metastatic tumors treated by resection and radiation. *Neurosurgery* 34:888-894, 1994.
- Wilson JT, **Penar PL:** The effect of AGM-1470 in an improved intracranial 9L gliosarcoma rat model. *Neurological Research* 16:121-124, 1994.

Shatos MA, Orfeo T, Doherty JM, **Penar PL**, Collen DJ, Mann KG: Alpha-thrombin stimulates urokinase production and DNA synthesis in cultured human cerebral microvascular endothelial cells. *Arteriosclerosis, Thrombosis, & Vascular Biology* 15:903-911, 1995.

Yu J, Lakin WD, **Penar PL**: A hybrid asymptotic-numerical study of a model for intracranial pressure dynamics. *Studies in Applied Mathematics*. 95:247-267, 1995.

Penar PL, Lakin WD, Yu J: Normal pressure hydrocephalus: an analysis of etiology and response to shunting based on mathematical modeling. *Neurological Research*. 17:83-88, 1995.

Lakin WD, Yu, J, **Penar PL**: Mathematical Modeling of Pressure Dynamics in the Intracranial System. *Nova Journal of Mathematics, Algebra, and Game Theory* 5:103-130, 1996.

Penar PL: "Cost and Outcome Analysis" in Harsh GR (ed), *Treatment of Cerebral Metastases*, Neurosurgical Clinics of North America, Vol 7, No.3, July 1996, pp. 547 - 558. (review)

Gokina NI, Wellman TD, Bevan RD, Walters CL, **Penar PL**, Bevan JA: Role of calcium-activated potassium channels in the regulation of membrane potential and tone of smooth muscle in human pial arteries. *Circulation Res* 79:881-886, 1996

Shatos MA, Doherty JM, **Penar PL**, Sobel BE: Suppression of plasminogen activator inhibitor-1 release from human cerebral endothelium by plasminogen activators: a factor potentially predisposing to intracranial bleeding. *Circulation* 94(4):636-42, 1996.

Kadas ZM, Lakin WD, Yu J, **Penar PL**. A mathematical model of the intracranial system including autoregulation. *Neurological Research* 19:441-450, 1997.

Penar PL, Khoshyomn S, Bhushan A, Tritton TR: Inhibition of epidermal growth factor receptor-associated tyrosine kinase blocks glioblastoma invasion of brain. *Neurosurgery* 40:141-151, 1997

Khoshyomn S, **Penar PL**, Wadsworth MP, Taatjes DJ: Localization of CD44 at the Invasive Margin of Glioblastomas by Immunoelectron Microscopy. *Ultrastructural Pathology* 21:517-525, 1997.

Thorin-Trescases N, Bartolotta T, Hyman N, **Penar PL**, Walters CL, Bevan RD, Bevan JA. Diameter dependence of myogenic tone of human pial arteries: Possible relationship to distensibility. *Stroke* 28:2486-2492, 1997.

Khoshyomn S, **Penar PL**, McBride WJ, Taatjes DJ: Four-dimensional analysis of human brain tumor spheroid invasion into fetal brain aggregates using confocal scanning laser microscopy. *Journal of Neuro-Oncology* 38:1-10, 1998.

Penar PL, Khoshyomn S, Bhushan A, Tritton TR: Inhibition of Glioma Invasion of Fetal Brain Aggregates. *In Vivo* 12(1):75-84, 1998 (review).

Bevan RD, Dodge J, Nichols P, **Penar PL**: Weakness of sympathetic neural control of human pial compared to superficial temporal arteries reflects low innervation density and poor sympathetic responsiveness. *Stroke* 29:212-21, 1998.

Florman JE, **Penar PL**, Vieco PT: Percutaneous access to the anterior spinal canal through a cervical disc space. *Neuroradiology* 40:597-599, 1998.

Lakin WD, **Penar PL**, Yu J: Analysis and validation of a mathematical model of intracranial dynamics in the rabbit. *Mathematical and Computer Modeling of Dynamical Systems* 5 (1):54-73, 1999.

Khoshyomn S, **Penar PL**, Rossi J, Bhushan A, Tritton TR, Wells A: Inhibition of glioma invasiveness by an inhibitor of PLC gamma activation and the dominant negative PLC-gamma-1 gene fragment. *Neurosurgery* 44:568-77, 1999.

Khoshyomn S, Lew S, DeMattia J, Singer EB, **Penar PL**: Brain tumor invasion rate measured *in vitro* does not correlate with Ki-67 expression. *Journal of Neuro-oncology* 45:111-116, 1999

Khoshyomn S, Manske, G, Lew SL, Wald SL, **Penar PL**: Synergistic action of genistein and cisplatin on growth inhibition and cytotoxicity of human medulloblastoma cells. *Pediatric Neurosurgery* 33:123-131, 2000.

Wellman GC, Perez GJ, Jaggar JH, **Penar PL**, Nelson MT: Ca²⁺ sparks activate large conductance Ca²⁺-activated K⁺ (BK) channels in human cerebral arterial myocytes. *Society of Experimental Biology FASEB J.* 14(4):A576, 2000.

Penar PL, Editor, *Emedicine Textbook Chapters: Spinal Stenosis, Trigeminal Neuralgia, Subdural Hematoma, Spinal Malformations, Subarachnoid Hemorrhage, Craniopharyngioma, Spinal Cord Abscess, Tumors of the Conus and Cauda Equina, Head Injury* (<http://www.emedicine.com/med/neurosurgery.htm>), 2001-2005.

Archard J-M, Fournier A, Mazouz H, Caride VJ, **Penar PL**, Fernandez LA: Protection against ischemia: a physiological function of the renin angiotensin system. *Biochemical Pharmacology* 62:261-271, 2001.

Wellman GC, Nathan DJ, Saundry CM, Perez GP, **Penar PL**, Tranmer BI, Nelson MT: Ca²⁺ sparks and their function in human cerebral arteries. *Stroke* 33(3):802-8, 2002.

Penar PL, Nathan DJ, Nathan MH, Salsali A: Pituitary Tumor Diagnosis And Treatment *in* Brust JCM, Fahn S, *Editors*; *Neoplasms*, Liang B (section editor); *Current Neurology and Neuroscience Reports (Curr Neurol Neurosci Rep)* 2(3):236-245, 2002 (Review).

Mao-Draayer Y, Braff SP, Nagle KJ, Pendlebury W, **Penar PL**, Shapiro RE: Emerging Patterns of Diffusion-weighted Imaging in Creutzfeldt-Jakob Disease: Case Report and Review of Literature, *American Journal of Neuroradiology AJNR* 23: 2002.

Khoshyomn S, Braff SP, **Penar PL**: Tumefactive Multiple Sclerosis Plaque: Case Illustration. *Journal of Neurology, Neurosurgery, & Neuropsychiatry* 73:85, 2002.

Penar PL, McBride LA, Brega KE: *Intracranial Masses*. Wood ME, Philips G (eds): *Hematology/Oncology Secrets*, 3rd Edition, Hanley & Belfus, Inc., Philadelphia PA, 2002

Khoshyomn S, Manske, G, Nathan D, **Penar PL**: Synergistic action of genistein and BCNU on growth inhibition of gliomas. *J Neurooncol* 57(3):193-200, 2002.

Khoshyomn S, Braff SP, McKenzie MA, Florman JE, Pendlebury WW, **Penar PL**: Metastatic Intraventricular Melanoma, Case Illustration. *Journal of Neurosurg* 97:726, 2002.

Lakin WD, Stevens SA, Tranmer BI, **Penar PL**: A whole-body model for intracranial pressure dynamics. *Journal of Mathematical Biology* 46:347-383, 2003.

Khoshyomn S, **Penar PL**, Nagle K, Braff P: Survival From Severe Penetrating Non-Missile Brainstem Injury: Case Report. *Journal of Trauma* 56(5):1131-4, 2004 (May).

Wellman TL, Jenkins J, **Penar PL**, Tranmer B, Zahr R, Lounsbury KM: Nitric Oxide and Reactive Oxygen Species Exert Opposing Effects on the Stability of Hypoxia-Inducible Factor-1alpha (HIF-1alpha) in Explants of Pial Arteries *FASEB J.* 18(2):379-81, 2004 (Feb).

Stevens SA, Lakin WD, **Penar PL**: Modeling steady-state intracranial pressures in supine, head-down tilt, and microgravity conditions. *Aviation, Space and Environmental Medicine* 76(4), 329-38, 2005.

Stevens SA, Lakin WD, **Penar PL**: Modeling Steady-State Intracranial Pressures in Microgravity *in* Simos TE, Psihoyios G, Tsitouras Ch (Eds), International Conference on Numerical Analysis and Applied Mathematics, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany, pp 502-505, 2005.

Stevens SA, Lakin WD, Thakore NJ, **Penar PL**, Tranmer BI: A modeling study of idiopathic intracranial hypertension. *Modelling in Medicine and Biology VI*, Ursino M et al, eds., WIT Press, Southampton, UK, pp. 47-56, 2005.

Wellman GC, Ishiguro M, Morielli AD, Tranmer BI, **Penar PL**: Oxyhemoglobin- induced suppression of K_v channels in cerebral arteries by enhanced tyrosine kinase activity and channel endocytosis. *FASEB J* 2006

Pulver-Kaste RA, Barlow CA, Bond J, Watson A, **Penar PL**, Tranmer B, Lounsbury KM: Ca^{2+} Source-dependent Transcription of CRE-containing Genes in Vascular Smooth Muscle. *Am J Physiol Heart Circ Physiol* 291:H97-105, 2006.

Ishiguro M, Morielli AD, Zvarova K, Tranmer BI, **Penar PL**, Wellman GC: Oxyhemoglobin-induced suppression of voltage-dependent K^+ channels in cerebral arteries by enhanced tyrosine kinase activity. *Circ Res* 2006 99(11):1252-60, 2006.

Ewend MG, Brem S, Gilbert M, Goodkin R, **Penar PL**, Varia M, Carey LA: Treatment of single brain metastasis with resection, intracavitary carmustine-polymer wafers, and radiation therapy is safe and provides excellent local control. *Clin Cancer Research* 15;13(12):3637-41, 2007

Stevens SA, Previte M, Lakin WD, Thakore N, **Penar PL**, Previte M, Thakore NJ, Hamschin B: Idiopathic intracranial hypertension and transverse sinus stenosis: a modeling study. *Mathematics Medicine and Biology (Math Med Biol)* 24(1):85-109, 2007

Stevens SA, Thakore NJ, Lakin WD, **Penar PL**, Tranmer BI: A Modeling Study of Idiopathic Intracranial Hypertension: etiology and diagnosis. *Neurological Research*, 2007 (in press)

Koide M, **Penar PL**, Tranmer BI, Wellman GC: Heparin-binding EGF-like growth factor mediates oxyhemoglobin-induced suppression of voltage-dependent potassium channels in rabbit cerebral artery myocytes. *Am J Physiol Heart Circ Physiol*. June 2007

In Review or Preparation

Lakin WD, Stevens SA, **Penar PL**: Modeling steady-state intracranial pressures in microgravity: The influence of the blood-brain barrier on the development of space adaptation syndrome. *Mathematical Methods in the Applied Sciences*

Stevens SA, Stimpson J, Lakin WD, Thakore NJ, **Penar PL**: A Model for Idiopathic Intracranial Hypertension and Associated Pathological ICP Wave-forms. *IEEE Transactions on Biomedical Engineering*

Khoshyomn S, **Penar PL**, Rossi J, Demattia J, Singer E, Abramson DL: ErbB-4 expression and reduced invasiveness in primary brain tumors.

Polifka AJ, Nathan DJ, **Penar PL**: Cerebral Infarction Secondary to Leptomeningeal Dissemination of Malignant Rhabdoid Glioblastoma: Case Report

Penar PL, McSherry J: Evoked Potential Guidance in Placement of a Laminotomy Lead for Cervical Cord Stimulation.

Visioni A, **Penar PL**: Iliioinguinal nerve section for entrapment neuropathy.

Editorial Comments

"Magnetic Resonance Imaging Utilization in the Managment of Central Nervous System Trauma." *J Trauma* 42 (3): 524, 1997 [Nichols JS et al, p. 520 - 523].

"Late Whiplash Syndrome: Correlation of Brain SPECT with Neuropsychological Tests and P300 Event-Related Potential." *J Trauma* 52:526, 2002 [Lorberboym M et al, p. 521-6]

"Direct costs of microsurgical management of radiosurgically amenable intracranial pathology in Germany." *Acta Neurochir (Wein)* 145:255, 2003 Apr [Wellis et al, p. 249-55]

"Linear acceleration radiosurgery in treatment of central neurocytomas." *Acta Neurochir (Wein)* 145:754, 2003 Sept. [Martin JM et al, p.749-54].

Meeting Abstracts & Presentations

Penar PL, Fischer DK, Goodrich I, *et al*: Spinal Epidural Hematomas. New England Neurosurgical Society Annual Meeting, 1986 (presentation).

Penar PL: A Model of Embolic Cerebral Ischemia in the Rat. American Association of Neurological Surgeons Annual Meeting, 1986 (poster abstract).

Penar PL & Greer CA: The Effect of Intravenous Tissue-Type Plasminogen Activator in a Rat Model of Embolic Cerebral Ischemia. American Association of Neurological Surgeons Annual Meeting, 1986 (poster abstract).

Gross CE & **Penar PL**: Spinal Synovial Cysts. New England Neurosurgical Society Annual Meeting, 1988 (presentation).

Penar PL, Fernandez L, & Tirrel S: Inhibition of Glioblastoma-induced Neovascularity in the Rat Cornea by the Angiotensin II Receptor Blocker Saralasin. American Association of Neurological Surgeons Annual Meeting, April 1990, p.480 (poster abstract).

Penar PL, Leivy SW, Pinard TS: Quantitation of Experimental Intracranial Tumor Vascularity by Computerized Image Analysis. American Association of Neurological Surgeons Annual Meeting, April 1991, p.544 (poster abstract, 3rd prize).

Penar PL, Lakin WD, Yu J: Consistent Mathematical Analysis of Compartmental Models of the Intracranial System. Congress of Neurological Surgeons Annual Meeting, October 1991 (poster abstract).

McSherry JW, **Penar PL**, Tonzola NG: Intracerebral localization: Noninvasive Techniques. American Electroencephalographic Society Annual Meeting, December 1991 (poster abstract).

Bevan RD, Dodge J, Nichols P, **Penar PL**, Walters C, Wellman T, Bevan J: Absence of Neurogenic Constrictor or Dilator Responses of Human Small Pial Arteries. Federation of American Societies for Experimental Biology 1992: A1462 (abstract)

Penar PL, Roland T: Low Dose Rate I-125 Brachytherapy for Resected Glioblastoma Multiforme. New England Neurosurgical Society Meeting, 1992 (presentation)

Bevan JA, Bevan RD, Klaasen A, **Penar PL**, Poseno T, Walters C: Myogenic (stretch-induced) and flow-regulated tone of human pial arteries. The human brain circulation: functional changes in disease. Basin Harbor Club, Vergennes, VT. October 4-7, 1992.

Penar PL, Wilson J: Surgical resection and radiation of cerebral metastases: survival and cost analysis. American Association of Neurological Surgeons Annual Meeting, April 1993 p. 467 (poster abstract).

Penar PL, Roland T: Permanent low-dose rate I-125 implants for brachytherapy of resected glioblastoma multiforme. American Association of Neurological Surgeons Annual Meeting, April 1993 p. 509 (poster abstract).

Shatos M, Orfeo T, Doherty J, **Penar P**, Collen D, Mann K: Thrombin Regulates fibrinolysis and proliferation in cultured human cerebral microvascular endothelium. American Heart Association, 1993 (abstract).

Orfeo T, Doherty J, Adey G, **Penar P**, Shatos M: Percussion trauma alters human cerebral microvascular endothelial cell nonthrombogenicity *in vitro*. American Society of Hematology Annual Meeting, 1993 (abstract). Blood 82:278a, 1993

Penar PL, Wilson JT: The Effect of AGM-1470 on the Growth of the Intracranial Gliosarcoma in the Rat. American Association of Neurological Surgeons Annual Meeting, April 1994 (poster abstract).

Penar PL, Lakin WD, Yu J: Normal pressure hydrocephalus: an analysis of etiology and response to shunting based on mathematical modeling. New England Neurosurgical Society Annual Meeting, 1994 (presentation).

Penar PL, Khoshyomn S, Bhushan A, Tritton TR: Inhibition of epidermal growth factor receptor-associated tyrosine phosphorylation blocks glioblastoma invasion of brain. New England Neurosurgical Society Annual Meeting, 1995 (presentation).

Lakin WD, Yu J, **Penar PL**: Modeling pressures and flows in the human intracranial system. 32nd Annual Meeting of the Society of Engineering Science, October 1995 (presentation).

Bhushan A, Khoshyomn S, **Penar PL**, Tritton TR. Inhibition of glioblastoma invasion by epidermal growth factor receptor tyrosine kinase inhibitors. Proc Amer Assoc Cancer Res 37:84, 1996. American Association for Cancer Research Annual Meeting Washington DC, April 20 -24, 1996 (poster abstract).

Khoshyomn S, **Penar PL**, Rossi J, Bhushan A, Tritton TR, Wells A: Inhibition of glioma invasiveness by an inhibitor of PLC gamma activation and the dominant negative PLC-gamma-1 gene fragment. Congress of Neurological Surgeons, September 1996, p. 407 (poster abstract).

Khoshyomn S, **Penar PL**, Rossi J, Bhushan A, Wells A, Tritton TR, Abramson DL: Inhibition of PLC-gamma1 Activation Blocks Glioma Cell Motility and Invasion of Fetal Rat Brain Aggregates. 14th Regional Cancer Research Symposium, Vermont Cancer Center, March 24-25, 1997, Burlington VT (poster abstract).

Rossi J, Khoshyomn S, Wells A, Tritton TR, Bhushan A, **Penar PL**: Inhibition of glioma invasiveness by Inhibition of PLC-gamma. New England Neurosurgical Society Annual Meeting, February 7, 1997 (presentation).

Penar PL, Khoshyomn S, Bhushan A, Tritton TR: Inhibition of glioma invasiveness with receptor-specific typhostins. New England Neurosurgical Society Annual Meeting, February 7, 1997 (presentation).

Bhushan A, Khoshyomn S, **Penar PL**, Rossi J, Wells A, Tritton TR, Abramson DL: Inhibition of PLC-gamma1 Activation Blocks Glioma Cell Motility and Invasion of Fetal Rat Brain Aggregates. American Association for Cancer Research Annual Meeting, April 1997 (poster abstract).

Penar PL, Khoshyomn S, Demattia J, Abramson DL, Rossi J: The Potential Significance of ErbB-4 Expression in Primary Brain Tumors. American Association of Neurological Surgeons Annual Meeting, April 1999 (poster abstract).

Wellman GC, Perez GJ, Jaggar JH, **Penar PL**, Nelson MT: Ca²⁺ sparks activate large conductance Ca²⁺-activated K⁺ (BK) channels in human cerebral arterial myocytes. Society of Experimental Biology FASEB J. 14(4):A576, 2000.

Ewend MG, Brem S, Gilbert M, Goodkin R, **Penar PL**: Safety of Treating Brain Metastases with Surgery, BCNU-Polymer Wafers and Radiation Therapy: Phase I-II Trial. Society for Neurooncology Meeting, Chicago IL, November, 2000.

Khoshyomn S, **Penar PL**, Lew SM, Wald SL, Manske GC: Synergistic Action of Genistein and Cisplatin on Growth Inhibition and Cytotoxicity of Human Medulloblastomas. 29th Annual Meeting of Section on Pediatric Neurological Surgery of the AANS/CNS; San Diego, California, December 6-9, 2000

Khoshyomn S, **Penar PL**, Nagle K, Braff SP: Surviving A Penetrating Non-missile Brainstem Injury: The Story of a Modern Day Phineas Gage. New England Neurosurgical Society, Manchester Village, Vermont; March 2, 2001.

Ewend MG, Brem S, Gilbert M, Goodkin R, and **Penar PL**: Treating Single Brain Metastasis with Resection, Placement of BCNU-Polymer Wafers, and Radiation Therapy. The American Association of Neurological Surgeons, April, 2001, Toronto, Canada.

Ewend MG, Brem S, Gilbert M, Goodkin R, **Penar PL**: The Treatment of single brain metastasis with surgery, BCNU-polymer wafers, and radiation therapy: results of Phase I-II Trial. ASCO 37th annual meeting, May 12-15, 2001, San Francisco CA.

Khoshyomn S, **Penar PL**, Nagle K, Braff SP: "Surviving A Penetrating Brainstem Injury: The Story of a Modern-Day "Phineas Gage", Congress of Neurological Surgeons Annual Meeting, San Diego, CA Sept 29 - Oct 4, 2001.

Khoshyomn S, Manske, G, Nathan D, **Penar PL**: Synergistic action of genistein and BCNU on growth inhibition of gliomas. Pediatric Section, AANS, New York City, November 28-30, 2001.

DeMattia JA, Khoshyomn S, Manske G, **Penar PL**: Tyrphostin AG17 [(3,5-Di-tert-butyl-4-hydroxybenzylidene)-malononitrile] inhibits invasion of malignant glioma cells *in vitro*. American Association of Neurological Surgeons Annual Meeting, April 2002, Chicago.

Stevens SA, Thakore NJ, Lakin WD, **Penar PL**, Tranmer BI: A modeling study of idiopathic intracranial hypertension. The 3rd Annual Neural Hydrodynamics Symposium 2005. The University Plaza Hotel & Conference Center, Columbus, Ohio, May 12 - 14, 2005

Stevens SA, Lakin WD, **Penar PL**: Modeling Steady-State Intracranial Pressures in Microgravity. In ICNAAM 2005 proceedings, International Conference on Numerical Analysis and Applied Mathematics 2005 (Rhodes, Greece, September 2005). Published in Simos TE, Psihoyios G, Tsitouras Ch (Eds). WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim, Germany. (2005) pp 502-505

Stevens SA, Lakin WD (presenter), Thakore NJ, **Penar PL**, Tranmer BI: A modeling study of idiopathic intracranial hypertension. Sixth International Conference on Biomedicine 2005, Modelling in Medicine and Biology, Bologna, Italy. September 2005. Published in Modelling in Medicine and Biology VI, Ursino M et al, eds., WIT Press, Southampton, UK (2005), pp. 47-56.

Penar PL, Stevens SA, Tranmer BI, Lakin WD, Thakore NJ: A Modeling Study of Intracranial Hypertension. Congress of Neurological Surgeons Annual Meeting, Boston, MA, October 2005 (electronic poster).

Penar PL, McSherry J: Evoked Potential Guidance in Placement of a Laminotomy Lead for Cervical Cord Stimulation. Congress of Neurological Surgeons Annual Meeting, Boston, MA, October 2005 (oral presentation).

Invited Presentations

"Cryptococcal Mass Lesions," Neuroscience Grand Rounds, University of Illinois College of Medicine at Peoria, 9-11-87.

"Etiology of Brain Tumors," Neuroscience Grand Rounds, University of Illinois College of Medicine at Peoria, 2-26-88.

"Intracranial Pressure-Volume Relationships," Surgery Grand Rounds, University of Illinois College of Medicine at Peoria, 5-20-88.

"Etiology of Brain Tumors," Neuroscience Grand Rounds, University of Vermont College of Medicine, 09-15-88.

"Tumor Angiogenesis," Neuroscience Grand Rounds, University of Vermont College of Medicine, 05-18-89.

"Tumor Angiogenesis," Surgery Research Conference, University of Vermont College of Medicine, 05-01-89.

"Functional Brain Anatomy and Lesions", Physical Therapy Department, Medical Center Hospital of Vermont, 8/2/89.

"Current Treatment of Malignant Brain Tumors", Neuroscience Grand Rounds, University of Vermont College of Medicine, 1/4/90.

"Intracranial Pressure-Volume Relationships", Neuroscience Grand Rounds, University of Vermont College of Medicine, 9/27/90.

"Current Treatment of Malignant Brain Tumors", Surgical Grand Rounds, University of Vermont College of Medicine, 3/15/90.

"Tumor Angiogenesis", Vermont Center for Vascular Research Symposium, University of Vermont College of Medicine, 4/25/90.

"Iodoantipyrine blood flow techniques," Surgery Research Conference, University of Vermont College of Medicine, 7/19/90.

"Intracranial Pressure-Volume Relationships," Neuroscience Grand Rounds, University of Vermont College of Medicine, 9/27/90.

"Tumor Angiogenesis," Vermont Regional Cancer Center Seminar, 12/17/90.

"Tumor Angiogenesis," Surgery Grand Rounds, University of Vermont College of Medicine, 1/10/91.

"Von Hippel Lindau Syndrome", Surgery Grand Rounds, University of Vermont College of Medicine, 2/7/91.

"Introduction to Image Analysis", Surgery Research Conference, University of Vermont College of Medicine, 11/14/91.

"Cerebral Mass Lesions and ICP Monitoring", Critical Care Service, University of Vermont College of Medicine, 12/16/91.

"Tour of Optimas Image Analyzer," Surgery Research Conference, University of Vermont College of Medicine, 1/9/92.

"Permanent Low-Dose I¹²⁵ Brachytherapy for Resected Glioblastoma Multiforme," Neuroscience Grand Rounds , University of Vermont College of Medicine, 2/13/92.

"Current Management of Metastatic Disease of the Brain and Spine," University of Vermont Department of Surgery CME Series "Update for General Practice: Neurological Disorders"; 7/8/92.

"Current Treatment of Malignant Brain Tumors", Medical Staff Rounds, Rutland Regional Medical Center, Rutland, VT, 3/2/93.

"Brain Tumor Resection: Anatomy, Techniques, and Results", Neuroscience Grand Rounds, University of Vermont College of Medicine, 4/22/93.

"Treatment of Brain and Spine Metastasis", Medical Staff Rounds, Northeast Vermont Regional Hospital, St. Johnsbury, VT, 5/13/93.

"Brain Tumor Resection - Anatomy, Techniques, and Results", Surgery Grand Rounds, University of Vermont College of Medicine, 9/2/93.

"Treatment of Metastatic Brain Tumors", Neuroscience Grand Rounds, University of Vermont College of Medicine, 9/9/93.

"Current Treatment of Malignant Primary Brain Tumors", Physicians Staff Rounds, Central Vermont Medical Center, Barre, VT; 2/4/94

"Current Treatment of Metastatic Disease of the Brain and Spine," Physicians Staff Rounds, Central Vermont Medical Center, Barre, VT; 3/3/94 .

"Mathematical Modeling of Intracranial Dynamics," Neuroscience Grand Rounds, University of Vermont College of Medicine, 10/20/94.

"Cost and Outcome Analysis in the Neurosciences," Neuroscience Grand Rounds, University of Vermont College of Medicine, 12/21/95.

"Cost and Outcome Analysis in Medicine," Medical Grand Rounds, University of Vermont College of Medicine, 3/1/96.

"Management of the Postop Brain," Surgical ICU conference , University of Vermont College of Medicine, 3/11/96.

"The Role of EGF Receptor in Glioblastoma Invasion of Brain," Pharmacology Research Seminar, Department of Pharmacology, University of Vermont College of Medicine, 3/21/96.

"Cost and Outcome Analysis in Medicine," Medical Staff Grand Rounds, Champlain Valley Physicians Hospital Medical Center, Plattsburgh, NY, 5/31/96.

"Medical Cost and Outcome Analysis: Treatment of Metastatic Brain Tumors," Surgery Grand Rounds, University of Vermont College of Medicine, 11/14/96.

"Effective Inhibition of Glioblastoma Brain Invasion," Neuroscience Grand Rounds, University of Massachusetts Medical Center (Worcester, MA); Visiting Professor, 12/10/96.

"The IACUC Review Process", Surgery Research Conference, University of Vermont College of Medicine, 12/19/96.

"Effective Inhibition of Glioblastoma Invasion: Update of Laboratory Studies," Neuroscience Grand Rounds, University of Vermont College of Medicine, 1/16/97.

"Modulation of Glioma Cell Invasion of Brain," Anatomy and Neurobiology Department Seminar, University of Vermont College of Medicine, 1/24/97.

"Skull Base Tumors Presenting With Tongue Atrophy," Neuroscience Grand Rounds, University of Vermont College of Medicine, 3/6/97.

"Effective Inhibition of Glioblastoma Invasion: Update of Laboratory Studies," Surgery Research Conference, University of Vermont College of Medicine, 3/20/97.

"Effective Inhibition of Glioblastoma Invasion of Brain," Surgery Grand Rounds, University of Vermont College of Medicine, 4/3/97.

"The History of Surgical Treatment of Parkinson's Disease Symptoms," Parkinson's Awareness Day, Radisson Hotel, Burlington, VT; invited speaker sponsored by UVM Department of Neurology and Green Mountain Parkinson's Disease Support Group; 9/12/97.

"The Andy Fund and Brain Tumor Research," The Annual Andy Fund Dinner, guest of honor & invited speaker, The Swift House Inn, Middlebury, VT; 11/06/97.

"Surgical Treatment of Parkinson's Disease Symptoms," Neuroscience Grand Rounds, University of Vermont College of Medicine, 2/5/98

"Across the Fence" WPTZ television show featured guest, 3/2/98.

"The Role of Growth Factors in Glioma Invasion of Fetal Rat Brain Aggregates," Vermont Cancer Center, Translational Research Minisymposium on Brain Tumors; co-chair; 4/2/98.

"Spinal Epidural Abscess," Neuroscience Grand Rounds, University of Vermont College of Medicine, 12/3/98

"Update on Research Sponsored by The Andy Fund," The Annual Andy Fund Dinner, invited speaker, The Swift House Inn, Middlebury, VT; 12/3/98.

"Signal Transduction in Neoplasia," Surgical Residents Basic Science Course, University of Vermont College of Medicine, 2/4/99.

"Pituitary Tumor Surgery," Endocrinology and Metabolism Conference, University of Vermont College of Medicine, 4/30/99.

"Glioblastoma Research," The Annual Andy Fund Dinner, invited speaker, The Swift House Inn, Middlebury, VT; 11/4/99

"Surgery for Parkinson's Disease Symptoms," Parkinson's Awareness Day, Clarion Hotel, South Burlington, VT; invited speaker sponsored by UVM Department of Neurology and Green Mountain Parkinson's Disease Support Group; 09/26/00

"Vagal Nerve Stimulation for Epilepsy," Sheraton Hotel, South Burlington, VT; 09/27/00

"New Developments in Brain Tumor Treatment," The Annual Andy Fund Dinner, The Swift House Inn, Middlebury, VT; 10/25/00

"Radiosurgery," Neuroscience Grand Rounds, University of Vermont College of Medicine, 2/22/01

"Vagal Nerve Stimulation for Epilepsy - Surgical Implantation Procedure," Vagus Nerve Stimulation Symposium and Workshop, Stowe/Flake Resort, Stowe, VT; 2/24/01

"Prognosis and Pathophysiology of Primary and Metastatic Brain Tumors", Senior Major Pathophysiology Course, University of Vermont College of Medicine, 3/19/01

"The Oral Presentation", Surgery Research Conference, University of Vermont College of Medicine, 4/5/01

"Radiosurgery," Surgery Grand Rounds, University of Vermont College of Medicine, 5/25/01

"Radiosurgery," Fletcher Allen Health Care, Nursing Education, 6/21/01

"Management of Head Injury and Spinal Cord Injury," Acute Care Aspects of Patients with Neurological Problems, University of Vermont College of Medicine, 8/16/01

"Radiosurgery", Vermont Cancer Center Grand Rounds, 11/06/01

"The Oral Presentation", Surgery Research Conference, University of Vermont College of Medicine, 11/29/01

"Cortical Heterotopia, A Tale of Two Seizures," Neuroscience Grand Rounds, University of Vermont College of Medicine (with Dr. Keith Nagle), 12/20/01

"Head Injury," Student Interest Group in Neuroscience (SIGN), UVM Medical School, 10/24/2002

"Head Injury", Vermont Emergency Nurses Association, Hampton Inn, Colchester, VT; 11/08/2002

"Prognosis and Pathophysiology of Primary and Metastatic Brain Tumors", Senior Major Pathophysiology Course, University of Vermont College of Medicine, 3/25/02

"Management of Head Injury and Spinal Cord Compression," Acute Care Aspects of Patients with Neurological Problems, University of Vermont College of Medicine Department of Neurology, 08/22/2002

"Medical and Scientific Presentation", Surgery Research Conference, University of Vermont College of Medicine, 02/14/2003.

"Prognosis and Pathophysiology of Primary and Metastatic Brain Tumors", Senior Major Pathophysiology Course, University of Vermont College of Medicine, 3/14/2003.

"Medical Cost and Outcome Analysis," Gifford Medical Center, Randolph, VT; 03/28/2003.

"Surgery for Parkinson's Disease Symptoms - History and Update," Gifford Medical Center, Randolph, VT; 09/05/2003

"Surgical Treatment of Parkinson's Disease Symptoms" in Basic Science of Neurological Diseases, Univ of Vermont Anatomy & Neurobiology Department, 09/25/2003

"Role of Resection in Primary Malignant Brain Tumors", Neurosurgery faculty & resident staff seminar, 10/2/2003.

"Role of Surgery and Radiosurgery in Treatment of Metastatic Brain Tumors", Neurosurgery faculty & resident staff seminar, 03/11/2004.

"Noncontroversies in Epilepsy Surgery", presentation and discussion of basics of epilepsy surgery; Neurosurgery faculty & resident staff seminar, 06/24/2004.

"Prognosis and Pathophysiology of Primary and Metastatic Brain Tumors", Senior Major Pathophysiology Course, University of Vermont College of Medicine, 3/19/2004.

"Tumor & Seizure" case discussion (with Dr. Keith Nagle), medical school class, approximately 50 students, 4/27/05

"Treatment of Solitary Brain Metastasis," (with Susan Burdette-Radoux MD and Thomas Roland MD), Vermont Cancer Center Grand Rounds, 25 people, 9-6-2005

"Surgical Treatment of Parkinson's Disease Symptoms," Central Vermont Medical Center Grand Rounds, 12 attendees, 11/17/05

"Tumor & Seizure" case discussion (with Dr. Keith Nagle), first year medical school class, approximately 50 students, 4/24/06

Teaching Presentations

Introduction to Brain Tumors
Prognosis and Pathophysiology of Primary and Metastatic Brain Tumors
Treatment of Metastatic Brain Tumors
Surgery for Pituitary Tumors
Introduction to Head Injury
Management of Head Injury (ATLS)
Management of Spine Injury (ATLS)
Headache, Intracranial Hypertension and Mass Lesions
Functional Brain Anatomy and Lesions
Brain and Spinal Metastatic Disease
Spinal Epidural Hematoma
Spinal Cord Compression
Cerebrovascular Disease
Spinal Cord Anatomy
Anatomy of the Hypothalamus
Cerebral Cortex Anatomy
Introduction to Image Analysis

Clinical Interests

Neuro-Oncology and Radiosurgery
Stereotaxis and Functional Neurosurgery

Research Interests

Mechanisms of malignant brain tumor infiltration; the role of growth factor receptor and tyrosine kinases; pharmacologic inhibition of infiltration.

Development of a computerized mathematical model of intracranial physiology and pathophysiology, in collaboration with Dr. William Lakin, Department of Mathematics.

Previous:

Surgery with Gliadel and radiation for operable CNS metastasis, Rhône-Poulenc Rorer Pharmaceuticals Inc. (center PI, 3/98 - 2000).

Clinical trial of the Picker Viewpoint™ intra-operative imaging localization system for Neurosurgery (center PI, 1995-1996)