Medical College of Georgia
Neuroscience Outlook
Department of Neurosurgery Newsletter
Volume 4, Issue 2 - Winter 2008

Inside This Issue

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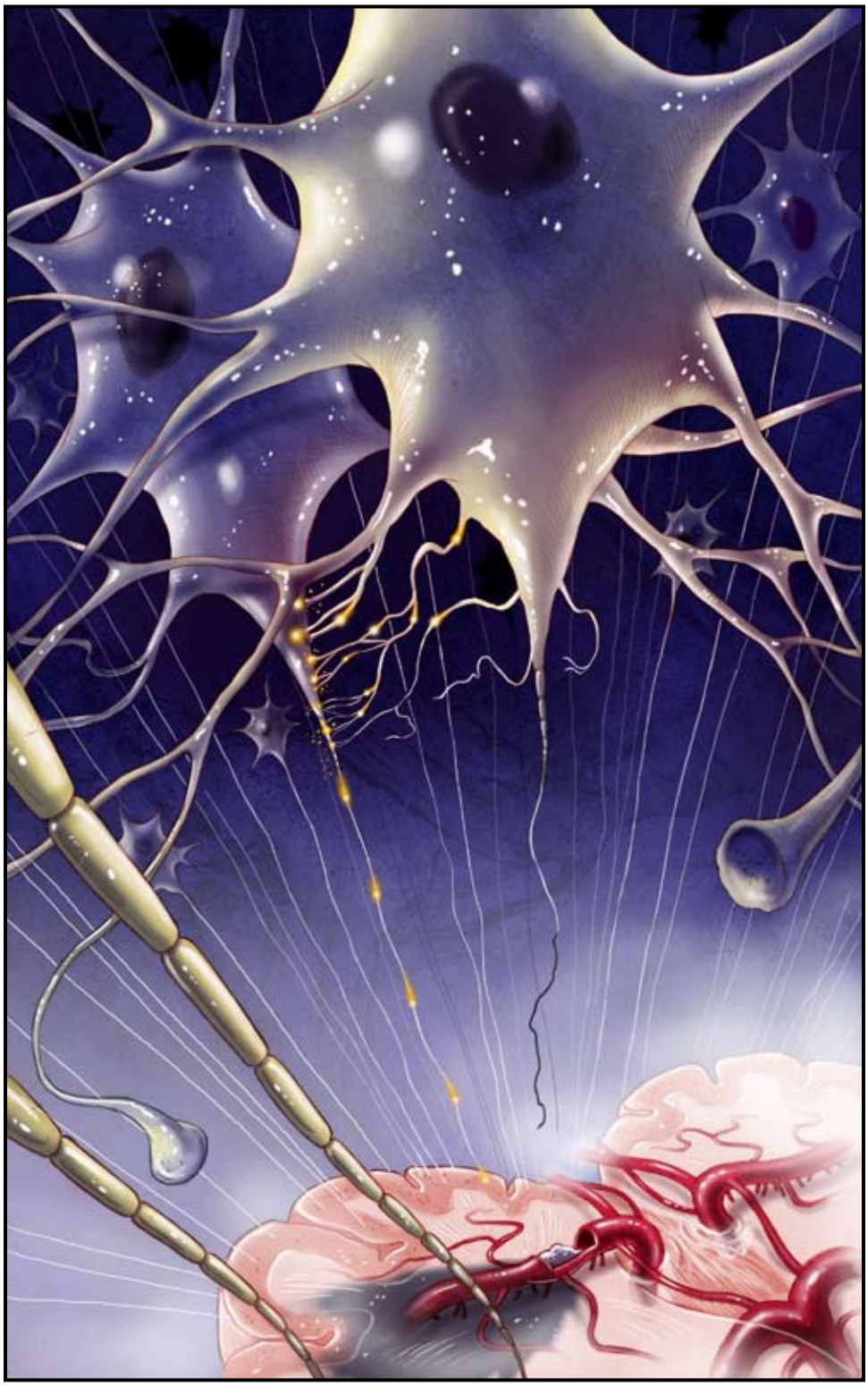
Neuroscience Center



Research Spotlight: ***Tools of Neuroscience Research: Imaging and Modeling***

Chair's Message

Welcome to the Winter 2008 issue of our departmental newletter Neuroscience Outlook. In this issue we focus on some of the modern tools we are utilizing in the field of neuroscience research in the **Synapse lab**, the **Cerebrovascular lab**, and the **Human Brain lab**. These include a variety of imaging techniques in live animal models, specimens, and individual cells. These techniques and others to be elucidated in upcoming issues of the Outlook, will be critically important in our quest to advance translational research.

Since our last issue, we have had some notable events such as our departmental retreat. This served to bring all the clinicians, researchers, physician extenders and key nursing staff together for a day to assess our progress as a department and to plan for the future. Also in this issue, we highlight notable achievements by our faculty and we chronicle the academic productivity of the department over the past 6 months.

Lastly, we are thankful for the varied donations and funding received. As funding and reimbursement from the typical sources continue to shrink, the charitable donations from individuals and organizations take on a much greater importance. We invite alumni and other well-wishers to make a tax-deductible donation to the Neurosurgery Foundation, the Neurosurgery Resident Education Fund, the Neurosurgery Book Fund or the Marshall Allen Lectureship Endowment at the Medical College of Georgia. A self addressed envelope is conveniently provided. We hope you enjoy this issue.

Cargill H. Alleyne, Jr., M.D.
Associate Professor and Allen Distinguished Chair
Director, Cerebrovascular Service
Residency Program Director
Department of Neurosurgery

Faculty Update

Accomplishments and Recognition

John Vender, M.D.

John R. Vender, M.D. served as President of the Georgia Neurosurgical Society at the Fall Meeting of the Georgia Neurosurgical Society in Atlanta, GA in November 2007.

Dion Macomson, M.D.

S. Dion Macomson, M.D., was named the Assistant Residency Program Director for the Department of Neurosurgery. Dr. Macomson will assist Dr. Alleyne in his duties as Program Director.

Haroon Choudhri, M.D.

Haroon F. Choudhri, M.D. was the Program Chair for the Fall Meeting of the Georgia Neurosurgical Society in Atlanta, GA in November 2007. Dr. Choudhri was also Visiting Professor at King Fahd Hospital, in Jeddah, Saudi Arabia and at the Saudi National Guard Hospital in King Khalid Medical City, Saudi Arabia, in September 2007.

Haroon Choudhri, M.D.

Cargill H. Alleyne. Jr., M.D. was officially honored at the inaugural Chair Investiture ceremony during which Dr. Norman Chutkan of Orthopedic surgery and Dr. Ana Murphy of Obstetrics and Gynecology were also honored. Dr. Alleyne was also a guest examiner at the Neurosurgical Oral Board Examinations in Houston, Texas from November 6th to 9th, 2007. Additionally, Dr. Alleyne was a member of the Scientific Program Committee of the Congress of Neurological Surgeons in San Diego, CA in October 2007.

Michael Jensen, M.S.

Michael A. Jensen, M.S. passed the written portion of the Certified Medical Illustrators examination in November 2007. This examination represents the highest recognition of competence in the field of medical illustration. It tests broad knowledge of science, anatomy and medical conditions and also tests terminology, competency in complex drawing problems, and mastery of ethics and business practices. We congratulate Mike on this impressive achievement.

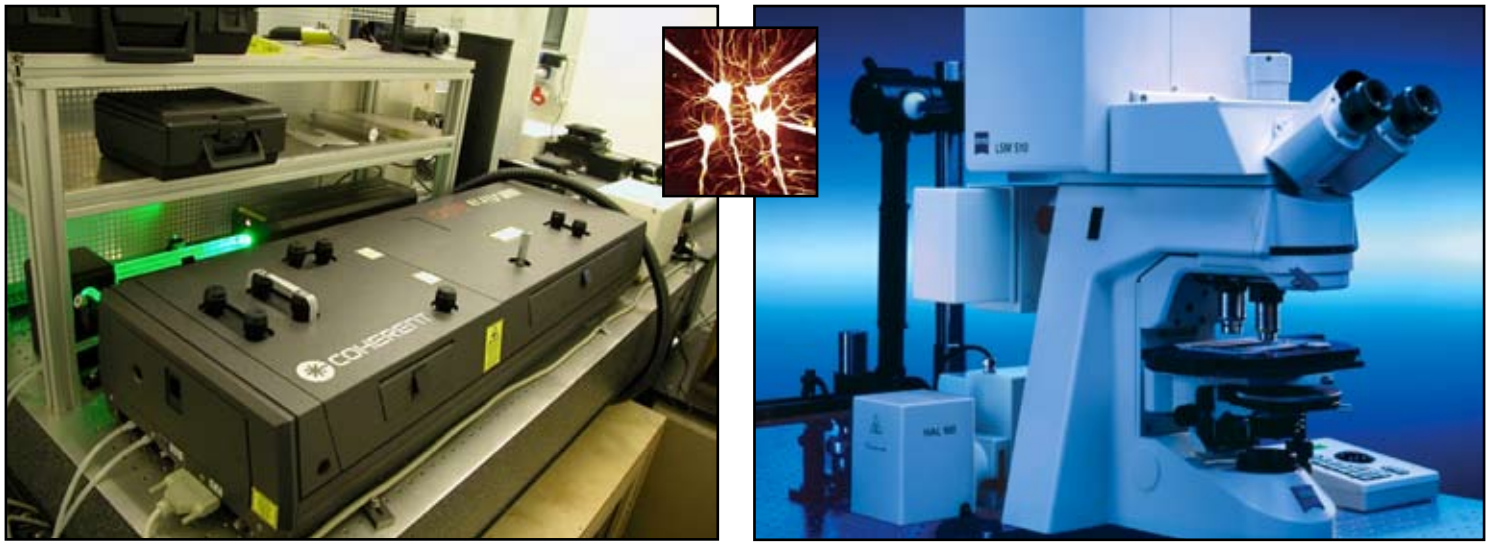
Joseph R. Smith, M.D.

Joseph R. Smith, M.D. was Visiting Professor at the Department of Neurosurgery of University of Wisconsin, Madison, WI, from October 9th to12th, 2007.

Research Spotlight

Tools of Neuroscience Research: Cellular Imaging

Many technological developments during the last two decades have revolutionized the light microscopy techniques, making it possible to visualize the fine structure of the nervous tissue under physiological and pathological conditions. The combination of cutting edge imaging techniques such as 2-photon laser scanning microscopy (2PLSM) with the most advanced electrophysiological techniques such as the whole-cell patch clamp recordings permits focusing on the fundamental mechanisms of the



cellular plasticity in the brain with unprecedented detail. Three-dimensional 2PLSM imaging in the midst of the highly scattered brain tissue preserves temporal and spatial characteristics on the micron scale providing a resolution unparalleled in other live-imaging laboratory techniques. In this respect the quantitative 2PLSM data are radically different from the descriptive data generated by single time point histological and electron microscopy studies and have advantages over the data generated by imaging studies of cultured cells grown in a dish. Here we provide some examples of a quantitative imaging methodology that we use for studying the cellular dynamics of the neurovascular unit (which include neurons, astrocytes and blood vessels) as well as “the tripartite synapse” (which include dendrites axons and astrocytes) under normal and pathological conditions such as stroke, traumatic brain injury and epilepsy.

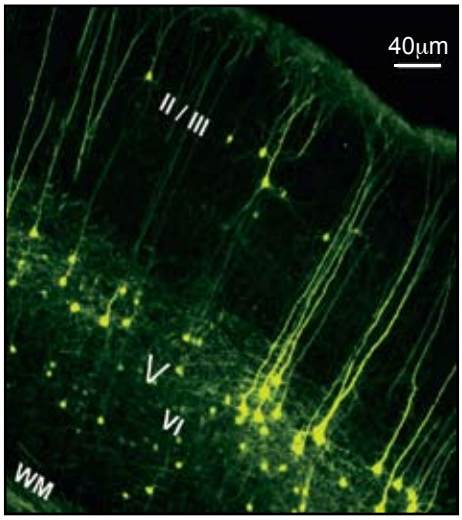


Figure 1a

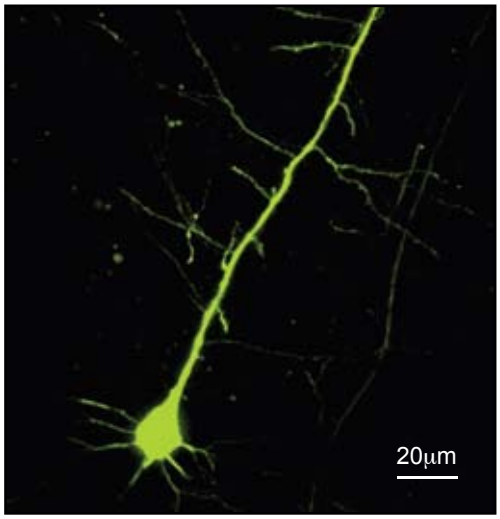


Figure 1b

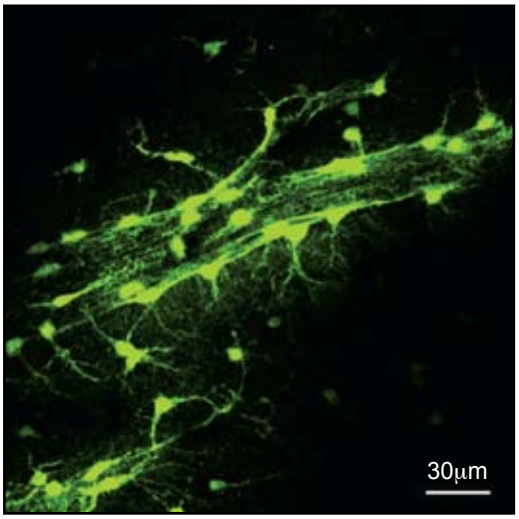


Figure 1c

Imaging *in vitro*

Brain slices are one of the most important *in vitro* model systems for studying brain function. Slices are made by quickly cutting live brain tissue to 350-500 μm thickness. In recent years the wide availability of transgenic mice expressing fluorescent proteins of different colors in a subset of neurons and glia greatly facilitated live imaging with 2PLSM (Fig. 1a,b,c). Brain slices contain fully- arborized neurons that can be imaged deep to the cut surface where the native tissue architecture and cellular milieu is preserved. Brain slices permit rapid alteration of the bathing media, discrete stimulation of synaptic pathways and resolution of single living neurons (Fig. 1b) and astrocytes (Fig. 1c). They also provide an experimental model to test potentially useful therapeutics because the preparation lacks the blood-brain barrier that must be bypassed *in vivo* for drug delivery to injured CNS. In experi-

Research Spotlight *(continued)*

ments involving brain tissue from non-fluorescent transgenic animals or human tissue fluorescent dye can be loaded using a patch pipette (Figure 2a, b, c).

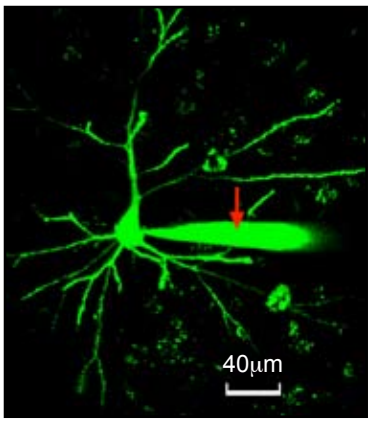


Figure 2a

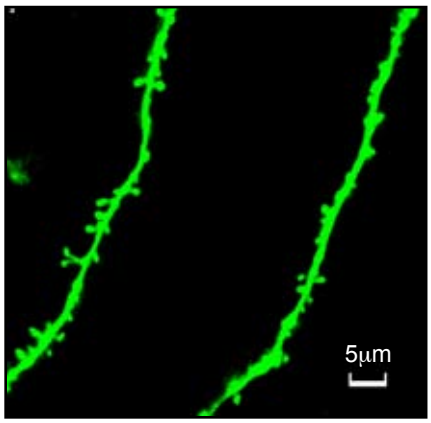


Figure 2b

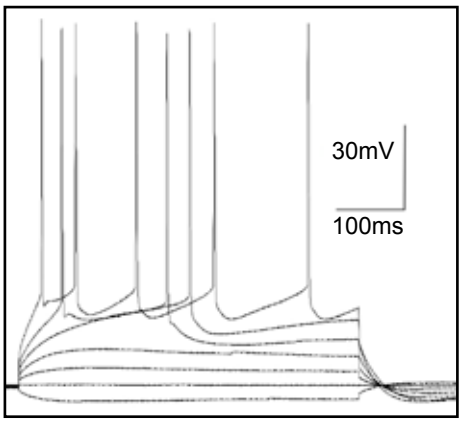


Figure 2c

Imaging *in vivo*

The benefits of 2PLSM are numerous, and one advantage of this methodology is deep tissue submicron non-contact and non-invasive imaging. When combined with the inherent high temporal, spatial and three-dimensional resolution, it makes 2PLSM the technique of choice for *in vivo* acute and long-term imaging through a cranial window. Simultaneous imaging of neurons, astrocytes and blood vessels (Figures 3, 4) permits studies that were impossible just few years ago. The use of this methodology will quickly add to our knowledge of stroke and trauma associated neuronal (Figures 5a, b) and astroglial injury. *In vivo* imaging with 2PLSM will help to understand how brain cells are damaged, how they recover and ways to aid their recovery. This technology should greatly facilitate discovery of therapeutic targets to treat pathological outcomes of brain injury.

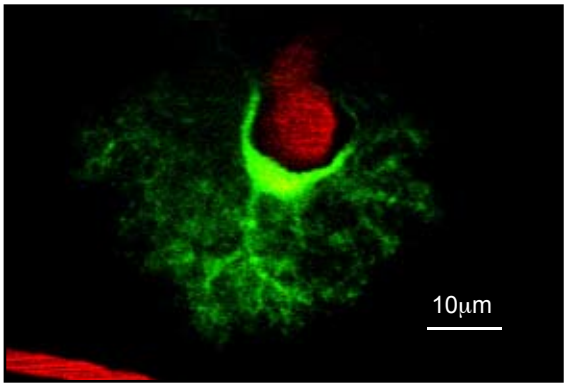


Figure 3

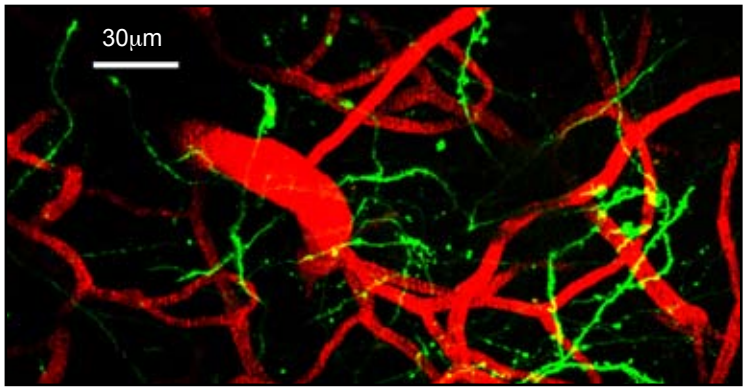


Figure 4

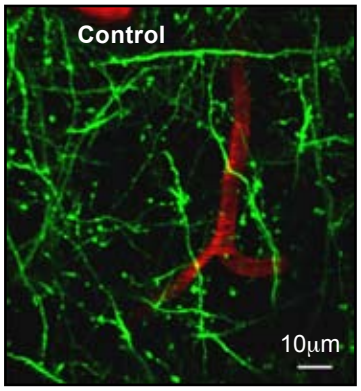


Figure 5a

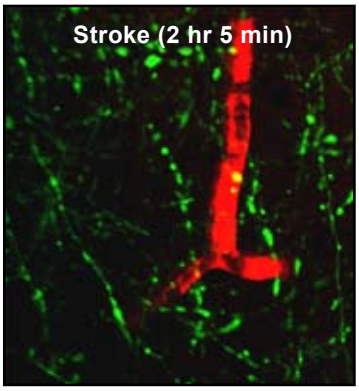


Figure 5b

Tools of Neuroscience Research: Live Animal Imaging

The 7 Tesla animal MRI unit.

The Small Animal Imaging Facility at MCG is a self-contained lab for conducting MRI and optical imaging research, capable of supporting murine and rodent clinical models as well as basic methodological imaging research. The facility is directed by Dr. Tom Hu, who has an established track record in the use of molecular and cellular MR contrast agents to investigate cardiovascular related disease area(s). Other personnel working closely with Dr. Hu include Dr. Nathan Yanasak, who has experience in clinical and murine brain imaging, two graduate students who are pursuing cardiac studies, and three staff members who have expertise in performing small animal cardiac surgery and optical image. The facility consists of several resources:

1) **A Bruker BioSpec 7 Tesla MRI machine** in a fully-shielded room, with detection coils and other apparatus for performing 1H, 31P, and 13C MR imaging and spectroscopy on mice and rats.
2) **A Xenogen optical system**, for imaging various fluorescent and biolumi-

Research Spotlight *(continued)*

nescent agents/models relevant in small animal diseases.
3) **Two surgical benches**, for performing small animal surgery with or without intubation. These benches are equipped with high-quality surgical microscopes and video recording equipment.
4) **Multiple anesthetic-delivery systems and hardware for monitoring and recording vital signs** such as ECG, CO2 level, and respiratory signals, during imaging or surgery.

Tools of Neuroscience Research: Tissue Modeling

Figure 6a

Figure 6b

Subarachnoid hemorrhage model

Ventral side of the mouse brain following sham surgery (left) or subarachnoid hemorrhage (right). We use this model to study the molecular and cellular sequelae of SAH to better understand the disease process and to identify novel therapeutics which may be used to treat patients in the future.

Brain injury model

Immunofluorescent image of (Figure 7) glial fibrillary acidic protein (GFAP), a specific marker for astrocytes, in the mouse cerebral cortex following brain injury. By 24 hours post-injury, astrocytes appear damaged (see rounded cells). An improved understanding of the role of astrocytes following neurological injuries may provide novel therapeutic targets.

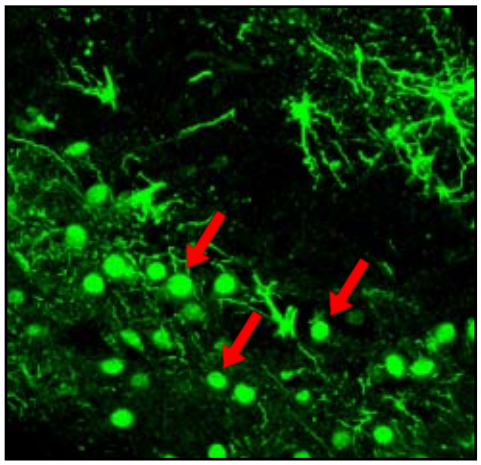


Figure 7

Brain tumor model

Detection of membrane damage in human glioblastoma cells following treatment with a novel therapeutic compound. Control cells (Figure 8a) shown no accumulation of propidium iodide whereas low (8b) and high (8c) concentrations show a progressive accumulation of dye (see red color).

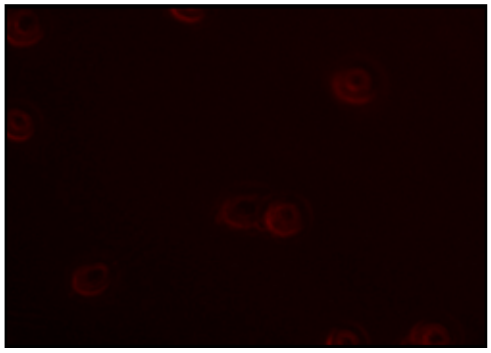


Figure 8a

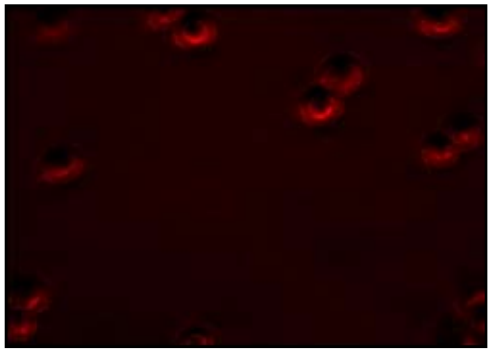


Figure 8b

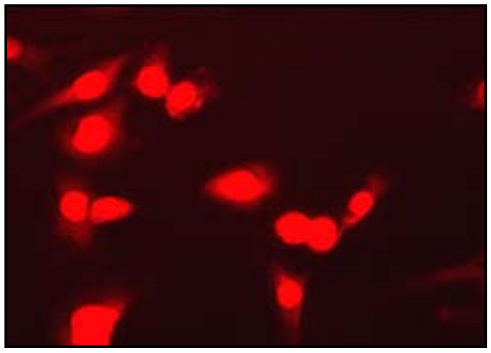


Figure 8c

Vascular injury model

The hemoglobin oxidation product, hemin, induces cell death in cerebral microvessel cells. This cell culture model (Figures 9a, b) in utilized to better understand the molecular pathogenesis of vascular injury following a brain hemorrhage.

Sergei A. Kirov, Ph.D. and
Krishnan Dhandapani, Ph.D.

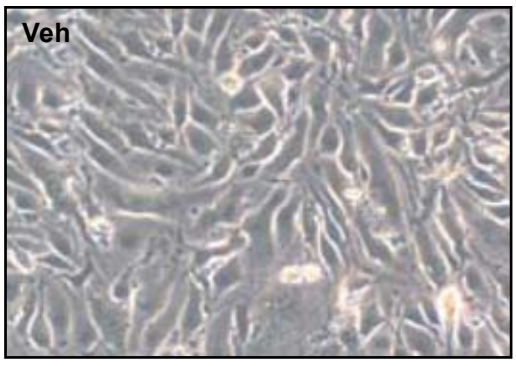


Figure 9a

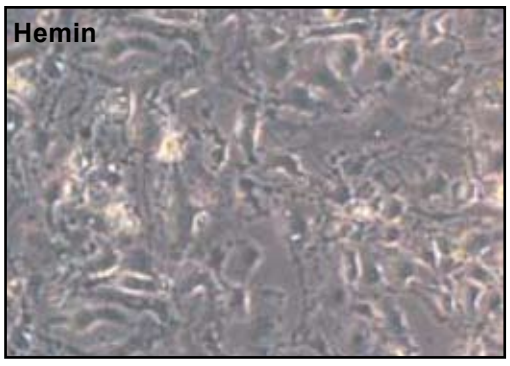


Figure 9b

To learn more more about the MCG Human Brain Laboratory, please visit: **www.mcg.edu/som/neurosurgery/research.htm**

Department News

Department of Neurosurgery conducts retreat

On October 5th, 2007 the Neurosurgery Department held its first retreat. This took place at the MCG Alumni Center in Augusta. The event was well attended and well received, and provided an opportunity for us to take stock of our five-year history as a full Department and to plan for the future. The Dean of the Medical School, Dr. Doug Miller was present to give some remarks. The full program is detailed here:

Neurosurgery Retreat Program:

10:00-10:20 am	**Overall vision for Department** – *Cargill Alleyne, Jr., M.D.*
10:20-10:40 am	**Head injury and pain program** – *John Vender, M.D.*
10:40-11:00 am	**Residency program** – *Dion Macomson, M.D./Cargill Alleyne, Jr., M.D.*
11:00-11:20 am	**Spine program** – *Haroon Choudhri, M.D.*
11:20-11:40 am	**Neurovascular program**– *Cargill Alleyne, Jr., M.D.*
11:40-11:50 am	**Neuropathology: an update and perspectives** – *Suash Sharma, M.D.*
11:50-12:00 pm	**Surgical research service** – *Mary Anne Park, MSN, CCNC*
12:00-1:00pm	Lunch
1:00-1:15 pm	Dean's Remarks *Doug Miller, M.D.*
1:15-1:40 pm	**Synapse and Human Brain Lab** – *Sergei Kirov, Ph.D.*
1:40-2:05 pm	**Neurovascular lab** – *Krishnan Dhandapani, Ph.D.*
2:05-2:20 pm	**Neurooncology research** – *John Vender, M.D.*
2:20-2:30 pm	**Patient and family-centered care initiative** – *Bernard Roberson, M.S.*
2:30-2:40 pm	**International opportunities** – *Cargill Alleyne, Jr., M.D.*
2:40-2:55 pm	**Office of Technology Transfer** – *Charles Nawrot, Ph.D.*
2:55-3:00 pm	Conclusion

Departments of Neurology and Neurosurgery hold holiday party

Our annual Neurology and Neurosurgery Holiday party was held on December 14, 2007 at the Clubhouse in Augusta, Georgia. A good time was had by all!

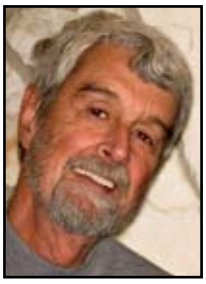
Electric slide, anyone?

Mary Ann Turner and Amy Watkins sing a duet

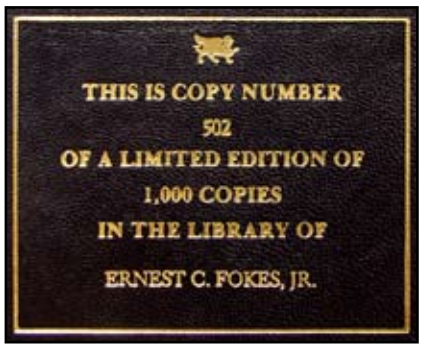
Karen Shellito does the Egyptian

Contributor acknowledgement

Dr. Fokes, 1967



Dr. Fokes, 2008



We are honored to accept a donation of several dozen books in the Classics of Neurology and Neurosurgery series by **Ernest C. Fokes, M.D.** a graduate of the Neurosurgical program in 1969. These books are one of a kind, part of the limited edition of 1000 copies and carry a considerable historical value. These include classic texts such as *The Pituitary Body*, by Harvey Cushing; *The Brain*, by Walter Dandy; *Anatomy of the Brain and Nerves*, by Thomas Willis; *Injuries of Nerves*, by S. Weir Mitchell; *Harvey Cushing*, by John Fulton; *Pathology of Cerebral Hemorrhage,* by Charles Bouchard and texts by many other luminaries such as Sherrington, Cajal, Gowers, Macewen, Mayo, Osler, Head and others. We're deeply grateful to Dr. Fokes.

We also thank the following companies and individuals for their kind monetary donations:

Crosslink Orthopedics, LLC, for an educational grant that helped to defray publication costs of the previous issue of the Neuroscience Outlook.
Cyberonics, for a donation toward the retirement party for **Dr. Joseph Smith** which took place last July 2007.
Susanne Touchtone, an MCG employee, for her monthly contributions to the Neursurgery foundation.

Residents' and Fellows' Corner

Spine Fellowship update

Synthes Spine has generously supported the educational mission of our Department by providing an educational grant to fund the Complex spine fellowship directed by **Dr. Haroon Choudhri**. This gift will ensure the continued viability of this fellowship.

Presentations and Publications (January 2008 - June 2008)

Presentations

Choudhri H: Indications for Revision of Spinal Instrumentation. Egyptian Neurosurgical Society, Ras Sudr, Egypt, July 2007

Choudhri H: Treatment Strategies for Cervical Kyphotic Deformity. Egyptian Neurosurgical Society, Ras Sudr, Egypt, July 2007

Choudhri H: Thoracic Spine Instrumentation: 90 Consecutive Cases with Vertical Distraction Cages. Ras Sudr, Egypt, Egyptian Neurosurgical Society, July 2007

Choudhri H: How to Develop Spine Training Programs (Panelist). Egyptian Neurosurgical Society, Ras Sudr, Egypt, July 2007

Choudhri H: How to Develop Spine Research Programs (Panelist). Egyptian Neurosurgical Society, Ras Sudr, Egypt, July 2007

Kirov SA: Rapid synaptic and astroglial structural plasticity in mature hippocampus. Keio University, Tokyo, Japan, July 2007

Andrew RD and **Kirov SA**: Two-photon microscopy reveals real-time volume responses by astrocytes to osmotic and ischemic stress in cortical brain slices. Fifth International Conference of Aquaporin, Nara, Japan, July 2007

Kirov SA: Real-time neuronal and astroglial dynamics during osmotic stress and simulated stroke. Nagoya City University. Nagoya, Japan, July 2007

Kirov SA: Two-photon microscopical imaging of neurons and glia during osmotic stress and simulated stroke. Neuroscience Seminar Series, Riken Brain Science Institute, Tokyo, Japan, July 2007

Collins G, Marshall R , Roberson B, Williams J: Sustaining Patient and Family Centered Care Philosophy. The 3rd International Conference on Patient- and Family-Centered Care. Seattle, WA, August 2007

Kirov SA, Risher WC, Ard DA, Andrew RD: Real-time imaging of single neurons and astrocytes during osmotic and ischemic stress. The International Symposium on Topical Problems of Biophotonics, Nizhniy Novgorod-Moscow, Russia, August 2007

Alleyne CH, Wakade C, Laird MD, Dhandapani KM: Curcumin reduces the development of cerebral vasospasm following subarachnoid hemorrhage in mice. Congress of Neurological Surgeons Annual Meeting, San Diego, CA, September 2007

Choudhri H: Complex Spine Surgery Part 1: Revision Spine Surgery. King Fahd Hospital, Jeddah, Saudi Arabia, September 2007

Choudhri H: Complex Spine Surgery Part 2: Management of Iatrogenic Cervical Deformity. King Fahd Hospital, Jeddah, Saudi Arabia, September, 2007

Choudhri H: Spinal Instrumentation. Saudi National Guard Hospital, King Khalid Medical City, Saudi Arabia, September 2007

Choudhri H: Indications for Revision of Spinal Instrumentation, Pan Arab Spine Society, Tunis, Tunisia, October 2007

Kirov SA: Two-photon microscopical imaging of single neurons and glia deep in cortex during ischemia. The 28th Annual Southeastern Pharmacology Society Meeting, Augusta, GA, October 2007

Risher WC, **Lee MR**, Andrew RD, Hess DC, **Kirov SA**: Dibucaine potently inhibits anoxic depolarization in human neocortical slices exposed to ischemic conditions. The 28th Annual Southeastern Pharmacology Society Meeting, Augusta, GA, October 2007

Smith JR: Closed-Loop Stimulation in the Treatment of Focal Epilepsy. University of Wisconsin, Neurosurgery Grand Rounds, Madison, WI, October, 2007

Alleyne CH: Vascular access. Fundamental Critical Care Support Course (Instructor), Medical College of Georgia, November 2007

Choudhri H: Surgical Management of Patients with Iatrogenic Kyphotic Deformity: Indications and Options for Surgery. Georgia Neurosurgical Society, November 2007

Khan MM, Dhandapani KM, De Sevilla LM, Brann DW: Estrogen-induced synaptic plasticity in the cerebral cortex: a focus on the excitatory vs. Inhibitory synapse formation and estrogen signaling. Society for Neuroscience Meeting, San Diego, CA, November 2007

Risher WR, Lee MR, Andrew RD, Hess DC, **Kirov SA:** Dibucaine inhibits propagating depolarizations in human neocortical slices during simulated ischemia, The 37th Society for Neuroscience Annual Meeting, San Diego, CA, November 2007

Laird MD, Dhandapani KM: Curcumin reduces aquaporin-4 expression and cerebral edema following traumatic brain injury in mice. Society for Neuroscience Meeting, San Diego, CA, November 2007

Shakir A, Rahimi S, Alleyne CH: Brainstem compression from kissing vertebral arteries: Case report and review of the literature. Georgia Neurosurgical Society Meeting, Atlanta, GA, November 2007

Tuttle J, Brown J, **Alleyne CH:** Paraganglioma of the cauda equina: Case report and review of the literature. Georgia Neurosurgical Society Meeting, Atlanta, GA, November 2007

Witcher MR, Park YD, Lee MR, Harris KM, **Kirov SA:** Larger synapses are associated with astrocytic apposition in the epileptic human hippocampus. The 61st American Epilepsy Society Meeting, Philadelphia, PA 2007. December 2007

Publications

Davies ML, **Kirov SA**, Andrew RD: Whole isolated neocortical and hippocampal preparations and their use in imaging studies. J Neurosci Methods 166:203-216. [Epub ahead of print]

Hewett SJ, **Dhandapani KM**, Uliasz T, Pilbeam CA, Hewett JA: The transcription factor Sp1 regulates constitutive neuronal cyclooxygenase-2 expression. J Neurochem 102 (Suppl 1): 233, 2007

Fountas KN, **Smith JR:** Historical evolution of stereotactic amygdalotomy for the management of severe aggression. J Neurosurg 106 (4); 710 – 713, 2007.

Fountas KN, **Smith JR:** Subdural Electrode-Associated Complications: A 20 -year Experience. Stereotact Funct Neurosurg 85; 264 – 272, 2007.

Fountas KN, Kapsalaki E, **Smith JR:** Focal cortical dysplasia. Part I. Pathogenesis, histopathological characteristics, and epileptogenicity. Contemporary Neurosurgery 29(22), 2007

Fountas KN, Kapsalaki E, **Smith JR:** Focal cortical dysplasia. Part II. Surgical management and outcome. Contemporary Neurosurgery 29(23), 2007

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Neuroscience Outlook

To learn more about the MCG Department of Neurosurgery, please visit:
www.mcg.edu/som/neurosurgery

Conference Schedule *(February 2008 - July 2008)*

All grand rounds and conferences take place on Friday in the 3 West amphitheater.

Feb 01	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Grand Rounds: Dr. Hemant Yagnick	
Feb 08	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Feb 15	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Radiology Review	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Feb 22	9:00 - 10:00	Neuropathology	
	10:00 - 11:00	Radiology Review	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	M&M	
Feb 29	NO CONFERENCE		
Mar 07	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	TBD	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Mar 14	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Neuro 101: Dr. Cargill Alleyne	*"Carotid Disease"*
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Mar 21	9:00 - 10:00	Neuropathology: Dr. Sharma	
	10:00 - 11:00	Radiology Review	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Mar 28	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Patrick Youssef	*"Vertebral/Basilar Disease"*
	12:00 - 1:00	M&M	
Apr 04	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	TBD	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Apr 11	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	TBD	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Apr 18	9:00 - 10:00	Neuropathology: Dr. Sharma	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Apr 25	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Scott Rahimi	*"Arteriovenous Malformations"*
	12:00 - 1:00	M&M	
May 02	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
May 09	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Jonathan Tuttle	*"Spinal Cord Tumors"*
	12:00 - 1:00	Case Conference	
May 16	9:00 - 10:00	Neuropathology: Dr. Sharma	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
May 23	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Ahmed Shakir	*"Occipital, C1, C2 Trauma"*
	12:00 - 1:00	M&M	
May 30	NO CONFERENCE		
Jun 06	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Jun 13	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Hamid Shah	*"Phakomatoses"*
	12:00 - 1:00	Case Conference	
Jun 20	9:00 - 10:00	Neuropathology: Dr. Sharma	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
Jun 27	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Neuro 101: Dr. Douglas Hughes	*"Facial Pain"*
	12:00 - 1:00	M&M	
July 4	NO CONFERENCE		
July 11	9:00 - 10:00	Radiology Review	
	10:00 - 11:00	Neuro 101: Dr. John Vender	*"Pain and Spasticity"*
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
July 18	9:00 - 10:00	Journal Club	
	10:00 - 11:00	Radiology Review	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	Case Conference	
July 25			
	9:00 - 10:00	Neuro 101: Dr. Dion Macomson	*"Spinal Biomechanics"*
	10:00 - 11:00	Spine Conference	
	11:00 - 12:00	Anatomy	
	12:00 - 1:00	M&M	

Upcoming Meetings *(January 2008 - June 2008)*

Southern Neurosurgical Society
2/6-9, Las Croabas, PR

AANS/CNS Section on Cerebrovascular Surgery
2/18-19, New Orleans, LA

International Stroke Conference
2/20-22, New Orleans, LA

AANS/CNS Section on Disorders of the Spine & Peripheral Nerves
2/27-3/1, Orlando, FL

American Association of Neurological Surgeons
4/26-5/1, Chicago, IL

Society of Neurological Surgeons
5/18-20, Madison, WI

Georgia Neurosurgical Society
5/23-25, Sea Island, GA

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