

THE AMERICAN ACADEMY OF  
NEUROLOGICAL SURGERY



THE RITZ CARLTON  
NAPLES, FLORIDA



**THE 54TH ANNUAL MEETING OF**

**THE**

**AMERICAN ACADEMY OF**

**NEUROLOGICAL SURGERY**

**RITZ CARLTON**

**NAPLES, FLORIDA**

**OCTOBER 21 - 25, 1992**

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**THE AMERICAN ACADEMY OF  
NEUROLOGICAL SURGERY**

**October 21 - 25, 1992**

**Ritz Carlton  
Naples, Florida**

**Wednesday, October 21, 1992**

- 1:00 - 5:00 PM      Registration  
Plaza Foyer**
- Executive Committee Meeting  
Doctor Henry D. Garretson's  
Suite**
- 6:00 - 8:30 PM      Welcoming Reception  
Center Court  
Alternate: Salon III & IV**
- "WELCOME TO FLORIDA"**

**Thursday, October 22, 1992**

- 7:00 - 8:00 AM      Breakfast Business Meeting  
(members only)  
Salon I**
- 8:00 - 5:00 PM      Registration  
Plaza Foyer**
- 8:00 - 10:20 AM     Scientific Meeting  
Plaza Ballroom**
- 10:20 - 10:40 AM    Coffee Break  
Plaza Foyer**

10:40 - 1:00 PM      **Scientific Meeting**  
                         **Plaza Ballroom**

                         1:30 P M      **Golf Tournament**  
                         **Audubon Golf Club**  
                         **(transportation provided)**  
                         **John Van Gilder-Coordinator**

7:00 - 9:30 PM      **Beach Party**  
                         **North Beach**  
                         **Alternate: Salon III & IV**

**Friday, October 23, 1992**

7:00 - 8:00 AM      **Breakfast Business Meeting**  
                         **(members only)**  
                         **Salon I**

8:00 - 5:00 PM      **Registration**

8:00 - 10:10 AM      **Scientific Meeting**  
                         **Plaza Ballroom**

10:10 -10:30 AM      **Coffee Break**  
                         **Plaza Foyer**

10:30 - 1:00 PM      **Scientific Meeting**  
                         **Plaza Ballroom**

4:00 - 6:00 PM      **Tennis Tournament**  
                         **Tennis Center**

6:30 - 7:30 PM      **Reception**  
                         **(Invitation only)**  
                         **Doctor Garretson's Suite**

7:00 - 8:00 PM      Reception  
Ballroom Foyer

8:00 - 11:00 PM     Dinner Dance  
Salon III & IV

**Saturday, October 24, 1992**

7:00 - 8:00 AM      Breakfast Business Meeting  
(members only)  
Salon I

8:00 - 10:20 AM     Scientific Meeting  
Plaza Ballroom

10:20 - 10:40 AM    Coffee Break  
Plaza Foyer

10:40 - 1:00 PM     Scientific Meeting  
Plaza Ballroom

**Sunday, October 25, 1992**

Travel Day



## **CONTINUING MEDICAL EDUCATION**

### **THE STATEMENT ON CERTIFICATION:**

**The Joint Committee on Education of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons designates this continuing medical education activity for (13) credit hours in Category 1 toward the Continuing Education Award in Neurosurgery and the Physician's Recognition Award of the American Medical Association. The Joint Committee on Education of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons is accredited by the Accreditation Council for Continuing Medical Education to sponsor continuing medical education for physicians.**

**GUEST ACTIVITIES**

**Wednesday, October 21, 1992**

**6:00 - 8:00 PM Welcoming Reception  
Center Court  
Alternate: Salon III & IV  
"WELCOME TO FLORIDA"**

**Thursday, October 22, 1992**

**8:00 - 9:30 AM Guest's  
Continental Breakfast  
The Grill**

**9:30 AM Walking Tour of the  
Ritz Carlton Art  
Collection**

**1:30 PM Golf Tournament  
John Van Gilder - Coordinator  
Audobon Golf Club  
Transportation Provided**

**7:00 - 9:30 PM Beach Party  
North Beach  
Alternate: Salon III & IV**

**Friday, October 23, 1992**

- |                        |  |
|------------------------|--|
| <b>8:00 - 9:30 AM</b>  | <b>Guest's<br/>Continental Breakfast<br/>The Grill</b>                             |
| <b>9:30 - 10:00AM</b>  | <b>Naples Area Presentation<br/>The Grill</b>                                      |
| <b>4:00 - 6:00 PM</b>  | <b>Tennis Tournament<br/>Tennis Center<br/>Susan and John Tew<br/>Coordinators</b> |
| <b>7:00 - 8:00 PM</b>  | <b>Reception<br/>Ballroom Foyer</b>  |
| <b>8:00 - 11:00 PM</b> | <b>Dinner Dance<br/>Salon III &amp; IV</b>   |

**Saturday, October 24, 1992**

- |                       |  |
|-----------------------|--|
| <b>8:00 - 9:30 AM</b> | <b>Guest's<br/>Continental Breakfast<br/>The Grill</b> |
|-----------------------|--|

**SCIENTIFIC PROGRAM**

**Thursday, October 22, 1992**

**8:00 AM WELCOME: Henry D. Garretson, President**

**MODERATOR: CHARLES J. HODGE, JR.**

**8:10 AM NEW INSIGHTS INTO THE VASCULATURE OF  
THE NORMAL AND TRAUMATIZED SPINAL  
CORD**

**Charles H. Tator**

**8:30 AM EXPERIMENTAL COMPRESSIVE CERVICAL  
MYELOPATHY**

**Ossama Al-Mefty**

**8:50-10:20 AM SYMPOSIUM: DEGENERATIVE  
LUMBAR DISEASE**

**8:50 - 9:08 AM LUMBAR DEGENERATIVE DISEASE:  
PATHOLOGY IMAGING  
Frederick Simeone**

**9:08 - 9:26 AM LUMBAR STENOSIS AND AVOIDANCE  
OF HEAVY METAL POISONING  
John Jane**

**9:26 - 9:43 AM INDICATIONS AND TECHNIQUES FOR  
LUMBAR INSTRUMENTATION  
Sanford Larson**

**9:43 -10:01 AM THE FAILED BACK: ARE WE DOING  
TOO MANY LUMBAR  
PROCEDURES?  
Donlin Long**

Thursday, October 22, 1992

10:01-10:19 AM WHAT TO DO WHEN NOTHING WORKS  
Burton M. Onofrio

10:20 AM COFFEE BREAK

MODERATOR: BURTON M. ONOFRIO

10:40 AM SURGICAL EXPERIENCE IN THE  
MANAGEMENT OF HIGH  
CERVICAL INTRAMEDULLARY SPINAL  
CORD TUMORS  
Bennett M. Stein

11:00 AM NEUROLOGICAL OUTCOME OF ZINC  
SUPPLEMENTED HEAD INJURY  
PATIENTS  
Byron Young

11:20 AM PALLIDOTOMY FOR PARKINSON'S  
DISEASE  
Lauri Laitinen

11:40 AM PARTIAL SENSORY RHIZOTOMY FOR  
TRIGEMINAL NEURALGIA  
Jacob Young

12:00 PM LESSONS IN HUMAN PAIN  
PERCEPTION FROM THALAMIC  
EXPLORATION FOR DBS IN STROKE-  
INDUCED PAIN  
Ronald R. Tasker

12:20 PM PRESIDENTIAL ADDRESS  
HENRY D. GARRETSON  
INTRODUCTION: BURTON M. ONOFRIO

Friday, October 23, 1992

MODERATOR: PETER BLACK

- 8:00 AM - 1:00 PM SYMPOSIUM:  
NEUROSURGERY AND THE NEW  
BIOLOGY
- 8:00 - 8:15 AM INTRODUCTORY REMARKS  
PETER BLACK
- 8:15 - 8:45 AM MOLECULAR BIOLOGICAL MECHANICS  
IN NEURAL REGENERATION  
Larry Benowitz
- 8:45 - 9:00 AM THE EFFECT OF CILIARY  
NEUTROTROPHIC FACTOR (CNTF) ON  
NEURITE OUTGROWTH FROM SPINAL  
CORD NEURONS: IMPLICATIONS FOR  
AXONAL REGENERATION  
Nelson M. Oyesiku *ACADEMY AWARD -  
HONORABLE MENTION*
- 9:00 - 9:25 AM CONCEPTS OF MOLECULAR GENETICS  
AND BIOLOGICAL FACTORS  
IN THE COMPREHENSION AND  
TREATMENT OF C.N.S. NEOPLASIA  
Robert L. Martuza
- 9:25 - 9:40 AM CHROMOSOME LOSS DURING HUMAN  
ASTROCYTOMA PROGRESSION  
Dan Fulls
- 9:40 - 9:55 AM EXPANDED SPECTRUM OF VIRAL  
THERAPY IN TREATMENT OF  
NERVOUS SYSTEM TUMORS  
James Markert *ACADEMY AWARD-  
HONORABLE MENTION*

Friday, October 23, 1992

- 9:55 -10:10 AM DEVELOPMENT OF MONOCLONAL ANTIBODIES FOR GLIOMA THERAPY  
David Eng *ACADEMY AWARD - RUNNER UP*
- 10:10 AM COFFEE BREAK
- 10:30-10:55 AM MOLECULAR ANALYSIS AND PRINCIPLES OF NEURAL PROTECTION  
Julian T. Hoff
- 10:55-11:20 AM MOLECULAR BIOLOGY OF THE CEREBROVASCULAR WALL  
Ralph G. Dacey
- 11:20-11:35 AM NITRIC OXIDE MEDIATES CHEMOREGULATION AND AUTOREGULATION OF CEREBRAL BLOOD FLOW IN PRIMATES  
B.Gregory Thompson *ACADEMY AWARD - HONORABLE MENTION*
- 11:35-12:10 PM SYNAPTIC PLASTICITY: PHOTBLEACHING RECOVERY IN LIVING ANIMALS DEMONSTRATES POSTSYNAPTIC RECEPTOR MOVEMENT  
Adam P. Brown *ACADEMY AWARD - WINNER*

**Friday, October 23, 1992**

**12:10-12:30 PM FUTURE PROSPECTUS OF INFLUENCE  
OF MOLECULAR BIOLOGY ON  
NEUROSURGICAL PRACTICE  
Charles J. Hodge, Jr.**

**12:30- 1:00 PM PANEL**                      **Larry Benowitz  
Robert Martuza  
Julian T. Hoff  
Ralph G. Dacey  
Charles J. Hodge**

**Saturday, October 24, 1992**

**MODERATOR: HENRY D. GARRETSON**

**8:00 AM                      FACTORS THAT PREDICT SUCCESS OR  
COMPLICATIONS AFTER  
STEREOTACTIC RADIOSURGERY FOR  
BRAIN ARTERIOVENOUS  
MALFORMATIONS  
L. Dade Lunsford**

**8:20 AM                      PETROSAL DURAL AVM's  
Roberto C. Heros**

**8:40 AM                      THE SCOPE AND LIMITATIONS OF  
SURGERY THROUGH THE MOUTH  
H. Alan Crockard**

**9:00 AM                      MECHANISM OF CEREBRAL VASCULAR  
'STEAL' PHENOMENON DURING  
HYPERCARBIA  
C.M. Loftus**



**Saturday, October 24, 1992**

- 9:20 AM HYPOTHERMIA: MECHANISM OF ITS PROTECTION IN CNS ISCHEMIA  
Joung Lee**
- 9:40 AM VESTIBULAR NEUROTOMY FOR MENIERE'S DISEASE: OUTCOME PREDICTORS  
Richard Foltz**
- 10:00 AM SPONTANEOUS TEMPORAL ENCEPHALOCELE: A REVIEW OF FIVE TYPES  
Robert Wilkins**
- 10:20 AM COFFEE BREAK**
- MODERATOR: GEORGE A. OJEMANN**
- 10:40 AM NORMAL CONUS POSITION TETHERED SPINAL CORD  
J.A. Winfield**
- 11:00 AM CYTOKINE PRODUCTION IN THE PITUITARY GLAND  
Stanley Martin**
- 11:20 AM IMPROVEMENT IN PITUITARY FUNCTION AFTER TRANS-SPHENOIDAL REMOVAL OF LARGE ADENOMAS  
Warren Selman**

**Saturday, October 24, 1992**

- 11:40 AM            TRANSIENT HYPONATREMIA AFTER  
                         PITUITARY SURGERY:  
                         POSSIBLE SECOND PHASE  
                         Paul Nelson**
- 12:00-1:00    PM   SYMPOSIUM: NEUROSURGICAL  
                         ASPECTS OF CORTICAL  
                         LANGUAGE LOCALIZATION**
- 12:00-12:15    PM CORTICAL LANGUAGE LOCALIZATION  
                         BY STIMULATION MAPPING, OPTICAL  
                         IMAGING AND NEURONAL RECORDING  
                         George A. Ojemann**
- 12:15-12:30    PM CORTICAL LANGUAGE LOCALIZATION  
                         IN GLIOMA RESECTIONS  
                         Mitchel Berger**
- 12:30-12:45    PM CORTICAL LANGUAGE LOCALIZATION  
                         IN AVM RESECTIONS  
                         Henry D. Garretson**
- 12:45- 1:00    PM DISCUSSION**

**PROGRAM OBJECTIVES FOR THE AMERICAN ACADEMY OF  
NEUROLOGICAL SURGERY**

- 1. Discuss the indications for surgical therapy, particularly instrumentation in degenerative lumbar spine disease.**
- 2. Describe findings from molecular biology that are germane to aspects of neurosurgery including neurogeneration, growth of brain tumors, neuroprotection and structure of cerebral blood vessels.**
- 3. Indicate the value of cerebral cortical language localization techniques in neurosurgical management, particularly of gliomas and arteriovenous malformations.**

Thursday, October 22, 1992

8:10 AM

**New Insights Into the Vasculature of the Normal and Traumatized Spinal Cord**

Charles H. Tator, Izumi Koyanagi, David Anthes, Elizabeth Theriault  
Toronto Canada

Spinal cord trauma profoundly effects the vasculature of the spinal cord. Intramedullary hemorrhage and ischemia are major components, and have been implicated in the etiology of the secondary effects of trauma. Our group has used two new methods as well as transmission electron microscopy for examining the vasculature of the normal and traumatized rat spinal cord. The first method is silicone angiography produced by injecting colored silicone rubber into the vasculature which is then viewed three-dimensionally in tissues cleared by methylsalicylate. The second method is corrosion cast angiography produced by injecting a polyester resin into the vasculature followed by corrosion of the tissues with sodium hypochlorite and viewing by scanning electron microscopy.

In the normal rat the anterior sulcal arteries supply the anterior two-thirds of the spinal cord including both white and gray matter. Contrary to the classical view, there is no so-called "pial plexus" for supplying the peripheral white matter. The venous drainage of the dorsal cord was partly through longitudinal veins coursing at the grey-white junction at the dorsal median septum. In addition to major loss of the capillary microcirculation, trauma caused marked changes in the sulcal arterial system and longitudinal veins. The sulcal system was the origin of some of the post-traumatic hemorrhages, but more importantly showed progressive obliteration and narrowing, and played a major role in producing post-traumatic ischemia. The longitudinal veins were the origin of many of the hemorrhages at the site of injury, and for the majority of the remote hemorrhages rostrally and caudally. The microvasculature showed evidence of stasis, and occlusion.

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These studies revealed several new anatomical features of the arterial supply and venous drainage of the normal rat spinal cord, and showed the anatomical substrate for previously recognized post-traumatic vascular changes, especially hemorrhage and ischemia.

8:30 AM

**Experimental Compressive Cervical Myelopathy**

Ossama Al-Mefty      Maywood IL

A wealth of clinical and laboratory studies have led to some understanding of the pathophysiology of cervical spondylotic myelopathy but they have also raised a host of questions. No satisfactory animal model of chronic spinal cord compression without intentional vascular compromise outside of the spinal canal has been previously devised which can adequately address these questions. The authors present a dog model which simulates chronic spinal cord injury seen in cervical spondylosis and results in a delayed progressive myelopathy. This model allows for controlled compression, ongoing neurological assessment, diagnostic imaging, frequent electrophysiologic testing, local blood flow measurement, and post mortem histologic examination.

Fourteen dogs were treated with subclinical cervical cord compression utilizing a posterior teflon washer and anterior teflon screw to produce a 35% canal stenosis while four dogs underwent sham operations. The animals were followed for 18 months and then sacrificed. Evidence of myelopathy was produced in 12 dogs and tended to appear, on average, 7 months after initial compression. Clinical, radiologic, and histopathologic correlates will be presented.

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Spinal cord blood flow studies using the hydrogen clearance method showed significant transient increase in spinal blood flow immediately after compression. Somatosensory evoked potential studies paralleled clinical deterioration. MRI studies revealed intramedullary cavitation depicted in 6 dogs. Histological studies showed cavitation of cord at compression level, loss of anterior horn cells and vessel enlargement at and immediately adjacent to the compressed area, and lack of significant glial infiltration or scarring. Staining for degenerated fibers revealed sparse amounts of axonal debris in animals with long term compression.

**8:50-10:20 AM SYMPOSIUM:  
DEGENERATIVE LUMBAR DISEASE**

**8:50 - 9:08 AM LUMBAR DEGENERATIVE DISEASE:  
PATHOLOGY IMAGING**

Frederick Simeone Philadelphia PA

**9:08 - 9:26 AM LUMBAR STENOSIS AND AVOIDANCE  
OF HEAVY METAL POISONING**

John Jane Charlottesville VA

**9:26 - 9:43 AM INDICATIONS AND TECHNIQUES  
FOR LUMBAR INSTRUMENTATION**

Sanford Larson Milwaukee WI

**9:43 -10:01 AM THE FAILED BACK: ARE WE DOING  
TOO MANY LUMBAR PROCEDURES?**

Donlin Long Baltimore MD

**10:01-10:19 AM WHAT TO DO WHEN NOTHING WORKS**

Burton M. Onofrio Rochester MN

**10:20 AM COFFEE BREAK**

Thursday, October 22, 1992

10:40 AM

**Surgical Experience in the Management of High Cervical Intramedullary Spinal Cord Tumors**

Bennett M. Stein, Paul C. McCormick New York NY

Ten patients with mixed pathology (mostly ependymoma) tumors located in the high cervical and cervical medullary junction are used for an evaluation of the MRI features and the surgical techniques as well as results.

These tumors represent special cases since they involve respiratory centers and obviously all of the spinal cord function below this level. Many of the tumors were extremely large when evaluated and operated.

Special considerations were given to respiratory control both during the operation and afterwards and evoked potential studies were used but not found to be overly useful in many of the cases.

The surgical results appear to justify an aggressive approach to these tumors even though large and located in treacherous area of the nervous system.

11:00 AM

**Neurological Outcome of Zinc Supplemented Head Injury Patients**

Byron Young Lexington KY

Patients with severe head injury have hypozincemia and increased urinary zinc loss. We have suggested these patients have an increased requirement for zinc. Zinc may be important in neural reorganization and may decrease secondary neural damage. Zinc supplementation or standard therapy (placebo) was given from hospitalization until 3 months post injury to 68 patients with severe head injury in a prospective randomized controlled trial. The groups were not significantly different in admission Glasgow

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Coma Scale Score (GCS), the Dementia Rating Scale (DRS), and a neurological battery. At 15 days post injury, the zinc patients (Z) had improved GCS scores compared to placebo control patients (P) ( $F(1,27) = 3.9; p < 0.001$ ). At 3 months post-hospitalization, those patients who were testable, yet too impaired to complete a full neuropsychological battery, were administered the DRS. (Z) patients ( $n = 6$ ) were compared to (P) controls ( $n = 4$ ) on the DRS. The (Z) patients exhibited higher scores on the DRS (mean Attention score: (Z) =  $34.5 \pm 3.02$  (P) =  $26.75 \pm 9.03$ ,  $p=0.04$ ; mean Concept score: (Z) =  $30.83 \pm 2.48$  (P) =  $22.25 \pm 1.18$ ,  $p=0.03$ ) even though patients were comparable at study entry (GCS: (Z) =  $7.170.90$ ; (P) =  $6.75 \pm 0.43$ ). The GOS scores tended to be more favorable (Good Recovery, Moderate Disability) in the (Z) group at 3 months and 1 year post injury. (3 months (Z) = 51% (P) = 35%; 1 year (Z) = 70% (P) = 51%). At one year post injury mortality rate was 15% in the (Z) group and 26% in the (P) group. No significant differences were observed at 1 year between groups of patients given the neuropsychological battery at 1 year post injury and twelve percent were lost to follow-up. We conclude that zinc supplementation appears to improve short term neurological outcome. Further studies are required to assess its possible beneficial effects on mortality and cost of hospital stay/rehabilitation.

11:20 AM

#### **Pallidotomy for Parkinson's Disease**

Lauri V. Laitinen, Stockholm, Sweden

Laboratory evidence in the early 1980's suggested that dopamine-deficiency in the putamen leads to an increased inhibitory action on the medial pallidum where a release of all parkinsonian symptoms were thought to take place. Therefore, it was tempting to interrupt some striopallidal pathways in the ventroposterolateral (VPL) pallidum between the putamen and the medial pallidum.



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Patients and Methods: From 1985 to June 1992, I performed VPL pallidotomies on 117 parkinsonian patients who suffered from drug-resistant bradykinesia, rigidity, tremor, and L-dopa induced dyskinesias. The pallidotomy was unilateral in 110 and bilateral in 7 patients. Several patients had previously had thalamotomy on one side and pallidotomy was done on the other side.

Results: All patients tolerated the surgery well and left the hospital within 1-2 days postoperatively. The optimal pallidal target lay 2 mm anterior to the midcommissural point, 6 mm below the intercommissural line, and 21 (female) to 22 mm (male) lateral to the midline. At the clinical follow-up study 1-88 months later, a good or fair result was recorded in 95% of the patients. Pallidotomy had a good effect on all parkinsonian symptoms and on the L-dopa induced dyskinesias. The gait, the balance and the speech volume also showed good improvement. The effect seemed to be long lasting. Pallidotomy increased the psychomotor speed and precision. Stroop's Color Word Test also indicated that some cognitive functions had improved. Complications were observed in 12 patients (10%). Ten had a permanent partial homonymous scotoma in the central lower field. One of them also had a transient dysphasia and facial weakness. One patient had a minor stroke with transitory hemiparesis one week after surgery.

Conclusions: This study shows that all parkinsonian symptoms (tremor, rigor, bradykinesia and L-dopa induced choreoathetosis) can be effectively abolished by VPL pallidotomy. Left thalamotomy may still have place in the treatment of resting tremor without marked hypokinesia. A combination of thalamotomy on one side and pallidotomy on the other side may be a good solution for some patients.

11 40 AM

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**Partial Sensory Rhizotomy For Trigeminal Neuralgia**

Jacob N. Young, Robert H. Wilkins Durham, NC

In the treatment of trigeminal neuralgia, our first choice of open procedures is microvascular decompression (MVD). However, in approximately 25% of cases, MVD cannot be done, either because no vascular compression is found at surgery, or because a patient's vascular anatomy prohibits the safe performance of MVD. Partial sensory rhizotomy (PSR) has been our alternative in these instances. The outcome after PSR was reviewed retrospectively in 83 patients with an average follow-up of 72 months. Outcome was considered excellent if there was no pain recurrence, transient or otherwise. Outcome was considered good if pain recurred, but was less severe than the preoperative pain, either with or without medications. A poor outcome was defined as pain recurrence equal in severity to the preoperative pain and refractory to medical therapy, or any recurrence severe enough to require subsequent surgery. Forty (48%) patients had excellent outcomes with no pain recurrence. The outcome was good in 17 (21%) and poor in 26 (31%) patients. Follow-up durations were similar for the three outcome categories. The first year failure rate was 17% with a yearly failure rate averaging 2.6% thereafter. Using survival analysis, two variables were predictive of a poor outcome: prior surgery and lack of preoperative involvement of the third trigeminal division. Postoperative sensory deficits in the trigeminal distribution were absent or mild in 82% of patients. Twenty-eight (34%) patients had no sensory deficits after PSR, forty (48%) patients had slight decreases in facial sensation and 15 (18%) were densely numb in one or more trigeminal distributions. The rate of major complications was 3% and that of minor complication was 11%. We conclude that PSR is a safe and effective alternative to MVD when neurovascular compression is not identified at operation, or when MVD cannot be performed for technical reasons.

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12 00 PM

**Lessons In Human Pain Perception From Thalamic Exploration For DBS In Stroke-Induced Pain**

Ronald R. Tasker, Jo Dostrovsky, A. Parrent Toronto, Canada

Some patients who have had strokes develop intractable pain on the affected side of the body for which the most appropriate surgical treatment appears to be chronic brain stimulation (DBS). Originally called "thalamic pain", and many workers still consider the pathophysiology thalamic, such pain occurs after large or small lesions located at any level within the central nervous system which usually alter somatosensory (particularly spinothalamic) function. Be that as it may the pathophysiology remains obscure.

In patients with stroke-induced central pain we have used single cell recordings and microstimulation for physiological localization of DBS electrode implant sites. Recording examines the somatosensory pathways from receptor to thalamus, stimulation from thalamus to cortex. We have recognized a variety of abnormalities: absence of all or part of either limb of the system, reorganization, neurons with a bursting firing pattern, abnormal responses to stimulation and changes in threshold for sensory stimulation. Yet the clinical picture is similar in all

Case histories will be presented to illustrate these points and to suggest that in some patients at least contralateral thalamocortical function is not responsible for the pain; rather ipsilateral thalamocortical function may be responsible.

**12:20 PM PRESIDENTIAL ADDRESS  
HENRY D. GARRETSON**

**Introduction: Burton M. Onofrio**

Friday, October 23, 1992

**MODERATOR: PETER BLACK**

**8:15 AM - 1:00 PM SYMPOSIUM:**

**NEUROSURGERY AND THE NEW  
BIOLOGY**

- 8:00 - 8:15 AM**      **INTRODUCTORY REMARKS**  
Peter Black      Boston MA
- 8:15 - 8:45 AM**      **MOLECULAR BIOLOGICAL  
MECHANICS IN NEURAL  
REGENERATION**  
Larry Benowitz
- 8:45 - 9:00 AM**      **THE EFFECT OF CILIARY  
NEUTROTROPHIC FACTOR  
(CNTF) ON NEURITE OUT-  
GROWTH FROM SPINAL  
CORD NEURONS:  
IMPLICATIONS FOR AXONAL  
REGENERATION**  
Nelson M. Oyesiku *Academy  
Award - Honorable Mention*
- 9:00 - 9:25 AM**      **CONCEPTS OF MOLECULAR  
GENETICS AND BIOLOGICAL  
FACTORS IN THE  
COMPREHENSION AND  
TREATMENT OF C.N.S.  
NEOPLASIA**  
Robert Martuza  
Washington DC
- 9:25 - 9:40 AM**      **CHROMOSOME LOSS DURING  
HUMAN ASTROCYTOMA  
PROGRESSION**  
Daniel Fults  
Salt Lake City, UT

**Friday, October 23, 1992**

- 9:40 - 9:55 AM**            **EXPANDED SPECTRUM OF  
VIRAL THERAPY IN THE  
TREATMENT OF NERVOUS  
SYSTEM TUMORS**  
**James Markert Academy  
Award - Honorable Mention**
- 9:55 -10:10 AM**            **DEVELOPMENT OF MONOCLONAL  
ANTIBODIES FOR GLIOMA  
THERAPY**  
**David Eng Academy  
Award Runner Up**
- 10:10-10:30 AM**            **COFFEE BREAK**
- 10:30-10:55 AM**            **MOLECULAR ANALYSIS AND  
PRINCIPLES OF NEURAL  
PROTECTION**  
**Julian T. Hoff Ann Arbor MI**
- 10:55-11:20 AM**            **MOLECULAR BIOLOGY OF THE  
CEREBROVASCULAR WALL**  
**Ralph Dacey St. Louis MO**
- 11:20-11:35 AM**            **NITRIC OXIDE MEDIATES  
CHEMOREGULATION AND  
AUTOREGULATION OF  
CEREBRAL BLOOD FLOW IN  
PRIMATES**  
**B. Gregory Thompson -  
Academy Award -  
Honorable Mention**

**Friday, October 23, 1992**

**11:35-12:10 PM SYNAPTIC PLASTICITY:  
PHOTBLEACHING RECOVERY  
IN LIVING ANIMALS  
DEMONSTRATES POSTSYNAPTIC  
RECEPTOR MOVEMENT  
Adam P. Brown  
ACADEMY AWARD-  
WINNER**

**12:10-12:30 PM FUTURE PROSPECTUS OF  
INFLUENCE OF MOLECULAR  
BIOLOGY ON NEUROSURGICAL  
PRACTICE  
Charles J. Hodge, Jr.  
Syracuse NY**

**12:30- 1:00 PM PANEL:  
Larry Benowitz  
Robert Martuza  
Julian T. Hoff  
Ralph G. Dacey  
Charles J. Hodge, Jr.**

**Saturday, October 24, 1992**

**MODERATOR HENRY D. GARRETSON**

**8:00 AM  
Factors That Predict Success or Complications After  
Stereotactic Radiosurgery for Brain Arteriovenous  
Malformations  
L Dade Lunsford Pittsburgh PA**

In order to assess factors that predict successful obliteration or complications and to improve selection of patients with arteriovenous malformations (AVM) for stereotactic radiosurgery, we reviewed our five year experience.

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Methods and Materials: During a five year interval, 348 patients (50% female, 50% male) with angiographically identified AVMs underwent stereotactic radiosurgery using a 201 source Cobalt-60 gamma knife. Prior cerebral hemorrhage occurred in 59% of patients, 47% had headaches and 32% had a seizure disorder. At least one attempt at surgical removal had been performed in 47 patients (13.5%). Intravascular embolization was performed in 56 patients (16%) in order to reduce the size of the AVM to one suitable for radiosurgery. AVM volumes ranged from .06 to 46 cm<sup>3</sup>.

Results: Radiosurgical obliteration rates (n=111) were dependent upon the initial AVM volume:  $\leq 1\text{cm}^3$ . 88% total obliteration;  $< 4\text{cm}^3$  81% complete obliteration. For AVM volumes above 7 cm<sup>3</sup> five of 16 had complete obliteration. Failure to obtain complete obliteration was related to increasing initial AVM volume, time of angiography, and recognition of an additional AVM nidus not identified at the time of initial stereotactic radiosurgery. No statistically significant conclusion regarding efficacy of a specific dose was possible. Magnetic resonance imaging had a 50% predictive accuracy for total obliteration subsequently confirmed by angiography. Seizures improved in more than 50% of patients and headaches improved in more than 70%. Re-hemorrhage after radiosurgery was observed in 18 patients compared with 16 patients projected by a statistical model to re-hemorrhage during the latency interval after undergoing stereotactic radiosurgery (p= .65).

Discussion: Stereotactic radiosurgery using the multi-source Cobalt-60 gamma unit was a valuable treatment option for carefully selected AVM patients. Larger volume AVMs responded completely in fewer patients and required multi-modality approaches, including intravascular embolization and staged radiosurgical procedures performed at different intervals (dose staging) or for different regions of the AVM (volume staging). Conservative management of most patients with brain AVMs can no longer be recommended.

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8:20 AM

**Petrosal Dural AVMs**

Roberto C. Heros, Daniel Ruefenacht

Minneapolis MI

Dural AVMs most commonly develop in the region of the cavernous and transverse-sigmoid sinuses. In our experience the third most common site is the region of the tentorial incisura. The latter lesions have several peculiarities that make them unique enough to be considered as a separate type of dural AVM; herein referred to as "petrosal dural AVM". They are fed primarily by tentorial branches of the internal carotid artery; it is difficult and risky to embolize these vessels. They drain primarily into the petrosal sinus and the petrosal vein. At the time of clinical presentation, the petrosal sinus is most frequently occluded so that the drainage is primarily in a retrograde fashion into the petrosal vein and the pial venous system which then becomes diffusely arterialized, particularly throughout the posterior fossa. Because of the latter, patients present primarily with hemorrhage, or with signs of increased intracranial pressure and cerebellar or brain stem dysfunction.

The treatment of these petrosal dural AVMs is also different. Mullan has emphasized the safety and effectiveness of treating dural fistulas by simple obliteration of the venous drainage. This is particularly applicable to petrosal AVMs because at the time of presentation they almost always drain through a single dilated vein, the petrosal vein. Therefore the treatment of these AVMs is primarily surgical rather than endovascular. We approach them subtemporally, transtentorially with obliteration of the obvious arterial feeders in the tentorium to prevent recurrence and then obliteration and transection of the draining vein.

In our series of five patients, three presented with hemorrhage and two with signs of cerebellar and brain stem dysfunction. All were treated successfully by surgical obliteration of draining vein, preceded by embolization in two cases.



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8 40 AM

## **The Scope and Limitations of Surgery Through the Mouth**

H. Alan Crockard FRCS      London, England

Transoral surgery is not new. Various attempts to reach the skull base and craniovertebral junction have been described since the turn of the century, but, until the widespread availability of non-invasive imaging techniques, the extent and variety of pathology in the area, was not appreciated. A further problem, now resolved, has been the availability of dedicated instrumentation to allow exposure and surgical manipulation at depths of up to 20 cms from the incisors.

Over the last decade, our group has evaluated a large number of craniovertebral and clival pathology and performed a variety of surgical procedures through the mouth on almost 300 patients. All patients have been followed up on a long-term basis and, based on the outcome, disability and complications, we have modified and re-assessed our indications for various procedures.

In general terms, if there is an anterior midline compressive lesion, particularly if it is extradural, of the clivus, craniovertebral junction and the first two cervical vertebra, then transoral surgery is particularly useful; lateral extensions may be inaccessible. For lesions below the foramen magnum, elevation of the palate will allow exposure; division of the soft palate will expose the foramen magnum. In extreme basilar invagination, or extensive midline tumors involving the whole of the clivus, a Le Fort I osteotomy in combination with a midline palatal split (the extended maxillotomy or open door maxillotomy), will provide good exposure.

Our main pathological material has been severe basilar invagination and translocation associated with end-stage rheumatoid arthritis, congenital malformations and extradural

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tumors. A small number of intradural tumors and mid-basilar aneurysms have also been tackled.

The major drawback to the procedure is the risk of CSF leak and meningitis. These risks are minimized with lumbar drainage for five days immediately post-operatively. Thrombin fibrin glue and a multi-layer closure at the site of surgery and, if the defect is large, a vascularized muscle flap, such as sternomastoid is used.

9:00 AM

**Mechanism of Cerebral Vascular "Steal" Phenomenon During Hypercarbia**

Christopher M. Loftus                      Iowa City IA

After occlusion of an artery to the brain, hypercarbia and seizures may produce a paradoxical reduction or "steal" in cerebral blood flow to the ischemic area. We measured pressure in an occluded branch of the middle cerebral artery and used a new method to measure regional cerebral blood flow (rCBF) to collateral-dependent cerebrum in dogs (n=25), to examine hemodynamic mechanisms that account for the steal. During hypercarbia ( $P_aCO_2 = 70 \pm 1$ ), rCBF to collateral-dependent cerebrum, measured with microspheres and identified using the "shadow flow" technique, decreased from  $95 \pm 6$  ml/100 g/min (mean  $\pm$  SE) to  $71 \pm 9$  ( $p < 0.05$ ), while flow to normal brain increased from  $105 \pm 9$  to  $281 \pm 15$  ( $p < 0.05$ ). Pressure in a branch of the middle cerebral artery decreased during hypercarbia from  $50 \pm 6$  mmHg to  $25 \pm 3$  ( $p < 0.05$ ), concurrent with a significant increase in resistance of collateral vessels. Small vessel resistance was the same in collateral-dependent cerebrum from  $128 \pm 16$  to  $67 \pm 11$  ( $p < 0.05$ ), and flow to normal brain increased from  $169 \pm 14$  to  $418 \pm 17$  ( $p < 0.05$ ). Small vessel resistance decreased in both regions, but the decrease was much greater in normal cerebrum.

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Changes in cerebral artery pressure and resistance of collateral vessels during seizure were similar to those during hypercarbia. Thus, in collateral-dependent cerebrum, the steal phenomenon during hypercarbia and seizures is the result of a large decrease in perfusion pressure, a greater decrease in resistance in normal cerebrum than in collateral-dependent cerebrum, and an increase in resistance of collateral vessels.

9:20 AM

**Hypothermia: Mechanism of its Protection in CNS Ischemia**

Joung H. Lee, John Jane      Charlottesville VA

Treatment and protection of the CNS cells following ischemia remains as a major challenge today. Hypothermia's protective role in ischemia has been well demonstrated. However, its specific mechanism of neuronal protection is not clearly elucidated to date. In the past, metabolic inhibition was proposed as a primary mechanism of its protection. However, barbiturates, which reduce the CNS metabolism to approximately 40% of the basal level by completely inhibiting synaptic activity, were found to not have the same capability of neuronal protection as hypothermia. This implies that metabolic inhibition alone is not the critical mechanism which accounts for hypothermia's protective effects in ischemia.

In this study, bovine chromaffin cells were used as a model for neuronal cells. The whole-cell recording configuration of the patch-clamp technique was utilized to study the effects of varying degrees of hypothermia on Na, CA and K currents of the neuronal membrane. The results are as follows:

T(°C)	I <sub>Na</sub> (pA)	I <sub>Ca</sub> (pA)	I <sub>K</sub> (pA)
37-38	1428	629	4361
31-32	904	406	4127
25-26	526	359	3406
19-20	561	125	2375

(n=15-18 recordings in each group)

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This study clearly shows that hypothermia nonspecifically reduces transmembrane ionic currents of Na, K and Ca. Although effects on K currents were less dramatic with only 5% reduction, mild hypothermia (31-32°C) caused 37% reduction in Na currents and 35% reduction in Ca currents. This study provides direct electrophysiological evidence for membrane-stabilizing effects of hypothermia. By reducing transmembrane ionic fluxes, hypothermia may 1) reduce cellular energy requirement, 2) reduce Na-mediated cellular swelling, 3) decrease cytotoxic intracellular Ca load, 4) lower membrane excitability, 5) decrease synaptic activity, and 6) reduce cellular secretions, including release of excitotoxic neurotransmitters.

9:40 AM

**Vestibular Neurotomy for Meniere's Disease: Outcome Predictor**

Richard M. Foltz, J.T. McElveen, Robert Wilkins Durham NC

We treated 50 patients with Meniere's disease by vestibular neurotomy between May 1983 and July 1992. To evaluate the postoperative status, each patient was sent a questionnaire. As a measure of surgical outcome, the questionnaire focused on 4 areas:

- 1.) The frequency of spells per month
- 2.) The influence of the operation on vertigo
- 3.) The patient's disability status (work capacity)
- 4.) The overall patient satisfaction

There were 43 respondents to the questionnaires

The operative group of 50 patients was composed of 22 males and 28 females. For the 43 respondents, the length of follow-up ranged from 12 to 110 months (median = 31 months). Initial symptoms occurred predominantly in the 4th and 5th decades of life. The duration of symptoms ranged from 7 to 360 months (median = 33 months) before the vestibular neurotomy

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Postoperatively the frequency of spells per month declined significantly in both the males and females: 25 of 43 respondents reported no postoperative vertigo ( $V_0 = 58\%$ ) and an additional 13 patients reported improvement ( $V_1 = 88\%$ ). Patients ranked their pre- and postoperative disability as none, mild, moderate, or severe: 6 patients ranked their preoperative disability as none, 10 as mild, 9 as moderate, and 18 as severe. Postoperative disability improved in 28 patients (65%), remained the same in 9 (21%), worsened in 6 (14%). However, when patients rated their overall result, 81% reported that they were better (35/43), 14% the same (6/43), and 5% worse (2/43). When asked whether the operation was worthwhile, 88% (38/43) responded yes while 12% (95/43) reported no.

Preoperative factors associated with dissatisfaction and a greater postoperative disability were: 1) no preoperative disability (the ability to work was not affected by symptoms), and 2) bilateral symptoms.

Postoperative factors associated with dissatisfaction were: 1) increased imbalance, and 2) progression of disease (especially progressive hearing loss).

10:00 Am

### **Spontaneous Temporal Encephalocele: A Review of Five Types**

Robert H. Wilkins     Durham NC

Five main types of spontaneous temporal encephalocele have been described. Each type has typical clinical features which are different from those of the other types. The lateral temporal encephalocele extends through a defect at the pterion or occasionally at the asterion and is apparent in infancy. The anterior temporal encephalocele extends forward into the

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ipsilateral orbit and typically produces ipsilateral proptosis. The anteromedial temporal encephalocele extends into the sphenoid sinus and typically presents with CSF rhinorrhea. The posteroinferior temporal encephalocele ordinarily projects through the tegmen tympani into the tympanic antrum or epitympanic recess, causing CSF otorrhea or otorhinorrhea. And the anteroinferior temporal encephalocele, which projects through the floor of the middle fossa into the infratemporal area, is usually associated with medically intractable complex or simple partial seizures. Each of the five types of spontaneous temporal encephalocele can be diagnosed with the aid of modern radiological techniques, and each is usually best managed surgically.

10:40 AM

**Normal Conus Position Tethered Spinal Cord**

J. A. Winfield, L. Hochhauser, C.J.Hodge,Jr. Syracuse NY

The classical diagnosis of tethered spinal cord (TSC) hinges on 2 radiological features: a low (below L2; Barson 1970) position of the conus medullaris, and an abnormally thick filum terminale (>2mm; Fitz 1976). TSC with a normal conus position (NCP) has infrequently been reported in the Pediatric neurosurgical literature and not well described in adults. We have untethered 4 adults and 1 juvenile patient, all without cutaneous stigmata of spinal dysraphism, who were felt on clinical history to have symptoms best explained by TSC. NCP was observed in these cases, in absence of other spinal pathology such as osteoarthritis or HNP which could account for the clinical presentation.

Case 1: An 80 yr old developed a sudden painless foot drop while moving a large clay pot in his garden. Four days later he was untethered, after which his foot drop resolved within 48 hours.

Case 2: A 41 yr old developed persistent incontinence following a routine D&C procedure. One year later she underwent untethering and regained normal bladder function by hospital discharge.

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Case 3: A 38 yr old with back and diffuse bilateral leg pain for 36 months, developed progressive dual sphincter dysfunction and was untethered. Her pain resolved, and sphincter function returned.

Case 4: A 21 yr old male with a left concave scoliosis complained of back pain and an entire left numb leg. He underwent untethering and fusion of a Grade 1 L<sub>5</sub>S<sub>1</sub> spondylolisthesis with resolution of his pain and return of sensation in his left leg.

Case 5: A 13 yr old with, severe back and bilateral leg pain, underwent untethering after 3 years of failed conservative physical therapy. His pain and urgency resolved and he has returned to normal activity.

This group of patient's histories and diagnostic studies will be presented to illustrate the radiologic features of the terminal filum and cauda equina in NCP-TSC, and to draw attention to this clinical entity in adults. *A thickened filum, greater in thickness than any adjacent cauda equina nerve root, the presence of fat in the filum, and/or persistent dorsal position of the cord and filum with the double "V" pattern of the cauda equina, are all indicators of the presence of Normal Conus Position Tethered Spinal Cord.* Both pain and dysfunctional sphincters, can resolve in this clinical entity following untethering in adults.

11:00 AM

**Cytokine Production in the Pituitary Gland**  
Stanley B. Martin, Anthony Cerami, Richard Bucala  
New York, NY

Recent studies have emphasized the critical role played by cytokines in the systemic response to inflammation. During the course of infection, cells of the immune system produce cytokines such as tumor necrosis factor and interleukin-1. These cytokines have broad biological activities and modulate neuroendocrine activity at the levels of the hypothalamus and pituitary. Because the hypothalamic/pituitary axis plays such a crucial role in maintaining global homeostasis, we hypothesized that the pituitary gland itself might secrete cytokines.

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We studied the secretory response of pituitary cells to stimulation by bacterial lipopolysaccharide (LPS). When cultured with LPS for 48 hours, the murine pituitary cell line AT-20 elaborates a specific 12 kilodalton protein, as detected by gel electrophoresis and silver staining. Under serum-free conditions, peak induction occurs after culture with 50 micrograms/ml of LPS, and is not observed after stimulation with tumor necrosis factor, interleukin-1, interleukin-6, or phorbol myristate acetate. Detailed protein sequence analysis reveals that this 12 kD protein is identical to migration inhibitory factor(MIF).

MIF is a cytokine produced by activated lymphocytes which inhibits macrophage migration and enhances their ability to kill microorganisms. Its expression at a variety of sites of inflammation has suggested a role for MIF in the local regulation of the immune system. Our results indicate that the pituitary gland, in addition to its known indirect effects via ACTH, may directly potentiate the systemic response by producing the cytokine MIF.

11 20 AM

### **Improvement in Pituitary Function After Transsphenoidal Removal of Large Adenomas**

Warren R. Selman, Z.T.Madhoun, Baha M. Arafah Cleveland OH

**INTRODUCTION:** Patients with pituitary macroadenomas often present with hypopituitarism which is believed to be caused by stalk compression, and as such should be reversible.

**METHODS:** We examined the function of the pituitary-adrenal axis in 13 patients with hypothyroidism during the first week after selective adenectomy of non-secreting adenomas

**RESULTS:** All patients had a glucocorticoid deficiency, hypogonadotrophism, and 10 of 13 had hypothyroidism. Patients were given glucocorticoids before, during, and after surgery.



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Thereafter steroids were abruptly stopped and serum cortisol levels were carefully monitored. Patients could be categorized into two groups based on serum cortisol levels as follows:

#### POSTOPERATIVE DAY

GROUP I, n=9	13.3±1.5	14.3±1.5	13.8±1.1	11.0±1.2	13.3±1.5
GROUP II, n=4	2.2±0.3	2.4±0.3	4.1±0.9		

Serum cortisol levels were normal in group I and were similar to those previously reported by us in patients with normal adrenal function who underwent transsphenoidal surgery. All 9 patients were discharged to home on no replacement therapy and were documented by dynamic testing to have a normal pituitary adrenal axis. The 4 patients in group II, in contrast, had low serum cortisol levels, developed symptoms of glucocorticoid deficiency by the 5th day and were discharged on replacement therapy. Only one of these patients had normal adrenal function when examined 3 months later. In retrospect it was apparent that Group I patients had higher responses to Cortrosyn (increment  $13.1 \pm 1.2$  vs  $8.7 \pm 2.3$   $p < 0.02$ ) and higher serum prolactin levels ( $40.4 \pm 8.5$  vs  $16.3 \pm 4.3$   $p < 0.05$ ).

**CONCLUSIONS:** In the majority of patients with hypopituitarism improved pituitary function can be documented immediately after surgical adenomectomy. A preoperative elevation of serum cortisol  $\geq 9$  ug/dl following Cortrosyn administration is associated with a high probability (9 of 10) of immediate recovery of adrenal function. These data support the contention that hypopituitarism in patients with macroadenomas is caused by compression of the portal vessels and/or the infundibulum.

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11:40 AM

**Transient Hyponatremia After Pituitary Surgery:  
Possible Second Phase**

Paul B. Nelson                      Pittsburgh PA

Two recent clinical reports, in addition to two cases of our own have identified patients that developed hyponatremia following pituitary surgery. The onset is generally five to ten days following surgery, and lasts three to four days. The hyponatremia in most instances has been associated with a clinical deterioration in the patient. The onset and resolution of the hyponatremia was similar to a second phase of the triphasic response to diabetes insipidus without seeing the first and third stages. To test this hypothesis, 35 adult male Sprague-Dawley rats underwent stereotactic placed radio-frequency lesions targeted to partially destroy the supraoptico-hypophyseal tract. Sixteen control rats underwent skull incision and drilling, but no radio-frequency lesions were placed.

Twenty-two of the lesioned animals went on to develop either diabetes insipidus or hyponatremia without proceeding diabetes insipidus. The serum sodium nadir was  $128.7 \pm 1$  mmol/L compared to a sodium nadir of  $140.0 \pm 39$  mmol/L for sham operated rats. The sodium reached its nadir one to three days post lesion and returned to normal by day seven. Antidiuretic hormone levels at the nadir of serum sodium were elevated relative to the serum sodium.

The data supports the concept that diabetes insipidus during pituitary surgery is secondary to partial damage to neurohypophyseal tracts. The remaining intact antidiuretic hormone neurons may protect against the diabetes insipidus of the first and third phase. The leak of antidiuretic hormone from the damaged neuron is sufficient to cause an isolated second phase. Isolated second phase should replace the term SIADH.

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Understanding the possibility of an isolated second phase helps anticipate potential morbidity in patients undergoing pituitary surgery.

12:00 AM - 1:00 PM SYMPOSIUM

**NEUROSURGICAL ASPECTS OF  
CORTICAL LANGUAGE LOCALIZATION**

- 12:00-12:15 PM CORTICAL LANGUAGE LOCALIZATION BY  
STIMULATION MAPPING, OPTICAL IMAGING  
AND NEURONAL RECORDING  
George A. Ojemann Seattle WA
- 12:15-12:30 PM CORTICAL LANGUAGE LOCALIZATION IN  
GLIOMA RESECTIONS  
Mitchel Berger Mercer Is WA
- 12:30-12:45 PM CORTICAL LANGUAGE LOCALIZATION IN AVM  
RESECTIONS  
Henry D. Garretson Louisville KY
- 12:45-1:00 PM DISCUSSION
- 1:00 PM ADJOURNMENT

NOTES

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**WINNER**

**ADAM P. BROWN, M.D.**

DEPARTMENT OF NEUROLOGICAL SURGERY  
WASHINGTON UNIVERSITY SCHOOL OF MEDICINE  
ST. LOUIS, MO

SYNAPTIC PLASTICITY: PHOTOBLEACHING RECOVERY IN LIVING  
ANIMALS DEMONSTRATES POSTSYNAPTIC RECEPTOR MOVEMENT

**RUNNER UP**

**DAVID Y. ENG, M.D.**

DEPARTMENT OF NEUROSURGERY  
SUNY-HSC  
SYRACUSE, NY

DEVELOPMENT OF MONOCLONAL ANTIBODIES FOR GLIOMA  
THERAPY

RESIDENT PAPER AWARD WINNERS

**HONORABLE MENTION**

**JAMES M. MARKERT, M. D.**

SECTION OF NEUROSURGERY  
UNIVERSITY OF MICHIGAN MEDICAL CENTER  
ANN ARBOR, MI

EXPANDED SPECTRUM OF VIRAL THERAPY IN THE TREATMENT  
OF NERVOUS SYSTEM TUMORS

**B. GREGORY THOMPSON, M.D.**

DEPARTMENT OF NEUROSURGERY  
UNIVERSITY OF PITTSBURGH SCHOOL OF MEDICINE  
PITTSBURGH, PA

NITRIC OXIDE MEDIATES CHEMOREGULATION AND  
AUTOREGULATION OF CEREBRAL BLOOD FLOW IN PRIMATES

**NELSON M. OYESIKU, M.D.**

DEPARTMENT OF NEUROSURGERY  
EMORY CLINIC  
ATLANTA, GA

THE EFFECT OF CNTF ON NEURITE OUTGROWTH FROM SPINAL  
CORD NEURONS: IMPLICATIONS FOR AXONAL REGENERATION

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ROBERT PUDENZ	1965
FRANCIS A. ECHLIN	1966
BENJAMIN WHITCOMB	1967
HOMER S. SWANSON	1968
AUGUSTUS McCRAVEY	1969-70
EDWARD W. DAVIS	1971
JOHN R. GREEN	1972
GEORGE J. HAYES	1973
RICHARD L. DeSAUSSRE	1974
ERNEST W. MACK	1975
FRANK E. NULSEN	1976
ROBERT S. KNIGHTON	1977
ROBERT G. FISHER	1978
H. T. BALLANTINE, JR.	1979
GEORGE EHNI	1980
COURTLAND H. DAVIS, JR.	1981
JOHN F. MULLAN	1982
HUGO RIZZOLI	1983
JAMES W. CORRELL	1984
E.B. HENDRICK	1985
GRIFFITH R. HARSH III	1986
ELLIS B. KEENER	1987
ROBERT GROSSMAN	1988
JIM STORY	1989
JOHN A. JANE	1990
STEWART B. DUNSKER	1991

### PAST SECRETARY-TREASURER

FRANCIS MURPHEY	1938-40
A.EARL WALKER	1941-43
C.ERICKSON	1944-47
WALLACE B. HAMBY	1948-50
THEODORE B. RASMUSSEN	1951-53
EBEN ALEXANDER, JR.	1954-57
ROBERT L. McLAURIN	1958-62
EDWARD W. DAVIS	1963-65
ROBERT G. FISHER	1966-68
BYRON C. PEVEHOUSE	1969-72

### PAST SECRETARY

BYRON C. PEVEHOUSE	1973
RUSSEL H. PATTERSON, JR.	1974-76
PHANOR L. PEROT, JR.	1977-80
JOHN T. GARNER	1981-83
JAMES T. ROBERTSON	1984-86
NICHOLAS T. ZERVAS	1987-89
WILLIAM A. BUCHHEIT	1990-92

### PAST TREASURER

RUSSEL H. PATTERSON, JR.	1973
PHANOR L. PEROT, JR.	1974-76
JOHN T. GARNER	1977-80
JAMES T. ROBERTSON	1981-83
NICHOLAS T. ZERVAS	1984-86
WILLIAM A. BUCHHEIT	1987-89
JULIAN T. HOFF	1990-92

PAST MEETINGS OF THE ACADEMY

HOTEL NETHERLAND PLAZA,CINCINNATI, OHIO	OCTOBER 28-29,1938
ROOSEVELT HOTEL, NEW ORLEANS, LOUISIANA	OCTOBER 27-29,1939
TUDOR ARMS HOTEL,CLEVELAND,OHIO	OCTOBER 21-22,1940
MARK HOPKINS HOTEL,SAN FRANCISCO AND AMBASSADOR HOTEL LOS ANGELES, CALIFORNIA	NOVEMBER 11-15,1941
THE PALMER HOUSE, CHICAGO, ILLINOIS	OCTOBER 16-17,1942
HART HOTEL,BATTLE CREEK, MICHIGAN	SEPTEMBER 17-18,1943
ASHFORD GENERAL HOSPITAL,WHITE SULPHUR SPRINGS, WEST VIRGINIA	SEPTEMBER 7-9, 1944
THE HOMESTEAD, HOT SPRINGS, VIRGINIA	SEPTEMBER 9-11, 1946
BROADMOOR HOTEL, COLORADO SPRINGS, COLORADO	OCTOBER 9-11,1947
WINDSOR HOTEL, MONTREAL, CANADA	SEPTEMBER 20-22,1948
BENSON HOTEL, PORTLAND, OREGON	OCTOBER 25-27,1949
MAYO CLINIC, ROCHESTER, MINNESOTA	SEPTEMBER 28-30,1950
SHAMROCK HOTEL, HOUSTON, TEXAS	OCTOBER 4-6,1951
WALDORF-ASTORIA HOTEL NEW YORK CITY	SEPTEMBER 29-OCTOBER 1,1952
BILTMORE HOTEL,SANTA BARBARA,CA	OCTOBER 12-14,1953
BROADMOOR HOTEL, COLORADO SPRINGS, COLORADO	OCTOBER 21-23,1954
THE HOMESTEAD, HOT SPRINGS, VIRGINIA	OCTOBER 27-29,1955
CAMELBACK INN, PHOENIX, ARIZONA	NOVEMBER 8-10,1956
THE CLOISTER, SEA ISLAND, GEORGIA	NOVEMBER 11-13,1957
THE ROYAL YORK HOTEL, TORONTO, CANADA	NOVEMBER 6-8,1958
DEL MONTE LODGE, PEBBLE BEACH, CA	OCTOBER 18-21,1959
COPLEY SHERATON PLAZA,BOSTON, MASSACHUSETTS	OCTOBER 5-8,1960
ROYAL ORLEANS, NEW ORLEANS,LOUISIANA	NOVEMBER 7-10,1962
EL MIRADOR,PALM SPRINGS, CALIFORNIA	OCTOBER 23-26,1963
THE KEY BISCAYNE, MIAMI, FLORIDA	NOVEMBER 11-14,1964
TERRACE HILTON HOTEL, CINCINNATI, OHIO	OCTOBER 14-16,1965
FAIRMONT HOTEL & TOWERS, SAN FRANCISCO, CALIFORNIA	OCTOBER 17-19,1966
THE KEY BISCAYNE, MIAMI, FLORIDA	NOVEMBER 8-11,1967
BROADMOOR HOTEL, COLORADO SPRINGS, COLORADO	OCTOBER 6-8,1968
ST. REGIS HOTEL, NEW YORK CITY	SEPTEMBER 21, 1969
CAMINO REAL HOTEL,MEXICO CITY	NOVEMBER 18-21,1970
SAHARA-TAHOE HOTEL, STATELINE, NEVADA	SEPTEMBER 26-29,1971
NEW COLLEGE, OXFORD, ENGLAND	SEPTEMBER 4-7,1972

HUNTINGTON-SHERATON HOTEL, PASADENA, CALIFORNIA	NOVEMBER 14-17,1973
SOUTHAMPTON PRINCESS HOTEL, SOUTHAMPTON, BERMUDA	NOVEMBER 6-9,1974
THE WIGWAM(LITCHFIELD PARK), PHOENIX ARIZONA	NOVEMBER 5-8,1975
MILLS HYATT HOUSE, CHARLESTON, SOUTH CAROLINA	NOVEMBER 10-13,1976
MAUNA KEA BEACH HOTEL, KAMUELA,HAWAII	NOVEMBER 2-5,1977
HOTEL BAYERISCHER HOF, MUNICH, GERMANY	OCTOBER 2-25,1978
HYATT REGENCY, MEMPHIS, TENNESSEE	NOVEMBER 76-10,1979
WALDORF ASTORIA, NEW YORK, NEW YORK	OCTOBER 1-4,1980
SHERATON PLAZA,PALM SPRINGS, CA	NOVEMBER 1-4,1981
RITZ-CARLTON HOTEL, BOSTON MASSACHUSETTS	OCTOBER 10-13,1982
THE LODGE AT PEBBLE BEACH, CALIFORNIA	OCTOBER 23-26,1983
THE HOMESTEAD, HOT SPRINGS, VIRGINIA	OCTOBER 17-20,1984
THE LINCOLN HOTEL POST OAK, HOUSTON, TEXAS	OCTOBER 27-30,1985
THE CLOISTER, SEA ISLAND, GEORGIA	NOVEMBER 5-8,1986
HYATT REGENCY, SAN ANTONIO, TEXAS	OCTOBER 7-10,1987
OMNI NETHERLAND PLAZA,CINCINNATI,OHIO	SEPTEMBER 13-17,1988
LOEWS VENTANA CANYON RESORT, TUCSON, ARIZONA	SEPTEMBER 27-OCTOBER 1,1989
AMELIA ISLAND PLANTATION AMELIA ISLAND,FL	OCTOBER 2-7,1990
SALISHAN LODGE, GLENEDEN BEACH, OREGON	SEPTEMBER 22-26,1991

MEMBERSHIP LIST 1991  
AMERICAN ACADEMY OF NEUROLOGICAL SURGERY

HONORARY MEMBERS	ELECTED
GUY LAZORTHES 26 Rue D Auriol 31 Toulouse, France	1973
VALENTINE LOGUE (Anne) 16 Rowan Road Hammersmith London W6 7DU England	1974
GOSTA NORLEN (Gunvor) Linnegaten 35 IV 11447 Stockholm, Sweden	1973
BERNARD PERTUISET(Francoise) 53 Avenue Montaigne 75008 Paris FRANCE	1986
BRONSON R. RAY 178 East 70th Street New York, New York 10021	1991
KEIJI SANO (Yaeko) Teikyo University Hospital 2-11-1 Kaga Itabashi-ku Tokyo 173, Japan	1975

<b>SENIOR MEMBERS</b>	<b>ELECTED</b>
<b>EBEN ALEXANDER, JR. (Betty)</b> Bowman Gray School of Medicine 300 South Hawthorne Winston-Salem, North Carolina 27103	<b>1950</b>
<b>GEORGE S. BAKER (Enid)</b> 607 Litchfield Road Litchfield Park, Arizona 85340	<b>1940</b>
<b>H. THOMAS BALLANTINE, JR. (Elizabeth)</b> Massachusetts General Hospital 15 Parkman Street - ACC 312 Boston, Massachusetts 02114	<b>1951</b>
<b>E. HARRY BOTTERELL (Margaret)</b> 2 Lakeshore Boulevard Kingston, Ontario, Canada K7M 4J6	<b>1938</b>
<b>HARVEY CHENAULT (Bille)</b> 6340 Briar Hill Road Paris, Kentucky 40361	<b>1949</b>
<b>SHELLEY N. CHOU (Jolene)</b> University of Minnesota Medical Center 420 Delaware Street S. E., Box 96 Minneapolis, Minnesota 55455	<b>1974</b>
<b>GALE G. CLARK</b> 12621 Brookpark Road Oakland, California 94619	<b>1970</b>
<b>W. KEMP CLARK (Fern)</b> 5323 Harry Hines Boulevard Dallas, Texas 75235	<b>1970</b>



WILLIAM F. COLLINS, JR. (Gwendolyn) Yale University School of Medicine 333 Cedar Street New Haven, Connecticut 06510	1963
COURTLAND H. DAVIS, JR. (Carolyn) Bowman-Gray School of Medicine Winston-Salem, North Carolina 27103	1967
RICHARD L. DESAUSSURE, JR. (Phyllis) 4290 Heatherwood Lane Memphis, Tennessee 38117	1962
DONALD F. DOHN (Carolyn) Cleveland Clinic Florida 3000 West Cypress Creek Road Ft. Lauderdale, Florida 33309	1968
R.M. PEARDON DONAGHY (Francis) P.O. BOX 5035, Road 1 Horn of the Moon Road Montpelier, Vermont 05602	1970
CHARLES G. DRAKE (Ruth) University Hospital London, Ontario, Canada N6A 5A5	1958
DEANE H. ECHOLS (Fran) 1550 Second Street New Orleans, Louisiana 70130	Founder
ROBERT FISHER (Connie) Box 846, Star Rt. 1 Bristol, New Hampshire 03222	1957

<p>ELDON L. FOLTZ (Catherine)            UCI Medical Center            Division of Neurosurgery            101 City Drive, South            Orange, California 92668</p>	1960
<p>LYLE A FRENCH (Gene)            P.O. Box 1007            Pauma Valley, California 92061</p>	1954
<p>JAMES G. GALBRAITH (Peggy)            2515 Crest Road            Birmingham, Alabama 35223</p>	1947
<p>SIDNEY GOLDRING (Lois)            Department of Neurosurgery            Washington University Medical Center            4901 Barnes Hospital Plaza            Saint Louis, Missouri 63110</p>	1964
<p>PHILIP D. GORDY (Silvia)            253 South Lennox            Casper, Wyoming 82601</p>	1968
<p>EVERETT G. GRANTHAM (Mary Carmel)            234 East Gray Street            Louisville, Kentucky 40202</p>	1942
<p>JAMES GREENWOOD, JR. (Mary)            3702 Arnold Avenue            Houston, Texas 77005</p>	1952
<p>WALLACE B. HAMBY (Eleanor)            750 Welsh Road            Suite 215            Palo Alto, California 94304</p>	1941

JOHN W. HANBERY (Shirley) 750 Welch Road, Suite 215 Palo Alto, California 94304	1959
MAJ. GEN. GEORGES S. HAYES (Catherine) 303 Skyhill Road Alexandria, Virginia 22314	1962
JESS D. HERMANN (Mary Jo) 1812 Coventry Lane Oklahoma City, Oklahoma 73120	1938
WILLIAM E. HUNT (Carole) University Hospital 410 West 10th Avenue Columbus, Ohio 43210	1970
WILLIAM A. KELLY (Joan) 16925 Inglewood Road, N.E. Seattle, Washington 98011	1977
ROBERT B. KING (Molly) University Hospital Upstate Medical Center 750 East Adams Street Syracuse, New York 13210	1958
ROBERT S. KNIGHTON (Louise) 9388 Avenida San Timoteo Cherry Valley, California 92223	1966
THOMAS W. LANGFITT (Carolyn) Glenmede Trust Company 229 South 18th Street Philadelphia, Pennsylvania 19103	1971

<b>RAEBURN C. LLEWELLYN (Carmen)</b> 5640 Read Boulevard, Suite 840 New Orleans, Louisiana 70127	1963
<b>WILLIAM M. LOUGHEED (Grace)</b> E.W. 14-224 200 Elizabeth Street Toronto, Ontario, Canada M5G 2C4	1962
<b>JOHN J. LOWREY (Katy)</b> P.O. Box 4302 Kawaihae, Hawaii 96743	1965
<b>ERNEST W. MACK (Bobbie)</b> 505 South Arlington Avenue Suite 106 Reno, Nevada 89509	1956
<b>ROBERT L. McLAURIN</b> 250 William Howard Taft Road Suite 205 Cincinnati, Ohio 45219	1955
<b>WILLIAM F. MEACHAM (Alice)</b> 4230 Harding Road #709 Nashville, Tennessee 37212	1952
<b>FRANCIS MURPHEY (Marge)</b> 3951 Gulf Shore Blvd. North Naples, Florida 33940	Founder
<b>BLAINE S. NASHOLD, JR., (Irene)</b> Duke University Medical Center Durham, North Carolina 27710	1967

GUY L. ODOM (Mataline) 2812 Chelsea Circle Durham, North Carolina 27707	1946
BYRON C. PEVEHOUSE (Lucy) 2351 Clay Street San Francisco CA 94115	1964
J. LAWRENCE POOL (Angeline) P.O. Box 40 West Cornwall, Connecticut 06796	1940
ROBERT W. PORTER (Aubrey Dean) 6461 Bixby Hill Road Long Beach, California 90815	1962
ROBERT H. PUDENZ (Rita) 574 Garfield Avenue South Pasadena, California 91030	1943
JOHN RAAF (Lorene) 1120 N.W. 20th Avenue, #100 Portland, Oregon 97209	Founder
AIDEN A. RANEY (Mary) 125 North Las Palmas Avenue Suite 203 Los Angeles, California 90004	1946
JOSEPH RANSOHOFF II (Lori) New York University Medical Center 550 First Avenue New York, New York 10016	1965
THEODORE B. RASMUSSEN (Catherine) 29 Surrey Drive Montreal, Quebec, Canada H3P 1B2	1947

HUGO RIZZOLI (Helen) 2150 Pennsylvania Avenue, N.W. Washington, D.C. 20037	1973
HENRY G. SCHWARTZ (Reedie) Washington University School of Medicine 4901 Barnes Hospital Plaza St. Louis, Missouri 63110	1942
C. HUNTER SHELDEN (Elizabeth) Huntington Medical Research Institute 10 Pico Street Pasadena, California 91105	1941
ANTHONY SUSEN (Phyllis) 504 Remora Circle Fripp Island, South Carolina 29220	1965
WILLIAM H. SWEET (Elizabeth) 309 Goddard Avenue Brookline, Massachusetts 02146	1950
JOHN TYTUS (Virginia) P.O. Box 279 Arlington, Washington 98223	1967
ALFRED UHLEIN (Ione) P.O. Box 2237 Vail, Colorado 81658-2237	1949
A. EARL WALKER (Agnes) 1445 Wagontrain Drive, S.E. Albuquerque, New Mexico 87123	1938
ARTHUR A. WARD, JR. (Janet) 4001 N.E. Belvoir Place Seattle, Washington 98105	1953

<b>EXUM WALKER (Nellie)</b> <b>490 Peachtree Street, N.E.</b> <b>Atlanta, Georgia 30308</b>	<b>1938</b>
<b>W. KEASLEY WELCH (Elizabeth)</b> <b>25 Gould Road</b> <b>Waban, MA 02168</b>	<b>1957</b>
<b>BENJAMIN B. WHITCOMB (Margaret)</b> <b>RFD Box 124</b> <b>Surrey, Maine 04684</b>	<b>1947</b>
<b>LOWELL E. WHITE, JR. (Margie)</b> <b>University of South Alabama</b> <b>Division of Neuroscience</b> <b>Mobile, Alabama 36688</b>	<b>1971</b>

<b>ACTIVE MEMBERS</b>	<b>ELECTED</b>
<b>MICHAEL J. APUZZO (Helene)</b> 1200 N. State Street Los Angeles, California 90030	<b>1988</b>
<b>JAMES I. AUSMAN (Carolyn)</b> The University of Illinois at Chicago Department of Neurosurgery (M/C 799) 912 South Wood Street Chicago, Illinois 60612	<b>1978</b>
<b>DONALD P. BECKER (Marie)</b> UCLA Medical Center Department of Neurosurgery Rm 74-140 Chs 405 Hilgard Los Angeles, California 90024	<b>1990</b>
<b>GILLES BERTRAND (Louise)</b> Montreal Neurological Institute 3801 University Street Montreal, Quebec, Canada H3A 1B4	<b>1967</b>
<b>PETER M. BLACK (Katherine)</b> Brigham and Women's Hospital 75 Francis Street Boston MA 02115	<b>1988</b>
<b>ROBERT S. BOURKE (Marlene)</b> 5802 Nicholson Lane Rockville, Maryland 20852-2967	<b>1983</b>
<b>JERALD S. BRODKEY (Arielle)</b> 24755 Chagrin Boulevard Suite #205 Beachwood, Ohio 44122	<b>1977</b>



<b>WILLIS E. BROWN, JR. (Ann)</b> Division of Neurosurgery The University of Texas Health Science Ctr. 7703 Floyd Curl Drive San Antonio, Texas 78284-7843	1984
<b>DEREK A. BRUCE (Frances)</b> 7777 Forrest Lane #C703 Dallas, Texas 75230	1984
<b>WILLIAM A. BUCHHEIT</b> 3401 North Broad Street Philadelphia, Pennsylvania 19140	1980
<b>PETER W. CARMEL</b> Neurological Institute 710 West 168th Street New York, New York 10032	1991
<b>WILLIAM F. CHANDLER (Sue)</b> 2124D/338 Taubman Center 1500 East Medical Ctr. Drive Ann Arbor MI 48109	1989
<b>PAUL H. CHAPMAN (Tansy)</b> Department of Neurosurgery Massachusetts General Hospital Boston, Massachusetts 02114	1983
<b>EDWARD S. CONNOLLY (Elise)</b> Ochsner Clinic 1514 Jefferson Highway New Orleans, Louisiana 70121	1973
<b>JAMES W. CORRELL (Cynthia)</b> 710 West 168th Street New York, New York 10032	1966

<b>ROBERT CROWELL (Mary)</b> Massachusetts General Hospital Chief, Cerebrovascular Section Department of Neurosurgery/ACC 312 Boston, Massachusetts 02114	<b>1990</b>
<b>RALPH G. DACEY (Corinne)</b> Washington School of Medicine Division of Neurosurgery Barnes Hospital Plaza St. Louis, Missouri 63110	<b>1990</b>
<b>ARTHUR L. DAY (Dana)</b> University of Florida Health Ctr Department of Neurosurgery Box J 265 Gainesville, Florida 32610	<b>1990</b>
<b>STEWART B. DUNSKER (Ellen)</b> Mayfield Neurological Institute, Inc. 2123 Auburn Avenue Suite 441 Cincinnati, Ohio 45219	<b>1975</b>
<b>HOWARD M. EISENBERG (Janet)</b> The University of Texas Medical Branch Division of Neurosurgery Galveston, Texas 77550	<b>1985</b>
<b>WILLIAM H. FEINDEL (Faith)</b> Montreal Neurological Institute 3801 University Street Montreal, Quebec, Canada H3A 2B4	<b>1959</b>
<b>EUGENE FLAMM (Susan)</b> Hospital of the University of Pennsylvania 3400 Spruce Street Philadelphia, Pennsylvania 19104	<b>1979</b>

<b>RICHARD A.R. FRASER (Sarah Anne)</b> 525 East 68th Street New York, New York 10021	<b>1976</b>
<b>JOHN T. GARNER (Candace)</b> 50 Allesandro Place Suite 400 Pasadena, California 91105	<b>1971</b>
<b>HENRY GARRETSON (Marianna)</b> Health Sciences Center 316 MDR Bldg. University of Louisville Louisville, Kentucky 40292	<b>1973</b>
<b>STEVEN L. GIANNOTTA (Sharon)</b> LAC/University of Southern California Medical Center 1200 North State Street Rm # 5046 Los Angeles, California 90033	<b>1991</b>
<b>ROBERT G. GROSSMAN (Ellin)</b> Baylor College of Medicine One Baylor Place Houston, Texas 77030	<b>1984</b>
<b>ROBERT GRUBB (Julia)</b> Washington University School of Medicine 4901 Barnes Hospital Plaza St. Louis, Missouri 63110	<b>1985</b>
<b>GRIFFITH R. HARSH, III (Craig)</b> Division of Neurosurgery UBA Station Birmingham, Alabama 35294	<b>1980</b>

<b>MARK PETER HEILBRUN (Robyn)</b> Division of Neurosurgery #3B320 University of Utah Medical Center 50 North Medical Drive Salt Lake City, Utah 84132	<b>1984</b>
<b>E. BRUCE HENDRICK (Gloria)</b> Hospital for Sick Children 555 University Avenue, Room 1502 Toronto, Ontario, Canada M5G 1X8	<b>1968</b>
<b>ROBERTO C. HEROS (Deborah)</b> University of Minnesota Medical Center 420 Southwest Delaware Street Box 96 Minneapolis, MN 55455	<b>1985</b>
<b>CHARLES HODGE (Linda)</b> 750 East Adams Street Syracuse, New York 13210	<b>1982</b>
<b>JULIAN HOFF (Diane)</b> Department of Neurosurgery University of Michigan Ann Arbor, Michigan 48109	<b>1975</b>
<b>HAROLD HOFFMAN (Jo Ann)</b> The Hospital for Sick Children Suite 1502, 555 University Avenue Toronto, Ontario, Canada M5G 1X8	<b>1982</b>
<b>EDGAR M. HOUSEPIAN (Marion)</b> The Neurological Institute 710 West 168th Street New York, New York 10032	<b>1976</b>
<b>ALAN R. HUDSON (Susan)</b> St. Michael's Hospital 38 Shuter Street Toronto, Ontario, Canada M5B 1A6	<b>1978</b>

<b>JOHN A. JANE (Noella)</b> Department of Neurosurgery, Box 212 University of Virginia Charlottesville, Virginia 22908	1982
<b>ELLIS B. KEENER (Ann)</b> 915 East Lake Drive, N.W. Gainesville, Georgia 30506	1978
<b>DAVID KELLY, JR. (Sally)</b> Bowman Gray School of Medicine 300 S. Hawthorne Winston-Salem, North Carolina 27103	1975
<b>GLENN W. KINDT (Charlotte)</b> Division of Neurosurgery Box C-307 University of Colorado Medical Center 4200 East 9th Avenue Denver, Colorado 80262	1977
<b>WOLFF M. KIRSCH (Marie-Claire)</b> Chief of Neurosurgery Univ. of New Mexico Medical School Albuquerque, New Mexico 87131	1971
<b>DAVID G. KLINE</b> Louisiana State University Medical Center 1542 Tulane Avenue New Orleans, Louisiana 70112	1972
<b>RICHARD S. KRAMER (Mollie)</b> Duke Hospital Medical Center Durham, North Carolina 27710	1978
<b>THEODORE KURZE (Joan)</b> 1936 Palisades Drive Pacific Palisades, CA 90272	1967

<b>SANFORD LARSON (Jackie)</b> Medical College of Wisconsin 8700 W. Wisconsin/Neurosurgery Milwaukee WI 53226	<b>1989</b>
<b>EDWARD R. LAWS, JR. (Peggy)</b> University of Virginia Medical School Department of Neurosurgery/Box 212 Charlottesville, VA 22908	<b>1983</b>
<b>DONLIN M. LONG (Harriet)</b> Department of Neurological Surgery Johns Hopkins Medical School 601 N. Wolfe Baltimore, MD 21205	<b>1983</b>
<b>ALFRED J. LUESSENHOP (Frances)</b> Georgetown University Hospital 3800 Reservoir Road Washington, D. C. 20007	<b>1976</b>
<b>JOE MAURICE McWHORTER (Barbara)</b> Bowman Gray School of Medicine Winston-Salem NC 27103	<b>1989</b>
<b>LEONARD MALIS (Ruth)</b> 1176 Fifth Avenue New York, New York 10029	<b>1973</b>
<b>ROBERT L. MARTUZA (Jill)</b> George Washington University Medical School Department of Neurosurgery 300 Reservoir Road, N.W. Washington, D.C. 20007	<b>1989</b>
<b>RICHARD B. MORAWETZ (MaryJean)</b> Division of Neurosurgery University Station Birmingham, Alabama 35294	<b>1990</b>

JOHN F. MULLAN (Vivian) 5844 Stoney Isle Avenue Chicago, Illinois 60637	1963
PAUL B. NELSON (Tere) Emerson Hall #139 545 Barnhill Drive Indianapolis, Indiana 46202	1991
FRANK E. NULSEN (Ginny) 32 10th Avenue, South Naples, Florida 33940	1956
GEORGE OJEMANN (Linda) 6424 E. Mercer Way Mercer Island, Washington 98040	1975
ROBERT G. OJEMANN (Jean) Neurosurgery Service Massachusetts General Hospital Boston, Massachusetts 02114	1968
ANDRE OLIVIER (Nichole) 3801 University Street Suite #107 Montreal PQ H3A 2B4	1989
BURTON ONOFRIO (Judith) Mayo Clinic Rochester, Minnesota 55905	1975
RUSSEL H. PATTERSON, JR. (Julie) New York Hospital 525 East 68th Street New York, New York 10021	1971
SYDNEY J. PEERLESS (Ann) 1501 N. W. 9th Avenue Miami, Florida 33136	1977

<p>PHANOR L. PEROT, JR.            Department of Neurosurgery            Medical University of South Carolina            171 Ashley Avenue            Charleston, South Carolina 29425</p>	<p>1970</p>
<p>DAVID G. PIEPGRAS (Jane)            Mayo Clinic            200 First Street, S.W.            Rochester, Minnesota 55905</p>	<p>1987</p>
<p>DONALD O. QUEST (Ilona)            The Neurological Institute            710 West 158th Street            New York, New York 10032</p>	<p>1968</p>
<p>ROBERT A. RATCHESON (Peggy)            University Hospital            2074 Abington Road            Cleveland, Ohio 44106</p>	<p>1986</p>
<p>ALBERT L. RHOTON, JR. (Joyce)            University of Florida, Box J265            Department of Neurosurgery            Gainesville, Florida 32610</p>	<p>1984</p>
<p>J. CHARLES RICH, JR. (Jasmine)            324 10th Avenue #206            Salt Lake City, Utah 84103</p>	<p>1987</p>
<p>THEODORE S. ROBERTS (Joan)            Department of Neurological Surgery            University Hospital            1959 Pacific Avenue, N.E., RI 20            Seattle, Washington 98195</p>	<p>1976</p>



<b>JAMES T. ROBERTSON (Valeria)</b> Department of Neurosurgery University of Tennessee, Memphis 956 Court Avenue Memphis, Tennessee 38163	<b>1971</b>
<b>JON H. ROBERTSON (Carol Ann)</b> 920 Madison Avenue Suite #307 Memphis, Tennessee 38103	<b>1991</b>
<b>MICHAEL R. SCOTT (Susan)</b> Children's Hospital Bader 3 300 Longwood Avenue Boston, Massachusetts 02115	<b>1991</b>
<b>EDWARD L. SELJESKOG (Margaret)</b> University of Minnesota Hospital 420 Delaware Street Box 479 Minneapolis, Minnesota 55455	<b>1991</b>
<b>WILLIAM SHUCART (Laura)</b> New England Medical Ctr. #178 750 Washington Street Boston MA 04401	<b>1989</b>
<b>FREDERICK A. SIMEONE</b> Pennsylvania Hospital 800 Spruce Street Philadelphia, Pennsylvania 19107	<b>1981</b>
<b>JAMES C. SIMMONS (Vanita)</b> 920 Madison Avenue, 201-N Memphis, Tennessee 38103	<b>1975</b>

<b>KENNETH R. SMITH, JR. (Marjorie)</b> St. Louis University Hospital 3635 Vista Avenue St. Louis, Missouri 63110-2500	<b>1987</b>
<b>ROBERT R. SMITH (Helen)</b> University of Mississippi Medical Ctr. Department of Neurosurgery Jackson MS 39216	<b>1989</b>
<b>DENNIS SPENCER (Susan)</b> 333 Cedar Street New Haven CT 06510	<b>1989</b>
<b>BENNETT M. STEIN (Bonita)</b> 710 West 168th Street New York, New York 10032	<b>1970</b>
<b>JIM L. STORY (Joanne)</b> Division of Neurosurgery The University of Texas Health Science Ctr 7703 Floyd Curl Drive San Antonio, Texas 78284-7843	<b>1972</b>
<b>RONALD R. TASKER (Mary)</b> Toronto General Hospital Room 215, 14th Floor 200 Elizabeth Street Toronto, Ontario, Canada M5G 2C4	<b>1971</b>
<b>CHARLES H. TATOR (Carol)</b> Toronto Western Hospital 399 Bathurst Street Toronto, Ontario M5T 2S8 Canada	<b>1991</b>

JOHN TEW, JR. (Susan) 506 Oak Street Cincinnati, Ohio 45219	1973
GEORGE TINDALL (Suzie) Emory University School of Medicine Division of Neurosurgery 1365 Clifton Road, N.E. Atlanta, Georgia 30322	1968
SUZIE C. TINDALL (George) Emory University School of Medicine Division of Neurosurgery 1327 Clifton Road, N.E. Atlanta, Georgia 30322	1990
JOHN C. VAN GILDER (Kerstin) University of Iowa Hospital Iowa City, Iowa 55242	1980
CLARK WATTS (Patty) One Hopital Drive Ste. N.522 Columbia, Missouri 65212	1975
BRYCE K. A. WEIR (Mary Lou) 2D2-102 WMC 8440-112th Street Edmonton, Alberta, Canada T6G 2B7	1984
MARTIN H. WEISS (Debby) USC Medical Center 1200 North State Street Los Angeles, California 90033	1981

<b>ROBERT WILKINS (Gloria)</b> <b>Duke University Medical Center</b> <b>Box 3807</b> <b>Durham, North Carolina 27710</b>	<b>1973</b>
<b>CHARLES B. WILSON</b> <b>Department of Neurological Surgery</b> <b>University of California Medical Center</b> <b>Third and Parnassus</b> <b>San Francisco, California 94143</b>	<b>1966</b>
<b>ALLEN WYLER (Lily)</b> <b>3525 West Howe</b> <b>Seattle, Washington 98199</b>	<b>1990</b>
<b>DAVID YASHON (Myrna)</b> <b>St. Anthony Medical Center</b> <b>1492 East Broad street</b> <b>Suite 1100</b> <b>Columbus, Ohio 43205</b>	<b>1972</b>
<b>ALFRED BYRON YOUNG (Judy)</b> <b>University of Kentucky Medical Ctr.</b> <b>800 Rose Street</b> <b>Division of Neurosurgery</b> <b>Lexington KY 40506</b>	<b>1989</b>
<b>RONALD F. YOUNG (Sheila)</b> <b>University of California at Irvine</b> <b>101 The City Drive South</b> <b>Orange, California 92668</b>	<b>1986</b>
<b>NICHOLAS T. ZERVAS (Thalia)</b> <b>Fruit Street</b> <b>Massachusetts General Hospital</b> <b>Boston, Massachusetts 02114</b>	<b>1972</b>

**INACTIVE MEMBERS**

**JOHN P. KAPP (Lurese)**  
**406 North Main Street**  
**Galax, Virginia 24333**

**SENIOR CORRESPONDING MEMBERS**

- JEAN BRIHAYE (Martine Van Geertruyden)** 1975  
98 Ave. Des Franciscainn  
1150 Bruxelles, Belgium
- KARL AUGUST BUSHE (Eva)** 1971  
Neurochirurgischen Klinik  
Josef-Schneider-Strasse II  
D-8700 Wurzburg, West Germany
- JOHN HANKINSON (Nicki)** 1973  
Westacres  
Woolsington Hall  
Newcastle-Upon-Tyne  
England
- SHOZO ISHII** 1975  
Department of Neurosurgery  
Juntendo Medical College  
Tokyo 113, Japan
- HANS-PETER JENSEN (RETA)** 1980  
Neurochirurgische Universitätsklinik Kiel  
Weimarer Strasse 8  
D-2300 Kiel/West Germany
- KATSUTOSHI KITAMURA (Yoshiko)** 1970  
Shinkokura Hospital  
1-2-1 Kanada  
Kokurakita-Ku  
Kitakyushu, 803 Japan
- KRISTIAN KRISTIANSEN (Brit)** 1962  
Ullevål Hospital  
0407 Oslo, 4 Norway

<b>WILLIAM LUYENDIJK (Tony)</b> <b>Pr Bernhardlaan 60</b> <b>Oegstgeest, The Netherlands</b>	<b>1973</b>
<b>B. RAMAMURTHI (Indira)</b> <b>2nd Main Road G.I.T. Colony</b> <b>Madras 4, India 600 004</b>	<b>1966</b>
<b>KURT SHURMANN</b> <b>Director</b> <b>Neurochirurg</b> <b>Univ-Klinik Mainz</b> <b>Langenbeskstr 1</b> <b>6500 Mainz, West Germany</b>	<b>1978</b>

**CORRESPONDING MEMBERS**

- LEIGH R. ATKINSON (Alexandra)** 1989  
201 Wickham Terrace  
4000 Brisbane, Qld.  
Australia
- FERNANDO CABIESES** 1966  
Inst. Peruano De Formento Educativo  
Av. Arenales 371, of. 501  
Apartado 5254  
Lima, Peru
- JUAN CARDENAS** 1966  
Insurgentes Sur 594  
Av. Insurgentes  
Mexico City, Mexico 40
- LUC CALLIAUW (Dora)** 1988  
Bisschopdreef 53  
8310 Brugge, Belgium
- JUAN C. CHRISTENSEN** 1970  
Jose C. PAZ 234  
Acassuso (1641)  
Buenos Aires, Argentina
- GUISEPPE DALLE ORE (Giusi)** 1970  
Clinica Neurochirurgica  
Universita di Verona  
Piazzale Stefani  
37100 Verona, Italy
- NOEL G. DAN** 1989  
Suite 5  
Specialist Medical Center  
235-285 New South Head Road  
Edgecliff  
2027 Sydney, N.S.W.  
Australia



JACQUES DEVILLIERS (Jeanne Marie) Department of Neurosurgery Groote Schuur Hospital Observatory 7925 Cape Town Republic of South Africa	1986
HANS ERICH DIEMATH (Karin) Landesnergenklinik Ignaz Harrer-Strasse 79 A-5020 Salzburg, Austria	1970
HERMANN DIETZ Neurosurgical Clinic Hannover School of Medicine Hannover 3000-61 West Germany	1980
VINKO DOLENC (Petra) Klinicki Bolnicki Ctr. Klinika Neurokirurgijo Zaleski C7 6100 Ljubljana, Yugoslavia	1988
RUDOLPH FAHLBUSCH 8524 Neunkirchena Brand Im Kirschgarten 7 Erlangen, Germany	1991
JOHN F. GILLINGHAM (Judy) Royal Infirmary Lauriston Place Edinburgh, Scotland EH43 PB United Kingdom	1962
JAMIE G. GOMEZ (Lucy) V.I. Medical Foundation Bldg. #103 Charlotte Amalie, St. Thomas U.S. Virgin Islands 00802	1975

SALVADOR GONZALEZ-CORNEJO (Rosalie) Av. Chapultepec Sur 130-204 Guadalajara, Mexico 44100	1982
ERNEST H. GROTE (Julie) Neurosurgery Department University Clinic, Calwer Strasse 7 7400 Tubingen, Federal Republic of Germany	1984
DAE HEE HAN University of Korea 28 Wyouon-dong Chougno-gu Seoul 110-744 Korea	1991
HAJIME HANDA (Hiroko) Hamamatsu Rosai Hospital 25 Shogen-Cho, Hamamatsu 430 Japan	1985
FABIAN ISAMAT (Marivi) Clinica Sagrade Familia Torras y Pujalt, 1 08022 Barcelona, Spain	1986
RICHARD JOHNSON Department of Neurological Surgery Royal Infirmary Manchester, England	1974
LAURI LAITINEN (Kerstin) Rosnedalsslingan 21 18633 Vallentuna Sweden	1971
FRANK MARGUTH Clinic in Klinikum Grosshadom Marchioninstr 15 800 Munich,70 Germany	1978

PAUL MARINO, JR. (Milu) Rua Maestro Cardim, 808/814 S. Paulo-SP Brazil	1977
J. DOUGLAS MILLER Western General Hospital Crewe Rd. Edinburgh EH4 2XU Scotland	1988
KENICHIRO SUGITA Nagoya University School of Medicine 65 Tsumai-Cho, Showa-Ku Nagoya 466, Japan	1988
CHARAS SUWANWELA Chulalongkorn Hospital Medical School Bangkok, Thailand	1972
LINDSAY SYMON (Pauline) The National Hospital Queen Square London, WC1N 3BG England	1982
KINTOMO TAKAKURA University of Tokyo Hospital 7-3-1 Hongo, Bunkyo-ku Tokyo 113, Japan	1988
KJELD VAERNET (Ann) Department of Neurosurgery Rigshospitalet 9 Blegdamsvej 2100 Copenhagen, Denmark	1970

**SIDNEY WATKINS**  
The London Hospital  
Whitechapel, London E 1 England

1975

**GAZI YASARGIL (Dianne)**  
Neurosurgical Clinic  
University Hospital  
Ramistrasse 10  
CH-8091 Zurich, Switzerland

1975

<b>DECEASED MEMBERS</b>		<b>ELECTED</b>
<b>SIXTO OBRADOR ALCALDE</b> Madrid, Spain (Honorary)	4 / 1978	1973
<b>JAMES R. ATKINSON</b> Phoenix, Arizona (Active)	2 / 1978	1970
<b>PERCIVAL BAILEY</b> Evanston, Illinois (Honorary)	8 / 1973	1963
<b>EDWIN B. BOLDREY</b> San Francisco, California (Senior)	6 / 1988	1941
<b>SPENCER BRADEN</b> Cleveland, Ohio (Active)	7 / 1969	Founder
<b>HOWARD A. BROWN</b> Walnut Creek, California (Senior)	2 / 1990	1939
<b>DONALD COBURN</b> Wilmington, Delaware (Senior)	9 / 1988	1938
<b>WINCHELL McK. CRAIG</b> Rochester, Minnesota (Honorary)	2 / 1960	1942
<b>EDWARD DAVIS</b> Troutdale, Oregon (Senior)	10 / 1988	1949

<b>R. M. PEARDON DONAGHY</b> Montpellier, Vermont (Senior)	<b>11/26/91</b>	<b>1970</b>
<b>FRANCIS ECHLIN</b> New Paltz, New York (Senior)	<b>4/1988</b>	<b>1944</b>
<b>DEANE H. ECHOLS</b> New Orleans, Louisiana	<b>11/26/91</b>	<b>Founder</b>
<b>GEORGE EHNI</b> Houston, Texas (Senior)	<b>9/1986</b>	<b>1964</b>
<b>ARTHUR ELVIDGE</b> Montreal, Quebec, Canada (Senior)	<b>1/1985</b>	<b>1939</b>
<b>THEODORE C. ERICKSON</b> Madison, Wisconsin (Senior)	<b>10/1986</b>	<b>1940</b>
<b>JOSEPH P. EVANS</b> Kensington, Maryland (Senior)	<b>5/1985</b>	<b>Founder</b>
<b>JOHN D. FRENCH</b> Los Angeles, California (Senior)	<b>1/1989</b>	<b>1951</b>
<b>JOHN R. GREEN</b> Phoenix, Arizona (Senior)	<b>1/1990</b>	<b>1953</b>
<b>WESLEY A. GUFTAFSON</b> Jensen Beach, Florida (Senior)	<b>7/1975</b>	<b>1942</b>

<b>HANNIBAL HAMLIN</b> Providence, Rhode Island (Senior)	<b>6 / 1982</b>	<b>1941</b>
<b>HENRY L. HEYL</b> Hanover, New Hampshire (Senior)	<b>3 / 1975</b>	<b>1951</b>
<b>OLAN HYNDMAN</b> Iowa, City, Iowa (Senior)	<b>6 / 1966</b>	<b>1942</b>
<b>KENNETH G. JAMIESON</b> Brisbane, Australia (Corresponding)	<b>7 / 1976</b>	<b>1970</b>
<b>SIR GEOFFREY JEFFERSON</b> Manchester, England (Honorary)	<b>3 / 1961</b>	<b>1951</b>
<b>WILLIAM KEITH</b> Toronto, Canada (Senior)	<b>12 / 1987</b>	<b>Founder</b>
<b>HUGO KRAYENBUHL</b> Zurich, Switzerland (Honorary)	<b>1985</b>	<b>1974</b>
<b>WALPOLE S. LEWIN</b> Cambridge, England (Corresponding)	<b>1 / 1980</b>	<b>1973</b>
<b>HERBERT LOURIE</b> Syracuse, New York (Senior)	<b>3 / 1987</b>	<b>1965</b>

M. STEPHEN MAHALEY, JR. Maggie Valley, North Carolina (Inactive)	3 / 18 / 92	1972
GEORGE L. MALTBY Boston, Massachusetts (Active)	1988	1942
DONALD D. MATSON Boston, Massachusetts (Active)	5 / 1969	1950
FRANK H. MAYFIELD Cincinnati, Ohio (Senior)	1 / 2 / 91	Founder
AUGUSTUS McCRAVEY Chattanooga, Tennessee (Senior)		1944
KENNETH G. McKENZIE Toronto, Ontario, Canada (Honorary)	2 / 1964	1960
JAMES M. MEREDITH Richmond, Virginia (Active)	12 / 1962	1946
W. JASON MIXTER Woods Hole, Massachusetts (Honorary)	3 / 1968	1951
EDMUND J. MORRISSEY San Francisco, California (Senior)	2 / 1986	1941



<b>GÖSTA NORLÉN</b> Stockholm, Sweden (Honorary)	<b>1 / 16 / 92</b>	<b>1973</b>
<b>PIETRO PAOLETTI</b> Pavia ITALY (Corresponding)	<b>11 / 18 / 91</b>	<b>1990</b>
<b>HANS-WERNER PIA</b> Giessen, West Germany (Corresponding)	<b>7 / 1986</b>	<b>1978</b>
<b>WILDER PENFIELD</b> Montreal, Canada (Honorary)	<b>4 / 1976</b>	<b>1960</b>
<b>HELMUT PENZHOLZ</b> West Germany (Corresponding)	<b>1985</b>	<b>1978</b>
<b>RUPERT B. RANEY</b> Los Angeles, California (Active)	<b>11 / 1959</b>	<b>1939</b>
<b>DAVID L. REEVES</b> Santa Barbara, California (Senior)	<b>8 / 1970</b>	<b>1939</b>
<b>DAVID REYNOLDS</b> Tampa, Florida (Active)	<b>4 / 1978</b>	<b>1964</b>
<b>R.C.L. ROBERTSON</b> Houston, Texas (Senior)	<b>2 / 1985</b>	<b>1946</b>

STEWART N. ROWE Pittsburgh, Pennsylvania (Senior)	10/1984	1938
RICHARD C. SCHNEIDER Ann Arbor, Michigan (Senior)	6/1986	1970
WILLIAM B. SCOVILLE Hartford, Connecticut (Senior)	2/1984	1944
R. EUSTACE SEMMES Memphis, Tennessee (Honorary)	3/1982	1955
SAMUEL R. SNODGRASS Galveston, Texas (Senior)	8/1975	1939
GLEN SPURLING LaJolla, California (Honorary)	2/1968	1942
C. WILLIAM STEWART Montreal, Quebec, Canada (Corresponding)	1948	1948
THORALF M. SUNDT Rochester, Minnesota (Active)	9/9/92	1971
HENDRIK SVIEN Rochester, Minnesota (Active)	6/1972	1957

<b>HOMER S. SWANSON</b> Atlanta, Georgia (Senior)	<b>6 / 1987</b>	<b>1949</b>
<b>THOMAS A. WEAVER, JR.</b> Dayton, Ohio (Senior)	<b>1985</b>	<b>1943</b>
<b>BARNES WOODHALL</b> Durham, North Carolina (Senior)	<b>1985</b>	<b>1941</b>
<b>FRANK WRENN</b> Greenville, South Carolina (Active)	<b>2 / 1990</b>	<b>1973</b>

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