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## Highlights of the 30th Annual Meeting of the American Society of Neuroradiology.

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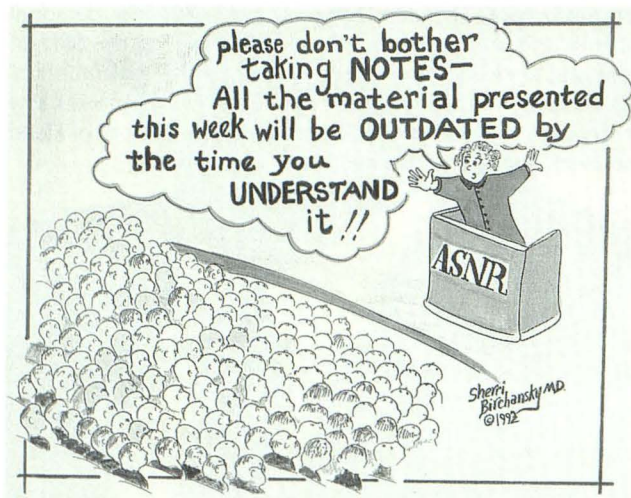
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# MEETING SUMMARY

## Highlights of the 30th Annual Meeting of the American Society of Neuroradiology

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The 30th Annual Meeting of the American Society of Neuroradiology was held at the Adam's Mark Hotel in St. Louis, Missouri, from May 31st through June 5th, 1992. It was preceded by a categorical course entitled "New Techniques in MRI" and followed by a categorical course on "Interventional Neuroradiology." The course on magnetic resonance (MR) imaging techniques was directed by Dr Robert Grossman and the course on interventional radiology was directed by Dr Fernando Vinuela. More than 1,700 persons attended the meeting with a professional attendance of over 800.



The Scientific Program, under the direction of President-Elect and Program Chairman David Norman, was marked by a number of innovations. On several days, parallel sessions were held on different subjects. However, these were summarized on subsequent days so that those who were not able to attend all of the sessions could be brought up to date. The summary sessions also included resumes of the poster sessions.

Special focus sessions touched on MR angiography (MRA) and a panel discussion on this subject compared the various advantages and disadvantages of time-of-flight angiography and phase-contrast angiography. Another presented findings of the North American Symptomatic Carotid Endarterectomy Trial (NASCET) study on extracranial carotid artery disease. Other topics covered in special session were diskography and endoscopic sinus surgery, staging of head and neck tumors, brain injury, functional brain imaging, pediatric neuroimaging with emphasis on sedation, child abuse and perinatal asphyxia, image manipulation and analysis, intracranial thrombolysis, and embolization of intracranial aneurysms.

A lecture entitled "Put the Patient in the Driver's Seat" was delivered by Daniel H. Johnson, Speaker of the House of Delegates of the American Medical Association. The Annual Business Meeting was followed by a "town hall" discussion and update session on current procedural terminology (CPT) coding for interventional and diagnostic neuroradiology.

There were 182 papers presented from the podium, 51 poster presentations, and 52 scientific exhibits (see summary of Scientific Exhibits on page 000). A few of the papers considered to be of particular interest by a panel of reviewers are presented in the following paragraphs.

### Carotid Imaging

A number of papers on carotid imaging were introduced by an address by Dr G. Patrick Claggett of the Executive Committee of NASCET. He emphasized the beneficial effect of carotid endarterectomy in symptomatic patients with stenoses ranging between 70% and 99%. This talk updated radiologists on the NASCET method of determining the severity of stenoses. This method assesses the ratio of the diameter of the stenotic segment divided by the

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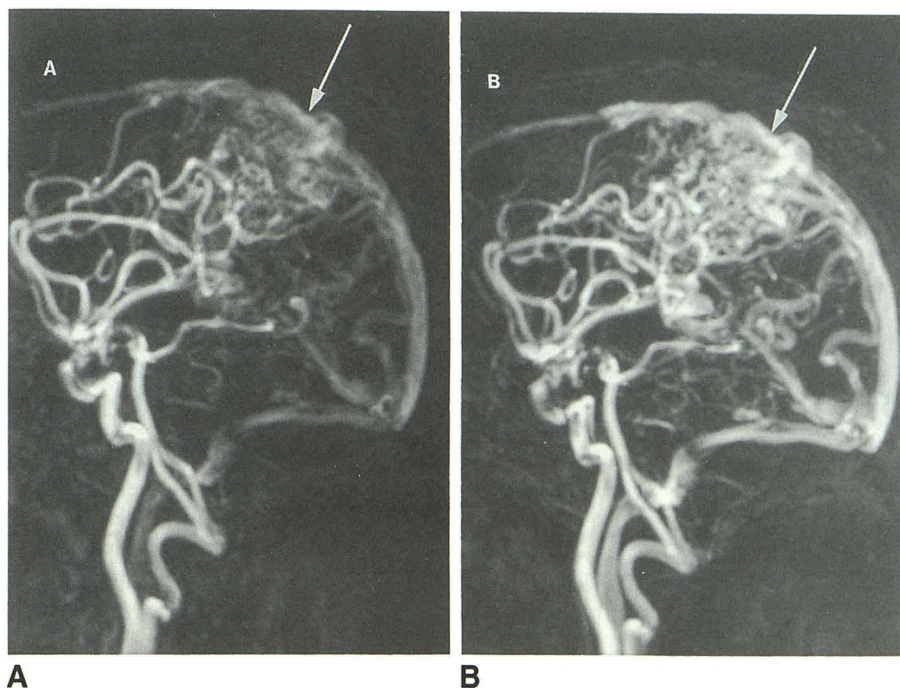


Fig. 1. Tu et al—Sagittal 2-D phase-contrast MRA in a patient with a parietal AVM demonstrating improved vessel visualization following enhancement with 0.3 mmol/kg of gadolinium. Precontrast image (A) is on the left and postcontrast image is on the right (B). Note the increased signal in the nidus of the malformation and draining veins (arrows).

diameter of the nearest distal normal segment  $\times 100$  to yield the percent stenosis. A. J. Fox et al (London, Ontario) described the angiographic findings of 331 patients who had been part of the medical arm of the NASCET trial. Thirty-five percent of the carotid vessels that were followed for an average of 20 months showed occlusion, 45% showed no change, and 15% were improved. They postulated that the improvement was on the basis of reabsorption of intraplaque hemorrhage. They reported that there were no good radiographic or clinical predictors of which lesions may progress and which would resolve. In an analogous work, Rankin et al (London, Ontario) described the carotid duplex ultrasound findings in 936 patients in the NASCET trial. Their results indicated that, compared to angiographic measurements using the NASCET criteria, Doppler ultrasound had a sensitivity of 59.3% and a specificity of 80.4% for the detection of stenoses greater than 70%. Twelve percent of cases diagnosed as mild stenosis were actually found to have severe stenosis according to angiographic criteria and 33% of those described as severe by Doppler examination were actually less than 70% stenosed.

With respect to the ability of radiologists consistently to interpret conventional angiographic studies for stenosis, Heiserman et al (Phoenix, Arizona) compared measurements made by four neuroradiologists in 73 bifurcations using a five-point grading scale of diameter narrowing. Statistical analysis demonstrated good inter- and intraobserver variability. Discrepancies were noted to be most common for lower grades of stenosis.

Blatter et al (Salt Lake City, Utah) and Davis et al (Salt Lake City) compared a variety of MRA techniques to conventional angiography in evaluating the carotid bifurcation. Three-dimensional time-of-flight overlapping thin-slab acquisitions compared most favorably to conventional angiography. Two-dimensional time-of-flight MRA exag-

gerated stenoses in both studies while 3-D phase-contrast images were occasionally degraded by inappropriate selection of velocity-encoding gradients and/or velocity-phase aliasing. Atkinson et al (Iselin, NJ) demonstrated radiofrequency background suppression and excitation modifications of conventional 3-D time-of-flight MRA for evaluation of the intracranial circulation. Their technique showed improved vascular contrast and especially good visibility in third-order branches of the intracranial circulation.

Two papers dealt with the use of gadolinium in MRA. The rationale was that gadolinium would improve vessel visualization by decreasing the effect of flow saturation and improving the signal-to-noise ratio in small vessels. Tu et al (Madison, Wisconsin) evaluated the effect of high-dose gadoteridol (0.3 mmol/kg) on vessel intensity and flow saturation using 2-D phase-contrast angiography. The authors used theoretical predictions (Bloch equations) in clinical cases (Fig. 1) to demonstrate an improvement in vessel signal and visualization with paramagnetic contrast material. This improvement was most marked in small vessels and those vessels with slow flow. Because of the excellent background soft tissue suppression of phase-contrast MRA, no interference from enhancing soft-tissue structures was noted. Although the authors did not consider the role of more conventional doses of paramagnetic contrast material (0.1 mmol/kg), their calculations suggested a significantly smaller improvement in vessel signal intensity with the smaller dose.

A paper by Kramer et al (Boston, Massachusetts) found a paramagnetic contrast material was not useful in MRA in patients with aneurysm and was only marginally helpful in those with vascular malformations. The principal difference in this study and that of Tu et al was the angiographic technique employed. The study of Kramer et al used 3-D time-of-flight MRA. Without the background suppression



of phase-contrast angiography, the standard maximum intensity projection images were nearly uninterpretable following contrast administration, due to the projection of enhancing background tissue in the skull base and cavernous sinus into the maximum intensity projection image. The possibility was discussed of limiting background signal from enhancing tissue by using alternative processing algorithms.

Moran et al (St. Louis, Missouri) and Napel et al (Stanford, California) investigated technical aspects of spiral computed tomography (CT) in the evaluation of carotid artery stenosis. The study by Napel et al used 3-D reconstructions. The study by Moran et al used a plexiglass phantom. Napel et al used a bolus of iodinated contrast material and were able to demonstrate the cervical internal carotid artery and its intracranial portion and pathologic findings (Fig. 2). Artifacts in the projection techniques from bone and calcification somewhat degraded the images.

Fast spin-echo (FSE) imaging of the brain was discussed in the papers by Norbash et al (Stanford, California) and Johnson et al (Phoenix, Arizona). The two studies used slightly different techniques, but their conclusions were similar. High-signal lesions were detected equally well with FSE and conventional spin echo (CSE), while low-signal lesions (primarily hemosiderin) were less well detected with the FSE technique. The presenters of these papers suggested using a gradient-echo sequence in combination with FSE when there is a possibility that there may be a low-signal lesion such as might be seen with hemosiderin or acute intracerebral hemorrhage.

Magnetization transfer imaging was discussed in a paper by Blatter et al (Salt Lake City, Utah). Many authors feel this is a new method of tissue characterization. The investigators in this study found a correlation between tumor "hardness" and the magnetization transfer effect.

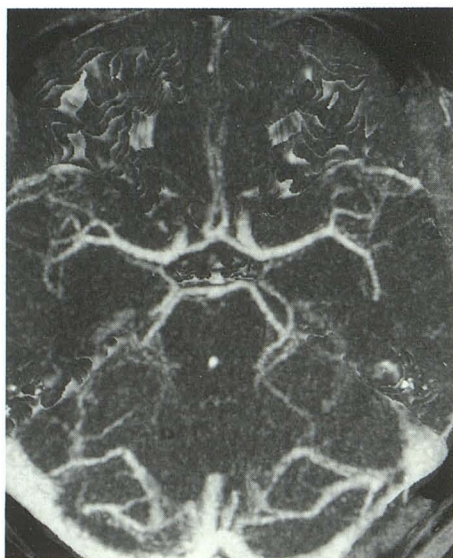


Fig. 2. Napel et al—Axial (superior/inferior) view of the intracranial circulation using the spiral CT technique.

## Spine

Becerra et al (Miami, Florida) examined the phenomenon of wallerian degeneration following spinal cord injury. They examined the spinal cords of patients who had suffered injury from 8 days to 22 years prior to examination. Spinal cords were removed and studied with MR images and also with a variety of histologic stains to show myelin, axons, and connective tissues. On the MR scans, no findings were seen up to 7 weeks. After 7 weeks, there was increased signal noted in the dorsal columns above the injury. Histologically, early wallerian degeneration was seen above, and a few days later below, the injury level within the first 2 weeks.

Dina et al (Washington, DC) examined two groups of patients following surgery for diskitis. Long repetition time (TR) and gadolinium-enhanced short TR studies were performed 3 weeks, 3 months, and 6 months following surgery. The authors found that gadolinium enhancement of the disk space, decreased signal on T1-weighted images with subsequent enhancement of adjacent vertebral body marrow, and increased signal of adjacent vertebral body marrow and disk on T2-weighted image correlated with diskitis. They suggested that these MR changes are uncommon in the asymptomatic group and should not be assumed to be normal. However, they acknowledged that in cases in which some of these findings were demonstrated preoperatively, problems of diagnosis would remain.

Grand et al (Brussels, Belgium) examined 26 patients with cervical spondylosis, of whom 17 displayed high signal in the spinal cord on long TR SE MR. These foci were either at or slightly above the area of spondylosis and were presumed to be secondary to venous compromise. Following surgery, there were persistent hyperintensities in the cord in all 17 patients from 2 to 3 years postsurgery. The authors concluded that high signal is not a contraindication nor is it a poor prognostic factor for operation. They suggested that one of the reasons for their high rate of clinical improvement may have been the strict criteria that they applied in the selection of their patients with respect to myelopathy rather than radiculopathy. One of the discussants suggested that the high signal probably represented a spectrum of pathologic entities.

Murtagh et al (Tampa, Florida) described percutaneous drainage of Tarlov cysts that were located at the site of the ganglion. They retrospectively examined 500 lumbar spine MRs and found that 4.5% had these cysts. They suggested that pressure on the nerve roots was responsible for the pain. They described percutaneous aspiration of the cysts with consequent relief of from weeks to months. Chemonucleolysis of cervical disks was the topic of the paper by Krause et al (Strasbourg, France). They treated 252 patients with disks from C4 to T1 using slow injection of chymodiactin (Fig. 3). Thirty-five percent had relief of symptoms in the first 36 hours and 50% in the first 8 days. Ten percent of patients did not benefit from the procedure. Complications included one case of subarachnoid hemorrhage and three cases of diskitis. Resolution of the disk herniation was visualized on CT within 6 to 8 weeks.



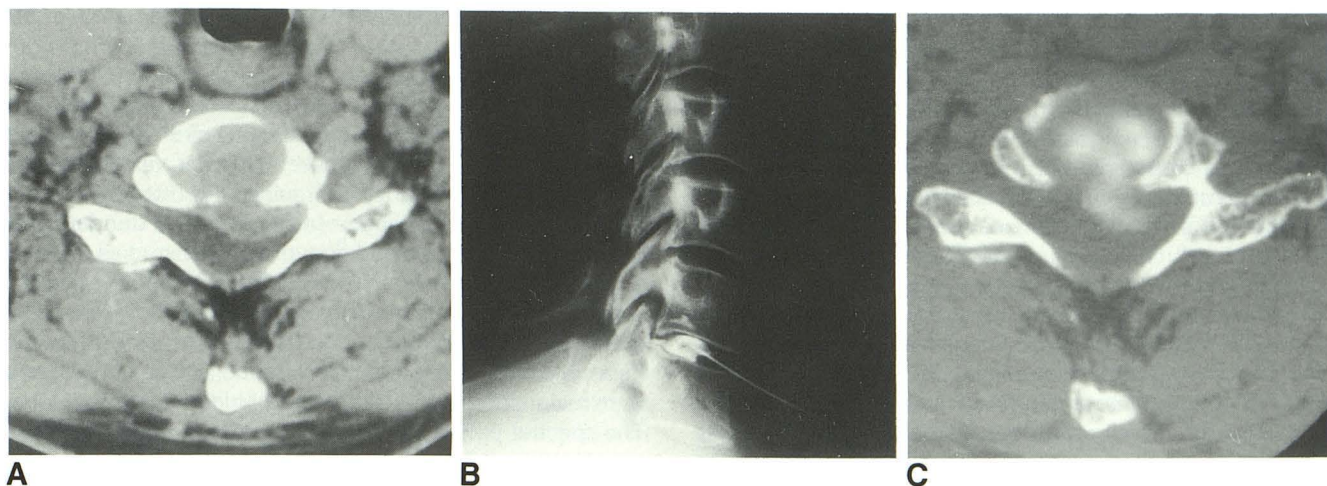


Fig. 3. Krause et al—A, Axial CT scan showing a left-sided herniated nucleus pulposus at C6-C7. B, Sagittal/radiograph during C6-C7 diskography prior to chymodiactin injection. C, Postchemonucleolysis diskography/CT scan. The nucleus and fragment are opacified and by the same token have been exposed to the enzyme.

following the procedure. Schellhas et al (Minneapolis, MN) described thoracic diskography in 164 disks. Patients had diffuse pain syndromes (upper thoracic or lower thoracic). The authors cautioned that it was necessary to place the needle medial to the costovertebral joint and lateral to the interpediculate line to avoid complications such as pneumothorax or cord infection.

Two papers dealt with the use of MR to describe cord motion. Mikulis et al (Toronto, Canada) showed the normal oscillatory movement of the spinal cord following systole, presumably due to tethering and elastic rebound from the dentate ligaments. They noted decreased oscillation with Chiari malformation, but increased oscillations in a case of posterior fossa arteriovenous malformation (AVM). Levy et al (Washington, DC) described the dynamic MR of syringomyelia. Cases with Chiari malformation showed decreased cord motion. The crowding of the foramen magnum by the cerebellar and tonsillar motion appeared to obstruct cerebrospinal fluid (CSF) during certain phases of the cardiac cycle, possibly contributing to syrinx formation.

## Head and Neck Radiology

There were two papers of particular interest from the first session of Otorhinolaryngologic Radiology. The first of these by Casselman et al (Brugge, Ghent and Utrecht, The Netherlands) retrospectively analyzed imaging studies in patients with Cogan syndrome, which affects young adults with nonsyphilitic interstitial keratitis and vestibuloauditory dysfunction. There is fibrous, noncalcific obliteration of the membranous labyrinth in patients with this disease. The authors used a CISS-3DFT (construction interference in steady state-three-dimensional Fourier transformation) gradient-echo sequence on all patients. This allowed acquisition of 1-mm contiguous T2-weighted images of the inner ear. The cranial nerves, fluid spaces, and membranous labyrinth were routinely imaged by this technique. When

CT showed no calcific obliteration of the membranous labyrinth but MR showed tissue intensity material within its fluid spaces, the diagnosis of fibrous obliteration was made (Fig. 4). The active oblitative process was diagnosed when there was postcontrast enhancement of the membranous labyrinth. When no signal came from the area of the membranous labyrinth, calcific or ossific obliteration was diagnosed.

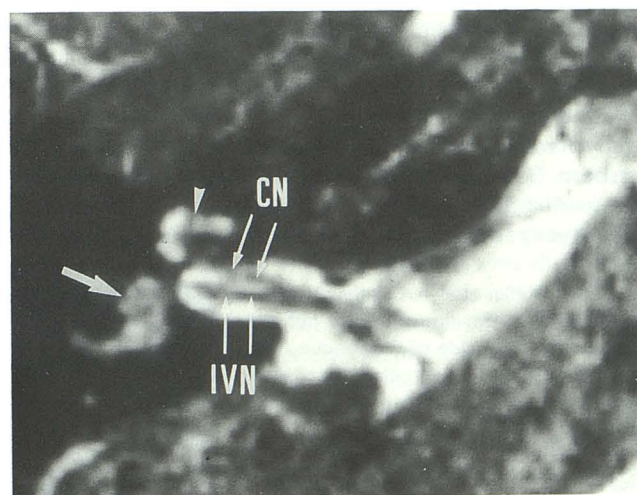


Fig. 4. Casselman et al—A 1-mm thick axial CISS-3DFT section through the right temporal bone at the level of the inferior part of the internal auditory canal in a patient with Cogan syndrome. Normally, the signal of the CSF in the internal auditory canal and the signal in the endolymphatic and perilymphatic fluid in the cochlea, vestibule, and semicircular canals are identical. In this image the signal loss is seen in the cochlea (arrowhead) and in the vestibule (large arrow). The scan was normal, suggesting that the signal loss in the membranous labyrinth is caused by noncalcified or fibrous obliteration of the labyrinth fluid spaces. Note the demonstrating of the bifurcation of the cochlear nerve (CN) and the inferior vestibular nerve (IVN).



The detailed anatomy of the fluid spaces of the membranous labyrinth as well as the individual cranial nerves that can be seen with current gradient-echo sequences should provide useful information in patients suspected of having cochlear pathology. CT allows the diagnosis of labyrinthine ossifications, but it is not useful in peering into the membranous labyrinth fluids spaces.

Keller et al (Toronto, Canada) studied 25 patients with squamous cell carcinoma of the tongue with CT and MR to determine the accuracy of the image modalities compared with that determined by histologic section, using standard T1 and T2 axial SE images and postcontrast T1-weighted images with and without fat saturation. The CT and MR scans were interpreted independently without knowledge of the clinical stage of the tumor. The results confirm the impression that CT is a marginal study in the oral tongue region. Eight out of the 25 patients had negative CT scans of their tumors. MR was nondiagnostic in only one of 25. Compared to CT, MR was more accurate in assessing tumor size (Fig. 5). Both CT and MR overestimated the actual size of the tumor. The use of paramagnetic contrast material with and without fat saturation did not significantly change the impression of the interpreters regarding tumor location, size, or extent.

## Interventional

Papers comprising the interventional program provided a good indication of the direction of growth of interventional neuroradiology, toward a time when it becomes a discipline for critical study and scientific methods are of greater importance than personal experience and opinion.

In a clinical study aimed at examining the possibility of using a modified guide wire placed endovascularly to record electroencephalogram waves and evoked potentials directly from adjacent neural structures, Stoeter et al (Ravensburg, Germany) demonstrated, in a series of 18 patients, the feasibility and potential value (ie, higher signal amplitude than recordings made from standard external elec-

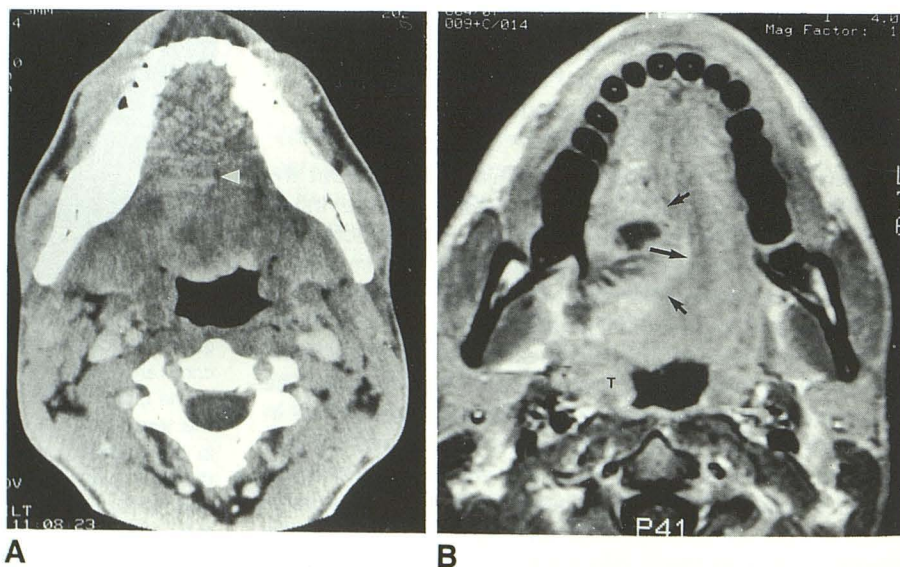
trodes) of the technique. No morbidity was reported in this series.

In another illustration of endovascular techniques used to obtain physiologic measurements, Chaloupka et al (Los Angeles, California) reported the results of a study in swine in which the relationship between Doppler velocity measurements made with an 0.018 guide wire fitted with a 12-MHz transducer and those obtained with a standard implantable volumetric blood flow probe was studied. In their series of eight animals, there was found to be an excellent correlation between carotid average peak velocity as measured with the Doppler wire and volumetric blood flow as measured with the external flow probe. These correlations were maintained over a wide range of blood flow conditions. The spectral patterns obtained from the Doppler wire also correlated well with those made with a duplex scanner. Eskridge et al (Seattle, Washington) presented convincing evidence of the variability of language localization in the cerebral hemispheres. Their technique of using selective injection of a short-acting barbiturate to access language was also discussed. Of interest to those who already use this technique was a related paper by Chaloupka et al (Los Angeles) who, in a swine model, found no evidence of endothelial toxicity after injection of a variety of concentrations of amygdal solution.

Continued interest and evolution in endovascular techniques suitable for the treatment of intracranial saccular aneurysms was reflected in papers by Mawad et al (Houston, Texas), Berenstein et al (New York, NY), Marks et al (Stanford, California) and Gobin et al (Paris, France). Berenstein et al described their experience with the Guglielmi detachable coil and they concluded that the technique was effective and that it had low morbidity in the treatment of a variety of difficult aneurysms. Gobin et al reported 71 patients whose saccular aneurysms were treated with fibered platinum coils and these devices were also found to be effective. The morbidity and mortality reported in this series compared favorably with those of an earlier international series treated by traditional surgical techniques.

Fig. 5. Keller et al—A, Axial postcontrast CT scan showing a poorly defined mass in the right side of the tongue. The lingual septum has been almost obliterated (arrowhead), suggesting extension across the midline.

B, The postcontrast T1-weighted MR clearly shows a mixed intensity lesion (small arrows) involving the posterior two thirds of the right side of the tongue crossing the midline (large arrow) and extending to, but not involving, the right tonsil (T).





The experimental study of Mawad et al (Houston) of the long-term endothelial changes occurring in experimental canine aneurysms treated with the Guglielmi detachable coil demonstrated that, in this model, there is regrowth of healthy-appearing endothelium over the neck (ostium) of the embolized aneurysm. Marks et al (Stanford) described a technique for the mechanical control of coil detachment with the potential for development of another tool that will be of use in the armamentarium of the interventional neuroradiologist.

Johnson et al (Pittsburgh, Pennsylvania) used cerebral blood flow techniques to study the effect of dopamine-induced hypertension on cerebral blood flow in patients with ischemia secondary to vasospasm. They concluded that such intervention has potential for improving flow in regions of ischemia, but could be harmful if applied when there already exists a state of reduced global flow. In their opinion, such therapy should be considered only after evaluation of cerebral blood flow studies. Phillips et al (Charlottesville, Virginia) demonstrated the utility and low incidence of adverse effects of intra-arterial papaverine in reversing vasospasm occurring after subarachnoid hemorrhage. This preliminary study suggests that the technique will be a valuable therapeutic option in this condition.

Papers by Tsai et al (Kansas City, Missouri) and Mawad et al (Houston, Texas) reported experience with the use of thrombolytic therapy for the treatment of dural sinus thrombosis (Tsai et al) or acute arterial occlusions occurring during interventional neuroradiologic procedures (Mawad et al). The reports of these workers demonstrated impressive results and indicated a need for continued intensive investigation of this potentially important therapy. Khayata et al (Phoenix, Arizona) presented a series of 66 patients extracted from 260 patients with a combination of AVMs and arterial aneurysms. In these patients, embolization therapy was targeted at the aneurysm to prevent subsequent bleeding. Eighty-four percent of intranidal aneurysms and 65% of feeding pedicle artery aneurysms were eliminated. Although follow-up length was not specified, none of the protected patients suffered hemorrhage, but 17% of the unprotected patients did bleed, mostly in the 2 or 3 months following the embolization procedure.

Norbash et al (Stanford, California) correlated intravascular pressure measurements from artery pedicles in cerebral AVMs with angiographically demonstrated risk factors and steal. It was found that feeding artery pressures were significantly decreased in patients with angiomatous change, which may explain the positive correlation with steal symptoms and negative correlation with hemorrhage. Higher pressures were demonstrated in the feeders of AVMs with central venous drainage, which may explain the correlation with hemorrhage. No statistically significant relationship could be demonstrated between the steal symptoms and feeding artery pressure, hemorrhage and feeding artery pressure, or AVM size and feeding artery pressure.

Setton et al (New York, NY) presented a series of five patients with vertebral artery fistulae that were deemed unusual because of their clinical presentation (radiculomotor and sensory signs), anatomical location (higher seg-

ments of the vertebral artery) or unique endovascular treatment (contralateral vertebral approach, ascending pharyngeal-C3 vertebral anastomotic approach). Embolization resulted in complete anatomic closure of all fistulae without complication. Wakhloo et al (Freiburg, Germany) presented the results of research performed with balloon expandable and self-expandable Strecker stents placed in dog carotid aneurysms and arteriovenous (AV) fistulae. Two types of stents were used: stents coated with fresh harvested autologous vein graft or lyophilized human vein graft, and noncoated stents. They found that coated stents showed good biocompatibility and were excellent for vessel reconstruction as well as for treatment of fusiform aneurysms and large AV fistulae. Noncoated stents showed promise in the treatment of large carotid aneurysms.

Tomsick and Snowden (Cincinnati, Ohio) reviewed the records of 105 patients with direct, high-flow, posttraumatic carotid cavernous fistulae with particular attention to cerebral venous hypertension complications. Prospective recognition of this phenomenon and early treatment can lead to prevention of the complications of intracerebral hemorrhage and brain stem edema that may arise in untreated cases.

Gobin et al (Paris, France) described a series of five patients with a rare anomaly: intracranial dural AV fistula with perimedullary venous drainage. These are located in the dura mater of the posterior fossa and drain through anastomotic pathways to the perimedullary veins. They are particularly difficult to recognize because the neurologic signs often indicate the disease in the spinal cord. These patients presented with ascending myelopathy. Embolization therapy was curative in three cases and had to be completed by surgery in two patients. This recently recognized interesting category of dural AV fistulae has been named "type 5" in the Djindjian and Merland classification. Duckwiler et al (Los Angeles, California) described five patients with pediatric dural arteriovenous fistulae, presumably congenital in nature, presenting with congestive heart failure, hydrocephalus, seizure disorders, and progressive neurologic deficits. All, but one patient who died, were improved by embolization therapy.

Deveikis (Ann Arbor, Michigan) described his experience with provocative amytal and lidocaine testing in the external carotid circulation, and concluded that amytal testing revealed substantial anastomoses with the internal and vertebrobasilar arterial systems and lidocaine testing revealed cranial nerve supply. The finding of a positive test should lead to the choice of larger particles for embolization or abstinence from embolization.

Gobin et al (Paris, France) described their experience with direct puncture embolization technique using a sclerosing agent (Ethibloc) in the treatment of 51 patients with lymphatic malformations and 220 patients with capillary venous malformations; a total of 750 procedures were performed. The procedure was safe and efficient (5% minor complications) with no extensive necrosis. In 25% of patients, the embolization was followed by surgery. The procedure was found to avoid extensive surgery and provide adequate palliation.



Bonneville et al (Besancon, France) reviewed their experience with a series of 38 patients who underwent transluminal angioplasty of the subclavian and innominate arteries. Only one ischemic complication occurred. Only one restenosis of a left subclavian ostial lesion occurred and was redilated. Heavily calcified eccentric lesions, most often found in the right subclavian artery, gave rise to the poorest results (residual stenosis in more than 50%). Concentric and hourglass-shaped noncalcified lesions responded best.

### Demyelinating Diseases/New Techniques

Two papers focused on brain lesions associated with immune suppression. DeLaPaz (New York, NY) presented two cases of nonenhancing lymphoma of the brain (Fig. 6). Both were large B cell malignant lymphomas in immunosuppressed patients. The reason for nonenhancement was not clear. The paper by Rowley et al (San Francisco, California) illustrated the broad spectrum of central nervous system (CNS) pathology encountered with liver transplantation, reflecting the underlying primary organ failure, immunosuppression, drug toxicity, and operative factors.

Results from a multiple sclerosis collaborative research group were presented by Simon et al (Denver, Buffalo, Cleveland, Portland, and Washington). It was shown that enhancing plaques were present in 55% of patients despite absence of clinical signs of disease activity. A study by Beck et al (Tampa, Florida) revealed that brain plaques are common in patients with isolated optic neuritis and no other CNS symptoms. Both studies confirm the prevalence of asymptomatic brain lesions in multiple sclerosis.

An investigation of the cervical spine by Baka et al (Detroit, Michigan) showed the presence of intramedullary lesions in 59% of multiple sclerosis patients, brain lesions in 90%, and cord-only lesions in 9%. Degenerative changes were present in 49% but only 5% were potentially significant. In an MR study of 25 patients with transverse myelitis, Sherman and Meyer (Colorado Springs, Colorado) showed postcontrast enhancement in 15 and cord enlargement in 10 (Fig. 7). The upper thoracic cord was the most common site, usually with 1-2 segment involvement. Cord enlargement was a negative prognostic indicator because these patients were more likely to have a prolonged course and incomplete recovery.

Two groups compared CSE with FSE for evaluating myelination patterns in infants. Turner and Barkovich (San Francisco, California) noted better gray-white discrimination and fewer artifacts with CSE. Lindan et al (Phoenix, Arizona) thought the two techniques compared favorably. The follow-up discussion focused on the contrast differences between CSE and FSE, particularly the effect of TR. If long TR, (4,000–6,000 msec) are used with FSE, the T2-weighted images may overestimate the degree of myelination, and the white matter will cross through the isointense phase earlier in development. With this technique, CSE may be better in infants under 1 year of age and FSE better after 1 year. Alternately, the TR can be shortened to 2,600 msec to produce gray-white contrast similar to CSE. Brunberg et al (Ann Arbor, Michigan) presented a

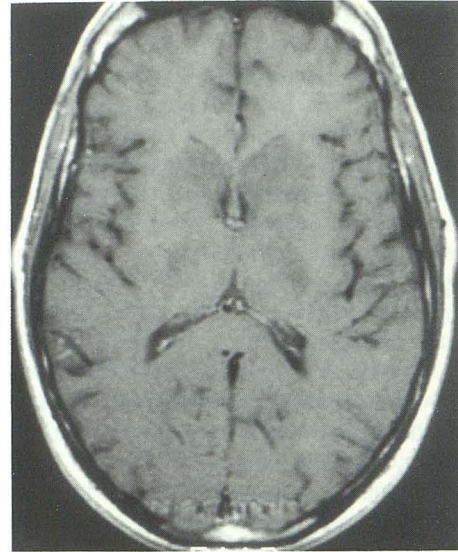


Fig. 6. De La Paz—B cell lymphoma. Although multiple lesions were noted in both hemispheres on T2-weighted images, a post-contrast T1-weighted scan showed no enhancement.

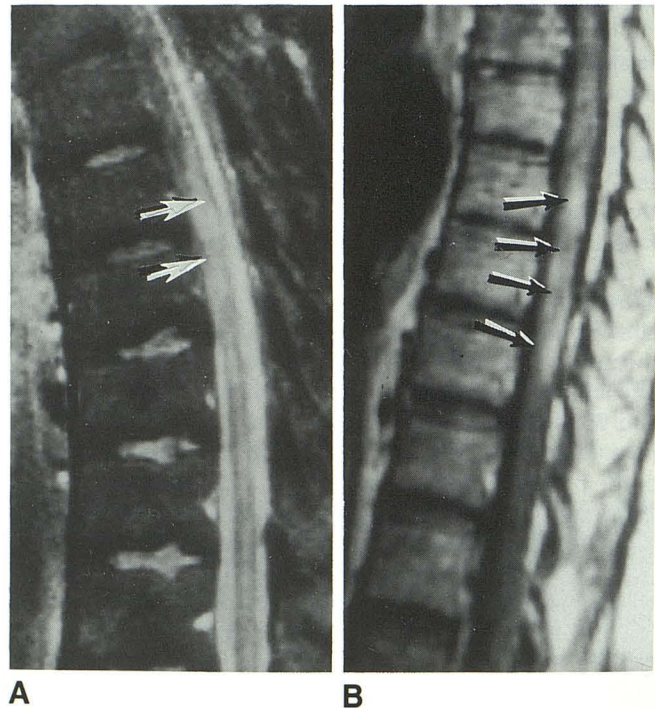


Fig. 7. Sherman and Meyer—Transverse myelitis. The T2-weighted sagittal image (A) demonstrates a high signal area (arrows) in the thoracic spinal cord. A postcontrast T1-weighted image (B) shows enhancement (arrows) of the cord.

very interesting paper on in vivo MR water diffusion coefficients in various neuropathologic entities. Columnar regions of interest were defined and diffusion coefficients determined for the 3 axes. Cerebral infarct had a distinctly low diffusion coefficient reflecting primarily cytotoxic edema. Intermediate values were found for permeative



neuroectodermal tumors, hamartoma, and a meningioma, and significantly higher values for high-grade astrocytomas. Cystic and necrotic components of tumors had distinctly high values. Diffusion coefficients are independent of T2 signal, reflect extracellular water components, and provide a unique measure of tissue structure.

## Stroke

Moody et al (Winston-Salem, North Carolina) used their unique endothelial staining technique with high-resolution microradiography to analyze, at autopsy, the brain microvasculature of 35 hypertensive patients, four of whom had died from intracerebral hemorrhage. Their purpose was to determine the prevalence of Charcot-Bouchard aneurysms in this population and assess the association of these lesions with intracerebral hemorrhage. Surprisingly, no such aneurysms were found in these specimens. However, numerous arteriolar coils and spirals were found which could easily be mistaken for aneurysms using traditional microscopy (Fig. 8). Additionally, previous studies of the brain microvasculature, using injection techniques, may have significantly overestimated the prevalence of Charcot-Bouchard aneurysms by creating false "aneurysms" as rupture artifacts. Contrary to conventional teachings, the data of Moody et al suggest that Charcot-Bouchard aneurysms are rare and only infrequently associated with cerebral hemorrhage.

Pfleger et al (Houston, Texas) made the interesting observation that fluid-fluid levels in brain are rare in patients with intracerebral hemorrhage unless the patient has an underlying coagulopathy. Only 1.5% of patients without coagulopathy will demonstrate such a sign, whereas a fluid-fluid level may be seen in up to 50% of patients when hemorrhage results from a coagulopathy (Fig. 9). In another paper, Bryan et al (Baltimore, Maryland) reported preliminary findings from a multicenter epidemiologic study of patients at risk for stroke. In this cohort, MR evidence of stroke was detected in 77% of patients with a history of stroke and in 23% of patients who had no such history. They concluded that MR evidence of stroke and clinical history are highly but imperfectly correlated.

## Imaging of Psychiatric and Metabolic Disorders

The papers by Boyko et al and Charles et al (Durham, North Carolina) described potential psychiatric applications of MR spectroscopy. Brain choline concentration (hydrogen spectroscopy) was seen to be elevated in patients with depression. The fluorinated antidepressant medication fluoxetine (Prozac®), was detected in phantom studies and in the brain using fluorine-19 MR spectroscopy.

Dreisbach et al (Denver, Colorado) studied 27 patients with chronic toluene abuse using MR and neuropsychologic testing. They reported hypointensity on T2-weighted MR in seven patients that correlated with the most severe cognitive dysfunction. The thalamic hypointensity was felt



Fig. 8. Moody et al—High-resolution microradiograph demonstrates that tortuous arterioles could be mistaken for Charcot-Bouchard aneurysms if examined with older, less precise methods.

to be due to alterations in the phospholipid component of the oligodendroglial membrane and myelin sheath.

Thomas et al (Durham, North Carolina) used biochemical assays to confirm the increase in brain iron related to age in specific basal ganglia regions but not in the corpus callosum. Ferric irons produced a greater decline in T2 than did ferrous irons in a correlative phantom study. Eleven patients with Wilson disease were presented by Magalhaes et al (São Paulo, Brazil). In addition to hyperintensity in the putamen on T2-weighted image, they reported additional foci of high signal intensity in the globus pallidus, caudate nucleus, red nucleus, thalamus, and periaqueductal gray matter.

Desmond et al (Victoria, Australia) assessed the medial temporal lobe both visually and quantitatively in patients with Alzheimer disease and found a decreased hippocampal and amygdala volume. Interestingly, the visual assessment was slightly more accurate than the other measurement.

Golomb et al (New York, NY) highlighted the use of the hippocampal lucency seen on axial images, as well as an





Fig. 9. Pflieger et al—When a fluid-fluid level is seen in an area of intracerebral hemorrhage, the probability is high that the patient has an underlying coagulopathy.

increased transverse fissure height seen on coronal images as imaging markers correlating with cognitive impairment in Alzheimer disease. In summary, this group of presentations focused on the increase in interactions between psychiatry and neuroimaging.

### Pediatrics/Excerpta Extraordinaire

Wilms et al (Leuven, Belgium) presented CT and MR findings of infants with macrocrania and pericerebral collections. They studied the MR findings in 19 infants who had rapidly enlarging head size and CT demonstration of enlarged extra-axial spaces. Eleven of these patients had uniform extra-axial CSF intensity collections on all sequences suggesting communicating hydrocephalus. Seven had definite and one had equivocal subdural space fluid collections on MR. There were only three definite and two equivocal subdural collections recognized on CT. Risk factors that suggest communicating hydrocephalus with subdural effusion include age of less than 5 months, absence of a family history of macrocrania, and suspicious CT findings. The authors concluded that those infants should undergo MR to facilitate detection and surgical intervention for subdural effusion or hematoma.

Brunberg and Schumacher (Ann Arbor, Michigan) reported venovenous extracorporeal membrane oxygenation (ECMO) with attention to early CT alteration following its use in severe neonatal respiratory failure. They examined the CT findings in 31 infants with severe respiratory failure following ECMO. For venovenous ECMO, a double lumen catheter is placed in the venous circulation. Returning oxygenated blood enters the right atrium. Although right atrial pressures are elevated, filtration of the returning blood to the lung prior to entering the arterial circulation was felt to be of benefit. The most frequent CT abnormality in

these patients was enlargement of the subarachnoid spaces. Ventriculomegaly was less frequent (Fig. 10). Intracerebral hemorrhage incidence (23%) compared favorably with venoarterial ECMO studies. It was felt that the enlarged subarachnoid spaces may result from increased venous pressure and secondary impairment of CSF resorption.

Provenzale et al (Boston, Massachusetts) reported the MR findings in six adults with Kearns-Sayre syndrome, a rare mitochondrial disorder. On MR, cerebral and cerebellar atrophy were common as are confluent white matter lesions on T2-weighted image in the corona radiata and centrum semiovale (Fig. 11). Although MR abnormalities were found to be frequent in Kearns-Sayre syndrome, a close correlation with clinical findings could not be established.

Meyding-Lamade (Oldenburg, Germany) reported the MR findings on 30 adults who had received dietary treatment for phenylketonuria as young children. Persistent findings of neuropsychologic and neurophysiologic impairment prompted the study. There were minimal to marked white matter lesions in 29 of 30 patients, usually in parieto-occipital white matter and optic radiations. Other foci were present in the brain stem and cerebellum. MR correlated poorly with IQ levels and with laboratory levels of phenylalanine byproducts. However, visual evoked response abnormalities paralleled the severity of the high-signal foci in the optic radiations on MR.

Lee and Barkovich (San Francisco, California) reported MR findings in five cases of atretic parieto-occipital cephalocele. These included a CSF-filled subcutaneous elevation at the defect site, abnormalities of the straight sinus, elongation of the tectum, and other migration abnormalities.

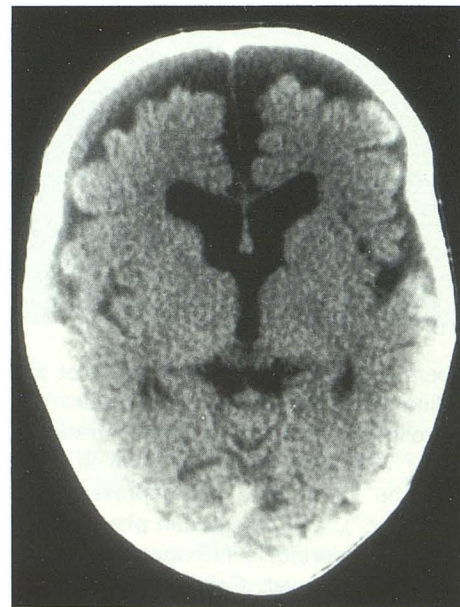


Fig. 10. Brunberg et al—CT scan of a 2-week-old child following venovenous ECMO. The study demonstrates enlarged extra-axial spaces and mild ventriculomegaly.





Fig. 11. Provenzale et al—A T2-weighted MR in a patient with Kearns-Sayre syndrome. There is cerebral and cerebellar atrophy and confluent and hyperintense foci in the deep periventricular white.

Interesting pediatric case reports included one by Yan et al (Long Beach, California) who described an infant with Alexander disease with characteristic enhancement of the white matter, optic chiasm, fornix, and midbrain on MR. This pattern was felt to be specific for Alexander disease when it occurs in an infant with delayed development, macrocephaly, and hydrocephalus. Kollias et al (Cincinnati, Ohio) presented MR findings in a rare case of duplication of the pituitary gland in a 16-year-old girl who also had associated sexual development delay and midline facial and cranial anomalies.

## Social Program

An intensive social program making use of some of the wonderful resources offered by the city of St. Louis was offered to the registrants. On Sunday evening, a "Gateway to the West" barbecue was held at the Adams Mark Hotel. Entertainment included country and western music. On Tuesday evening, the St. Louis Symphony entertained the Society at the beautiful Powell Symphony Hall. The musical selections were heavily weighted toward American composers and the Mississippi River. The highlight of the evening was a presentation by Chris Limber who read a variety of selections from the writings of Mark Twain. The final banquet was held at the 76-acre Missouri Botanical

Garden, one of the finest and most beautiful in the world. It was a balmy evening with ample opportunity to explore the gardens and sculpture collection (see page 1669), dine on gourmet food, and enjoy a variety of musical styles.

## Annual Business Meeting

The Annual Business Meeting was held on Wednesday afternoon, June 3 (see Dr Bryan's Presidential Address on page 1652 and Dr Drayer's Secretary's Report on page 1655). During the meeting, honorary membership was awarded to **Professor Ian Isherwood** of Manchester, England (see biography on page 1663). At the 29th Annual Meeting, honorary membership was awarded to **Professor Torsten Almén** of Malmo, Sweden. Professor Almén was unable to be in attendance at that time and received his honorary membership at this meeting (see biography on page 1665).

The Cornelius G. Dyke Memorial Award for the best original paper in neuroradiology by a trainee in neuroradiology, a resident in radiology, or a Junior Member of the American Society of Neuroradiology was shared by two individuals. They are **R. Gilberto Gonzalez** (Massachusetts General Hospital, Boston, MA) for his paper entitled "Quantitative In Vivo Human Brain Lithium Magnetic Resonance Spectroscopy" and **Frank J. Lexa** (Hospital of the University of Pennsylvania, Philadelphia, PA) for his paper entitled "Wallerian Degeneration in the Feline Visual System" (see biographies on page 1667-1668).

Two individuals were awarded 1992-1993 ASNR Fellowships in Basic Science Research. One was awarded to **Brian W. Chong, MD**, for a project entitled "A Search for Hidden MRI Flow Patterns in Human Cranial Vessels." Dr Chong will be working under the direction of John R. Hesselink, MD, in the Department of Radiology at the University of California-San Diego Medical Center. The other Fellowship was awarded to **Michael A. Kraut, PhD, MD**, for his project entitled "Lactate Production and Metabolism in Cerebral Activation." Dr Kraut will be working under the direction of R. Nick Bryan, PhD, MD, in the Department of Radiology at the Johns Hopkins Hospital.

Newly elected officers for 1993 are: President, David Norman, MD, San Francisco, California; President-Elect, Glenn Forbes, MD, Rochester, Minnesota; Vice President, Robert M. Quencer, MD, Miami, Florida; Secretary, Ruth G. Ramsey, MD, Chicago, Illinois; Treasurer, Thomas P. Naidich, MD, Miami, Florida.

The 31st Annual Meeting will be held in Vancouver, British Columbia, at the Vancouver Trade and Convention Centre, May 16-21, 1993.



# 1992 ASNR Presidential Address

R. Nick Bryan<sup>1</sup>

I would like to thank you, the membership of the ASNR, for allowing me the opportunity to serve and represent this Society for the past year. From the moment Dr Hilal walked me into my first ASNR meeting in Bermuda in 1975, I knew that this was the organization and people that I wanted to be associated with and work for. The ASNR clearly stood for the best of what I wanted my career work to be—the clinical and scientific study of the nervous system using imaging techniques, which, by the way, consisted almost exclusively of conventional x-ray film/screen techniques. Since then, I believe that the ASNR has continued to be one of the major stimuli for the almost miraculous advances in neurological imaging. As an organization, it has fostered research in the field and provided multiple formats for the rapid dissemination of an enormous amount of new knowledge. This has benefited us as practitioners and researchers and, most importantly, it has benefited our patients. It has been a real privilege and pleasure to participate in these traditional research and educational activities of the Society, which have continued to be my main interests.

However, being a traditional academician, it has surprised me that perhaps more rewarding, and certainly more challenging, has been my involvement with planning what I think are necessary changes in the Society to meet some new and different needs of our specialty and its members. The Society was 15 years old at the time of my first meeting; it is now 30 years old. To use a poor metaphor, the Society has grown from an adolescent trying to define itself to a mature adult just recognizing its broader social role and obligations. A major part of my own and the Executive Committee's work the past year has been an extensive review of the ASNR organization in light of its past, current and possible future activities.

This analysis of the Society was to a large extent in response to recent comments, questions and criticisms from the membership. But in addition, certain basic changes in our society and

the practice of medicine also lead us to consider changes to our organization. This review was initially undertaken by a committee headed by Dr Modic and including Drs Lo and Berenstein. Dr Ackerman of the Rules Committee and Dr Naidich of the Executive Committee then undertook the arduous and thankless task of actually writing a draft of bylaw amendments. These, in turn, were extensively and sometimes heatedly debated at a 3 day retreat that included not only the Executive Committee but representatives of most of the major Society committees. By the way, this retreat took place over a weekend in February here in this hotel and many of the participants still haven't forgiven me for this combination of date and place, even though we got a great deal from the hotel. Let me briefly review some of our thoughts and deliberations.

The main topics raised by the membership related to the fact that we have a small, closed Executive Committee to which the membership has limited access and the opinion that inadequate attention has been given to the needs of specific groups within the organization, such as subspecialists and private practitioners. More specifically, it has been pointed out that our elections aren't very democratic, we don't have an effective committee structure, we haven't given adequate support and recognition to subspecialists, we haven't actively participated in reimbursement policy decisions, and we haven't adequately defended our turf (other than that we've done a great job). The retreat participants agreed that these were legitimate and important points that could and should be addressed by some fundamental changes in the definition, organization, and activities of the ASNR.

Many of these points reflect basic changes in the ASNR and medical practice that have occurred over the last 5–10 years. Neuroradiology is no longer a small, esoteric corner of radiology or medicine in general. Approximately 25% of imaging studies are neuroradiological in nature. Furthermore, many of these studies tend to be some of the most technologically demanding and expensive. It has been estimated that perhaps one third of medical imaging costs relate to neurological exams. Because of its dramatic nature, as well as its cost, imaging of the brain has caught the attention of the public and the government

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<sup>1</sup> The Johns Hopkins Hospital, Baltimore, MD 21205.



and made us a very public part of medicine. We are "up-front," "high tech," controversial medical practitioners, and our society should reflect this new role.

This growth and change in our field is reflected in our membership—now approximately 1600, up from 600 at the time of my first meeting in Bermuda. Our projections are that we will have 2500 members by 1995. Furthermore, we are a more heterogeneous group, with significant numbers of our members concentrating in limited areas of neuroradiology. Such concentration is critical for intellectual growth and should be fostered, preferably under the broad umbrella of neuroradiology. The increase in the amount, nature, and scope of our work along with the growth in membership forces us to consider changes in our current organization which was designed—well designed—to operate a small, homogeneous society of a few hundred members which had a well-defined, but limited mission focusing on education, research, and self-recognition. An expanded scope and mission demands a larger number of participating individuals who have increased responsibility in old as well as new areas of activity.

Therefore, we are proposing an expanded, more democratically elected Executive Committee, with greater representation of the membership at large as well as subspecialty groups. A reorganized committee structure with four major policy/action committees, each with increased authority and responsibility for activities in its domain is recommended. This will allow us to increase our traditional education and research programs as well as branch into new fields such as public and governmental relations and practice standards. As with any new effort, there will be much to learn, and there probably will be initial missteps, mistakes and disappointments, but these should lead to eventual successes that greatly benefit not only the Society and its members, but the larger medical community. Despite a great deal of work by many people, we do admit that the proposed amendments to the by-laws aren't perfect and will probably need changes and fine tuning. However, I think they are a good start, and additional changes can easily be made over the next year.

One of the new types of Society activities we are proposing is the large field of public relations, commonly called politics. The increased governmental role in medicine requires organizations such as ours to consider much greater political

action. Individual physicians are having less and less effectiveness defending their practices and incomes. To be heard, organizations that represent groups of physicians are not required. The ASNR has not been a very loud voice for our membership. We were not significant players in the recent implementation of reimbursement schemes and our practices may have suffered. We should not abrogate our responsibilities in this area. We cannot count on the ACR to always represent our interests. We should have our own effective lobbying effort, just as SCVIR has.

While not insignificant, we are still a relatively small voice amongst many in medicine. Whenever possible, we should cooperate with other organizations for common goals. This is best done when we have direct, formal, interorganizational relationships, such as membership in the House of Delegates of the AMA. Such relationships usually require not only contact between the organizations, but individual memberships and contacts in the other organizations. We have been lax in developing such interorganizational relationships. For instance, this year our application for a seat in the AMA House of Delegates was not acceptable because fewer than 50% of our members are members of the AMA, a requirement for organizational membership. I must admit that I have not been a member of the AMA for some years, and Stormy [Johnson], I apologize and give you this personal check for my membership application. This is not easy because I don't always agree with AMA positions, and this check in the amount of 2 Ferragamo equivalents is not covered by my department account. However, I have come to realize that it is more important to concentrate on areas of agreement between individuals and organizations than on areas of disagreement. A recent example of multiorganizational political effectiveness was our recent meeting with the FDA. The AMA, the ASNR, the ASITN, SCVIR, and the ACR (under pressure) agreed that something had to be done about the FDA IDE policies related to endovascular devices. A combined effort, led by the AMA, resulted in a direct meeting with the FDA 2 weeks ago in Washington. As a result of this and follow-up meetings, I think a more satisfactory policy regarding these devices will evolve. Such a combination of organizations can greatly influence major policy decisions, and the ASNR must set up the mechanisms and means to participate in them.



However, words are cheap and our stated intentions to pursue new programs must be supported by real resources. More people working for the Society will be most important and many more of you will be called on to help. But, these added activities must also be financially supported. While it might appear that we are flush with money and can expand our activities with current fiscal policy, I don't think that this is true. While our current bank balance might seem like a lot, it is actually the minimum prudent amount required to cover our current activities. Our current balance barely covers the recommended 2-year reserve. While a total meeting loss seems impossible, I remind you that, if our meeting had been scheduled in certain Chicago hotels during the "flood," we could have had to cancel the meeting. I believe that the Western Society of Neuroradiology had a recent meeting at a site that was extensively damaged by an earthquake 2 weeks after their annual meeting. Disasters can occur and, since meeting insurance is prohibitively expensive, we must maintain an adequate reserve. Our current reserves are conservative in amount and do not allow us to take on major new projects. You will hear a motion during the Business Meeting for a dues increase to put "money behind our mouths" and I encourage you to support such motions, if you feel that the goals are worthy.

I would also like to clarify our expenditures on social activities. I personally think that we spend too much money on social functions and set out this year to cut back on parties and increase education and research income and expenditures. I failed. Despite many statements to the contrary, many of the commercial contributions to our meeting remain tied to social activities that the companies view as very good, and legal, advertising. David Norman and the Executive Committee remain committed to increasing commercial contributions to our educational and research programs, but it is easier said than done. It is not clear that we can actually convert social money into research and education money. In other words, we cannot count on companies following our new projects. Most certainly we cannot expect companies to support our political and governmental activities. We must decide to do this ourselves or leave these activities to others.

Another topic of major membership interest is the plan by the American Board of Radiology to offer Special Competency Certificates in Neuroradiology. Despite all our reservations about the

specifics of ACGME Training Program Accreditation and ABR Certification, these two official and medicolegally recognized documentations will legitimize the excellent training programs developed over the years by ASNR members. Courts, medical reimbursers, and institutional credentialing committees all understand and recognize ACGME accreditation and American Board certification. The ABR may take considerable heat this fall at the ACR meeting from general radiologists and, perhaps, some members of our society. Everyone is entitled to his or her opinion, but I encourage you to support the Board, and in an active and vocal fashion.

I would like to end with a few comments about research, still my main love (in terms of work, that is). Outcome analysis is one of, if not the, most important clinical research fields for the next decade. Not only is it critical for determining what the real value our studies and procedures is, but the results will almost certainly determine reimbursement. Our traditional "small N" anecdotal studies will not suffice. We must train investigators in this field, which often requires other types of resources, scientists, and multiple institutions. The Society should strongly consider financial support of such research.

Functional Imaging! Neuroradiologists must become involved. I stick by my statement last year that it is "more important to know what the brain is doing than what it looks like." A recent article on brain imaging in *Newsweek* is a good example of the importance of this field. The article illustrated the power of brain imaging—structural and functional. While it will be difficult, we must accept the challenge to image brain function as well as structure.

Finally, I must end with two sad notes, the absence at this meeting of two special people, dear and critical to our Society. Mrs Pat Grosshauser, our Executive Director, without whom this meeting could not have occurred, is recovering from major abdominal surgery. Pat, we wish you a quick recovery.

A personal disappointment is the absence of Sadek Hilal, my mentor, who taught me much of what I know about neuroradiology and who introduced me to this Society, for which I will always be grateful. I am pleased that Sadek is recovering from his operation and we all look forward to seeing him in Vancouver.

Thanks for your attention and I would now like to open the Annual Business Meeting of ASNR.



## Secretary's Report 1991–1992

Burton P. Drayer<sup>1</sup>

The Annual Meeting of the ASNR was held at the Adam's Mark Hotel in St. Louis, Missouri, May 31 to June 5, 1992. It was preceded by a Categorical Course on New Techniques in MRI and followed by a Categorical Course on Interventional Neuroradiology. Registration figures for the courses and meeting were as follows:

Total Professional Registration	926
Annual Meeting	854
Magnetic Resonance Course	843
Interventional Course	232
Accompanying Guests	242
Exhibitors	499
Total Attendance	2,219

The Annual Meeting included 167 papers, 51 posters, and 15 "excerpta"; 52 scientific exhibits; 46 technical exhibits; and 8 special focus sessions. During the Annual Business Meeting, held June 3, 1992, the Society admitted 112 new Senior members, 276 Juniors, 23 Associates, 5 Corresponding, and 1 Honorary (Professor Ian Isherwood). Following approval, total membership stood at 2,028.

Officers selected for 1992–93 were:

David Norman, MD, President  
Glenn Forbes, MD, President-Elect  
Robert M. Quencer, MD, Vice President  
Ruth G. Ramsey, MD, Secretary  
Thomas P. Naidich, MD, Treasurer

Since the last Annual Business Meeting in Washington, DC, the Executive Committee met three times, including an Executive Retreat. Highlights of major activities include the following:

- An analysis of the overall organization of the ASNR.
- Extensive constitutional reform, with a goal of improving the operational efficiency of a larger society and democratization of the selection of our leadership.
- A decision to increase the role played by the Society in socioeconomic issues, with emphasis on public relations, interaction with government and other third-party payers, and exploring potential collaborative efforts with other radiological societies.
- Development of Practice and Training Standards for Neuroradiology, and a decision to work more closely with the American College of Radiology.
- Discussion of interactions of the ASNR with corporate sponsors.
- Discussion of fellowship requirements and training program activities.

All standing committees, meeting committees, and ad hoc committees were active, with reports on file at the ASNR Central Office.

The Central Office of the ASNR maintains *lists of fellowship programs, institutions seeking neuroradiologists, and neuroradiologists seeking positions*. Any correspondence relating to these lists, and all inquiries in general, should be addressed to: American Society of Neuroradiology, 2210 Midwest Road, Suite 207, Oak Brook, Illinois 60521; phone: (708) 574-0220; fax: (708) 574-0661.

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<sup>1</sup> Southwest Neuro-Imaging Ltd, Phoenix, AZ 85016.



# Highlights of the Scientific Exhibits of the 30th Annual Meeting of the American Society of Neuroradiology

Eric J. Russell

A total of 52 scientific exhibits were presented at the 30th Annual Meeting of the ASNR. Exhibits were integrated with scientific poster presentations, allowing for easy viewing of all educational materials. There were many excellent exhibits (see list of awards on page 1660). The following short summary provides a look at several of the best presentations.

## Anatomy/Physiology

An award-winning exhibit by Hurley et al, from the Baylor College of Medicine, Houston, Texas, examined imaging correlates in neuropsychiatry. Anatomic pathways affected by lesions resulting in neurobehavioral disorders were presented in a "cutout" form, which could be reconstructed in three dimensions by avid viewers. Cases that supported a relationship between memory and emotion were presented, and lesions affecting the limbic-diencephalic system. An interesting case of global amnesia due to lesions in both mammillary bodies was shown to be related to thiamine deficiency. Such correlations should be recognized by the radiologist who may be in a position to suggest appropriate therapy, in the absence of a specific clinical diagnosis.

Magnetic resonance (MR) and computed tomography (CT) were employed to demonstrate all peripheral branches of the fifth cranial nerve by Poe et al, from the State University of New York Health Sciences Center at Syracuse, NY. Peripheral neural branches imaged effectively included the lacrimal, frontal, nasociliary, zygomatic, pterygopalatine, greater and lesser palatine, alveolar, and mandibular divisions. Anatomic demonstrations were supplemented by pertinent examples of pathologic conditions affecting these branches.

## Cerebral Infection

An exhibit by Gao et al, from the University of Iowa College of Medicine, Iowa City, illustrated unusual MR and CT findings in immunocompromised bone marrow transplant patients with brain abscess. Although brain abscesses in immunocompetent patients are characterized by extensive edema and ring enhancement, the immunocompromised patients studied frequently showed no apparent edema or enhancement (Fig. 1). The authors suggest that this phenomenon may be related to an absence of inflam-

matory response, and the relatively intact blood-brain barrier present in these patients. Other illustrated cases demonstrated recovery of the inflammatory response (and the appearance of vasogenic edema and contrast enhancement) in treated patients with recovering leukocyte and lymphocyte counts. Similar findings are likely to be found in other immunocompromised patients, including those with AIDS.

## Cerebral Neoplasia

Runge et al, from the University of Kentucky at Lexington, reviewed much of the available literature dealing with the utility of high-dose contrast-enhanced brain MR. They confirmed that increased lesion enhancement is consistently seen with Gd-DTPA doses higher than the standard 0.1 mmol/kg. When employed for the detection of intracranial metastatic disease, a greater number of lesions may be demonstrated with high-dose contrast. A dose of 0.3 mmol/kg may become standard for the detection of intracranial metastatic disease, if pricing considerations are not prohibitive.

The ongoing struggle to prospectively distinguish active neoplasm from therapeutically injured brains was the subject of an exhibit by Ende et al from the University of North Carolina School of Medicine at Chapel Hill. Eighteen post-operative brain tumor patients and one tumor patient treated with gamma knife radiosurgery were studied with proton MR spectroscopy. Fifteen of these patients had received either whole brain or regional radiotherapy. Spectroscopic findings were compared with T2- and enhanced T1-weighted MR images. Six patients showed increased choline/NAA and choline/CR ratios, indicating the likely presence of active tumor (Fig. 2). The authors also noted that phosphomonoester/CR ratios were elevated in all six patients with tumor. These findings differed significantly from those seen in patients without clear evidence of tumor recurrence. The authors concluded that spectroscopy combined with contrast-enhanced MR resulted in increased accuracy for determining the presence or absence of recurrent tumor.

Thompson et al, from the Medical College of Virginia in Richmond, reviewed the mechanisms of disease dissemination to the posterior fossa. Emphasis was placed on the role played by Batson's venous plexus. The authors showed that the communicating plexus extending from the sacrum to the craniovertebral junction may serve as a route for the spread of metastatic neoplasm. Transient elevation of intra-abdominal pressure promotes retrograde flow from the caudal primary tumor sites toward the upper portions of the venous plexus, which communicate with veins in the posterior fossa. This mechanism likely explains unusual cases of malignant pelvic neoplasms including prostatic

<sup>1</sup> Northwestern Memorial Hospital and Northwestern University Medical School, 710 N. Fairbanks, Olson Pavilion/Suite 3420, Chicago, IL 60611.



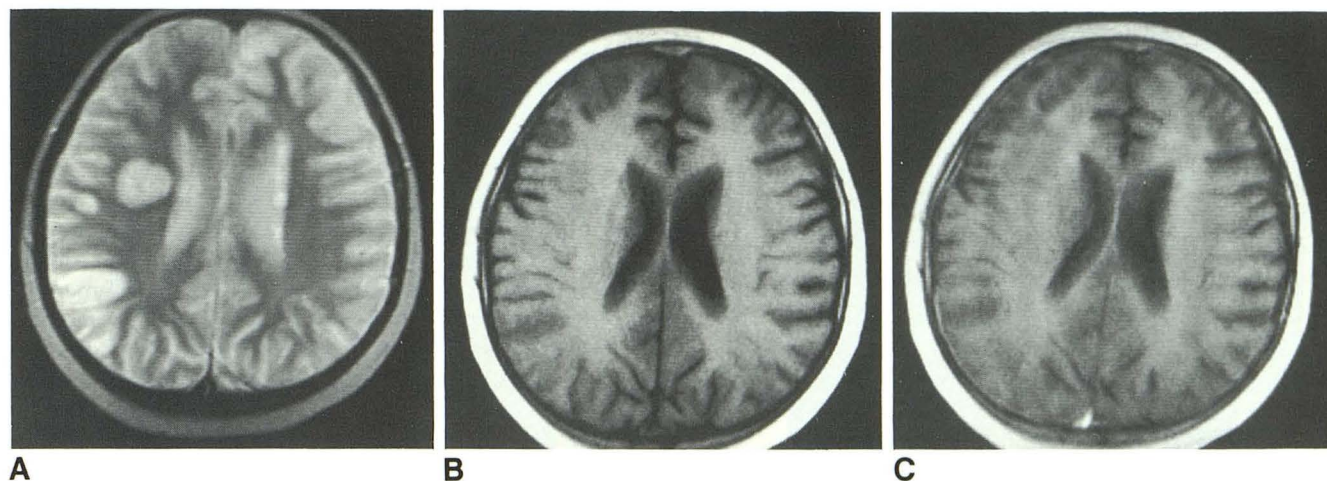


Fig. 1. Absence of vasogenic edema and contrast enhancement in a bone marrow transplant patient with low white cell count (Lao et al).

A, Precontrast axial T2-weighted image shows multiple hyperintense lesions (arrows) located in the corticomedullary junction as well as in the body of the left caudate nucleus.

B, Precontrast axial T1-weighted image. The lesions are not apparent.

C, Postcontrast axial T1-weighted image exhibits no evidence of contrast enhancement.

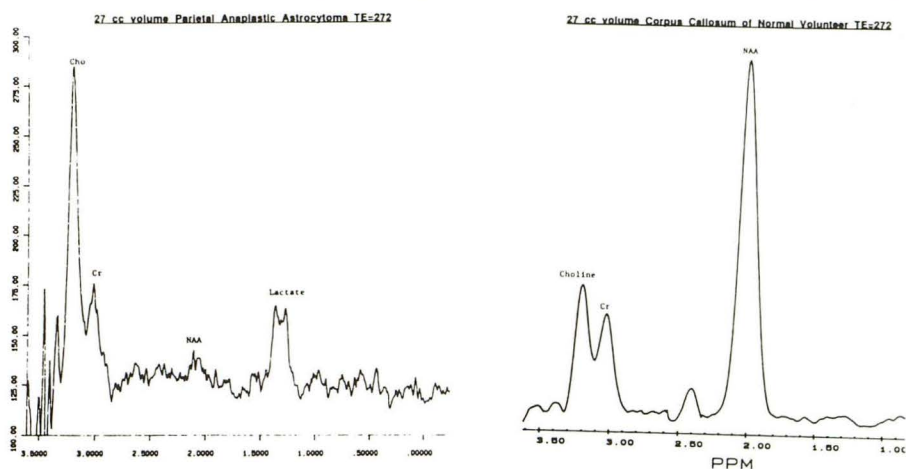


Fig. 2. Proton spectroscopy for the diagnosis of recurrent tumor after radiotherapy (Ende et al). Thirty-one-year-old white man 6 years s/p diagnosis of a low-grade astrocytoma and 5+ years s/p 6000 cGy to the tumor. MR showed no postcontrast enhancement. PET examination showed hypometabolism. The protein spectrum shows a marked elevation in choline, depressed levels of creatine and NAA, and the presence of lactate as compared to the normal spectrum, findings characteristic for active tumor. Biopsy revealed a grade 2 anaplastic astrocytoma.

carcinoma (Fig. 3), metastasizing to the posterior fossa. The authors indicated that, in the setting of secondary malignant disease confined to the posterior fossa, a primary process within the pelvic or spinal regions should be considered when no other primary site is initially detected.

### Sella Turcica

Mackey et al, from the Department of Radiological Sciences at UCLA, presented an excellent exhibit on new MR and MR angiography (MRA) applications for depicting the normal and abnormal cavernous sinus. Considering that most neoplastic and inflammatory diseases of the cavernous sinus enhance intensely with Gd-DTPA, such lesions are often difficult to separate from the enhancing venous compartment of the sinus and the adjacent pituitary gland. The dural interface between the pituitary and the cavernous venous compartment is also infrequently defined.

The authors studied 18 patients with low velocity encoded 2-D phase-contrast MRA. In all cases, normal cavernous sinuses were clearly different from pathologically involved sinuses. The authors found that 2-D phase-contrast MRA employing anteroposterior flow direction and low velocity-encoding (10 cm/sec) routinely visualized the normal cavernous sinus as a small discrete area of anterior or posterior flow. There was close correlation between the amount of pathologic cavernous sinus involvement and the lack of normal cavernous blood flow depicted by their technique. Total replacement of the cavernous sinus resulted in no demonstrated flow. Additionally, rapid coronal T1-weighted MR fast imaging following the bolus administration of intravenous Gd-DTPA was also shown to be useful for examining the sella and cavernous sinus. The normal cavernous sinus enhanced slightly before the pituitary gland. Both the left and right cavernous sinuses typically enhance simultaneously regardless of size asymmetry.



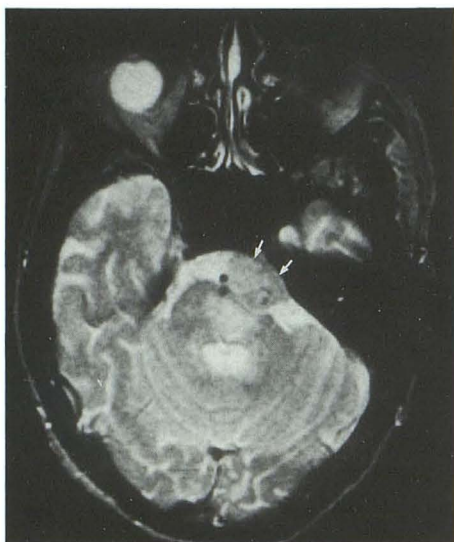


Fig. 3. Disease dissemination to the posterior fossa, presumably via Batson's spinal venous plexus (Thompson et al). T2-weighted MR scan in a patient with subarachnoid metastasis from prostatic carcinoma. Note left cerebellopontine angle mass (arrows) compressing the edematous pons.

Abnormal cavernous sinuses frequently demonstrated absent or asynchronous enhancement at the site of pathology.

### Cerebral Imaging

In an award-winning study of brain hemorrhage and its etiology, Moody et al, from the Bowman Gray School of Medicine in Winston-Salem, North Carolina, presented a thorough scientific investigation of the nature and prevalence of Charcot-Bouchard aneurysms. The authors reassessed current knowledge by examining thick (100–1000 mm) brain sections from 35 hypertensive patients and 20 normotensive patients. An alkaline phosphatase histochemical stain for endothelial cells was employed, with examinations made by light microscopy and high-resolution microradiography. Charcot-Bouchard aneurysms were found to be absent in both groups, including four patients with hypertensive intracranial hemorrhage. In the second portion of their study, 28,000 autopsy specimens collected

over a decade were examined. Only five examples of Charcot-Bouchard aneurysms were found, none of which were directly associated with parenchymal hemorrhage. They concluded that Charcot-Bouchard aneurysms are quite uncommon, and have little relationship to intracranial hemorrhage.

Several illustrated examples of superficial siderosis of the central nervous system were presented in exhibit form by Eames et al from the Department of Radiology at Albany Medical College, Albany, New York. The development of superficial siderosis (surface iron deposition) requires chronic extravasation of blood into the subarachnoid space. It rarely occurs after a single subarachnoid hemorrhage. The source of recurrent hemorrhages is often difficult to identify. Therefore, the first manifestation of chronic hemorrhage may be low-intensity surface outlining of the brain on heavily T2-weighted spin-echo images (Fig. 4). The superficial staining of such structures as the auditory nerve complex in the cerebellopontine angle cistern (Fig. 4B, arrow), may account for one of the characteristic symptoms of superficial siderosis, sensorineural hearing loss. Myelopathy may occur in the later stages of this process.

### Metabolic Disease

Blaser et al, from the Hospital for Sick Children and the University of Toronto in Toronto, Ontario, Canada, illustrated many examples of MR imaging enabling the diagnosis of metabolic brain disease. CT and MR studies were reviewed in 80 patients. Children with metabolic disorders may present with nonspecific clinical symptoms, such as seizures, hypotonia, and loss of milestones. Although neuroimaging findings may be nonspecific, the authors illustrated several characteristic imaging patterns which suggest a specific diagnosis. One specific leukodystrophy, Alexander disease, is illustrated (Fig. 5).

### Temporal Bone

Children with postmeningitic deafness may benefit from cochlear implantation. Johnson et al, from the Department of Radiology at the Medical College of Virginia in Richmond, employed high-resolution CT for the preoperative evaluation of 13 pediatric patients with postmeningitic deafness.

Fig. 4. MR of superficial siderosis of the CNS (Eames et al).

A and B, Heavily T2-weighted spin-echo MR scans in a 70-year-old woman with bilateral sensorineural hearing loss of more than 4 years duration. Note marked hypointensity (T2 shortening) along the surfaces of the brain stem, cerebellum, and acoustic nerves (arrow). Lumbar puncture produced xanthochromic cerebrospinal fluid, but cerebral angiography was normal.

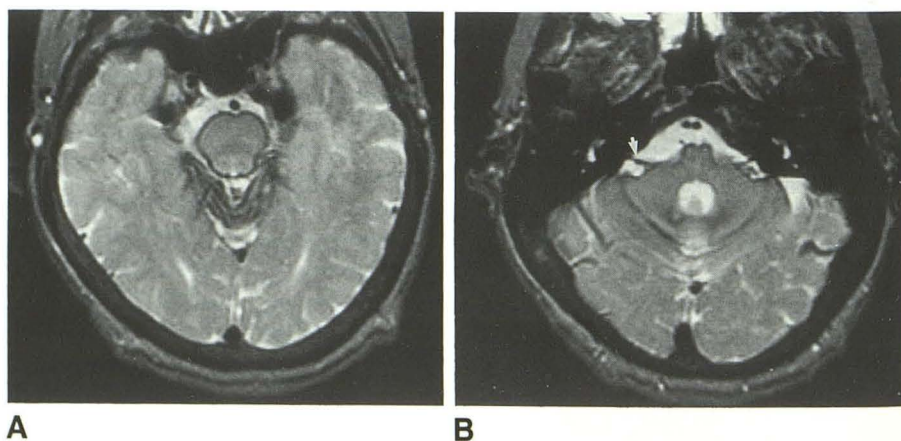






Fig. 5. MR in Alexander disease (Blaser et al). Late-stage coronal proton density-weighted MR scan in a patient with T2 prolongation in white matter due to Alexander leukodystrophy. Hydrocephalus is related to aqueductal obstruction secondary to the accumulation of Rosenthal fibers in the periaqueductal region.

Of significant interest, these patients had more difficulty during the implantation process than other patients with alternate etiologies of deafness. CT revealed partial or total obliteration of the cochlear lumen in the majority of patients. However, a normal CT examination (in three patients) did not ensure easy electrode insertion. Narrowing of the basal turn of the cochlea was the most frequent CT finding, seen in five out of 13 patients (Fig. 6). Ossification of the cochlear lumen was seen in four out of 13 patients (Fig. 7). The CT finding of cochlear ossification indicated that extensive drilling into the scala tympani would be required to achieve even partial electrode insertion. A subtler CT finding, hazy density within the cochlear lumen, may indicate the presence of fibro-ossific changes, findings which may not easily be appreciated even with careful review of CT scans.

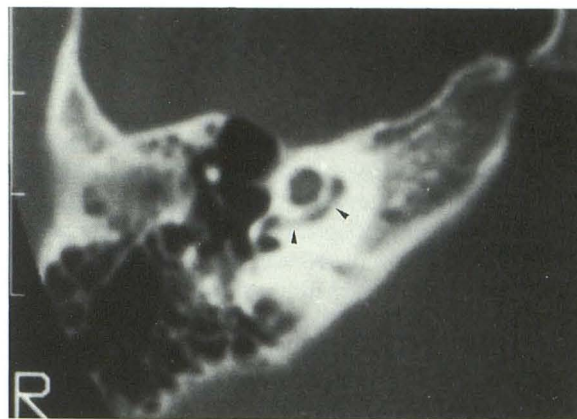


Fig. 6. Cochlear stenosis demonstrated by CT, in a pediatric patient with postmeningitic deafness (Johnson et al). Axial scan through the inferior cochlea reveals two regions of luminal narrowing (arrowheads).



Fig. 7. Cochlear ossification in a child with difficult electrode placement during cochlear implantation (Johnson et al). An axial CT section through the right cochlea shows several focal ossifications within the cochlear lumen (arrowheads).



## ASNR '92 Scientific Exhibit Awards

Committee Members:  
Anton N. Hasso, MD, Chair  
Robert Grossman, MD  
Dixon Moody, MD

### SUMMA CUM LAUDE

- Anatomical      **Anatomic Imaging in Neuropsychiatry**  
R. A. Hurley, J. R. Goldstein, S. Weathers,  
L. A. Hayman  
Baylor College of Medicine, Houston, TX
- Investigational      **Embolization of Experimentally Created Aneurysms with Intravascular Stent Devices**  
G. K. Geremia, M. Haklin, D. Charletta, P. Termin,  
L. Brennecke, S. Raju, D. Granato  
Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL

### MAGNA CUM LAUDE

- Anatomical      **Capacity of MR and CT To Image the Peripheral Branches of the Trigeminal Nerve**  
L. B. Poe, C. A. Benzo, R. M. Kellman, F. S. Yu  
SUNY Health Science Center at Syracuse, NY
- Clinical      **Neuroimaging of Metabolic Brain Disorders**  
S. Blaser, A. Sloane, D. C. F. Harwood-Nash, S. Chuang,  
D. C. Armstrong, P. E. Burrows, J. T. R. Clarke, V. Jay,  
L. E. Becker  
The Hospital for Sick Children and the University of Toronto, Toronto, Canada
- Investigational      **An Endovascular Snare for Use in Small Vessels**  
V. B. Graves, A. H. Rappe, I. Sepetka, A. Ahuja,  
C. M. Strother  
University of Wisconsin, Madison, WI

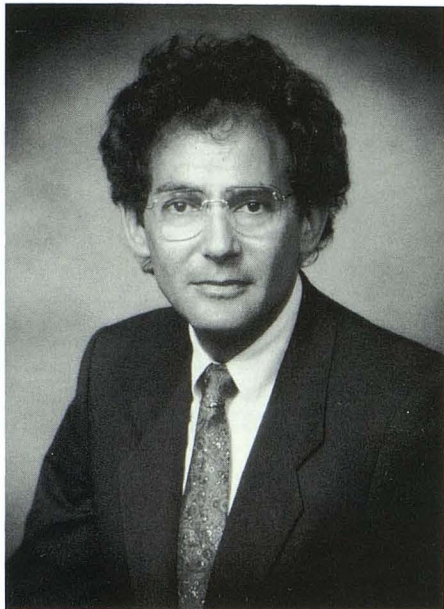
### CUM LAUDE

- Anatomical      **An MRI Atlas of Neuroanatomy Subserving Speech Production**  
D. M. Lefkowitz, R. Netsell  
Creighton University Medical Center, Boys Town National Research Hospital, Omaha, NE
- Clinical      **MR and CT Findings of Brain Abscess in Bone Marrow Transplant Patients**  
F. Gao, W. T. C. Yuh, E. T. Tali, H. Nguyen, N. A. Mayr-Yuh, D. P. Mueller, L. J. Burn  
The University of Iowa College of Medicine, Iowa City, IA
- Investigational      **Fundamental Experiments on the Three-Dimensional Time-of-Flight MR Angiography**  
T. Kodama, Y. Suzuki, T. Yano, Y. Unemura, K. Watanabe  
Miyazaki Medical College, Miyazaki, Japan



# David Norman, MD, 29th President of the American Society of Neuroradiology

Michael S. Huckman<sup>1</sup>



At the 30th Annual Meeting of the American Society of Neuroradiology, David Norman, MD was installed as the 29th President of the American Society of Neuroradiology. His is a name known to neuroradiologists and radiologists throughout the world as a true innovator in modern imaging of the brain.

David was born in Philadelphia on January 28, 1942, although he claims he is often accused of having been born in New York. His parents owned a children's summer camp in the Pocono Mountains of Pennsylvania and David spent many summers working there in general maintenance such as carpentry, electrical work, and plumbing. He jokingly suggests that his later interest in neuroradiology was spawned by his expertise in plumbing. He matriculated at Ursinus College in Pennsylvania. He intended to enter a career in engineering but decided he was "not smart enough" and ultimately entered medical school at the University of Pennsylvania in 1963.

After internship at that institution, he began a residency in radiology at Columbia Presbyterian Hospital in New York City under the direction of Dr William Seaman. Dr Hilal and Dr Wood were the neuroradiologists in the department at that time, and David recalls that there were so many people crowded into the neuroradiology reading room that binoculars were made available so that all could view the arteriograms. He also fondly remembers the struggle to

sequester the most interesting cases which he refers to as teaching file development by appropriation.

Upon completion of his residency, he entered what he called the "largest group practice in the world" and became Chief of Radiology at the 95th Evacuation Hospital in Da Nang, Viet Nam. (Dr Norman claims the multiple episodes of "M\*A\*S\*H," which he had watched previously, prepared him for this practice.) While at Da Nang, he claims he did the last "green screen" angiograms using a hand-pulled changer. This provided a maximum of three films during an arteriogram and he became quite expert in "timing the venous phase." His second year of service was spent at Fitzsimmons Army Hospital in Denver after which he was awarded on the last NIH Special Fellowships in Neuroradiology under the direction of Dr Hans Newton at the University of California at San Francisco. The other fellow training at that time was Dr Meredith Weinstein and, 2 months after joining them, Drs Newton and Weinstein left for a month and David found himself in charge of the neuroradiology service.

Upon completion of his training, he joined Dr Hans Newton on the staff at UCSF just after the installation of their first CT scanner. David was restless and thought he had a yen for private practice. Hans encouraged him to try it and, after a 2-week leave, he returned, and from that time on he and Hans were the only attending neuroradiologists in the section until they were joined by Michael Brant-Zawadzki in 1983.

David's early years in the department were the "halcyon days" of CT. The first third generation General Electric CT scanner was installed at UCSF in 1975 and this began a long association between David and the General Electric Company.

Looking back on those days he reminisces about how it took him 2 years to convince Blue Cross to drop their insistence that a plain skull film be obtained prior to a CT scan. Of the many research projects in which he participated, he thought the most ingenious of his contributions was the use of a plain skull film to localize a lesion on the CT scan. His technique predated the subsequent development of CT scan localizers. In addition to his fruitful collaboration with Hans Newton, David was also fortunate to be associated with the Neurology and Neurosurgery Departments at UCSF headed by Bob Fishman and Charlie Wilson, respectively. He did early work on balloon embolization and tested the first balloon that was FDA-approved for use in carotid cavernous fistula treatment.

In 1986, he became Director of the Section of Neuroradiology. In the years from 1975–1992, David has supervised the neuroradiology training of over 90 postdoctoral fellows and has hosted over 40 foreign visitors in neuroradiology. The list of those individuals comprise a "Who's

<sup>1</sup> Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL 60612.



Who" of neuroradiology. The fellowship program at UCSF is one of the most sought after in our specialty. Dr Norman has authored or coauthored over 160 journal articles, 35 book chapters, and a variety of books. He is much in demand as a speaker and has given a wide variety of national and international invited lectures. He has held many posts in the American Society of Neuroradiology prior to his ascending to the Presidency. He is also a Past President of the Western Neuroradiological Society and a member of the editorial boards of several journals.

In 1975, David met Chaney Li, also a noted neuroradiologist, to whom he was later married for 7 years. His pastimes includes skiing, tennis, running, and travel to just about everywhere in the world that is inhabited by radiologists.

David took a leave of absence from his work at UCSF to work with General Electric Medical Systems in Milwau-

kee and get a look at the corporate world. While there he met Ms Kathy Dell, and they plan to marry in the fall of 1992.

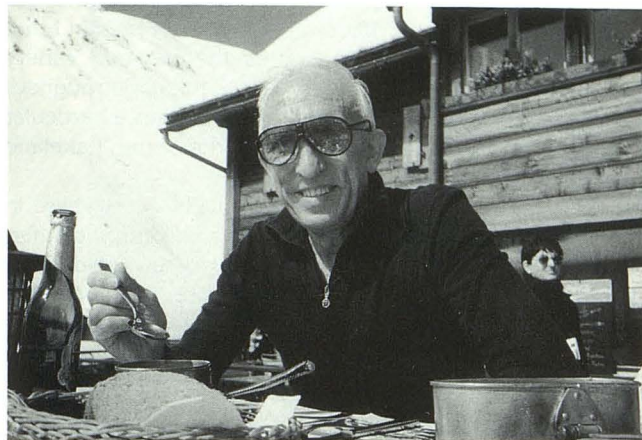
David is known among his friends for his fine sense of humor and his California disdain for formalities. John Trani, Senior Vice President of General Electric Medical Systems once said about David, "He thinks out of the box," referring to the fact that he tends to look at things differently than most people do.

His sense of humor and his "laid-back attitude" are the comic relief to a deadly seriousness when it comes to important matters. We have already had a chance to see the many innovations he has brought to the scientific program of our annual meeting during the past year. During his term as President, his "thinking out of the box" should provide the ASNR with some interesting food for thought.



# Professor Ian Isherwood, MD, FRCP, FRCR, FFR, RCSI

Michael S. Huckman<sup>1</sup>



At the 30th Annual Meeting of the American Society of Neuroradiology in St. Louis, Professor Ian Isherwood was elected to Honorary Membership. Professor and Mrs Isherwood attended the meeting, during which the crystal slant-cut of Honorary Membership was presented by Dr Bryan.

Ian, who currently serves as Professor of Diagnostic Radiology at the University of Manchester and Consultant Radiologist at the Manchester Royal Infirmary, is well known to North American neuroradiology and, indeed, to diagnostic radiologists throughout the world. He was born in Batley, Yorkshire in 1931. Among his vivid memories of childhood was the destruction of his family home on Christmas Eve 1940, during the "Manchester Blitz." His father, a head teacher at a local school, was on duty as an air-raid warden when the house was destroyed by a land mine dropped by parachute. He, his mother, and his brother were spared by having established Wartime sleeping quarters in the basement. Ten-year-old Ian was "most upset by the loss of the Christmas tree and presents."

Attending grammar school at Eccles, near Manchester, he played first eleven cricket and was involved in amateur dramatics, once starring in the title role in "The Importance of Being Ernest." Another student who was interested in dramatics was Jean Pennington who, in 1953, was to become Mrs Isherwood.

Ian always assumed that he would be a physician and never considered alternatives. He entered the University of Manchester in 1948 and, while there, distinguished himself academically and as a cricket player. In 1953, he and Jean were married. She had returned to Manchester to teach geography at the senior school. In 1954, Ian was awarded the degree of MB, ChB, from the University of Manchester.

At that time, the Medical School was known for its luminaries in the neurological sciences. The Head of Neurology was Fergus Ferguson and the Professor of Neurosurgery was Sir Geoffrey Jefferson (of Jefferson fracture fame). Radiology, and particularly neuroradiology, appealed to Ian because it was the opportunity to be part of a team in an area that greatly interested him.

He took his residency at the Manchester Royal Infirmary where a notable tradition in radiology had been established by Eric Gray, Reggie Reid, and Blair Hartley (Ian was later to establish the Gray-Hartley Lectureship). His first consultant post was in Derby working with the neurologist Brian Matthews, who later went on to Manchester and Oxford. In 1963, Ian became a Consultant Neuroradiologist at the Manchester Royal Infirmary and, in 1975, became occupant of the new chair in Diagnostic Radiology at the University of Manchester.

In 1972, Professor Isherwood visited James Ambrose at the Atkinson Morleys Hospital. It immediately became obvious to him that this "curious machine" called the EMI scanner "would clearly transform the way we look at things," and he wrote to the Department of Health offering his assistance in the evaluation of this new technology. As a result, the first commercial EMI scanner in the world was situated at the Manchester Royal Infirmary in April of 1973. With his physicist colleague, Brian Pullan, Professor Isherwood embarked on some of the most important early work on CT scanning of the brain. They introduced the idea of dual-energy scanning in neuroradiology and later in 1976 wrote the first paper on dual-energy scanning for bone mineral evaluation. They also wrote a number of papers in those early years that looked at the subject of texture analysis of CT images. To date, Professor Isherwood has authored over 200 scientific articles on a wide variety of subjects in neuroradiology and general radiology. His careful scholarship and novel ideas have won him the accolades of his colleagues in Britain, Europe, and throughout the world. He has lectured in virtually every nation, has delivered 13 named lectures, is an honorary member of 11 radiological societies, and is a fellow or member of 13 learned societies.

Professor Isherwood's interests outside of clinical radiology are legion. In 1975, he began working with Rosalie David, who headed the multidisciplinary group of Egyptologists at the Manchester Museum. He has fascinated audiences with his talks on "Science in Egyptology" which include radiology and CT, pathology, the study of fabrics, entomology, DNA typing, osteology, and just about every facet of science that has been applied to this topic.

His honors include the Presidency of the European Association of Radiology (the federation of 27 national societies of radiology), and Presidency of the British Institute of Radiology. The latter is the oldest radiological

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society in the world and numbers among its honorary members Wilhelm Conrad Roentgen. Visiting the British Institute of Radiology building near Regent's Park, one admires the portraits of past presidents of the institute that grace the circular staircase. These were presented to the institute by Professor and Mrs Isherwood.

He is also Chairman of the Centenary Congress Committee for the United Kingdom, which will oversee the first meeting of all the radiological science societies in Britain. This meeting is scheduled for 1995 and will include participation of the British Institute of Radiology, the Royal College of Radiologists, the College of Radiographers, the Institute of Physics and Science in Medicine, and the Royal Society of Medicine.

He not only serves as President of the Section of Radiology of the Royal Society of Medicine, but also is heavily involved in European radiology. He is the Dean of the newly created European College of Radiological Education under the auspices of the European Association of Radiology. He serves as Chairman of the History of Medicine Committee at the University of Manchester, and for the past 8 years has been Radiological Adviser to the Chief Medical Officer for England and Wales and the Department of Health.

Despite his heavy commitment to his practice and to organized radiology, many other pursuits occupy his time.

Cricket is a passion of his, and he claims to "balance membership in the Lancashire County Cricket Club with my Yorkshire origins. In England, we reenact the Wars of the Roses twice a year." He also possesses a fine collection of cricketing books and Vanity Fair cricket prints. He also had a world-class collection of opercula—not the kind that cover the sylvian fissure, but rather the cast-iron variety that covers the coal chutes that are ubiquitous throughout England. He is a collector of rare books and has a particular fondness for Irish literature and the works of the "Lakeland poets."

The Isherwoods have travelled virtually everywhere in the world. They are very proud of their children, Jennifer, Judith, and Christopher, who have also rewarded them with three grandchildren. Ian and Jean are "keen walkers" and they particularly enjoy hiking in the Peak District.

Those of us who have come to know Ian personally are captivated by his wry sense of humor and infectious laughter. There are few subjects one can bring up about which he cannot carry on an intelligent conversation. He is a fine representative of our profession in the academic world and throughout organized medicine when he is truly considered to be a "statesman." The members of the American Society of Neuroradiology take pride in adding his name to the list of Honorary Members.



# Torsten Almén, MD

Michael S. Huckman<sup>1</sup>



Professor Torsten Almén was elected an Honorary Member of the American Society of Neuroradiology at the 29th Annual Meeting in Washington, DC. Unfortunately, illness kept him away from the meeting, but he was present at the 30th Annual Meeting in St. Louis to receive his crystal slant-cut, the symbol of Honorary Membership in the American Society of Neuroradiology.

Torsten was born in Lund, Sweden in 1931. His father was a physician who ran a general practice and, as a child, Torsten often accompanied him on house calls. He remarked that "people got fine service along the south coast of Sweden in those days." His father was also an inventor of sorts and, during his career, developed automated red cell and white cell counters.

As a student he debated whether he wished to enter engineering or medicine. During his compulsory military service, the choice was made for him by a friend of his father who assigned him to a medical company. Having passed the equivalent of a US college education in various schools in his home town of Ystad, he began studies at the Medical Faculty of the University of Lund in 1950 and became an Authorized Swedish Physician in April 1958. After serving an externship in gynecology with special emphasis on anesthesiology, he decided that radiology was

more to his liking and entered the program in diagnostic radiology at the Malmö General Hospital under the direction of Solve Welln. Professor Welln was known for his interest in double contrast gastrointestinal examinations. In December of 1966, Torsten presented his dissertation in diagnostic radiology that described an instrument for steering angiography catheters. He had been introduced to animal research in angiography by his friend, Goran Nylander. The steering device he developed enabled him to catheterize the peripheral hepatic artery in dogs. However, he was concerned that he still was unable to see hepatic veins because of the limitations of the available contrast material. Performing angiography on patients, he noticed that they experienced considerable pain during the examination. It was at this time that he became determined to develop a painless contrast medium.

Having gained an appointment as Docent of Diagnostic Radiology at the University of Lund, he set out to solve this problem. He had no background in chemistry and the demands on angiographic contrast media were high water solubility and low viscosity. Therefore, he, bought textbooks on colloidal and organic chemistry to learn better the mechanisms behind solubility and viscosity.

It occurred to him that when he would swim in the Baltic Sea, he was able to open his eyes underwater, whereas he was unable to do this when he swam in the Mediterranean. He wondered whether the pain that he experienced in his eyes might be caused by the same factors that cause pain during arteriographic injection. Since the Baltic was hypo-osmolar compared with the Mediterranean, he suspected it was the high osmolality that caused the pain. Therefore, water-soluble contrast media should be designed which got a lower osmolality per contrast media, such as diatrizoate, iothalamate, and metrizoate. These ionic contrast media dissociate in water into anions, each containing three iodine atoms, and into cations, each containing zero iodine atoms. He hypothesized that these cations should be eliminated because they were responsible for half the osmotic effects of the media without having any contrast medium effect (they contain no iodine atoms), and that these contrast medium ions should be eliminated. He recommended instead the synthesis of iodine-containing contrast medium molecules that were made water-soluble by a number of hydroxyl groups just as sugar molecules are made water-soluble by their many hydroxyl groups. He hypothesized that such a solution of nonionic contrast medium molecules would be less irritating as an arteriographic contrast medium.

He was unable to interest any Swedish pharmaceutical companies in his ideas and from January 1967 to September of 1968 he accepted a position as Associate Professor in Physiology and Radiology at Temple University Medical Center in Philadelphia, where he was able to work on

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contrast-medium effects on the microcirculation of the bat wing under the direction of Professor Mary Wiedeman. He noticed that, with decreased osmolality, there was less toxic effect on vessel walls. He hypothesized that the side effects would actually disappear using isotonic contrast material. He suggested the development of nonionic monomers and dimers to two American pharmaceutical companies, both of which expressed no interest in his proposal.

He was then fortunate enough to meet the director of research at Nyegaard & Company AS (now Nycomed) and, from April 1970 to May 1971, he worked in contrast-medium research with Hugo Holtermann. He described Dr Holtermann as "a member of the Norwegian resistance who during World War II spent time in a concentration camp. It was obvious that he was someone who could take an independent path." During that span of time the first nonionic contrast medium (metrizamide) was developed. The material was clearly far less osmotoxic and far less chemotoxic than the ionic material. As a result, with Holtermann directing the synthesis, Professor Almén commuted between Malmö and Oslo and, with the development of metrizamide, he was recognized as the senior inventor of the product as described in the English patent. (Now, more than 20 years later, he is still commuting between Malmö and Oslo and the cooperation has resulted in iohexol and other contrast materials in different stages of development.)

A conference was convened shortly thereafter with a number of radiologists around the world and the opinion was that there was little or no need for a more expensive vascular contrast material. However, most felt that there was a need for a nonionic myelographic contrast. Therefore, the first clinical trials of the drug were for use in myelography. Professor Almén notes that "the first human intravenous injection was into the president of Nyegaard, Ulf Blix, for an intravenous pyelogram. Mr. Blix is still living today."

In 1987, Torsten was appointed Professor of Diagnostic Radiology and Chairman of the Department of Diagnostic Radiology at Malmö General Hospital, University of Lund. He is coinventor of various ionic and nonionic contrast media for radiology and MR imaging and is also coinventor of an instrument for chemical analysis using x-ray fluorescence. In 1988, Nycomed established Hafslund Nycomed Innovation AB in Malmö, Sweden. This is similar to what most North Americans would refer to as a university/industry research. It is here that he is currently working on new MR contrast media. Professor Almén is also "involved in research on a new rechargeable lithium battery utilizing a new chemistry and a special design."

Professor Almén's accomplishments have not gone unrecognized. In 1974, he was awarded the quadrennial Tage Sjögren prize "for outstanding contributions in contrast medium research." He also received the Annual Prize of the European Society of Neuroradiology in 1974 "for your outstanding work on metrizamide." At the Scandinavian Congress of Medical Radiology in Copenhagen in 1980, he was awarded the "prize for his research in diagnostic radiology," and he received the Antoine Bécclère's Prize in Paris in 1989, awarded every fourth year in connection with the World Congress of Radiology. He is an Honorary Fellow of the Royal College of Radiologists and a member of the Royal Swedish Academy of Scientists, the body which each year determines the recipients of the Nobel Prizes in Chemistry and Physics. However, the most cherished of his awards is the Erik Fernström's Great Nordic Prize for 1987 that was given "for important contributions within contrast medium research." One prize is given to a citizen of one Nordic country annually. In 1987, that prize went to Sweden, and for the first time to a diagnostic radiologist.

Professor Almén has a variety of interests among which are playing the piano and the oboe. His interest in music extends to his teaching. He has prepared a lecture on MR for beginners using musical instruments. He said, "when you listen to an orchestra, you're actually making a Fourier transform with your ear." He enjoys hiking in mountains (see photo). He began cross-country and slalom skiing at the age of 40 and has suffered two shoulder dislocations. He remarked that "I keep a rather low tension on my boots."

He takes great pleasure in telling a story about being absent-minded. While reading films one day, he saw the report of a previous study and decided he would like to talk with the doctor who had dictated the earlier report. He was unaware that he was the one who interpreted the earlier film and, to the amusement of his colleagues, proceeded to page himself over the loud speaker.

He has two children, Per who is working on his dissertation in chemistry, and Pål who is an engineering student, and has helped Professor Almén build equipment for his research.

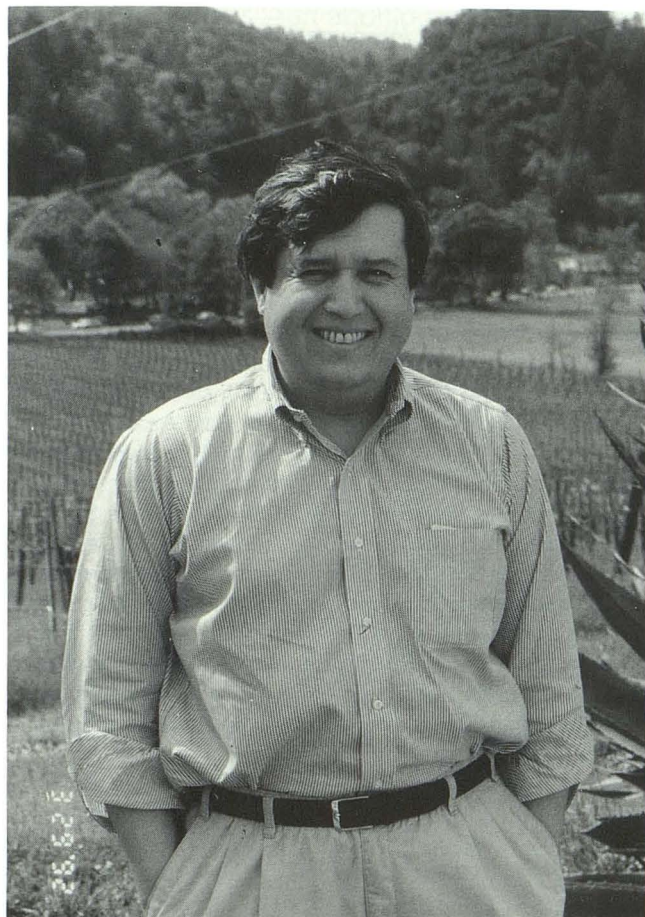
When asked about retirement, he replies "I enjoy my work and I have no plans to retire. Birds like to fly, fish swim, and I intend to do research. I am a research maniac. I am always interested in new and better MR and CT contrast materials."

Neuroradiologists and their patients are indebted to Professor Almén for taking the danger and the sting out of our work. We have not yet heard the final movement of his distinguished scientific career.



## R. Gilberto Gonzalez, PhD, MD: Corecipient of the Cornelius Dyke Award for 1992

Michael S. Huckman<sup>1</sup>



Ramon Gilberto Gonzalez, PhD, MD, corecipient of the Cornelius Dyke Award for 1992, was born in Nogales,

Arizona. He received his BS in chemistry from the University of Arizona and a PhD in chemistry from the University of California, Santa Cruz. His doctoral dissertation in the field of biophysical chemistry was on the subject of NMR of protein-nucleic acid interactions.

He received his MD from Harvard Medical School and, following internal medicine internship and diagnostic radiology residency at Brigham and Women's Hospital, Boston, he entered a postdoctoral fellowship at the Francis Bitter National Magnet Laboratory at the Massachusetts Institute of Technology. He served as Fellow in Neuroradiology at the Massachusetts General Hospital from 1990 to 1992, during which time the Dyke Award paper entitled "Quantitative In Vivo Human Brain Lithium MR Spectroscopy" was written.

Dr Gonzalez is fascinated by the use of MR spectroscopy to get chemical information from the brain that is not otherwise available. He is particularly interested in the study of Alzheimer disease by proton and phosphorous spectroscopy. He is also undertaking studies of other dementias and Parkinson disease.

Dr Gonzalez has an impressive list of 25 publications. He currently serves as Assistant Professor of Radiology at Harvard Medical School and is a staff neuroradiologist at Massachusetts General Hospital.

Dr Gonzalez's wife, Michelle, an atmospheric chemist, holds a PhD from the Massachusetts Institute of Technology and has recently accepted a faculty position at Amherst College. They reside in Cambridge and enjoy tennis, swimming, classical music, theater, and the many museums and cultural opportunities available in Boston.

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<sup>1</sup> Rush-Presbyterian-St. Luke's Medical Center, Chicago, IL 60612.



## Frank J. Lexa, MD: Corecipient of the Cornelius Dyke Award for 1992

Robert I. Grossman<sup>1</sup>



Frank J. Lexa VII, was born on August 13, 1959 in Detroit, Michigan. He was raised in Blue Bell, Pennsylvania and prepared for college at Wissahickon High School in Ambler, Pennsylvania. He was the recipient of a National Merit Scholarship and attended Harvard College graduating magna cum laude. While at Harvard he was a member of the varsity swimming team, served as news director of the radio station, and was a drummer in the Harvard marching

band. He then moved to Stanford University Medical School where he obtained an MS degree in physiology and an MD with special honors in research in 1985. He interned at the Brigham and Women's Hospital from 1985–1986, subsequently starting a residency in Diagnostic Radiology at University of California at San Francisco. He completed both his Diagnostic Radiology Residency and his Neuroradiology Fellowship at the Hospital of the University of Pennsylvania. Dr Lexa was awarded Basic Science Fellowship by the American Society of Neuroradiology in 1991 as well as a University of Pennsylvania Research Foundation Grant Award in 1991 and 1992.

Frank Lexa has many interests outside of medicine. He enjoys skiing and SCUBA, having extensive diving experience in South America, Africa, South East Asia, Australia, and the Sinai Peninsula. He successfully completed the Boston Marathon in 1986 and climbed Mt. Kilimanjaro in Tanzania during the summer of 1987. He speaks Spanish and German and also has some knowledge of Japanese and Czech. For the Dyke Award research, Frank performed a remarkable amount of work, meticulously following many pathways to complete his project. I am sure that Frank Lexa's stellar past performance will be a strong indicator of what promises to be a prodigious academic career, and his Dyke Award paper is the first trailmarker in a long path of important investigations.

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<sup>1</sup> Hospital of the University of Pennsylvania, Philadelphia, PA 19104



## Special Announcement

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### Results of ASNR's First (and probably last) Annual Limerick Interpretation/Sculpture Identification Session

On Thursday (June 4) of ASNR's Annual Meeting, members and guests were invited to try their hand at identifying nine of the many great pieces of sculpture displayed on the grounds of the Missouri Botanical Gardens—an additional bit of fun during a truly memorable evening at one of the loveliest botanical gardens in our country, if not in the world.

The following individuals came up with the correct answers in spite of limericks provided beforehand; these clue-laden nuggets from the motherload of the poet's (?) fancy were supposed to facilitate the participant's search.

The winners are to be congratulated for their intrepidity and demonstrated ability to use both their eyes and imaginations.

Gabriel Angres  
Shirin Blackwell  
John Cavaluzzi  
John K. Chin  
Larry Cromwell  
Ammu R. Devasthali  
R. Devasthali  
Vidusha Devasthali  
Don Eckard  
Amar N. Gulati  
Francis J. Hahn  
Juliana J. Hahn  
Theresa J. Hahn  
Skip Hellewell  
Bobbie Hsi  
Donald Jackson

C. W. Kerber  
Stephen A. Kieffer  
James Mestek  
Maidie Mestek  
Mike Mestek  
Jack D. Miller  
R. A. Nugent  
Chris Richards  
Hugh J. Robertson  
Donald and Anne Russell  
H. D. Segall  
Larry Tannenbaum  
Beth Tanton  
Rob Twyford  
Rosemary Utz  
G. L. Wismer