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GRAND ROUNDS

Differential diagnosis of neurodegenerative disorders in a 43-year-old female

Bullard SE, Lovejoy DW, Oakes HJ

The current study presents the behavioral abnormalities, neuroimaging and neuropsychological results of a 43-year-old woman with a previous history of osteogenesis imperfecta and scoliosis. She presented with a 4-year history of cognitive impairments, characterized by memory, attentional and word-finding difficulties and then followed by numbness, fatigue, urinary incontinence, balance difficulties, disinhibition and emotional flattening. Cranial CT study revealed advanced cerebral atrophy for a patient of this age. EEG study noted disturbance in the left temporal region. MRI finding evidenced prominent sulci over the frontal and parietal lobes and some thinning of the corpus collosum. PET study results indicated mild to moderate diminished metabolic activity within the temporoparietal cortex and decreased neuronal functional activity involving the medial segment of both hemispheres. The patient has been followed up 1 year later with neuropsychological testing and comparison of her neuropsychological profiles across examinations is presented. The results are discussed with reference to the features (clinical and neuropsychological) which distinguish neurodegenerative disorders and the relationship of theses findings to Pick's disease, corticobasal ganglionic degeneration (CBGD) and multiple system atrophy (MSA). The case illustrates the need for detailed neurological and neuropsychological testing and follow-up and consideration of neurodegenerative disorders in younger patients.

Neuropsychological and perfusion MRI correlates of revascularization in an adult case of moyamoya syndrome

Jefferson A, Glosser G, Liebeskind D, Detre J, Sinson G

Moyamoya syndrome is characterized by occlusion and stenosis in the distribution of the internal carotid, anterior, and middle cerebral arteries with progressive compromise of collateral blood flow. Large artery distribution strokes and ischemia due to collateral failure may precipitate significant disability. Revascularization has recently been promoted for stroke prevention in the setting of moyamoya syndrome,

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yet the efficacy of such procedures remains unclear. We present a case of a 49-year-old female attorney with moyamoya syndrome who suffered a right middle cerebral artery (MCA) stroke and subsequently underwent revascularization involving direct right superficial temporal artery to MCA bypass. A presurgical neuropsychological evaluation revealed deficits consistent with a lesion in the nondominant right hemisphere (e.g., visuospatial processes) as well as impairments in verbal tasks associated with the left hemisphere (e.g., verbal memory). Presurgical perfusion MRI showed global and bilateral decreases in cerebral blood flow consistent with diffuse neurocognitive dysfunction. Following revascularization, visual perception and nonverbal visuospatial memory improved. Unexpectedly, verbal memory mediated by the left hemisphere also improved to levels consistent with premorbid functioning. These global improvements in cognitive functioning were consistent with postsurgical widespread bilateral increases on perfusion MRI. Thus, findings suggest neuropsychological measures can identify both global and focal cerebrovascular dysfunction associated with moyamoya syndrome. Furthermore, neuropsychological evaluation shows that revascularization for moyamoya syndrome may engender cognitive and neurological improvement beyond focal regions of established ischemia, presumably due to augmentation of global cerebral blood flow.

Neuropsychological profile following suicide attempt by hanging: two adolescent case reports
Zabel TA, Slomine B, Brady K, Christensen J

Hippocampal damage and amnesia following hypoxia are described in the few published adult cases of suicide attempt by hanging. However, a recent review (Caine & Watson, 2000) suggests a more variable pattern of brain involvement and neuropsychological impairments following hypoxic injury that may or may not involve amnesia. We describe two cases of adolescents who survived hanging attempts that differed in degree of memory impairment. Patient #1 (11 years old) is a male with estimated hanging duration of $\sim$5 min, admission GCS $=$ 7, and coma $=$ 8 days. In Patient #1, initial CT and follow-up MRI were normal. Patient #2 (14 years old) is a male with estimated hanging duration of $\sim$15 min, admission GCS $=$ 5, and coma $=$ 13 days. In Patient #2, initial MRI showed bilateral parietal and temporal infarction, and follow-up MRI revealed mild atrophy. Both patients had similar IQ (VIQ $>$ PIQ), and deficits were noted in components of expressive and/or receptive language, visual-perceptual ability, attention, and working memory. Both patients also displayed symptoms of executive dysfunction in their acute recovery, including disinhibition and echopraxia (Patient #1), poor initiation, word-cluttering, and confabulation (Patient #2), and perseveration (both cases). Despite these similarities, only Patient #2 presented with classic amnesia, and this presentation continued into his postacute recovery. While Patient #1 initially displayed memory deficits, they were less severe and improved as initial confusion resolved. Injury-related variables thought to contribute to these variable patterns of neuropsychological deficits following attempted hanging in adolescents will be discussed, including hanging duration, time until restoration of respiration, and extent of neuroanatomic injury.

PEDIATRIC GRAND ROUNDS

The effects of hemorrhagic stroke on an 8-year-old child: a case study
Escalona A, Greene L, Mohrland M, Golden Z, Golden CJ

Incidents of strokes are more characteristic of elderly populations than of infancy or childhood (Spreen, Risser, & Edgell, 1995). In this case study, the client was an 8-year-old Caucasian female who had had a stroke at the age of six. Prior to the stroke she had complained of severe headaches accompanied by vomiting. Her father soon noticed that she was not using the right side of her body and that she

was noncommunicative. A CAT scan performed days later revealed that she had had a stroke. A MRI confirmed a left frontal temporal parietal infarction consistent with a large middle cerebral artery distribution stroke. An initial neuropsychological examination performed 2 months after the stroke revealed that the client suffered from aphasia with expressive deficits greater than receptive deficits, attention issues, impulsivity, and fine motor impairment in addition to right-sided weakness as evidenced by the client switching from right-hand dominance to left-hand dominance. Testing completed 2 years later revealed no significant improvement in deficits previously reported. The client continued to have difficulty in areas previously reported. The client also was found to have difficulty in the immediate recall of information and the learning and retention of new information particularly when information was verbally presented to her. She also had difficulty in abstract concept formation and the ability to shift and maintain mental sets. The results of previous and current testing are presented as well as developmental and neurological issues associated with children who have strokes.

Motor control planning problems and neuropsychological assessment in children with autism spectrum disorders

Meyer JA, Nemeth DG

Delays in motor development and deficits in motor planning are believed to underlie motor problems, such as imitation, coordination, locomotion and stereotypes, observed among individuals with autism spectrum disorders (Hughes & Russell, 1993). Motor control planning problems among participants with autism have recently been documented (Hughes, 1996). In this study, we present assessment data from a neurodevelopmental evaluation of an 8-year-old male with high functioning autism, who exhibited fine and gross motor delays. Results suggest that the Kaufman Assessment Battery for Children (K-ABC) Hand Movements subtest and the Developmental Neuropsychological Assessment (NEPSY) Imitating Hand Movements, Visuomotor Precision, and Design Copying subtests may be useful in identifying motor planning difficulties. This boy exhibited a profile of difficulties in motor planning and executive functioning. His intellectual ability and academic achievement scores were, otherwise, in the average range. Implications of weaknesses on these subtests for observed motor delays in gross and fine motor areas will be discussed.

Gyral typologies in children with orthographic, phonological, and mixed developmental dyslexia

Sanchez J, Lindstrom WA, Jones LA, Hynd GW, Miller CJ

Subtypes of developmental dyslexia have been well documented in the literature. These subtypes include the orthographic subtype, which is characterized by difficulties in visual–spatial perception and processing; the phonological subtype, which is characterized by difficulties with phonological processing; and the mixed subtype, which is characterized by difficulties in both areas. The following is a case study of six children diagnosed with reading disabilities as part of an on-going NIH research grant designed to study familial patterns of developmental dyslexia. All children were administered a full neuropsychological evaluation and underwent an MRI scan. Of the 70 children evaluated in this study, two children exhibited orthographic dyslexia and an additional two showed a mixed presentation of developmental dyslexia. Two children with phonological dyslexia were chosen to compare to the orthographic and mixed groups. Gyral typologies developed by Steinmetz et al. (1990) were applied to MRI scans of each hemisphere of the target brains. Increased incidence of atypical typologies in the brains of individuals with developmental dyslexia when compared to prevalence rates in a nondyslexic population was found.

ADULT NEUROLOGICAL DISORDERS: NEURODEGENERATIVE DISORDERS

The utility of a newly developed Semantic Interference Test among Spanish-speaking elders with mild Alzheimer's disease

Acevedo A, Loewenstein D, Barker W, Duara R

The number of older adults from different ethno-cultural/linguistic groups has increased considerably in the United States. Nevertheless, there is a paucity of research regarding the appropriateness of neuropsychological measures used to evaluate older individuals from different ethno-cultural/linguistic backgrounds. We present the psychometric characteristics of the newly developed Semantic Interference Test (SIT), a selective reminding test with interference trials where subjects are asked to recall a set of objects over three trials and then to recall a different set of semantically-related objects. Subjects are asked to recall the original set of objects immediately after the introduction of the second set of objects and after a 20-min delay, followed by a recognition trial. Logistic regression was used to investigate the sensitivity and specificity of the different indices of the SIT using a sample of Spanish-speaking elders that consisted of 21 mildly impaired AD patients and 16 cognitively intact elders. The Combined Interference Index correctly classified 90.5% of the AD patients while correctly classifying 86.7% of normal controls. When used alone, the Proactive and Retroactive Interference Indices correctly classified 85.7 and 90.5% of AD patients while correctly classifying 87.5 and 75.0% of controls, respectively. The Delayed Recall Index yielded a sensitivity of 85.7% and a specificity of 81.3%, while the Recognition Memory Index correctly classified 81.0% of AD patients and all of the normal controls. Consistent with previous results with English-speakers, the SIT evidenced excellent sensitivity and specificity in the identification of AD and normal cases among Spanish-speaking elders.

Coping strategies moderate the relationship between cognitive dysfunction and depression in MS patients longitudinally

Arnett PA, Randolph JR, Freske PJ

Cognitive dysfunction has been shown to be inconsistently related to depression in multiple sclerosis (MS) patients. This inconsistency may be due, in part, to the influence of moderating factors heretofore unexamined. Patients with cognitive deficits commonly associated with MS may be at greatest risk for depression when they also use few adaptive coping strategies or rely differentially on maladaptive ones. The current study was designed to test this hypothesis using a longitudinal design. The mean of *z*-scores from three speeded attentional measures (PASAT, Visual Elevator, Symbol Digit) and a central executive measure (Reading Span) comprised the cognitive index. The Disengagement and Active Coping indices from the COPE were used to measure maladaptive and adaptive coping, respectively, and the Chicago Multiscale Depression Inventory (CMDI) assessed depression. The COPE and cognitive tasks were administered to 49 definite or probable MS patients at Time 1, and the CMDI was administered to the same group after a 3-year interval. Regression analyses with depression as the criterion revealed significant effects for the cognitive index $\times$ active COPE index interaction [$F(1, 45) = 9.86$, $P < .005$, $r^2 = .15$], and for the cognitive index $\times$ disengagement COPE index interaction [$F(1, 45) = 5.41$, $P < .05$, $r^2 = .09$]. Conclusions: These interactions show that disengagement and active coping both moderate the relationship between cognitive dysfunction and depression in MS. Cognitive dysfunction predicts depression longitudinally only when patients use high levels of maladaptive (disengagement) and/or low levels of adaptive (active) coping.

Assessing ADLs and IADLs in a dementia referral sample: MMSE versus DRS versus PEDL
Beatty WW, Olson KA, Duff K, Adams RL

Although dementia screening measures are useful in making the diagnosis, identifying subtypes, and judging the severity of dementia, their ability to predict functional competence in daily activities is uncertain. The present study compared the accuracy of three screening measures in predicting ratings of activities of daily living (ADLs; e.g., bathing, dressing, feeding) and instrumental activities of daily living (IADLs; e.g., handling medications and money, getting to places outside of walking distance) in a sample of patient referred for a dementia evaluation. Forty-five patients referred for a dementia evaluation were administered three dementia screening measures: mini mental status examination (MMSE), Total score for the Dementia Rating Scale (DRS), and problems of everyday living (PEDL). On all screening measures, a higher score indicated better performance. These scores were related to their collaterals' ratings of ADLs and IADLs, in which a higher score indicated more impaired abilities. The PEDL was correlated with ADLs and IADLs at −.36 and −.33, respectively. The MMSE and DRS were correlated with IADLs at −.43 and −.49, respectively, but did not correlate with ADLs. Although a considerable amount of the variance is unaccounted for, the PEDL was the best (and only) predictor of ADLs, whereas the DRS was the best predictor of IADLs in this heterogeneous sample.

An exploratory study of executive functioning and intelligence in an Alzheimer's dementia population
Borosh B, Mleko A, Proctor-Weber Z, Katell M, Golden CJ

The present study evaluated the relationship between tests of executive functioning and selected subtests from an abbreviated version of the WAIS-R in an Alzheimer's dementia population. Participants were 248 elderly adults who were referred for a neuropsychological evaluation, which included a short form of the WAIS-R, Trails B, Benton Verbal Fluency Test (COWAT), and Stroop Color-Word interference to assess the presence of dementia. Average age was 80.8 years (S.D. = 6.2), and average education was 12.1 years (S.D. = 3.1). The sample was predominantly female (62.5%) and right-handed (93.5%). Ninety-seven percent of the sample was Caucasian. Correlations were calculated to compare the intellectual and executive measures. Mean scores for all variables were substantially below population norms. All selected subtests from the WAIS-R significantly correlated with only the Benton Verbal Fluency Test, $P < .001$. Significant correlations included: information (.428), digit span (.500), vocabulary (.478), similarities (.391), picture completion (.336), block design (.413), and digit symbol (.488). No significant correlations ($P < .001$) existed between Trails B, Stroop Color-Word and the selected subtests of the WAIS-R. The results indicate that the Benton Verbal Fluency Test may be a better test of intelligence, specifically measuring verbal skills, rather than an executive functioning measure of verbal fluency in an Alzheimer's dementia population. The remaining executive tests failed to show correlations with any of the WAIS-R measures suggesting that that are measuring independent factors even in this relatively severe population.

Depressed MS patients recall fewer positive words than nondepressed MS patients during and after a list-learning task that suppresses subvocal repetition
Bruce J, Arnett P, Strober L, Polen D, Smith M

Forty to sixty percent of multiple sclerosis (MS) patients have observable memory deficits and approximately 50% experience clinical or subclinical depression. Nonetheless, relatively little is known about

how depression may affect memory disturbances in MS. Previous research in non-MS depressives has demonstrated a direct relationship between depression and difficulty remembering positively laden material. One hypothesis is that "positive neglect" occurs because depressed patients employ less subvocal repetition when they are presented with positively laden words. In the current investigation, depressed ($n = 21$) and nondepressed ($n = 30$) MS patients attempted to recall positive and negative words that were presented as part of a working memory task that prevented subvocal repetition. Depressed MS patients recalled significantly fewer positively laden words than nondepressed patients during the task and at a delay (both $P < .05$). During the task, nondepressed MS patients recalled a higher percentage of positive words (53%) than depressed MS patients (50%, $P < .05$). At the delay, 55% of the words recalled by nondepressed patients were positively valenced compared with 40% of the words recalled by nondepressed patients ($P < .05$). A statistical trend was also noted in which depressed patients retained fewer positive words than nondepressed patients ($P = .06$). In this study, the suppression of subvocal repetition did not negate positive neglect in depressed MS patients.

Neuropsychological predictors of everyday memory and everyday functioning in Alzheimer's disease

Cahn-Weiner DA, Ready RE, Malloy PF

The purpose of the current study was to examine neuropsychological predictors of everyday memory and everyday functioning in a sample ($n = 24$) of mildly impaired Alzheimer's disease (AD) patients. The contributions of executive function, naming, visuoperception, and delayed recall to everyday memory abilities and everyday living activities were examined. Everyday memory was rated independently by the patient and by a caregiver using the Everyday Memory Questionnaire (Sunderland et al., 1983), and everyday functioning was rated by a caregiver using the Activities of Daily Living (ADL) Questionnaire (Lawton & Brody, 1969). For patient-rated everyday memory, verbal recall was a unique and significant predictor, accounting for 23% of the variance, while naming performance alone accounted for 58% of the variance in caregiver-rated everyday memory. Executive function, as measured by verbal fluency, was a unique and significant predictor of functional daily living skills, accounting for 40% of the variance in this measure. These findings suggest that specific neuropsychological measures are associated with different types of everyday abilities in AD patients. Patients may have relatively good insight into memory impairment in early AD. Caregiver-reports of memory impairment appear to be influenced by naming abilities, indicating that they may sometimes misinterpret language impairment as reflecting memory impairment. Helping caregivers distinguish between these two abilities may assist them in more accurately reporting on patients' impairments.

Clock drawing in dementia: validation of a novel scoring system sensitive to subcortical pathology

Cosentino SA, Jefferson AL, Chute DL, Kaplan E, Libon DJ

A novel scoring system for the Clock Drawing Test (CDT) was developed based on a review of errors in patients with dementia ($N = 105$). Error subscales including (1) graphomotor, (2) time, (3) executive control, and (4) spatial layout were retrospectively applied for validation purposes. Construct validity was assessed by correlating CDT subscale and neuropsychological performances. In the command condition, increased time errors correlated with impaired executive control ($r = -.33$, $P < .01$) and semantic knowledge ($r = -.32$, $P < .01$). In the copy condition, increased spatial layout errors ($r = -.27$, $P < .01$) and executive control errors ($r = -.38$, $P < .01$) correlated with impaired executive control. To assess criterion validity, patients were grouped according to degree of white

matter alteration (low WMA $n = 43$, high WMA $n = 43$), to allow for analysis of CDT performance with respect to a specific neuroanatomic index. No significant between-group differences were seen in the command condition, however in the copy condition, the HWMA and PD groups made significantly more errors than the LWMA group on the time (HWMA $Z = -2.9$, $P < .01$; PD $Z = -3.1$, $P < .01$), spatial layout (HWMA $Z = -3.3$, $P < .01$; PD $Z = -3.1$, $P < .01$), and executive control subscales (HWMA $Z = -3.6$, $P < .01$; PD $Z = -5.1$, $P < .01$). In contrast to many existing scoring methods, this empirically derived CDT scoring system exhibits construct and criterion validity for use in patients with dementia. Findings suggest that the CDT places demands largely on executive control, particularly in the copy condition, and is sensitive to subcortical pathology associated with periventricular and deep WMA and Parkinson's disease.

Neuropsychological correlates of magnetic resonance imaging of the brain in a sample of mild Alzheimer's disease patients

Crum TA, Lowenstein DL, Acevedo A, Luis CA, Barker WW, Duara R

There is increasing interest in quantifying the relationship between specific structural changes on magnetic resonance imaging (MRI) of the brain and neuropsychological test performance in patients with mild Alzheimer's disease (AD). In this study, the MRIs of 36 AD patients were coded as none, minimal, mild, moderate, and severe in the right and left hemispheres with regards to atrophy of the hippocampus, cerebral cortex and perisylvian regions, periventricular leukomalacia and ventricular dilatation. Bivariate correlations were performed between these MRI findings and neuropsychological tests tapping memory (Fuld OME, WMS-III Logical Memory, Rey Complex Figure Immediate and Delayed), language (Boston Naming Test), praxis (Rey Complex Figure Copy), attention (Digit Span), and executive functioning (FAS and Trails B). Contrary to expectations, hippocampal atrophy did not correlate with any of the memory measures but was associated with auditory attention (forward span for digits; $r = -.42$). Overall cortical atrophy also correlated with forward span for digits ($r = -.41$), as well as Rey Copy ($r = -.41$). Left hemisphere perisylvian atrophy correlated with performance on both the Rey Immediate ($r = -.47$) and Delayed ($r = -.51$) measures. Performance on the Fuld OME was most related to periventricular leukomalacia, bilaterally (right, $r = -.34$; left, $r = -.35$). The lack of correlation with hippocampal atrophy suggests that memory changes may be reflected by other biochemical and neuronal changes that precede hippocampal degeneration. Diffuse degeneration of the cortex and underlying white matter appeared to affect performance on neuropsychological measures more than localized cortical atrophy.

The relationship of executive performance to the cognitive and adaptive status of Parkinson's patients

Culbertson W, Moberg P, Duda J, Stern M

An increasing interest in the relationship of neuropsychological test performance to daily life functioning of elderly patient groups is evident. Deficits in executive functions can profoundly disrupt efforts to negotiate the demands of daily living. In the current study it was posited that the executive functioning of Parkinson's disease patients (PD) would associate with measures of cognitive and functional status. Intercorrelations between a measure of executive planning (Tower of London (TOLDX)), and measures of cognitive status (mini-mental state exam (MMSE); clock drawing (CD)) and adaptive functioning (UPDRS activities of daily living (ADL), and Schwab and England Activities of Living Scale (SEALS)) were examined. Twenty-five, male patients (mean age = 73.5) attending a VA clinic for PD were

assessed. Hoehn and Yahr impairment scores of the PD patients were within the mild to moderate range. All patients were medicated with levodopa or dopamine agonists. Results revealed that the MMSE correlated with the TOLDX total move ($r = .48$, $P < .03$), stimulus-bound ($r = -.75$, $P < .001$), and execution time ($r = -.47$, $P < .03$) scores. The TOLDX stimulus-bound score also associated with the ADL ($r = -.47$, $P < .04$) and CD ($r = -.77$, $P < .001$) scores. The SEALS related to the TOLDX total correct ($r = .96$, $P < .02$) and initiation time ($r = .76$, $P < .04$) scores. These findings lend support to a relationship between executive functions and cognitive-adaptive status of PD patients.

Beyond the CDR total score: predicting progression in early Alzheimer's disease using domain scores

Dahlman KL, Sewell MC, Schmeidler J, Mohs RC

For subjects with the same CDR total score, does the average of the six domains of the clinical dementia rating (CDR) predict decline, and are specific domains predictive of progression in CDR total score? Eighty nursing home or assisted living residents (mean age 85, 68% female) were staged as nondemented (CDR = 0, $n = 53$) or questionably-demented (CDR = 0.5, $n = 27$). Change in CDR total from baseline to 1-year follow-up was used to identify subjects as progressors or nonprogressors. The average of the six separate domain scores (memory, orientation, judgment and problem solving, community affairs, home and hobbies, personal care) was calculated for each subject. For each stage, *t*-tests were used to compare progressors and nonprogressors on the baseline average and the baseline domain scores. Results showed that 17% of nondemented and 41% of questionably-demented subjects progressed (Chi-square = 5.39, df = 1, $P = .020$). The average score was significantly higher for progressors than nonprogressors, for both nondemented ($t = 2.30$, df = 51, $P = .025$) and questionably-demented ($t = 2.17$, df = 24, $P = .040$) subjects. The most predictive domains were judgment ($t = 2.15$, df = 9.7, $P = .058$) for nondemented subjects and orientation ($t = 2.36$, df = 24, $P = .027$) for questionably-demented subjects. All nondemented subjects had memory scores of 0; memory scores were worse, but not significantly so ($t = 1.68$, df = 24, $P = .106$) in questionably-demented subjects. Among subjects with the same CDR total score, the six domain scores, and particularly their average, provide additional prognostic information, enhancing the utility of the instrument.

Visual memory performance in essential tremor and Parkinson's disease

Frutiger S, Clock S, Priddle T, Pahwa R, Wilkinson S

Previous studies have identified visual memory deficits in Parkinson's disease (PD) patients. However, visual memory skills have not been well characterized in essential tremor (ET) patients. This study evaluated visual memory skills in 43 age- and education-matched ET ($N = 22$) and PD ($N = 20$) patients. Visual memory tests required recognition of facial photographs or recall of the identity, location, and actions of characters in visual scenes. Although ET and PD patients displayed average immediate and delayed recognition of facial photographs, PD patients demonstrated significantly poorer immediate and delayed recall of complex visual scenes. Further analysis of group differences in recall of character identity, location, or action in the visual scene task indicated significantly poorer delayed recall of character identity by PD patients. A statistical trend suggested equivalent mismatching of characters and actions by PD patients during immediate and delayed memory testing, but a decline in mismatching of characters and action by ET patients during delayed recall. Given equivalent ET and PD performance on measures of visual attention span and visuospatial reasoning skills it is unlikely that group differences in memory performance were secondary to other visuospatial deficits.

Factors affecting the employment status of patients with multiple sclerosis
Gontkovsky S, Beatty W, McDonald N, Aupperle R

Multiple sclerosis (MS) has been cited to impact significantly the employment status of diagnosed individuals (Thompson, 1999). Indeed, research indicates that the majority of MS patients do not maintain gainful employment (Gulick, 1997; Martinez, Martinez, Hernandez, Martin, & Arbizu, 1999; Miller, Rudick, Cutter, Baier, & Fischer, 2000), despite being of employable age (i.e., <65). While investigations generally associate various disease severity indicators (e.g., mobility and fatigue) with reduced rates of employment in patients with MS (Dyck & Jongbloed, 2000; Kornblith, La Rocca, & Baum, 1986), other factors, including age, educational level, cognitive functioning, social support, and emotional status also have been implicated (Dyck & Jongbloed, 2000; Gulick, 1992; Hakim et al., 2000; Martinez et al., 1999). This study examined the rate of unemployment as well as those factors that best predict employment status in a sample of 63 patients who met criteria for clinically definite MS. Analyses indicated a total unemployment rate of 68.3% for the sample. Sixty-three percent of those unemployed patients had a progressive disease course, while the remaining 37% had a relapsing-remitting course. Variables that together best predicted employment status were age, delayed memory functioning, ambulation ability, and fatigue, adjusted $R^2 = .39$. Findings of this investigation have important implications with respect to necessary occupational accommodations for patients with MS, as prior research suggests that modifications in the work environment can maintain the employment status of individuals with the disorder (Verdier-Taillefer et al., 1995).

The mini-mental state examination, temporal lobe morphology and Alzheimer's disease
Hannan CR, Fearing M, White J, Mortensen J, Tate D, Bigler, ED

The mini-mental state exam (MMSE) is the most widely used brief screening instrument used for dementia. How MMSE findings relate to neuropathological changes observed on neuroimaging is not fully understood. Because of known temporal lobe atrophic changes associated with Alzheimer's disease (AD), we performed quantitative analyses of critical temporal lobe structures and compared MMSE performance in a group of AD patients and controls. MRI volumes of parahippocampal gyri, fusiform gyri, hippocampus and temporal horn were obtained in 20 controls and 77 subjects diagnosed with AD. The MMSE was administered to both groups. The right and left temporal lobe structures were combined into a single measure. Measures of the temporal lobe structures were correlated with performance on the MMSE. While atrophy of all temporal lobe structures measured correlated with the MMSE, the correlation between total temporal horn volume and performance on the MMSE was the most significant finding ($r = -.418$, $P < .01$). The most robust relationship between impaired performance on the MMSE in AD patients was temporal horn enlargement as an indicator of generalized temporal lobe atrophy rather than specific gyral atrophy or even hippocampal atrophy.

Neuropsychological predictors of driving ability in patients with cognitive compromise
Hatfield R, Wilde E, Lagenecker S, Kartje P, Giordani B

Prior research attempting to determine which neuropsychological measures, if any, are predictive of driving ability in demented patients has yielded inconclusive results. Some studies suggest that neuropsychological tests are moderately predictive of driving ability, whereas other studies indicate a much more limited relationship. We propose to further investigate ecological validity of neuropsychological tests in predicting which individuals will be able to actually pass or fail a driving evaluation utilizing

a road test. The majority of patients were diagnosed with dementia based on the results of a general neurological and neuropsychological examination prior to being referred for driving evaluations. Consistent with the findings of prior studies, results from exclusionary data indicate cognitive factors related to driving fitness include measures of visual attention and visuospatial abilities. We also have evidence that performance on measures of visual constructional abilities and visual–spatial memory may distinguish between individuals with poor driving ability and those that do not have significant problems with driving performance. The data also suggests that measures of executive functioning may correlate with driving ability, but these relationships may be weaker than measures of attention and visuospatial abilities. While the decision to drive or not drive should not be based solely on neuropsychological data, neuropsychological variables may help to develop more efficient criteria to identify individuals who are at greater risk for potential negative driving outcomes.

Neurodegenerative biopercular disease: a rare case of Foix–Chavany–Marie syndrome
Horowitz TL, Giacino JT, Isenberg N

Foix–Chavany–Marie syndrome (FCMS) is a rare type of pseudobulbar palsy resulting from bilateral cortical lesions in the anterior opercular regions. The primary and most debilitating feature is the loss of voluntary control over the face, tongue, and swallowing muscles, resulting in dysarthria or anarthria, and dysphagia. Automatic movements, such as eating, yawning, and smiling are preserved. Pathological crying or laughing is also a common symptom. The most common cause is multiple strokes affecting the corticobulbar tracts bilaterally. However, a neurodegenerative cause has also been described, with focal atrophy beginning in the anterior opercular regions, and additional nonmotor cognitive deficits becoming apparent a few years into the course of the disease. We present the case of a 78-year-old female with symptoms consistent with neurodegenerative FCMS, but with rapid progression of both motor and cognitive symptoms over the course of 1 year. Neuroimaging and neurologic findings are presented and discussed. Extensive neuropsychological testing was conducted. Results were indicative of adequate language comprehension, with the exception of difficulty processing syntactically complex language. Also, the appearance of agrammatism and literal paraphasias in writing was reminiscent of a Broca's aphasia. Mild executive dysfunction was present. Memory functions were adequate. This case will be compared and contrasted with the extant literature on this debilitating condition.

Reliability and factor structure of the neuropsychiatric inventory-nursing home version in geriatric inpatient psychiatry
Iverson G, DeWolfe K, Woodward T, Solomons K, Tindale J

The neuropsychiatric inventory-nursing home version (NPI-NH), a minor modification of the original NPI, is a structured interview designed to assess 12 domains of psychiatric problems in patients with dementia. The original NPI has been used in numerous studies; however, there are very few published studies involving the NPI-NH. The purpose of this study was to examine the internal consistency and factor structure of the NPI-NH. Participants were 132 inpatients from a geriatric psychiatry division at a provincial psychiatric hospital in Canada. The internal consistency coefficients (Cronbach's alpha) for the 12 domains were $\alpha = .66$ for the frequency ratings, $\alpha = .72$ for the severity ratings, and $\alpha = .75$ for the frequency by severity ratings. Exploratory principal axes factor analysis yielded a three-factor solution that accounted for 39.8% of the total variance. Factor 1 was labeled agitation; it accounted for 14.6% of the variance in the rotated frequency by severity solution. Items that appeared to be heavily influenced by this factor were agitation, disinhibition, and irritability/lability. Factor 2 was

labeled depression/apathy; it accounted for 13.6% of the variance in the rotated solution. Items heavily influenced by this factor were depression/dysphoria, apathy/indifference, and appetite/eating changes. Factor 3 was labeled psychosis; it accounted for 11.6% of the variance in the rotated solution. The items influenced by this factor were delusions and hallucinations. Additional research is needed to determine if these factors will replicate and if they will prove to be clinically meaningful.

Detection of mild and very mild Alzheimer's disease using a modified object memory interference paradigm

Loewenstein D, Acevedo A, Crum T, Luis C, Barker W, Duara R

This study was designed to evaluate the utility of a object memory semantic interference paradigm to distinguish between 45 very mild (CDR = 0.5; mean MMSE = 27.1 + 1.9) and 32 mild (CDR = 1.0; mean MMSE = 23.2 + 1.8) Alzheimer's disease (AD) patients and 60 normal community-dwelling elders. Using a selective reminding paradigm, subjects were first presented with 10 common objects that were learned over three trials interspersed with distractor tasks. Subjects then had to recall 10 new semantically-related objects and then to recall the original object list. Controlling for overall memory impairment, patients with mild AD demonstrated significantly greater proactive interference effects than very mild AD patients and the normal community-dwelling comparison group. Both mild and very mild AD patients demonstrated more semantic intrusions during the proactive interference task and greater total semantic interference (proactive + retroactive interference scores) relative to normal elders. Logistic regression revealed that recall of the original 10 targets over three learning trials and the proactive inference score correctly classified 88.9% of very mildly impaired AD patients and 93.3% normal elderly controls. Recall of the original 10 targets over the three learning trials correctly classified 100% of the mildly impaired AD patients and 96.6% elderly controls exhibiting superior classification rates than traditional neuropsychological measures of delayed recall. The authors discuss the potential utility of the brief object memory tests with semantic interference paradigms among those with mild cognitive impairment at risk for early AD.

Neuropsychological predictors of conversion to dementia among subgroups of MCI patients

Luis C, Warren B, David L, Ranjan D

Predictors of conversion to dementia among patients with mild cognitive impairment (MCI), an intermediate and heterogeneous state between normal cognition and dementia, requires further study, particularly in various MCI subgroups. This study examined conversion rates and predictors of conversion in three subgroups of MCI patients. The sample included 108 individuals presenting at a memory disorder clinic who were followed for 2.7 ± 1.9 years based on history, informant, neurocognitive screening and neurological examination, 69.4% were diagnosed MCI-AD ($n = 75$), 18.5% MCI-vascular type ($n = 20$), and 12.0% MCI-mood disorder ($n = 13$). No differences were found among subgroups on demographic variables, length of follow-up, presence of APOE E4, or initial MMSE score. Sixty patients (55.6%) converted to dementia: 47 (62.7%) MCI-AD, 8 (40%) MCI-vascular, and 5 (38.5%) MCI-depressed. The MCI-AD and MCI-mood subgroups converted at an average of 2.1 years versus 3.0 years for the MCI-vascular group. Sixty of the subjects had a baseline neuropsychological evaluation. Neuropsychological measures that differentiated converters from nonconverters included measures of learning and memory (i.e., 3-Trial FOMT, Logical Memory-II ($P < .001$) and orientation and functional assessment tasks ($P < .05$). These results substantiate that neuropsychological assessment is useful in identifying MCI patients at greatest risk for converting to dementia. In addition, the findings suggest the

MCI-mood disorder often represents a prodromal phase of dementia. Treatment with antidepressants and AchE inhibitors may therefore be indicated in patients diagnosed with MCI-mood disorder with evidence of cognitive impairment.

Neurobehavioral features of Machado–Joseph disease

Manning E, Langford L, McDowal O, Subramony S, Johnson S, Harris C

Limited information is available with regard to cognitive functions among cerebellar ataxias. We studied cognitive functions in a population of patients with molecularly proven Machado–Joseph disease (MJD). We studied a series of 21 patients (13 male, 8 female, mean age = 46.76, mean number of years of education = 12.90; mean duration of illness = 9.12 years) belonging to five families with molecularly proven MJD. The patients were subjected to a standard neurological examination and a battery of neuropsychological tests. The neurological exam yielded information including functional staging using criteria from the Unified Ataxic Disorders Rating Scale and number of CAG repeats (neurological exam results). Mean scores for expressive language and verbal IQ measures (Wechsler Abbreviated Scale of Intelligence), Wisconsin Card Sort data, and Wechsler Memory Scale-III data did not correlate with neurological exam results. Significant inverse correlations were obtained between staging and the Stroop Color *T*-score (Pearson correlation −.453, $P < .045$) and between number of CAG repeats and the Stroop Word *T*-score (Pearson correlation −.459, $P < .048$). A significant inverse relationship was exhibited between the recognition trial of the Rey and staging (Pearson correlation −.460, $P < .036$). Duration of illness did not correlate with either staging or number of CAG repeats, whereas the relationship between staging and number of CAG repeats was significant (Pearson correlation .565, $P < .01$). Functional staging and number of CAG repeats are indicators of illness severity. Illness severity appears to be related to some measures of executive functions and to some verbal retrieval/recognition tasks.

A cross-sectional investigation of the neuropsychological expression of Alzheimer's disease

McBride A, Wagner M

The purpose of this study was to provide a cross-sectional description of the neurobehavioral profile of Alzheimer's disease (AD) through analysis of neuropsychological data obtained from patients referred to a memory disorders clinic. Participants ($N = 559$, mean age = 73.5) underwent a diagnostic protocol including neurological and neuropsychological examinations and a geriatric nursing functional assessment. Diagnostic groups were created based upon clinical dementia ratings (CDR) used in staging of dementia: normal (CDR = 0), mild cognitive impairment (CDR = 0.5), and Alzheimer's disease (CDR = 1.0, 2.0, or 3.0). Analyses of demographic variables indicated that dementia severity was negatively correlated with educational attainment ($r = -.254$, $P < .001$), and positively correlated with age ($r = .342$, $P < .001$). Age ($\beta = -.268$, $P < .001$) and education ($\beta = .116$, $P < .01$) were significant predictors of verbal delayed memory scores, one of the earliest markers of AD. Across the domains of language, memory, orientation, intellectual function, and visuoconstruction/visuospatial ability, significant differences were present between most groups at each CDR; however, nonsignificant group differences were observed for VIQ, PIQ, visuospatial and verbal delayed memory, at the highest levels of dementia severity. Verbal and visual memory scores declined with increasing dementia severity, but were similar to each other at each CDR. Greater overall awareness of cognitive impairment was associated with more depressive symptoms, and was negatively correlated with dementia severity. Implications of this neurobehavioral profile are discussed in terms of functional impairment across stages of dementia severity.

The Benton Visual Retention Test, dementia, and temporal lobe pathology
Mortensen J, White J, Hannan CR, Fearing M, Tate D, Bigler, ED

Benton Visual Retention Test (BVRT) deficits in performance are clearly evident in dementia. However, how BVRT deficits relate to atrophic brain changes associated with dementia have not been fully investigated. Magnetic resonance imaging analyses were conducted on 20 control subjects, 20 Alzheimer's disease (AD), 39 vascular dementia, 30 mild/ambiguous, and 21 non-AD subjects. Diagnoses were established by a consensus diagnostic approach. The BVRT error scores and the number correct were recorded for each subject and the structures measured include the total temporal horn volume, total hippocampal volume, and volumes of the parahippocampal gyri, and fusiform gyri. Temporal horn volume is inversely related to volume of the temporal lobe. Accordingly, enlargement of the temporal horn is a sign of temporal lobe atrophy. When dementia groups were combined, the total number correct on the BVRT was negatively correlated with the total temporal horn volume ($r = -.234$, $P < .01$) and positively correlated with the hippocampal volume ($r = .233$, $P < .01$) and left temporal lobe volume ($r = .170$, $P < .05$). Clinical application of BVRT performance as it relates to atrophic changes in the temporal lobe associated with different types of dementias will be discussed. Atrophic changes in the temporal lobe were difficult to relate to the BVRT performance.

Reaction time in normal aging: evidence of process specific slowing in working memory
Mullin J

Despite the plethora of evidence of slowed reaction time with age, there is still no consensus regarding the relative contributions of generalized and process-specific factors to age-related cognitive slowing. This study examined the performance of 36 older adults and 36 younger adults on the California computerized assessment package (CalCAP), a computer-based measure consisting of 10 simple and choice reaction time tasks of varying degrees of complexity. Using a Brinley plot analysis, a regression equation was calculated in order to examine the linearity of the relationship between older and younger adult reaction time. In support of the generalized slowing hypothesis, the older adults had proportionally slower performance than younger adults on all tasks as a function of task complexity, with a slope of 1.4. In order to control for the effects of generalized slowing, the younger adult reaction times were entered into the regression equation and transformed into predicted older adult reaction times. Following the transformation of scores, the older adult group continued to demonstrate significantly slower reaction time on a measure of working memory that could not be solely attributed to generalized factors. These results are discussed in the context of recent evidence of age-related process specific slowing in working memory.

Understanding neurocognitive and functional impairment in a dementia clinic sample
Ouaou R, Short P, Cernich A, Kane R, Morris M

The current study examined the relationships between specific neurocognitive abilities and the preservation of functional skills in geriatric patients referred to a dementia clinic at the Baltimore, VA Medical Center. To this end, we developed a structural equation modeling approach to explain how domains of cognitive functioning (encoding, recall, executive functioning, language) are measured and how they related to impairments in functional abilities (ADLs and IADLs). The study compared neuropsychological and demographic data found in 106 patients previously referred for a comprehensive dementia work-up. Subjects were 66 Caucasian and 44 African-American male veterans, age 54–96 ($M = 75.7$,

S.D. = 6.68), with an educational level ranging from 4 to 18 years ($M = 10.7$, S.D. = 3.27). As part of the evaluation, subjects completed a modified consortium to establish a registry for Alzheimer's disease (CERAD) neuropsychological test battery. Subjects' ability to perform specific functions, such as managing medication regiments was noted, as well as patient level of overall functional independence. Several findings emerged between functionally impaired and nonimpaired groups. For the impaired group the model fit improved significantly when performance on Trial 1 of a 10-item word-list learning task cross-loaded three ways. Surprisingly, it was the single most important indicator for executive function. These findings suggest that in the impaired subjects, the inability to acquire information may be the underlying difficulty and that impaired executive functioning may be better classified as inability to maintain set because of memory deficits.

Gender differences and cognition among older adults

Parsons T, Rizzo A, McGee J, Buckwalter J

Gender differences in cognitive ability is a widely studied, and controversial, topic. The more solid generalizations about performance differences suggest female superiority on visuomotor speed and language ability and male superiority on mechanical and visuospatial tasks. Generally, group strengths found in the early school years become more established at adolescence and remain stable through adulthood. Of specific interest is whether or not the patterns established in the early years remain stable through time or if they are altered with age. The purpose of this study was to compare performance of males and females on a standardized neuropsychological battery of tests. We were interested to see if the participants in the study demonstrated differences along expected gender lines established in earlier years, or if the patterns have changed with advancing years. Thirty individuals between the ages of 64 and 86 (mean age = 73.6; mean years education = 15.4; % women = 50) participated in a study designed to validate a new test of spatial ability administered in virtual reality. As part of this project a standard neuropsychological battery was administered. Although gender showed significant associations with the nonverbal tasks (judgment of line orientation ($r = -.69$) and mental rotation task ($r = .53$)), there were no significant results found between gender and verbal tasks. The current results suggest that although the patterns established in the early years remain stable through time for men, the established patterns for women are altered with age.

Aging and cognitive decline in women using estrogen replacement therapy: comparison of back-propagation and regression models

Parsons TD, Buckwalter JG

Despite evidence that estrogen enhances aspects of cognition, studies of hormonal replacement (HRT) effects are equivocal. Difficulty in interpretation may be due to use of linear regression models, which do not take into account the tendency of data to cluster around certain regions and be skewed with respect to certain variables. An alternative is to use artificial neural networks (ANN) because they are more robust in the presence of correlated error. We proposed to (1) establish the association of HRT with cognitive performance among elderly women and (2) compare the applicability of an ANN with a conventional regression analysis. Fifty-eight women without dementia on HRT were randomly selected and matched on age and education with 47 women without dementia who were not using HRT. No significant differences were found between HRT groups on any of the neuropsychological tests. There were no differences between HRT use groups when analyzing the education or age groups in separate analyses. Results from the multiple regression model ($R^2 = .06$, $P < .89$; standard error = .49) were

compared with those of a backpropagated ANN ($R^2 = .05$, $P < .96$; standard error = .49), revealing no significant differences. Results suggest that the unexpected null findings stem from uncontrolled differences between users and nonusers of HRT. The advanced age of our participants suggests that HRT may not enhance cognition in this group. Comparison of an ANN with a conventional regression analysis, revealed very similar results. This suggests an ANN can perform as well as a regression.

Sex differences in mental rotation and spatial rotation in a virtual environment
Parsons TD, Larson P, Kratz K, Bluestein B, Thiebaux M, Rizzo A, Buckwalter JG

The visuospatial ability referred to as mental rotation has been shown to produce consistent sex differences, in favor of males. The current study utilizes a virtual environment for investigating rotational ability among 44 adult subjects. Based on the literature, we expected sex differences on both MRT and VRSR. Given sex differences in hemispheric specialization, we conducted an exploratory analysis of relations between rotation tasks and other neuropsychological measures. After a baseline measure of mental rotation ability was assessed using the Mental Rotation Test, subjects completed a neuropsychological battery administered under standard conditions. Next, subjects participated in a 15-min VRSR task that both assessed and trained mental rotation abilities. Subsequently, 100 training trials of increasing stimulus complexity were administered. After a 1-min break, the original 20 VR trials were administered again to measure changes in VRSR ability. Results replicate sex differences traditionally seen on paper-and-pencil measures, while no sex effects were observed in the virtual environment. These findings are discussed in terms of task demands and motor involvement. Sex differences were also seen in the patterns of correlations between rotation tasks and other neuropsychological measures. The findings from this utilization of VE for evaluating sex differences on a spatial task are intriguing. As predicted, sex differences on paper-and-pencil version of MRT were replicated. However, sex differences predicted on the VRSR measures of efficiency and duration were not found. Current results suggest men may rely more on left hemisphere processing than women when engaged in rotational tasks.

Collateral rating of memory impairment: misappraisal due to depression
Patton DE, Duff K, Schoenberg MR, Scott JG, Adams RL

The present study sought to determine the extent to which patients' emotional factors influence how they are perceived cognitively by collateral informants. It was hypothesized that emotional factors, such as depression, would lead a patient to be viewed as functioning below their actual ability level. To test this hypothesis, a mixed clinical sample of 95 patients ages 57–79 (mean = 69.6, S.D. = 5.66) referred for neuropsychological assessment were divided into two groups based on the difference *z*-score (*z*-DIFF) between their actual memory (i.e., *z*-score on RAVLT Trial 7) and a collateral's appraisal of their memory (i.e., *z*-score on the CBRS MD scale). Patients in the OVEREST ($n = 26$) group had *z*-DIFF scores = +1.0, suggesting that collaterals underestimated their abilities. The groups were compared on the Geriatric Depression Scale (GDS). The UNDERST group scored significantly higher than the OVEREST group on the GDS. The two groups did not differ significantly on age or DRS Total Score. Depressed patients were perceived by collaterals as functioning below par with regard to memory, despite the fact that their actual performance suggested that their functioning was intact. Conversely, nondepressed patients were viewed as functioning within normal limits by collateral informants, despite the fact that their actual performance suggested that their functioning was impaired. These findings suggest the need to consider potential moderating factors when interpreting collateral ratings of patient performance.

Differences in word-list learning between Alzheimer's patients and Parkinson's patients with and without dementia

Perachio N, Scott JG, Adams RL, Ruwe WD

Differences in acquisition and retrieval processes of verbal memory in patients with Parkinson's disease without dementia (PD), Parkinson's disease with dementia (PDD) and Alzheimer's disease (AD) were examined using multitrial word-list learning, as measured by the Rey Auditory–Verbal Learning Test (RAVLT). Participants included 23 PD, 12 PDD, and 20 AD patients, with no significant difference in age or education across groups. Patients were classified as demented using a cutoff of 26 on the mini-mental state exam. Group differences were evident for Trial 1, learning rate, savings score, and recognition measures. The PD group recalled more words than either dementia group, but only the difference between the PD and PDD groups reached significance ($P = .02$). The PDD and AD groups had significantly lower learning rates overall when compared to the PD group ($P < .001$). Savings scores were significantly better for the PD group than the AD group ($P = .007$), with the PDD group scores falling between the two but not significantly different from either. A similar pattern of results emerged for recognition performance, as measured by the difference between hits and false positive errors ($P < .001$). The AD group showed more false positive errors than the PD group. The PDD group exhibited more false positive errors than the PD group only for words phonemically similar to those on List A ($P = .003$) and for words from List B ($P = .003$). Overall, the acquisition and recognition processes for the PDD and AD groups were similar.

Longitudinal predictors of learned helplessness in MS

Polen DM, Arnett PA

Individuals with multiple sclerosis (MS) consistently show high rates of depression. Shnek et al. (1995) found that a measure of learned helplessness predicted depression better than other attributional measures in these patients. Interestingly, learned helplessness has long been theorized to be a final common pathway to depression generally. The present study was designed to explore whether three core features of MS–MS disability, fatigue, and cognitive dysfunction-predict learned helplessness longitudinally. Method: Fatigue (Fatigue Impact Scale, FIS), cognitive function (mean *z*-score of Tower of London indices, visual elevator subtest from the test of everyday attention, symbol digit, PASAT, and reading span), and MS disability (EDSS) were assessed 3 years prior to the measure of learned helplessness (MS Attitudes Index, MSAI) in 49 definite MS patients. Correlational analyses revealed that the MSAI correlated significantly with FIS ($r = .37$, $P < .01$), cognitive function ($r = -.35$, $P < .01$), and EDSS ($r = .46$, $P < .001$) measures. Stepwise regression analysis indicated that both the EDSS and the FIS contributed significant ($P < .002$ and $P < .05$, respectively) unique variance to scores on the MSAI (r^2 change values = .21 and .07, respectively). Our results suggest that at least two factors—MS disability and fatigue may independently affect the development of learned helplessness in MS patients, something that is likely to put these individuals at risk for depression. Psychotherapeutic treatment that targets perceptions of learned helplessness may reduce this risk.

Differential cognitive substrates underlying delayed verbal recognition memory in dementia

Price CC, Garrett K, Cosentino SA, Jefferson AL, Penney D, Kaplan E, Swenson R, Thomas D, Libon D

Patients with ischaemic vascular disease (IVD) perform better than patients with Alzheimer's disease (AD) on tests of delayed recognition memory. However, the cognitive substrates underlying this behavior

have not been extensively investigated. In this study, delayed recognition memory was assessed with the Philadelphia (repeatable) Verbal Learning Test [*P*(*r*)VLT]. Modeled after the CVLT-9, the *P*(*r*)VLT is a nine-word serial list learning test with repeatable test versions specifically designed to assess learning and memory in dementia. Patients with AD ($n = 21$) and IVD ($n = 15$) matched for age, education, and dementia severity were compared using the *P*(*r*)VLT delayed Recognition Memory Index. IVD patients obtained higher recognition discriminability scores (M IVD $= 82.8$, M AD $= 63.0$, $P < .001$), and made fewer false positive responses (M IVD $= 4.6$, M AD $= 11.8$, $P < .001$) than AD patients. An error analysis of false positive responses revealed a dissociation: IVD patients endorsed a higher percentage of List B interference foils (M IVD $= 62.8\%$, M AD $= 32.8\%$, $P < .001$), while AD patients endorsed a higher percentage of semantic foils (M IVD $= 31.2\%$, M AD $= 49.7\%$, $P < .018$). For all dementia patients, List B interference foils were correlated with poor performance on executive control tasks (WMS nonautomatized mental control; $r = -.431$, $P < .018$), while semantic foils were correlated with disrupted semantic organization as measured with the Animal Fluency Association Index (AI; $r = -.433$, $P < .020$). These findings suggest distinct cognitive substrates, involving executive control and semantic knowledge, for delayed recognition memory.

An exploratory look at the relationship between executive functioning ability and memory in Alzheimer's patients

Proctor-Weber Z, Selden J, Marsh J, Chang A, Golden CJ

The purpose of this study was to explore the relationship between executive functioning ability and memory functioning in Alzheimer's patients. Two hundred and forty eight adults with a diagnosis of Alzheimer's disease were administered Trails B, Benton Verbal Fluency Test, Stroop Color-Word and WMS-R as part of a comprehensive neuropsychological battery. The subjects ranged in age from 61 to 93 years of age, with 62.5% being female. The sample was 97.2% Caucasian, 2% African-American and/or Caribbean Black and 0.8% Hispanic. It was expected by investigators that executive functioning ability would be strongly related to a patient's ability to remember verbally and visually presented information. Executive functioning measures of general brain function, verbal output inhibition and spontaneous production of words included the Trails B, Stroop Color-Word and COWAT. These variables were compared to selected WMS-III measures of auditory and visual memory functioning: logical memory, verbal paired associates and visual reproduction. A correlational analysis yielded mixed results. A significant relationship was found between Trails B scores and visual reproduction short-term scores at the $P < .01$ level ($r = .480$). COWAT scores were positively correlated with logical memory immediate ($r = .258$), VPA immediate ($r = .328$), VPA short-term ($r = .241$) and visual reproduction short-term ($r = .278$) at the $P < .01$ level. There were no significant findings between Stroop scores and memory functioning, indicating that prefrontal pathology may not be related to the ability to recall information.

Development of a culturally fair test for the assessment of prospective memory in mild Alzheimer's disease

Salvatierra JL, Justice A, Acevedo A, Loewenstein D, Duara R

Decreased prospective memory, the ability to remember to perform future actions, is a common complaint in normal elderly adults and in individuals who have mild Alzheimer's disease (AD). Unfortunately, prospective memory has not been adequately studied in populations of diverse ethno-cultural/linguistic backgrounds. We present validity and reliability data on the newly developed Prospective

Memory Test (PMT) developed by Loewenstein and Acevedo (2001). This test consists of event- and time-based prospective memory tasks, which require the subject to complete an action in response to a cue or to the passage of time, respectively. The event-based task evidenced excellent discriminative validity (Mann–Whitney *U*-test, $U = 34.0$, $z = -4.67$; $P < .001$) based on 23 patients with probable or possible AD and 17 of their cognitively intact spouses. A perfect score on this task yielded excellent sensitivity and specificity (87.0/88.2%, respectively). The task also evidenced excellent test–retest reliability ($r = .814$) on a study of 12 AD patients (test–retest interval = 7.3 + 2.1 days). The time-based task also evidenced excellent discriminative validity in a study with 12 patients and 10 of their cognitively intact spouses (Mann–Whitney *U*-test, $U = 10.0$, $z = -3.64$; $P < .001$). A perfect score on the task yielded a sensitivity and specificity of 83.3/100.0%, respectively. Test–retest reliability of the task was also high ($r = .830$, test–retest interval = 7.1 + 2.3 days). Preliminary cross-cultural data also suggest that the PMT may be sensitive and specific in differentiating mildly impaired AD patients from normal elderly controls in both English- and Spanish-speaking elderly.

Coping and hoping: two possible buffers against general psychopathology in MS patients

Schurle AC, Arnett PA

Although depression has been studied extensively in multiple sclerosis (MS) patients, little attention has been devoted to exploring possible contributors to and buffers for psychopathology more generally. In the current study, we examined whether two variables shown to serve as protective factors for depression in other patient groups—optimism and active coping—would be inversely related to generalized psychopathology in MS patients. Method: The following measures were included: an Active Coping Index created from several subscales of Carver et al.'s (1989) COPE measure, thought to measure adaptive coping; the agency component of the Hope Scale assessing an individual's general optimism; and the Global Severity Index (GSI) of the SCL-90-R, assessing current level/depth of generalized psychopathology. Procedure: Measures were administered to 46 definite MS patients. Results: Strong negative correlations were found between both the Active Coping Index ($r = -.46$, $P < .002$) and the Hope-Agency Index ($r = -.49$, $P < .002$) with the GSI. Hierarchical regression analysis revealed that the Active Coping Index accounted for 21% ($P < .002$) of the variance in the GSI and the Hope-Agency Index accounted for an additional 9% ($P < .05$). Conclusions: Both active coping and optimism are inversely related to generalized psychopathology in MS patients. These factors may serve as buffers for the development of psychopathology in these patients. Because it has been demonstrated that coping strategies and an individual's level of optimism can be modified through cognitive behavioral psychotherapy, targeting these factors in MS patients may help reduce their generalized psychopathology.

The degree to which years of retirement distinguishes neuropsychological performance in an elderly, memory disorder population

Selden JJ, Borosh B, Katell M, Golden CJ, Todd ME

Literature suggests that a lack of intellectual stimulation can be deleterious to one's cognitive functions. The present study sought to evaluate whether the number of years elderly patients had been retired at the time of neuropsychological assessment could differentiate performance on neuropsychological measures. Participants were elderly adults who were referred for evaluation to assess the presence of memory impairment. We classified 137 patients in this referred population as being active (0–3 years of retirement), recently inactive (4–10 years of retirement), and chronically inactive (11 or more years of retirement) at the time of examination. Average age was 77.8 years, and average education was 13.1

years. The sample was predominantly male, right-handed, and Caucasian. One-way ANOVAs were conducted to compare activity status against performance on WAIS-R/WAIS-III subtests, WRAT-R subtests, Rey-O, Boston Naming Test, Benton Verbal Fluency Test, Stroop, WMS-R subtests, Trail Making Test, and MMPI Scales. These tests revealed significant results with alpha set at .05 for the WAIS-R digit symbol subtest, the WAIS-III vocabulary and similarities subtests, the Stroop Color and Color-Word Trials, and Trails B. It can be surmised that an elderly person's level of mental stimulation may contribute to his or her ability to execute higher level mental rotation and to perform novel tasks.

The relationship between driving and performance on the Trail Making Test in an elderly, memory disorder population

Selden JJ, Proctor-Weber Z, Greene L, Golden CJ, Todd ME

As individuals age, their ability to drive safely frequently becomes a salient issue. The present study sought to evaluate whether elderly patients who were active drivers at the time of their comprehensive neuropsychological evaluations outperformed nondriving patients on the Trail Making Test. Participants were elderly adults who were referred for evaluation to assess the presence of memory impairment. We classified 88 patients in this memory disorder population as being drivers or nondrivers according to their driving practices at the time of examination. Average age was 78.7 years, and average education was 13.1 years. The sample was predominantly female, right-handed, and Caucasian. One-way ANOVAs were conducted to compare driving status against performance on Trails A and B as measured in seconds and in age-corrected *T*-scores and standard scores. These tests were largely significant with alpha set at .05, suggesting that an elderly person's Trail Making Test results may reflect skills that are integral to an individual's driving ability. Results of this study suggest that in a referred memory disorder population, those patients who continue to drive perform better on both Trails A and B than do patients who no longer drive.

Factors contributing to unemployed and underemployed status in MS patients

Smith MM, Arnett PA

Rates of unemployment may be as high as 80% in MS populations. However, few studies have examined differences between patients who cut back on their employment versus those who become unemployed. Better understanding of factors contributing to changes in work status may result in the development of interventions that allow patients to remain employed, and as a result, improve their quality of life. Fifty-one definite or probable MS patients were administered an interview asking them about their employment status and, if not fully employed, the primary reasons for leaving or cutting back. Twenty-two (43%) patients left their last job due to MS symptoms (leave), 11 (22%) cut back their hours (cut back), and 18 (35%) remained fully employed. In the leave group, 36% cited fatigue as a symptom most responsible for their work change, 86% cited broad physical/neurological symptoms, and 27% cited cognitive problems. In the cut back group, these numbers were 91, 27, and 9%, respectively. The cut back group also reported significantly ($P < .05$) more education than the leave group. Our results show that fatigue is more often cited as a reason for cutting back than leaving employment, whereas physical/neurological symptoms and cognitive problems are more often cited as reasons for leaving than cutting back. Interventions that particularly target fatigue and disease progression in MS may result in patients being able to maintain their work status longer following their diagnosis. Additionally, education may serve as a buffer to unemployment in MS.

Effects on diagnosis and ethnicity on neuropsychological test performance in African-American and Euro-American patients with dementia

Strickland TL, Longobardi P, Alperson BL, Saxton E, Adams-Rodriguez G, Cummings J

Few studies exist comparing performance of African-American versus Euro-American patients with different diagnoses of dementia on neuropsychological tests. In this study, we examined performance on the consortium to establish a registry for Alzheimer's disease (CERAD) neuropsychological battery between Euro-American ($n = 421$) and African-American ($n = 87$) patients with diagnoses of possible/probable Alzheimer's, vascular, and mixed dementia. Participants were from UCLA and affiliated research sites. Age, sex, and education were explored as covariates. Interestingly, they contributed little to the understanding of the relationships. Diagnosis was significant as a factor for tests of visual naming, verbal fluency, constructional praxis, and on several word-list memory measures. Ethnicity was significant as a factor for verbal fluency and constructional praxis. Patients with possible/probable Alzheimer's disease scored lower than those with vascular and mixed dementia on visual naming, verbal fluency (only for African-Americans), constructional praxis (only for African-Americans), word-list learning over trials, and word-list recall. African-Americans with vascular dementia scored significantly higher than all groups of Euro-Americans on verbal fluency. There were no significant differences for word-list memory savings score. These findings suggest that diagnosis and ethnicity should be considered when interpreting performance on neuropsychological tests in elderly patients with dementia.

Neuropsychological test performance in African-American, Hispanic, and Euro-American patients with dementia

Strickland TL, Longobardi PG, Alperson BL, Saxton E, Adams-Rodriguez G, Cummings JU

Limited information exists on the performance of African-American versus Hispanic versus Euro-American patients with Alzheimer's disease, vascular dementia, or mixed Alzheimer's/vascular dementia on neuropsychological tests. In this study, we compared performance on the consortium to establish a registry for Alzheimer's disease (CERAD) neuropsychological battery among Euro-American ($n = 789$), Hispanic ($n = 52$), and African-American ($n = 116$) patients participating in the CERAD study through UCLA and affiliated research sites. Age and education were explored as covariates. Interestingly, they contributed little to the understanding of the relationships. Differences in performances among African-American, Hispanic, and Euro-American patients were observed on several of the cognitive measures. African-American patients scored lower than Euro-Americans on tests of visual naming and constructional praxis and on the mini-mental state examination. There were no statistical differences in performance on tests of fluency and word-list memory. Hispanic patients scored significantly higher than African-Americans on the visual praxis test and nonsignificantly different from either other group on the Visual Naming Test. These findings, consistent with those of other investigators, suggest that cultural or experiential factors may modify performance on specific neuropsychological tests.

Disease severity, sleep disturbance, and depression as predictors of fatigue in MS: a longitudinal study

Strober LB, Arnett PA, Bruce JM, Polen DM, Smith MM

Fatigue in multiple sclerosis (MS) is a common and debilitating problem. Despite its high prevalence, the etiology of fatigue is still poorly understood. In the present study, we looked at several possible

predictors of fatigue longitudinally: disease severity, depression, and sleep disturbance. We studied 52 definite MS patients (mean age = 46.4; EDSS = 4.5; education = 15) at Time 1 and then at Time 2, 3 years later. Stepwise regression analysis showed that sleep disturbance at Time 1 ($R^2 = .23$; $P < .001$) was the best predictor of fatigue at Time 2, followed by disease severity (D $R^2 = .13$; $P < .005$) and lastly, depression (D $R^2 = .07$; $P < .05$). These results suggest that sleep problems, disease progression, and depression may serve as risk factors for fatigue in MS. As such, treatment of these factors may result in a reduction of patients' fatigue and subsequent improvement in their quality of life.

Differences in degree of impaired daily functioning in Alzheimer's disease, ischemic vascular dementia, and fronto-temporal dementia

Tomaszewski FS, Mackin S, Mungas D, Reed B, Jagust W

Dementia is characterized by both deficits in cognitive functioning and resulting impairments in activities of daily living. There has been a great deal of research characterizing the different patterns of cognitive impairment associated with the various dementia types, including Alzheimer's disease (AD), ischemic vascular disease (IVD) and fronto-temporal dementia (FTD). However, there is little research examining difference in levels of daily functioning across these dementia groups. The purpose of the present study was to examine differences in functional impairment across AD, IVD and FTD. Daily functioning was measured by the Clinical Dementia Rating Scale, which is an informant-based measure of functional abilities. Results indicate that individuals diagnosed with probable AD were least impaired in daily functioning while individuals diagnosed with FTD were most impaired. The IVD group was within the intermediate range. One way in which these diagnostic groups differ is in terms of the degree of executive impairment. Thus, results suggest that greater executive dysfunction may lead to greater functional impairment in daily living. Neuropsychological predictors of functional impairment across the different diagnostic groups were also examined.

The effect of APOE on unawareness of cognitive deficit and depression in Alzheimer's disease

Wagner M, Bachman D

The objective of this study was to test whether the APOE gene influences the expression of unawareness of cognitive deficit in Alzheimer's disease. The punitive APOE four allele has been shown to increase the risk of Alzheimer's disease and is associated with earlier onset. It is less clear whether the punitive four allele influences the behavioral expression. The sample consisted of 57 sequential patients seen for diagnostic evaluation who met NINCDS/ADRDA criteria for probable Alzheimer and who fell within the CDR questionable or mild dementia severity range. Standard diagnostic procedures were followed. APOE was assayed and unawareness was determined using a measure with sound properties of reliability and validity. Patients were grouped according to the presence of the four allele, with the APOE 2:3 and 3:3 combined (absent, $N = 16$), and the APOE 3:4 and 4:4 combined (present, $N = 41$). Data were analyzed using a 2×2 ANOVA with APOE and CDR as the independent variables and unawareness of cognitive deficit or depression as the dependent variables. For unawareness, there were significant main effects for APOE ($P < .0001$) and CDR ($P < .0065$), but no interaction. For depression, there was a main effect for APOE status ($P < .019$), but not dementia severity, with no interaction. It was concluded that independent of dementia severity, those with the punitive APOE four allele had greater awareness of cognitive deficit and more depression.

Expanding neuropsychological assessment through repeated behavioral measures: an integration of evaluative models

Warzak W, Galloway A

The evaluation of brain impaired patients has increasingly required both neuropsychological and behavioral assessment to provide a comprehensive picture of patient functioning. Neuropsychological assessment emphasizes brain–behavior relationships and is used to evaluate patient functioning, assist in rehabilitation planning, establish a baseline against which progress can be measured, and clarify medical and psychiatric diagnoses. These data are gathered infrequently and at considerable expense. Behavioral assessment emphasizes environment–behavior relationships. These data can be gathered frequently and inexpensively and also contribute greatly to an understanding of patient functioning and rehabilitation planning. Unfortunately, too often neuropsychologists and behavioral psychologists find themselves working independently, rather than collaboratively, thereby missing an opportunity to make maximum use of their respective contributions to patient care. An integration of neuropsychological and behavioral findings would increase the benefits of these respective procedures by providing on-going monitoring and greater specificity in treatment planning than could be obtained through either assessment tradition alone. The present paper attempts to bridge this gap by illustrating how neuropsychological and behavioral assessment can be integrated to further the evaluative process, permit repeated measures of patient function and evaluate the on-going effects of intervention, including medication effects. Neuropsychological and behavioral data are presented for two cases to illustrate how such an integrative approach can improve the care of brain impaired patients better than either approach alone.

Relationship between olfactory acuity, ERPs and neuropsychological performance in Alzheimer's patients

Wen J, Antolin T, Berman S, Segal S, Mitrushina M

With the progression of dementia of Alzheimer's type (DAT), a decline in smell identification as well as neuropsychological deficits have been consistently found. In addition, visual event-related brain potentials (ERPs), such as P300 amplitudes, which are associated with mental effort, were shown to discriminate between patients with DAT and normal aging adults. The objective of the present study is to determine the relative clinical utility of olfactory identification, neuropsychological assessment, and visual ERPs in detection of early stages of DAT. Eleven healthy elderly participants (M age $= 70.7$, S.D. $= 5.9$; M education $= 15.4$, S.D. $= 2.7$) were compared to eight participants in early stages of DAT according to NINCDS/ADRDA criteria (M age $= 68.2$, S.D. $= 7.5$; M education $= 15.5$, S.D. $= 3.4$), using the University of Pennsylvania Smell Identification Test (UPSIT), MMSE, a battery of neuropsychological tests, and P300 amplitudes of the midline electrodes (Fz, Cz and Pz) in response to a CPT task. As expected, the DAT group scored significantly lower on the MMSE ($P < .004$), UPSIT ($P < .01$), and a number of neuropsychological tests. These deficits corresponded to lower P300 amplitudes in DAT participants ($P < .05$) for all three electrode sites. Linear regression analysis revealed that the UPSIT is a strong predictor of performance on the MMSE, accounting for 75% of the variance for the DAT group. This was not found for the healthy elderly group. These results have promise in developing new clinical tools for differential diagnosis of early DAT.

The Controlled Oral Word Association measure and Animal Fluency Test and temporal lobe atrophy

White J, Mortensen J, Hannan CR, Fearing M, Tate D, Bigler ED

Verbal fluency is impaired in dementia; however, the relation of verbal fluency measures to atrophic brain changes in dementia is not fully understood. Magnetic resonance imaging analysis was conducted on 20 control, 62 Alzheimer's disease, 16 vascular dementia, 30 mild ambiguous, and 32 mixed neuropsychiatric subjects. Diagnoses were established by a consensus diagnostic approach. Verbal fluency measures included Animal Fluency Test and Controlled Oral Word Association. Structures measured included the total temporal horn volume, total hippocampal volume, and volumes of the parahippocampal gyri, and the fusiform gyri. Age was controlled for by using partial correlation. Total temporal horn volume was negatively correlated with performance on animal fluency ($r = -.322$, $P < .01$) and performance on Controlled Oral Word Association ($r = -.257$, $P < .01$). Total hippocampus volume was positively correlated with performance on the animal fluency measure ($r = .255$, $P < .01$) and the Controlled Oral Word Association ($r = .183$, $P < .05$). Performance on the animal fluency measure was positively correlated with the combined parahipppocampal gyrus and fusiform gyrus volumes for both the right ($r = .172$, $P < .05$) and the left hippocampus ($r = .233$, $P < .05$). In addition performance on the animal fluency task was positively correlated with the combined volume of the parahippocampal gyrus volume, fusiform gyrus, and the hippocampus for the left side ($r = .185$, $P < .05$). These findings indicate that widespread changes in temporal lobe structure are correlated with deficits in fluency. However, correlations and explained variance from temporal lobe atrophy appear to contribute minimally.

Comparison of clock drawing performance in Alzheimer's disease, Parkinson's disease, and dementia with Lewy bodies

Williams K, Cahn-Weiner DA, Grace J, Tremont G, Westervelt H, Stern R

The Clock Drawing Test (CDT) is commonly used in the neuropsychological assessment of dementia because it is sensitive to cognitive impairment and because it can provide information to help discriminate between various types of dementia. Previous studies have demonstrated that specific qualitative errors in clock drawing performance are often associated with different forms of dementia. The purpose of the current study was to examine quantitative and qualitative features of clock drawing performance in three patient groups: Alzheimer's disease (AD, $n = 22$), cognitively impaired Parkinson's disease (PD, $n = 17$), and dementia with Lewy bodies (DLB, $n = 20$). All patients were matched on age, education, and dementia severity. There was no significant difference between the three patient groups on a global quantitative CDT score. There were also no significant differences between the groups in many of the qualitative features evaluated, including stimulus-bound errors, perseverations, left hemispatial neglect, spatial errors, and writing the numbers counterclockwise. However, the DLB patients were more likely to make conceptual errors than the AD and PD patients, and the PD and DLB patients made more planning errors than the AD patients. These findings suggest that while modest differences may exist in the qualitative features of clock drawing performance between these patient groups, overall clock drawing performance is relatively similar.

Differential changes in clustering and switching after subthalamic stimulation in Parkinson's disease

Woods SP, Fields JA, Tröster AI

Decrements in verbal fluency are the most common neuropsychological sequelae of deep brain stimulation (DBS) of the subthalamic nucleus (STN) for treatment of Parkinson's disease (PD); however, few

studies have examined the cognitive mechanisms that might underlie these changes. Troyer et al.'s model posits that two processes are key determinants of verbal fluency: clustering (i.e., generating consecutive words within a semantic subcategory) and switching (i.e., shifting to a different semantic subcategory). In general, prior studies indicate that clustering is related to the temporal lobes and semantic memory stores, whereas switching is associated with fronto-striatal circuits and executive functions. The present study examined changes in clustering and switching in 23 patients with PD who were administered supermarket fluency at baseline and 5 months after bilateral STN DBS. Participants were classified as having demonstrated a postsurgical decline or gain of at least 0.5 standard deviations, or no change ($<$0.5 S.D.) in clustering and/or switching. A significantly larger proportion of patients demonstrated postsurgical improvements in clustering (44%) than in switching (17%). In contrast, mild postoperative declines in switching (39%) were more frequently observed than were declines in clustering (26%). Patients who evidenced a significant postsurgical decline in switching also demonstrated poorer overall verbal fluency performance at follow-up. Findings support the hypothesis that STN DBS may facilitate access to semantic networks and/or disrupt select attentional/executive functions. Future research is needed to determine whether postsurgical verbal fluency changes relate to stimulation parameters.

Variability among three neurologists in assigning diagnoses of Alzheimer's disease to patients in a memory and aging clinic

Zec R, Markwell S, Pyo G, Elble R, Ala T, McManus D

The Report of the Quality Standards Subcommittee of the American Academy of Neurology (2001) reaffirmed that NINCDS/ADRDA criteria for probable Alzheimer's disease (AD) or DSM-IIIIR/DSM-IV criteria for dementia of the Alzheimer type (DAT) should be routinely used (Guideline). We studied the consistency with which three neurologists in our Alzheimer Center assigned different diagnoses on the spectrum of DAT. We included all patients referred to our dementia clinic for the past 3 years who received diagnoses of probable AD, possible AD, uncertain, or mild cognitive impairment (160, 134, and 107 total patients for the three neurologists). The mean age, education, MMSE score, and ADAS-cog error score were similar for the three patient groups (e.g., age 77, 78, 73 years; education 12, 13, 13 years; MMSE 21, 22, 23; ADAS-cog 22, 19, 17). However, the neurologists differed greatly in the diagnoses that they assigned. The percentages of patients diagnosed with probable AD were 65, 54, and 29% for the three neurologists. The percentage of patients diagnosed with uncertain or MCI were 12, 33, and 34%. The diagnosis of uncertain was never made by one neurologist for patients with ADAS-cog scores above 10, whereas 25% of another neurologist's uncertain diagnoses were patients with scores in the 11–15 range (but no uncertain diagnoses above 15), whereas 61% of the third neurologist's uncertain diagnoses were patients with scores above 15. We recommend that established diagnostic criteria be closely followed and be better operationally defined, and that interdiagnostician agreement be periodically re-examined to insure sufficient consistency.

Well-preserved visual object recognition memory in the majority of patients with DAT in the mild to moderate stages

Zec R, Pyo G, Burkett N, Markwell S

Considerable research attention has been focused on episodic memory impairment in AD because it is the earliest presenting symptom and remains the cardinal feature throughout the course of the disease. However, there is a basic subtype of episodic memory that has not been systematically investigated in AD patients, that is, true–false visual object recognition memory (VORM). In the present study, we

examined VORM after a 5- and 45-min delay in a group of 39 patients diagnosed with either mild cognitive impairment or dementia of the Alzheimer type in the mild to moderate stages. We found that a clear majority of the patients studied (67 and 71%, respectively), including many with moderate dementia, have well-preserved VORM (90% or better correct) in the context of an anterograde amnesia on other more traditional measures of episodic memory. In fact, approximately 30% of the patients had perfect scores on both short and long delay VORM, and approximately 50% scored 97% or better. Performance was similar for both the short and long delay trials. True–false VORM was much better preserved than true–false word recognition memory. We theorize that dementia patients with preserved VORM have less complete destruction of the neural systems mediating episodic memory compared to patients with more impaired VORM. It is likely that those AD patients with relatively preserved VORM possess an important asset in episodic memory that serves them well in everyday functioning, whereas those patients in whom VORM is no longer relatively well preserved can be characterized as having profound impairment in episodic memory.

ADULT NEUROLOGICAL DISORDERS: SEIZURE DISORDERS

Assessing psychological function in patients with epilepsy

Brewer C, Westerveld M, Loring D, Chelune G, Bozeman EC

The Minnesota Multiphasic Personality Inventory (MMPI) is commonly used to assess psychopathology in epilepsy patients. However, there are concerns that symptoms related to seizures (e.g., peri-ictal sensory phenomena) may spuriously elevate clinical scales. In recent years an alternative measure, the Personality Assessment Inventory (PAI), has emerged as a possible alternative for assessing clinical populations, but has yet to be applied consistently to epilepsy populations. The purpose of this investigation was to test the hypothesis that the MMPI may over-pathologize features in epilepsy patients in comparison to profiles obtained from the PAI. In this study, 90 patients being evaluated for possible epilepsy surgery were each administered the MMPI and the PAI as part of a neuropsychological battery. The level of agreement for main clinical scales and subscales were examined by Chi-square analysis between the two inventories. Results demonstrate significantly more clinical scale elevations with respect to anxiety, depression, paranoia, and schizophrenic features in the MMPI compared to the PAI. The hypothesis that the MMPI may overdiagnose clinical features in epilepsy populations is supported by this research. Conclusions are discussed in terms of the dimensionality of psychiatric features and the symptomology of neurologic dysfunction.

Perception and priming of affective faces in temporal lobectomy patients

Burton L, Wyatt G, Rabin L, Frohlich J, Bernstein S, Dimitri D, Labar D

Eighteen patients who had undergone standard anterior temporal lobectomy including removal of the amygdala and hippocampus (nine left, LTL; nine right, RTL) were administered an affective task composed of faces depicting negative emotions, and a neutral task consisting of faces with different lighting and orientation conditions. Both tasks required judgment of poser identity and indication of decision by pressing a reaction time button. Subjects were shown a set of photos in an exposure phase, followed by a test phase in which the photos previously seen (primed) were mixed with new photos (unprimed). The LTL subjects performed better than the RTL subjects for both the RT and accuracy data in both the neutral and affective tasks. The performance of the LTL subjects improved when the task had an affective component (affective vs. neutral task), whereas the RTL subjects did not show this benefit. In terms of specific emotions, for the LTL group, pain was responded to most slowly and shock was the

emotion responded to most quickly, and significantly more quickly than in the RTL group. Fear was the emotion responded to most slowly by the RTL group and significantly more slowly when compared to the LTL group. The only priming effect was a reverse priming for pain, such that stimuli seen before were responded to less accurately than new stimuli; this was not related to lesion side.

Objective evaluation of personality and psychopathology characteristics in temporal lobe versus extratemporal lobe epilepsy

Cragar DE, Fakhoury TA, Berry DT, Schmitt FA

Clinicians have long believed that certain personality traits as well as specific manifestations of psychopathology are more common in some types of epilepsy. Bear and Fedio (1977) described a temporal lobe personality syndrome that included increased philosophical concerns, deepened emotionality, unusual sexual proclivities, hypergraphia, and interpersonal dependency. Patients with a left temporal focus were more ideative and had more anger, depression and paranoia whereas patients with a right temporal focus were more emotional and reported more feelings of elation. In a recent review, Ritaccio and Devinsky (2001) concluded that the current data do not clearly support a consistent cluster of personality traits related to seizure type or focus. In this study, differences in personality and psychopathology between patients with right temporal, left temporal and extratemporal epilepsy were investigated using the NEO-PI-R, a measure of the Five Factor Model of personality, and the MMPI-2. Participants included 18 patients with right temporal epilepsy, 21 patients with left temporal epilepsy, and 24 patients with extratemporal epilepsy, all diagnosed with long-term video-EEG monitoring. Comparison of right and left temporal patients showed one significant difference on the NEO-PI-R Conscientiousness facet of order, with left temporal patients scoring lower. The effect size from this contrast was the only difference reaching a medium effect (0.5). There were no significant differences between patients with temporal and extratemporal epilepsy on the NEO-PI-R or the MMPI-2. Consistent with the report of Ritaccio and Devinsky, these findings fail to suggest distinctive personality or psychopathology characteristics for patients with temporal lobe epilepsy.

The Wada procedure and prediction of surgical outcome in anterior temporal lobectomy

Dilkes D, Tracy J, Sperling M, Glosser D, Liporace J, Nei M, O'Connor M, Salmon E

We examined the ability of Wada results to predict surgical outcome following left or right anterior temporal lobectomy, with the expectation that our Wada Lateralization Index would be a better predictor of seizure control than more general measures of cortical integrity. As the left and right hemisphere may have different capacities, we assessed prediction of outcome separately for left and right temporal lobectomy patients. Wada scores from a 176 left and 181 right temporal lobectomy patients were used, though analyzed based on side of surgery. Discriminant function analyses determined the relative power of the variables to predict postsurgical seizure control using a six-level scheme for classifying outcome: the isolated ipsilateral and contralateral Wada scores, the Wada lateralization ratio, verbal IQ, performance IQ, and handedness. The best predictor of postsurgical seizure control was the asymmetry between Wada scores for the two hemispheres; suggesting that when the contralateral side possessed a larger advantage in memory the surgical outcome was worse, and when ipsilateral memory was superior the surgical outcome was better. Our results suggest: (1) Wada memory variables that take into account the context of overall Wada performance provide better predictive power than the Wada memory scores from the isolated hemispheres, (2) Wada memory asymmetry predicts surgical outcome more strongly than measures of general cerebral integrity or gross indices of cerebral dominance, (3) if the asymmetry

in Wada scores reflects good functional reserve for memory in the hemisphere undergoing surgery than the prognosis for outcome is improved.

An assessment of semantic and phonemic confrontation naming errors in patients with temporal lobe epilepsy

Fargo J, Dulay M, Westbeld M, Schefft B

Prior studies have reported greater confrontation naming deficits in patients with left temporal lobe epilepsy (TLE) compared to patients with right TLE. Such studies suggest that the mechanisms for poor confrontation naming performance may be related to impoverished phonologic word retrieval and/or semantic knowledge. To address this issue the present study assessed the frequency and type of interictal confrontation naming errors produced by patients with medically intractable TLE. Sixty patients with unilateral TLE (25 left, 35 right) were administered the 60-item version of the Boston Naming Test (BNT). Errors were classified into four categories: verbal paraphasias (errors semantically related to a target word), literal paraphasias (errors share phonologic segments with target word), errors that were a combination of both verbal and literal paraphasias, and excluded errors (e.g., circumlocutions, perseverations, and nonsemantic perceptual errors). Results indicated that verbal and literal paraphasias were present in both TLE groups. ANOVA indicated no significant between-group difference in the production of verbal paraphasias. However, patients with left TLE produced significantly more literal paraphasias ($P < .05$). A higher number of literal paraphasias (but not verbal paraphasias) was associated with poorer BNT performance for left TLE, but not right TLE ($r = -.43$, $P < .05$). The differential rate of literal paraphasia production between groups, with similar verbal paraphasia production, would suggest a greater contribution of phonologic retrieval deficits in poor confrontation naming performance found in left TLE. Literal paraphasia production may be useful in lateralizing side of seizure focus.

Contralateral left hemisphere structure and function in right temporal lobe epilepsy

Kelly KC, Seidenberg M, Jones J, Dow C, Woodard A, Rutecki P, Sheth R, Hermann B

Although EEG monitoring in TLE patients typically identifies a unilateral seizure focus, recent research suggests that brain abnormalities in this population extend beyond this unilateral epileptogenic region. However, little is known about the status of the hemisphere contralateral to the seizure focus or the etiology of these extratemporal abnormalities. Therefore, through utilization of quantitative MRI volumetrics and neuropsychological measures of LH functions, the purpose of the present study was to comprehensively evaluate the structural and functional integrity of the LH in RTLE patients in comparison to healthy controls, and to examine the relationship between these abnormalities and clinical variables for the purpose of elucidating the etiology of these abnormalities. Subjects included: (1) 20 LH language-dominant, ictal EEG-monitored, RTLE patients and (2) 20 right-handed healthy controls matched for age, gender, and height. All subjects underwent a brain MRI and completed a neuropsychological evaluation of LH functions. LH regions of interest included the hippocampus, four lobes, gray/white matter, and total LH. Clinical variables included number of medications and epilepsy duration. RTLE patients performed significantly worse than healthy controls on measures of letter fluency, semantic fluency, and right-hand dexterity. Although MRI volumes did not differ significantly between the groups, significant correlations found between MRI volumes and neuropsychological measures suggest that LH brain dysfunction underlies the observed functional deficits. Epilepsy duration was unrelated to any of the measures. Number of anti-epileptic drugs correlated only with

letter fluency suggesting only a minor role for AEDs in the etiology of extratemporal abnormalities in TLE.

Memory for verbal material after temporal lobectomy in Spanish sample

Orozco C, Puente AE, Verdejo A, Pastor-Pons ED, Castañeda M, Altuzarra A, Sánchez-Alvar JC, Perez-García M

Drug resistant temporal lobe epilepsy is a complex alteration that greatly affects the neuropsychological functions, psychosocial adaptation and quality of life of the patients who suffer from it. Neurosurgery, and specifically the temporal lobectomy, is an effective alternative treatment for controlling the crises of some of these patients (Engel, 1987). Due to the pronounced relationship between the temporal lobe and the mnemonic functions, one of the important undertakings of clinical neuropsychology is the study of the effects of these surgical interventions on the patients' memory. Therefore, the purpose of this study is to examine any possible postoperative changes in discriminability at recognition for verbal material after the temporal lobectomy in a Spanish sample, by using both group and individual methodologies. Subjects were 27 patients with temporal lobe epilepsy with simple or complex partial crises and with or without secondary generalization. Subjects were administered the Spain-Complutense Verbal Learning Test (Benedet & Alejandre, 1998), an episodic memory task for the verbal material. Patients were evaluated presurgically and 6 months after the temporal lobectomy. The analyses showed no statistically significant changes in the left temporal lobectomy group, but a statistically significant improvement in the right temporal lobectomy group [$W(1, 21) = 1.992$; $P = .046$]. The case analyses showed that the improvements or deteriorations were no more frequent in any group, but we observed some clinically significant deteriorations in the left group, and some improvements in both groups. Results are discussed according with the current neuropsychological evidence in epilepsy surgery.

The diagnostic utility of WMS-III Auditory–Visual Memory Index Score discrepancies in temporal lobe epilepsy: a likelihood ratio approach

Pinkston JB, Kubu CS, Lineweaver TT, Naugle RI, Bingaman W, Najm I

The Wechsler Memory Scale-Third Edition (WMS-III) is a commonly used measure of memory functioning in the evaluation of epilepsy surgery patients. Despite its wide use, relatively few studies have directly examined the utility of the WMS-III in predicting side of presumed seizure focus at the individual patient level. The current study applied a likelihood ratio approach to study this question. Study participants ($N = 112$) were drawn from a larger series of patients with temporal lobe epilepsy (TLE) referred to a surgical epilepsy center. Auditory minus Visual Memory Index discrepancy scores were derived using both Immediate and Delayed Index scores. The discrepancy scores were then investigated for their utility at predicting those patients who ultimately went on to have a left versus nonleft (right) temporal lobectomy. For immediate memory, significant ($P < .001$) predictive utility was obtained using discrepancy scores of <-9 and >18 (sensitivity $= 0.762$; specificity $= 0.75$; likelihood ratio $= 3.05$). Similar significant results ($P < .0001$) were found using delayed memory discrepancy scores of <-11 and >13 (sensitivity $= 0.737$; specificity $= 0.821$; likelihood ratio $= 4.12$). The pretest probability of undergoing a left temporal lobectomy in this patient group was 46%. Use of the discrepancy scores as outlined above increased the posttest probability to 72–78%. These data illustrate the utility of WMS-III discrepancy scores in identifying ultimate side of surgery in patients with TLE. Furthermore, the data suggest that relatively small discrepancy scores (compared to the WMS-III normative data) can be clinically useful in predicting side of surgery in patients with TLE.

Functional MRI localization of abstract visual memory encoding and object naming
Schiehser DM, Williams JM, Schneider J, Mohamed F, Assaf B, Faro S, Koffler S

Functional MRI has emerged as a noninvasive and accurate method to localize verbal and nonverbal cognitive functions. The WADA procedure is currently used to lateralize cognitive functions in presurgical intractable epileptics. However, this procedure is invasive and only permits a gross estimation of function localization. The functional MRI method is an appealing alternative to the WADA procedure. The current study evaluated memory encoding of abstract visual stimuli and implicit verbal naming of common objects used during the WADA Test. Ten healthy normal adults were scanned using a whole-brain functional MRI procedure. Stimuli were presented using a 20-s on–off blocking procedure. Control and stimulus fMRI image contrasts were accomplished using statistical parameter mapping (SPM99). Results indicated that abstract visual stimuli were reliably lateralized within the right hemisphere and implicit verbal naming of common objects was lateralized within the left hemisphere. The results support the use of the functional MRI as an accurate and noninvasive method to localize abstract visual memory and object-naming, as well as a possible alternative to the WADA procedure.

Wada Test recognition memory scores are influenced by language laterality
Vyas SK, Walker JA, Lebby PC, Tanner DE

We evaluated whether Wada Test memory scores were influenced by patterns of language laterality. We also compared patients with a unilateral anterior temporal lobe focus (ATL, $n = 336$) to those with a focus outside the anterior temporal lobe (OTHER, $n = 59$). Our expectation was that the language laterality group would have an influence on memory scores, and that OTHER patients would not show a hemispheric memory asymmetry. Memory scores were derived from postrecovery recognition testing for items shown under drug, with a correction for guessing (targets correct + foils rejected/2). Language laterality was based on clinical criteria, and classified into five categories (L only, L > R, L = R, R > L, R only). Comparisons were made using MANOVA and post hoc tests, as needed. Overall, right ATL patients had better memory scores when using their left hemisphere, while Left ATL patients had better scores using their right hemisphere, though the asymmetry was smaller for the left group than the right group. When sorted by language laterality, it was clear that memory scores were affected by language laterality, as the pattern for patients with right-ward speech was the reverse of patients with left-ward speech. The pattern of memory asymmetry for the OTHER group did not differ from that for the ATL group. Although postrecovery recognition memory scores should be resistant to the effects of language disruption during the active phase of the amytal, it was clear that presence or absence of speech did have an influence on memory scores.

Neuropsychological predictors of nonepileptic seizures
Wagner M, Pritchard P, Topping K

Neuropsychological testing has been used to aid in the diagnosis of epileptic (ES) versus nonepileptic seizures (NES). In addition to neurocognitive screening, we believe that this data is the first time the PAI has been assessed relative to the NES/ES differential. Eighteen consecutive patients who completed long-term video EEG monitoring were diagnosed with either NES and nine had ES. The mean age was 35.4. There were no significant cognitive group differences. On the PAI, *T*-test group comparisons with showed no group difference on any of the validity scales. Group differences were found on the depression ($P < .032$), treatment rejection ($P < .029$), and dominance ($P < .043$) scales. The subscale conversion

disorder showed large group differences ($P < .010$). The NES group had greater physiologic signs of depression, were more willing to endorse the need for personal psychological change, and were retiring in personality style. Most striking difference was the NES group's tendency to endorse functional impairment due to symptoms associated with sensory and/or motor deficits (conversion). Using the conversion subscale scale only, a sensitivity of 67% and a specificity of 89% were found in classifying seizure type. While neurocognitive variables did not reveal group differences, the PAI shows promise in aiding in the differential diagnosis of NES versus ES and may prove useful in the development of psychiatric treatment planning for NES patients.

ADULT NEUROLOGICAL DISORDERS: OTHER NEUROLOGICAL DISORDERS

Palilalia and basal ganglia neuropathology: a case study

Bollich A, Black FW

Palilalia is an uncommon disorder of speech fluency characterized by prolonged involuntary repetition of single words or phrases during verbal output. Neuropathologically, palilalia has been reported secondary to stroke and trauma, usually bilateral and often subcortical. It is often seen as a sequelae of extrapyramidal disorders. A dose-related dyskinetic effect of levodopa has been reported, implicating the dopamine system in the maintenance of dysfluency. As it is relatively uncommon and can serve as a dramatic and interesting example of the cognitive effects of certain focal subcortical lesions, often the basal ganglia or the thalamus, palilalia is worthy of further neuropsychological/linguistic investigation. This is a case study of a patient who presented with sudden onset of palilalia, micrographia, and other cognitive and neurobehavioral changes following a time-limited exposure to carbon monoxide. MRI scans revealed discrete, bilateral symmetrical lesions in the globus pallidus, with some extension into the internal capsule. Two comprehensive neuropsychological evaluations were conducted at 20 and 36 months postexposure. Summary neuropsychological and linguistic data are presented, which document a pattern of deficits consistent with the lesion site, including extremely dysfluent speech, micrographia, a shuffling gate, and flat affect, with spared memory skills. There was no evidence of oral apraxia, but the patient had significant problems in generating or imitating transitive gestures, suggesting the presence of limb apraxia. The clinical and theoretical implications of the data for the understanding of this disorder are explored, within the context of the complex medical and psychiatric history.

Emotional disturbances in acute stroke patients with subarachnoid hemorrhage

Borgaro SR, Prigatano G, Grace C, Pogge D, Kwasnica C

Cognitive impairments have been widely documented in stroke patients with subarachnoid hemorrhage (SAH). While emotional disturbances are often clinically observed in SAH patients as well, they have not been the focus of research. The present study examined both cognitive and emotional functioning in acute SAH patients. Participants were 45 stroke patients with SAH ($n = 16$) and without SAH ($n = 29$) from an inpatient rehabilitation unit and assessed within 60 days of injury. Patients were administered the BNI screen for higher cerebral functions (BNIS) as an overall measure of cognitive functioning, and the Patient Distress Scale (PDS). The PDS is an 11-item self-report questionnaire that measures emotional disturbances (irritability/agitation, fatigue, discouragement, headaches, anxiety/nervousness, sleep, sadness, appetite, frustration, physical discomfort, and confusion). ANCOVAs, controlling for number of days from injury to assessment, were computed between the groups on the total BNIS and PDS scores. No significant differences were observed between groups on overall cognitive functioning ($P = .427$). However, the SAH group reported significantly higher levels of emotional distress on

the PDS than the non-SAH group ($P < .05$). The only item that significantly separated the groups was anxiety/nervousness, with the SAH group reporting higher levels of anxiety/nervousness than the non-SAH group ($P < .001$). There were no vascular distribution or lesion location interaction effects. These findings suggest that anxiety/nervousness is particularly problematic in acute stroke patients with SAH during the early stages of recovery. They further highlight the need for interventions aimed at reducing emotional distress during acute rehabilitation.

Cognitive reserve theory and recovery from mild traumatic brain injury (MTBI) in a case of Arnold Chiari malformation with hydrocephalus

Borrego R, Korinek L

Cognitive reserve theory proposes that larger head circumference serves as a buffer to the development of future neurologic problems. Arnold Chiari malformation is a congenital abnormality where the cerebellar tonsils extend into the cervical spinal canal. This malformation is frequently associated with hydrocephalus. It is proposed in this case study that hydrocephalus and head circumference effect cerebral volume and cognitive reserve. The patient's neurosurgeon referred her for a neuropsychological evaluation to obtain an objective assessment of her neurocognitive complaints and to determine if her deficits were due to MTBI from an MVA or to Arnold Chiari and hydrocephalus. Starting 10 months after the MVA, three separate neuropsychological evaluations where administered at approximately 1 year apart. The results were a key factor in the decision not to surgically insert a shunt. In analyzing the results of these evaluations several issues were considered. First, patients with hydrocephalus tend to have lower IQ scores and neurocognitive deficits. Second, the usual course and sequelae of MTBI needed to be taken into account. Finally, this patient was African-American; therefore, cultural and normative issues needed to be addressed. The series of evaluations resulted in impaired scores on the initial testing with higher and mostly normal scores on the second and third evaluations. It is hypothesized that the depressed scores from the initial evaluation were attributable to an altered (slower) course of recovery from a MTBI due to the decreased cognitive reserve related to Arnold Chiari with hydrocephalus.

Cultural and psychological considerations in neuropsychological assessment of a non-English speaking patient with right parieto-occipital meningioma

Borrego RP, Simon-Thomas JM

Neuropsychological testing with patients of different cultures and languages has been widely debated. Cultural and language differences can present obstacles to valid neuropsychological assessment as communication, language, mood, affect, thought disorders, and neurocognitive functions can be under or over interpreted. This case study examines the ability of neuropsychological tests, through an interpreter, to assess deficits caused by a large right parieto-occipital meningioma. The subject was a 46-year-old Russian-only speaking male. He originally sought treatment for depression, and then 1 year later presented with visual changes, dizziness, headaches, and decreased appetite, at which point the meningioma was identified. The patient was tested pre- and postsurgery. Prior to surgery, the patient displayed left hemineglect, executive function impairment, constructional dyspraxia, bilateral grip strength and motor speed deficits, decreased processing speed, and decreased visuospatial and perceptual organization. Patient underwent two craniotomies for resection of right falx tumor. Postsurgery, the patient's performance was still impaired but substantially improved in the areas of motor, executive functions, and processing speed. He was WNL on visuospatial, and perceptual organization. Comprehensive testing will be administered 3 months postsurgery. Initial results provide support for the validity of the tests administered with non-English speaking populations. In addition, right hemisphere tumors have been

connected to indifference, and more recently depression. This highlights the need for psychiatry to be sensitive to possible connections between brain injury and emotional disorders, and to routinely assess for such a connection.

Reversal of the ERP old/new effect during time-delayed word recognition in a patient with amnesia
Boulos MI, Zakzanis KK, Ashamalla AA

The effects of time delay (between study and test) and brain damage on the event-related potentials (ERPs) elicited during word recognition were examined. Previous research has shown that, on frontal recording sites, the correct recognition of old words is typically associated with two topographically distinct ERP old/new effects: an early, bilateral effect and a late, right-sided effect. During the current study, 26 students were taught a list of words and returned 1, 2, or 3 weeks later to perform a recognition task. A patient (FP), who had frontal and hippocampal lesions, was tested during a single session and had a 20-min delay between study and recognition trial. During all recognition tasks, right prefrontal activity was measured by electroencephalogram (EEG). Analysis of the ERPs in all the healthy participants revealed an old/new effect, which did not diminish with increasing retention intervals. The 1-week delay subjects elicited the greatest early, bilateral frontal activity, while the 2- and 3-week delay subjects elicited the greatest late, right frontal activity. These results support the view that the early effect is familiarity-driven, while the late effect functions to monitor retrieval. In the patient, the correctly classified new words, relative to the correctly classified old words, elicited the two positive-going deflections. To our knowledge, this is the first report of a reversal in the electrophysiology of the old/new effect. This effect can be thought of as a new/old effect, and may be a marker for certain brain injuries.

The decision to use the WMS-III with elderly patients
Braaten A, McCue R, Burns WJ, Sellers A

The purpose of this study is to find a brief measure that can predict the Wechsler Memory Scale-Third Edition (WMS-III) General Memory Index (GMI) in order that clinicians might use such a brief measure to decide whether it will be efficient to administer the entire WMS-III or not. The outcome of the WMS-III has been found to be misleading when extremely low scores are obtained by demented patients, because the norms offer standard scores when zero points are obtained. Forty-five participants were given the Folstein mini-mental state exam (FMMSE) and the WMS-III. The ability of the Information/Orientation (I/O) subtest of the WMS-III and the FMMSE to predict performance on the WMS-III test was evaluated. A correlational analysis of the I/O versus GMI and FMMSE versus GMI revealed a significant correlation only for the FMMSE ($R = .52$, $P < .001$). Thus, the FMMSE is better able to predict performance on the WMS-III, measured by the General Memory Index Score (GMI). These results suggest that the FMMSE should be selected when an examiner wishes to predict whether or not to give an entire WMS-III to assess for dementia in an elderly population.

Sensory processing and interhemispheric transfer in multiple sclerosis
Brown LN, Metz LM

This preliminary study investigated the potential of a cerebral lateralization technique that measures both, temporal judgments to sensory stimuli and interhemispheric transfer time (IHTT), as an outcome measure in multiple sclerosis (MS). Tactile stimulation was delivered to one or both hands by mechanical tactile stimulators. Pairs of light emitting diodes were presented to hemifields for visual stimulation. Response consisted of a binary forced-choice (YES/NO) judgment as to the simultaneity of the onset

of pairs of stimuli. Both tactile and visual temporal thresholds were significantly higher in MS patients than controls in every presentation condition. IHTT estimates (threshold differences between unilateral and bilateral presentations) for the tactile and visual tasks were also significantly longer in patients than controls. Age correlated with sensory temporal thresholds for the control group only. In order to examine the reliability of this technique a second experiment was conducted. A group of controls and nonrelapsing MS patients were tested on two separate occasions (2 weeks apart). Correlations of the two test sessions were significant indicating that the testing technique is highly reliable. These findings suggest that this technique may be a useful outcome measure in MS. We hypothesize that myelin injury slows central conduction therefore impairing the ability to judge the onset of sensory stimuli and increasing IHTTs.

The effects of gender and time on regional cortical perfusion in vascular dementia patients
Browndyke JN, Tucker KA, Sweet LH, Paul RH, Cohen RA

This study examined the relationship between gender and time on regional cortical perfusion in patients diagnosed with vascular dementia (VaD). Twenty patients (12 females and 8 males) meeting VaD criteria without the presence of cortical stroke were admitted into the study and assessed using resting HM-PAO SPECT imaging at baseline and 1-year follow-up. No significant baseline differences were noted for patient demographics (age and education), Hachinski score, cognitive impairment severity (MMSE total score), or regional cortical perfusion. A mixed model MANOVA was employed to investigate the within-subject variable of time and between-subject gender variable, as well as the interaction of time and gender, on regional cortical perfusion. Results of the multivariate analysis revealed a significant main effect for time ($P < .01$) and a significant time by gender interaction ($P < .05$). Subsequent univariate analyses indicated significant differences in baseline and 1-year follow-up cortical perfusion as a function of time in the right frontal, right and left temporal, left parietal, and left occipital lobes. Gender by time differences were noted in left temporal and right parietal lobes. Females demonstrated relative stability in left temporal perfusion and improved right parietal perfusion from baseline to 1 year, while males uniformly declined in left temporal and right parietal perfusion. These results suggest that for some cortical regions greater test–retest perfusion variability may exist in females diagnosed with VaD. Discussion is given to the possible mechanisms of gender differences in SPECT among patients diagnosed with VaD.

Multiple sclerosis: an historical perspective
Butler M, Bennett TL

This analysis examined how MS has been conceptualized from the 14th century through the early 20th century. Primary sources were consulted whenever possible and many of the original archival materials were accessed by the first author during an on-site visit to the Rare Book Room of the New York Academy of Medicine. Sources included biographies of the earliest recorded probable cases of MS, diaries/autobiographical accounts of individuals who had MS, scientific papers on histology of MS lesions, and clinicopathological profiles. MS may have existed as early as the 1300s or earlier, but the disease was not identified as such. MS was first identified and described scientifically in the mid-1800s and an abundance of case information was collected at this time. The knowledge base has since expanded from this early trend. There is a striking similarity between how MS presented in individuals throughout history compared to the 21st century. These similarities in symptomatology can be observed in all arenas relevant to MS, that is, sensorimotor, cognitive, urological, and sexual. However, conceptualization of etiology and treatment choices differed dramatically from today; these are a genuine reflection of the times in which they were created.

Potential clinical utility of a method for estimating prior standing in specific cognitive domains: a feasibility and illustration study

Correia S, Faust D

This study undertook a broad feasibility test of a potential strategy for improving detection of cognitive decline over current IQ-based methods. The proposed strategy involves estimating prior functioning on the specific cognitive domain(s) (SCD) most likely to be affected by the disorder in question. Test score distributions were reconstructed based on clinical and control group means and standard deviations for IQ measures and specific cognitive domain tests (SCDT) reported in previously published studies of mild Alzheimer's disease (mild AD), chronic alcohol abuse (CAA), and mild traumatic brain injury (mTBI). Control groups were assumed to provide the best available representation of the clinical groups' prior standing on IQ and SCDTs. The percentage of overlap between the reconstructed clinical and control group distributions was calculated for each test. Across studies measuring the same disorder, differences in the average amount of overlap for the IQ measures versus measures of a SCD (e.g., all the memory tests) were calculated. These values provided a marker of the degree to which estimated prior scores minus obtained scores (*D*-scores) for SCD versus IQ measures might be best able to detect decline in the disorder under consideration. Results showed that diagnostic accuracy could be improved considerably for mild AD using memory SCD *D*-scores versus IQ *D*-scores. The strategy was supported to a lesser extent for CAA and mTBI. The development of methods for estimating prior standing on specific cognitive domains appears clinically worthwhile, especially for mild AD.

Neuropsychological effects of inherited metabolic disease

Daniel M, Clay J

Acute intermittent porphyria (AIP) is an inherited metabolic disorder that disrupts synthesis of heme, a component of red blood cell hemoglobin responsible for oxygen and carbon dioxide transport. AIP results in insufficient heme and accumulation of intermediary metabolites. AIP typically is cyclic, with acute symptom flare-up occurring intermittent with often prolonged asymptomatic periods. CT, MRI, EEG and autopsy studies of patients during and between AIP attacks report findings ranging from no to extensive brain abnormalities. Varying neuropsychiatric symptoms can occur during acute attacks; in many cases these symptoms resolve when the acute attack remits, but in some cases they persist even after the attack has ended. Although there are a few literature references to specific memory deficits in AIP patients, the cognitive effects of AIP are largely unknown because no studies have reported comprehensive neuropsychological and psychological test findings for AIP subjects. This case report of the test results for an asymptomatic 49-year-old woman with AIP shows variable working memory and a consistent pattern of specific memory deficits without impairment of other cognitive abilities. These findings suggest clinicians should be alert to possible neurocognitive deficits in AIP patients, especially memory impairment.

Neuropathologic model of pathological laughter and crying

Deluca JJ

The phenomenon of pathological laughter and crying is a well-known correlate of many neuropathologic syndromes. The variety of the pathologic states reported to exhibit pathological laughter and crying, the lack of a systematic and comprehensive series of investigations into this phenomenon, and the absence

of a common theoretical model to explain pathological laughter and crying has significantly hampered efforts to diagnose, explain, and manage this behavior. This work proposes a model that accounts for the manifestations of pathological laughter and crying and its neuroanatomic and neurophysiologic correlates. Initially we describe pathological laughter and crying and compare and contrast it to emotional lability and emotional incontinence. These three disorders show some similarities but some critical differences. Then we describe these behaviors as fixed action patterns that in the normal individual are well controlled, but become disinhibited in a variety of ways in various neurologic conditions. The model explains why these phenomena are observed intermittently in such a variety of conditions. The various neurologic conditions exhibiting pathological laughter and crying show that there are several possible neuroanatomic pathologies that can disinhibit these fixed actions patterns. It is pointed out that the patterns themselves are not pathological, just their internal and external context. The development of this theoretical model is necessary as a basis from which aspects can be supported, disproven, or modified as experimental data yield new findings. Most importantly, a hypothetical construct of the underlying mechanisms will positively influence patient care by providing a better understanding of this problem.

Long-term adverse neuropsychological consequences of exposure to 1,2-dichloroethane
Dilks LS, Matzenbacher DL, Davis CS, Christianson LM, Whiteman JL

1,2-Dichloroethane is an organic solvent utilized in the manufacture of plastics, fumigants, and pesticides, as well as by the petrochemical industry. Forty-five individuals who experienced prolonged, chronic exposure to 1,2-dichloroethane were compared to 45 nonexposed, matched controls approximately 6.5 years postexposure. Significant differences were found between the two groups in three realms: memory functioning, language processing, and executive functioning. Exposed individuals exhibited significant deficiencies on the Reitan Indiana Aphasia Screening Test. Deficiencies in judgment, insight, and reasoning were also demonstrated, as evidenced by scores on the Category Test (short form), Trails A and B, and the Shipley Institute of Living Scale. Finally, exposed individuals exhibited lower scores on the Wechsler Memory Scale (Third Edition) relative to the nonexposed group. In many cases, index scores on this test were significantly lower than would be expected of individuals with their work or educational histories. In addition to data regarding individuals' memory, language, and executive functions, patient reports indicate significant psychiatric symptoms relative to nonexposed controls. The data are supportive of a hypothesis that exposure to 1,2-dichloroethane results in detrimental neuropsychological consequences which, at more than 6 years postexposure, do not appear to be reversible.

Neuropsychological sequelae in a case of Addison's disease: effects of the disease, its treatment, or comorbid mood disorder
Duff K, Adams RL

Addison's disease is a rare and potentially life-threatening neuroendocrine disorder in which a damaged adrenal cortex produces insufficient levels of corticosteroids. Physiologically, corticosteroid deficiency can lead to low levels of sodium and blood sugar and high levels of potassium, which can result in severe dehydration, weakened muscles, and immune system compromise. Treatment involves the replacement of corticosteroids and sodium. We present the case of a 53-year-old, right-handed Caucasian female who was diagnosed with Addison's disease after acute adrenal failure two to one 2 years prior to the present evaluation. At that time, she was severely dehydrated and required hospitalization.

She has been maintained on corticosteroids since that time. Currently, she complained of poor short-term memory, which started several months before her diagnosis. Longstanding depression and current psychosocial stressors were also present. General intellectual functioning was in the very superior range (WAIS-R FSIQ = 136, 99th percentile). Simple and sustained attention fell at expected levels (61–99th percentiles), but complex attention and working memory were variable and fell below expectations (19–37th percentiles). Verbal memory was also variable (29–88th percentiles), whereas visual memory was more consistent (79–91st percentile). Motor functioning was low average to average. Language and visuospatial skills tended to fall at expected levels, as did most measures of executive functioning. Mild depression and significant levels of anxiety were reported. The potential impact of her medical condition, its treatment, and a comorbid mood disorder on her neuropsychological functioning is discussed.

Residual neuropsychological manifestations of Legionnaire's disease: a case study
Feldman E, Martinez M, Cross J

Legionnaire's disease is a severe and often fatal form of pneumonia that presents with fever, chills, and a cough. Other symptoms include abdominal pain, diarrhea, headaches, muscle aches, chest pain, and shortness of breath. In the acute phase, neuropsychiatric symptoms including abnormal mentation, confusion, memory deficits, agitation, affective changes and hallucinations have been described. However, residual neuropsychological sequelae after remission from the infection have not been reported. We present the neuropsychological profile of a 55-year-old, right-handed male with 14 years of education referred by his neurologist 6 months after a 3-week acute hospitalization for the treatment of Legionnaire's disease. The patient presented with complaints of impaired memory and concentration, reduced efficiency at work, and affective changes. His neurological examination was normal and neurodiagnostic tests including CT, MRI, EEG and lumbar puncture, were unremarkable. A comprehensive neuropsychological evaluation revealed average naming, word fluency, abstract reasoning, visuospatial and visuoconstructional abilities, and visual memory. In contrast, memory for logical discourse was low average, cognitive flexibility and problem solving were mildly impaired, and word-list learning and recall were moderately impaired. Psychological screening revealed moderate to severe depressive symptoms. Cognitive and emotional complaints continued to be present in his neurological examination 18 months postillness. These findings suggest that neuropsychological deficits previously described as symptoms of the acute phase of the illness may persist after the legionella infection subsides. Therefore, neuropsychological follow-up of individuals who recover from Legionnaire's disease seems indicated.

Differential impact of alternate etiologies of brain injury on personality change
Golden ZL, Selden J, Greene L, Marsh J, Golden CJ

The current study was an attempt to empirically measure and compare the personality effects of Alzheimer's dementia, stroke, and head injury. The study hypothesized that there would be differences in the MMPI-2 patterns generated by the three groups. The subjects included 124 stroke clients, 290 head injury clients, and 166 dementia clients. These individuals averaged 58.04 years old, while the mean education was 12.67 years with a minimum of 7 years. The individuals were mostly Caucasian, but included 80 African-Americans, Hispanics, or others. The average chronicity was 77.55 months. The dependent variables were the patient's personality characteristics as measured by 15 MMPI-2 scales. A MANCOVA indicated that there was a significant difference among the three groups after covarying for

age, education, and gender [$F(30, 1116) = 11.03$, $P < .001$]. There were overall differences among 10 of the 15 MMPI scales according to univariate follow-up tests. The major pattern was increased pathology for the head injury group. The stroke and dementia groups differed on 6 of the 15 scales but the overall level of severity was similar. High scores on D and Sc were seen in all groups. The data appeared to suggest that such factors as the speed of onset of the injury as well as organic factors both played a role in determining personality dysfunction. The elevation on Sc reflected both personality dysfunction as well as a general elevation related to brain injury.

Long-term neuropsychological status postirradiation and vascular changes in a plasmacytoma patient: a case report

Goldstein B, Obrzut JE, Armstrong CL

Plasmacytoma is a rare vascular neoplasm that arises from plasma cells. These tumors are primarily localized, occur intracranially, and rarely invade the brain parenchyma. Currently, few studies in the literature have reported on the long-term neuropsychological status of patients diagnosed with these rare tumors. We report the neuropsychological status of a 51-year-old man who developed delayed frontal lobe dysfunction and apparent dementia-related symptoms following diagnosis and treatment for a left frontal extramedullary plasmacytoma. The patient was subsequently treated with surgery and irradiation. His initial neuropsychological examination revealed processing speed, verbal memory, sustained attention, and verbal expression deficits. He was neuropsychologically stable for 5 years postdiagnosis, when he began to exhibit a significant cognitive decline in auditory and verbal processing speed, verbal memory, accessibility of language functions, and in problem solving. The patient was extremely slow in responding to stimuli, consistent with severe frontal lobe dysfunction. His MRI demonstrated extensive white matter changes, possibly attributed to irradiation. There was also no evidence of tumor recurrence. Subsequently, the patient retired from his occupation and was placed in a full time medical care facility.

Are family members capable of rating accurately the presence and severity of patient memory deficits?

Gontkovsky ST, Hantla MR, McDonald NB, Ruwe WD

This investigation examined the relationship between patients' performance on measures of objective memory functioning and the subjective, quantitative ratings of these patients' memory status by family members/caregivers. Participants were 23 patients with medically confirmed brain dysfunction (M age = 39.5 years, M education = 13.7 years) referred for comprehensive outpatient neuropsychological evaluation. Objective memory status was assessed utilizing the Wechsler Memory Scale-Revised (WMS-R); family members' ratings of patients' everyday manifestations of memory impairment were obtained using the Memory Disorder Scale (MD) of the Cognitive Behavior Rating Scales. Pearson correlation coefficients revealed a significant association between MD scores and the WMS-R General Memory (GMI), verbal memory, and delayed recall indices. Results of hierarchical regression analysis indicated that GMI alone explained the largest proportion of variance in MD, adjusted $R^2 = .27$. Further analysis to examine which aspects of neurocognitive functioning might account for the additional variance indicated, as predicted, no significant relationship between MD scores and patient performances on the Stroop Color and Word Test, Category Test, Boston Naming Test, or Controlled Oral Word Association Test. A significant correlation was found between MD scores and patient performances on Trail Making Test Part A, $r = .63$, but not Part B. Subsequent hierarchical regression analysis

indicated that together the GMI and Trail Making Test Part A explained 18% more variance in MD than did the GMI alone. Results support MD as a valid indicator of memory impairment and suggest family members/caregivers are capable of rating accurately the presence/severity of patients' memory deficits.

Lateralized visual hallucinations: analysis of affective valence
Harrison DW, Walters RP, Williamson JA, Foster P

Extensive research of functional cerebral systems on comprehension of visual emotional information yields little or no data on associated emotional response. Research on emotion and laterality of emotion extends to a clinical population experiencing visual hallucinations, or visual formaesthesia, as this may be common among some patients post a cerebral vascular accident or head injury. Often reporting affective responses to formaesthesias upon clinical interview, these emotional responses are important in constructing training and education for both the patient and family members. The purpose of this project was to evaluate the relationship for the presence of visual formaesthesia relative to the left or right hemispace and associated emotional response. Based on current literature exploring asymmetries in the processing of emotional valence, it was predicted that right visual formaesthesias would be predominantly associated with positive emotion and left visual formaesthesias would largely be associated with negative emotion (fear). Review of archival data indicated 200 of a >3,500 patient data set from a regional medical center yielded a rate of approximately one in five cases endorsing visual formaesthesia upon neuropsychological interview. A sample of $N = 30$ patients both men and women, ages 36–93, was pulled alphabetically to determine a relationship between affective valence and the location of visual formaesthesia relative to hemispace. The results indicated support for the predicted interaction. These findings are discussed in the context of functional cerebral systems theory.

Neuropsychological effects of acute high dose organophosphate exposure
Herkov M

Organophosphates, commonly used in pesticides, affect the brain through the inhibition of acetycholinesterase. Research examining the cognitive effects of chronic low-level organophosphate exposure in humans is equivocal. However, acute exposure to higher doses has been linked to a variety or emotional and cognitive sequela including attention, memory and executive function deficits. Malathion is an organophosphate compound commonly used in agricultural pesticides. To date, there has not been any research examining the neuropsychological consequences of human exposure to acute, high dose levels of malathion. The present study examined five patients accidentally exposed to toxic levels malathion (i.e., concentration levels 30 times higher than recommended). Patients reported physical (e.g., skin lesions, pulmonary, neurological symptoms) and psychological (e.g., depression, anxiety, somatization) symptoms including subjective complaints of attention difficulties, memory disturbance and decreased processing efficiency. Results indicated consistent deficits in verbal functioning relative to other neuropsychological measures across subjects. While mean FSIQ was in the average range, all patients demonstrated lower VIQ than PIQ (i.e., mean 12-point VIQ1 S.D. relative to baseline) or no change. We used Chi-square tests to compare outcomes in three patient groups: SjO2 >95% before DHCA ($n = 26$), SjO2 <95% before DHCA ($n = 17$), and no SjO2 data ($n = 18$). Results and Conclusions: There were no statistically significant differences in neuropsychological outcome between groups and no trends suggesting differences that our study was too small to detect, despite higher esophageal

temperatures in patients without SjO2 data. The cooler temperatures associated with SjO2 data suggest that these patients were cooled longer. Our institution's profound cooling techniques (esophageal temperature 12–15 °C) or a too strict SjO2 target (>95%) may partially explain why we did not observe outcome differences.

Differences in time estimation: hostile interference

Higgins D, Harrison D

One hundred twenty-six right-handed undergraduate men ($N = 63$) and women ($N = 63$) were classified, using the Cook–Medley Hostility Inventory, into six groups of 21 (high-, mid-, and low-hostile). and group (hostility) differences were predicted as these participants were asked to complete two time estimation tasks (when they perceived that 30, then 180, seconds had passed). In order to analyze the participant's ability to accurately judge the passing of time (the participant's perception of time), data were analyzed for overall and group effects/interactions. No main effects of or group were found for time estimation scores. A by group interaction effect was found across trials [$F(2, 120) = 3.76$, $P < .026$], and during refined analyses, for each trial: 30 s [$F(2, 120) = 3.52$, $P < .033$]; and 180 seconds [$F(2, 120) = 3.30$, $P < .04$]. In addition, a by group by trial interaction effect was found on the time estimation task [$F(2, 120) = 3.30$, $P < .04$]. In men, as self-reported levels of hostility increased, the perception of time passage changed: the more hostile groups judged time to pass more quickly, compared to the less hostile groups. In women, as self-reported levels of hostility increased, the perception of time passage also changed: the more hostile groups judged time to pass more slowly, compared to the less hostile groups. Hostility has been viewed as a deficit of self-awareness, which lends support to this finding. It may be perceived as a perceptual disorder as much as another concept, such as a personality flaw.

One year neuropsychological recovery of alexia without agraphia and material specific memory deficit after PCA infarction

Hoye W

Alexia without agraphia has long been recognized as associated with lesions in the dominant occipital cortex with extension into the splenium. The left occipital/temporal junction, particularly the inferior temporal gyrus has also been cited. Retrosplenial cortex has also been implicated in memory disorders. This case study presents data from brief and comprehensive neuropsychological assessment during the 1 year recovery from alexia without agraphia and a severe, persisting verbal memory deficit. The patient was a 51-year-old computer consultant, premorbidly of very superior intellect. He suffered an ischemic stroke in the posterior cerebral artery distribution involving the left posterior temporal/occipital lobe and thalamus, as documented on CT/MRI. Neurological examination revealed a right visual field defect, with cranial nerves III–XII intact. He presented alexia without agraphia, right homonymous hemianopsia, color anomia, anomia for proper names and initial difficulty retrieving autobiographical information. Early in recovery, severe verbal memory deficits were evident. With very minimal motor involvement, his rehabilitation focused on the resultant cognitive issues. The repeatable battery for assessment of neuropsychological status was useful for early assessment of recovery and initial rehabilitation planning. Data from comprehensive neuropsychological assessments undertaken at 1, 6, and 12 months to assist with rehabilitation and vocational planning are presented. Assessment and management of depression was an on-going issue during his recovery. Reading was characterized by a slow letter-by-letter approach and did not recover to the extent that his premorbid

occupation could be resumed. Persistent verbal memory and visual impairments also limited vocational potential.

The influence of chemotherapy and radiation on neuropsychological test performance and self- reported functioning in breast cancer survivors

Jacquin K, Morse L, Adams-Price C, Ceminksy J, Wells-Parker E, Williams M

Cancer patients receiving chemotherapy or radiation treatment frequently report cognitive impairments (President's Cancer Panel, 1999). Five studies have examined the influence of chemotherapy on neuropsychological test performance in breast cancer patients (Ahles et al., 2002; Brezden et al., 2000; Schagen et al., 1999; van Dam et al., 1998; Wieneke & Dienst, 1995). Although deficits were found, the effect sizes were fairly small (Jacquin et al., 2002). In addition, test deficits rarely matched self-report, suggesting that the tests do not tap everyday functioning or that some other factors account for the self-reported impairments. Our study examines this question by evaluating the performance of breast cancer survivors on ecologically valid neuropsychological tests. Participants ranged from 42 to 74 years of age ($M = 57.22$, S.D. $= 10.82$). The small sample size ($N = 18$) prohibited comparisons based on chemotherapy (83% had received it), but groups were compared on the basis of receipt of radiation (44%) and current hormonal therapy (44%). On the Rivermead Behavioural Memory Test, an ecologically valid measure of everyday memory problems (Wilson et al., 1989), 78% of our sample scored in the normal range, 11% showed mild impairment, and 11% scored in the moderately impaired range. However, there were not significant differences in test performance across treatment groups. Similarly, group differences were not found on the Everyday Cognition Battery (Allaire & Marsiske, 1999), Neuropsychological Symptom Inventory (Rattan et al., 1989; McCoy et al., 1998), or any other test. Complete results, implications, and suggestions for future research will be discussed.

Self-reported health symptoms of Gulf War-era veterans: how have they changed?

Krengel M, Sullivan K, White RF, Honn V, Proctor SP

In a sample of treatment seeking, GW-era veterans, our research has shown that the most common health symptoms 5 years after their return (Time I) included forgetfulness, headaches, fatigue, and joint pain. The aim of the current study was to determine if these same symptoms persist. Based on clinical observation of numerous GW veterans, it was hypothesized that veterans would continue to report the same symptoms and at a similar rate. Fifty treatment seeking Gulf War veterans were given a health symptom questionnaire 5 years after their return and again 4 years later as part of a larger longitudinal study of cognitive functioning in GW veterans. The health symptoms questionnaire included a checklist with 52 symptoms. Veterans were asked to rate on a scale from not at all (0) to very often, almost every day (4) as to how frequent each symptom was experienced. The 52 symptoms were grouped into major categories. The categories most frequently endorsed as being problematic at Time I were neuropsychological (cognitive memory and attention), psychological (depression, sleep disorder, anxiety), neurologic (headache, numbness, dizziness), musculoskeletal (joint pain, backache, neck ache), dermatologic (skin rash, eczema, skin allergies), and gastrointestinal (stomach cramps, nausea, diarrhea). Preliminary findings suggest that at Time II, veterans continued to report health concerns in the neurologic and neuropsychological categories at a rate consistent with Time I. Etiologic explanations for symptom complaints are discussed.

Adult cognitive functioning in the presence of a large congenital cyst of the left hemisphere: a case study

Lebowitz BK, Testa SM, Schefft BK

Spared verbal and impaired nonverbal abilities in the presence of large space occupying lesions of the left hemisphere have often been reported in the developmental literature. While cognitive performance by these children has been suggested to represent acrowding phenomenon by which language and other verbal abilities occupy neural substrates that typically subserve nonverbal abilities, direct evidence is limited. Alternatively, some have suggested the possibility of delayed acquisition of nonverbal abilities in these individuals. Because little research has explored cognitive abilities in individuals with congenital left hemisphere lesions as adults, these competing hypotheses remain unresolved. We present the case of KG, a 33-year-old, left-handed male with 13 years of formal education and a large space occupying cyst of the left hemisphere. The cyst is presumably of early developmental origin as suggested by the presence of ipsilateral skull malformation. Neuropsychological assessment revealed average intellectual capacity with largely normal exam. However, impairment on tasks of nonverbal memory and visuospatial abilities were revealed. Because this pattern of cognitive performance is similar to that of children with early lesions of the left hemisphere, this case appears to represent support for thecrowding hypothesis over delayed acquisition.

Methylmalonic acid elevation is related to cognitive functioning among older adults

Lewis MS, Johnson MA, Hawthorne NA, Edmonds J, Stabler SP, Miller LS

Vitamin B12 deficiency may be a substantial risk for older adults. We recently reported more than 20% of a sample of older adults in the US Administration on Aging's Elderly Nutrition Program as B12 deficient (Brackett et al., 1999). Research suggests low Vitamin B12 intake and blood concentrations are associated with cognitive disorder (Eastley et al., 2000); however, this relationship remains unclear. We report cognitive data from a large treatment study of Vitamin B12 and multiple health factors in an Elderly Nutrition Program. Cognition was measured using a well-validated, computer-prompted cognitive battery (Cognitive Stability Index, CSI, Headminder Inc., 2000) and factor indices (Memory (MEM); Information Processing Speed-Accuracy (IPSA); Attention (ATT); Reaction Time (RT)) as dependent measures. Additional tests of executive functioning including the Controlled Oral Word Association Test (COWAT) and Matrix Reasoning (MR) subtest of the WASI were also administered. B12 deficiency was based on serum methylmalonic acid (MMA) levels. In 114 older adults, 31 (27%) were B12 deficient. B12 levels were associated with cognitive functioning in this community-based sample (MEM, $r = -.246$, $P < .05$; IPSA, $r = -.220$, $P < .05$; COWAT, $r = -.238$; MR, $r = -.221$) and MMA elevations appeared to account for a significant portion of the variance on tasks of memory ($R^2 = .06$, $P = .01$), processing speed ($R^2 = .049$, $P = .021$), verbal fluency ($R^2 = .056$, $P = .011$) and matrix reasoning ($R^2 = .049$, $P = .018$). Findings give further evidence of the role of B12 deficiency, as measured by elevations in MMA, in cognitive functioning among older adults.

The Clock Drawing Test as a brief measure of cognitive functioning in a mixed group of adult caregivers

Mani T, Lewis M, Miller S

The Clock Drawing Test (CDT) is a well-recognized screening measure of cognitive decline and dementia. It has been found to provide some measure of higher-order cognitive functioning, and has been

correlated with several tests of cognitive functioning. In order to investigate the relationship between the CDT and measures of cognition and functional status, the following study was conducted, in which individuals were asked to complete a series of measures of cognitive status and emotional and physical functioning. The sample consisted of 256 healthy caregivers of older adult care recipients; 23% were male and 77% were female, and they ranged in age from 20 to 88 years old. Results revealed that the quantitative and qualitative total scores from the CDT were significantly correlated with the overall NCSE score (−0.278 and 0.306, respectively). The overall Neurobehavioral Cognitive Status Examination (NCSE) scores explained a meaningful proportion of variance in the quantitative and qualitative CDT scores (7.3 and 8.6%, respectively). A number of significant correlations between NCSE cognitive domains and CDT scores were found, although only calculation and constructional questions accounted for a meaningful proportion of variance. Several functional status and depression rating variables, as well as age, were significantly correlated with CDT scores, although these measures did not account for a significant proportion of variance in CDT scores. Overall, the CDT correlated reasonably well with the NCSE, which supports the use of the CDT as a very brief screen of cognitive functioning in lieu of lengthier cognitive tests.

Changing conceptualizations in the neurocognition of multiple sclerosis
Newman JP

The objective of this study was to describe recent evolutionary changes in the conceptualization of neurocognitive deficits in multiple sclerosis. Classically, MS patients are reported to suffer from impaired attention and concentration, bradyphrenia, reduced manual speed and dexterity, and memory retrieval defects, findings consistent with subcortical disease. However, this white matter disease was not thought to produce cortically-based cognitive deficits. Results show that recent research has demonstrated differential degrees of cortical language deficits in relapsing-remitting and chronic-progressive forms of MS. Additionally, cognitive and neurological deficits referable to cortical sites have been shown to result from grey/white matter junction lesions. Further, recent global and regional cortical cerebral metabolic rate of glucose (CMRglc) studies demonstrate significant reductions in MS patients compared with normal controls. Cognitive dysfunction in some MS patients progresses rapidly even without motor deficits or other evidence of clinical deterioration. On the other hand, the insufficiently-investigated role of fatigability in cognitive performance of MS patients has been researched, with surprising findings: when fatigue is properly controlled, MS patients show no significant impairment in some classically-attributed domains relative to normals. However, with sustained effort, MS patients experience decrements in functioning in domains in which normal controls experience actual improvement. These findings have important practical implications for rehabilitation strategies in MS. Conceptualizations of neurocognition in MS have recently evolved to include the possibility of cortically attributable deficits along with differential responsiveness to fatigability and sustained effort. Additionally, some classical findings in the cognition of MS may be wrong when proper controls are applied.

Differential unilateral dysgraphia in a bilingual patient with a rostral callosal lesion
Newman JP, Biran I

The purpose of this study was to describe differential language representation manifested as primary and secondary language differences in degree of unilateral dysgraphia in a bilingual patient with a rostral corpus callosal lesion. Prior research has demonstrated cortical representation differences between primary and secondary languages. Corresponding differences in corpus callosal representation have not

been definitively reported. We report a bilingual patient with a large rostral callosal lesion permitting examination of language differences in brain representation. A previously-healthy 31-year-old female fluent in Hebrew and English presented with severe headaches, vomiting and transient aphasia but with no other gross neurological impairment. However, she had increased intracranial pressure and lymphocytosis. MRI disclosed a large rostral callosal lesion of unknown etiology. The patient underwent repeated neuropsychological examination in both languages, with results compared with those of a gender, age, education and language-fluency matched healthy control. Language writing skills were measured by counting number of errors in parallel texts dictated in both languages and written with both hands. Initially, the patient had a disconnection syndrome composed of unilateral dysgraphia, constructional dyspraxia and somesthetic disconnection. Number of writing errors was greater in the left than right hand in both languages. However, there were many more errors with the left hand in her secondary language than in all other conditions. These hand-language differences were not found in the healthy control. Further, all aspects of the disconnection syndrome resolved upon subsequent MRI-proven resolution of the callosal lesion. This case suggests cortical language representation for primary and secondary languages may be reflected in the location or quantity of callosal fibers disrupted. Future research may elucidate the callosal topographic representation of primary and secondary languages.

Effects of olanzapine on cognition and personality in pyromania: a case study
Parks RW, Green R, Girgis S, Hunter MD, Woodruff PW, Spence SA

Pyromania is a complex disorder involving multiple domains of cognition, behavior, and personality. A 20-year-old homeless white male with a 9th grade education was psychiatrically hospitalized after reports of fire setting behavior (e.g., laughing while setting individuals on fire with lighter fluid). It was hypothesized that olanzapine, a potent atypical antipsychotic serotonergic 5-HT2a receptor antagonist, would increase cognitive test performance, decrease aggressive behavior, and ameliorate psychotic symptoms. Prior longitudinal research with olanzapine in chronic schizophrenia has shown improvements in attention, verbal memory, and executive functions when compared with conventional antipsychotics. Baseline neuropsychological assessment revealed impairments in attention, verbal–visual memory, and executive functions. Performance showed preservative errors and rule breaking behavior. Visuospatial skills were intact. Projective testing suggested psychosis, impulsivity, and aggressive behavior. Five-month follow-up neuropsychological assessment showed substantial improvement on cognitive tests, while visuospatial skills remained within the normal range. Follow-up projective testing evidenced diminished aggressive themes, although psychopathology was still evident. In summary, neuropsychological testing is consistent with prior research on executive deficits in pyromania. These findings suggest fronto-subcortical and fronto-temporal mechanisms for the effects of olanzapine, as well as, potential psychopharmacological treatment of pyromania.

The relationship between daytime sleepiness, apnea severity and cognitive performance in obstructive sleep apnea patients
Persad C, Langenecker S, Giordani B, Ruzicka D, Chervin R

An important consequence of obstructive sleep apnea (OSA) is impairment of cognition, particularly attention and executive functions. Recent work has suggested that different aspects of sleep disturbances in OSA are related to different patterns of cognitive impairments. Specifically it has been suggested that daytime sleepiness resulting from apneic episodes and associated sleep disruption is more closely

related to attentional difficulties whereas the level of hypoxemia may be more related to deficits in executive functioning. In order to explore this idea more fully, we studied OSA patients with varying levels of self-reported daytime sleepiness and a range of apnea severity along with a group of normal controls (NC). All subjects were administered the Go-No-Go task that produced measures of vigilance and response inhibition, a function that has been related to executive control and the prefrontal cortex. In the Go condition, participants were required to make a button response whenever certain target letters were presented. In the No-Go conditions, participants responded once again to target letters, unless one of the target letters repeated at which point the subject was required to inhibit responding to that target letter. Reaction time, errors of commission and omission were recorded. Results are discussed in terms of the relationship between different measures of sleep apnea severity, the amount of subjective daytime sleepiness and performance on the Go-No-Go task with specific emphasis on the performance difference between vigilance and response inhibition in the patient groups as compared to NC.

Neuropsychological performance in a patient with Von–Hippel–Lindau disease
Raymond MJ

Von–Hippel–Lindau (VHL) disease is a rare autosomal dominant genetic disorder involving chromosome 3. It is a multisystem disorder manifested by primarily benign tumors (angiomatosis) involving the kidneys, pancreas, and adrenal glands. Central nervous system (CNS) involvement often includes blood vessels (hemangioblastoma) and occurs in the brain, spinal chord, and retina. Symptoms vary and are dependent upon the size and location of the tumors. Typical symptoms include headache, gait disturbance, dizziness, extremity weakness, hypertension and visual alterations. Treatment usually involves surgical or irradiation intervention to resect or reduce the tumor. This case study describes the neuropsychological performance (HRNB) of a 33-year-old, Caucasian, right-handed male with a Doctor of Pharmacy degree (Pharm D). GR was initially diagnosed with VHL approximately 20 years ago via genetic testing; his father succumbed to VHL in 2001. In the past, GR required surgical intervention to remove tumors and cysts including a partial bilateral nephrectomy (1998), T11-12 laminectomy (1990) and left partial nephrectomy (1991). Fortunately he remained asymptomatic until June 2001 when he developed R facial paresis and reduced R audition. On October 31, 2001 he underwent a right craniotomy for tumor resection of the brain stem and mastoid. GR was referred for baseline neuropsychological consultation in March 2002. Results suggested subtly reduced adaptive abilities (Halstead Impairment Index 0.3, GNDS 33). Greatest deficits were on tasks involving attention/concentration, R auditory comprehension, executive functions and dominant RUE sensorimotor abilities. This case underscores the importance of obtaining baseline neuropsychological data to assist in developing on-going treatment strategies.

The 2002 update: two samples of railroad shop workers with remote, long-term exposure to mixed organic and inorganic solvents exhibit chronic toxic encephalopathy
RoBards MA, RoBards MJ

A nonlitigating former Louisville railroad shop worker with significant remote occupational exposure to mixed organic and inorganic solvents was examined with a comprehensive neuropsychological battery approximately 15 years after the shop had closed and exposure ceased. To examine the possibility that her deficits were toxic exposure-related, 125 letters including a symptom survey were mailed to her former coworkers (ACN 16(8) 857, 2001). The first 39 consecutively self-referred, nonlitigating respondents reporting similar exposure history and symptoms consistent with toxic encephalopathy

were examined, without regard for their ability to pay (ACN 16(8) 858, 2001). Subsequently, a multiday series of front-page newspaper articles on toxic exposure at the local company was published (www.courier-journal.com/cjextra/csx). The next 30 nonlitigating patients evaluated differed from the first group because: (1) they were aware of the articles and (2) they had paid a $350 co-payment, or an attorney had done so on their behalf. We wondered if performance of the two groups well matched for age, education and exposure, and passing all effort/validity measuresódiffered by virtue of selection/motivation characteristics. Three patients were excluded: two from the group of 39, one for age and another for failed validity/effort measures, and one from the second group, for the latter reason. We used Fisher's *F* to analyze variance between the two groups and found no significant difference on the 16 measures used for diagnostic screening. *T*-tests, assuming equal variance, could not reject the hypothesis that the samples are from the same population (Bonferroni applied).

The 2002 update: chronic toxic encephalopathy among railroad shop workers with remote, long-term exposure to mixed organic and inorganic solvents
RoBards MJ, Allen C, RoBards MA, Pierce S, Share DB

Forty-three self-referred (nonlitigating) present and former Louisville railroad shop workers were examined to determine the prevalence of chronic toxic encephalopathy approximately 15 years after the shop closed. All had received long-term occupational exposure to mixed organic and inorganic solvents. The average subject was a 47.3-year-old (S.D. = 4.3) employed male (two females) with 12.5 years of education (S.D. = 1.2) with a Full-Scale IQ of 101.2 (WAIS-R, S.D. = 10.9) or 100.6 (NART, S.D. = 6.62) who began work at the shop in 1975 (S.D. = 4.2) and received a total of 16.0 years of exposure (S.D. = 6.87) with 10.9 (S.D. = 5.10) defined as "high." The 18.2% reported a severe toxic exposure-related incident on the job, requiring medical attention or hospitalization. Regardless of confounding variables and typical middle-age comorbidities revealed by clinical interview and history taking (including the Linz Railroad Workers Toxic Exposure Questionnaire) these subjects exhibited remarkable consistency on a comprehensive battery of psychological and neuropsychological tests. The following measures showed a frequency of impairment greater than expected by chance at the .05 level ($T < 34$): Category, GPB (bilateral), Seashore Rhythm, SSPT, Tapping (bilateral) TPT (all measures but bimanual) Trail-Making A and B, Raven Matrices, Reitan Story Learning, Rey AVLT (II–V, VII and Recognition), ROCFT (all measures), Stroop Color-Word, Symbol Digit Modalities (written and oral) WAIS-R Arithmetic, and WCST (perseverative responses) Halstead Impairment Index, and MMPI-2 PS and PK (derived posttraumatic stress disorder measures). All passed validity/effort measures of the Category Test, Raven, RAVLT: Recognition, Victoria Symptom Validity Test and Rey 15-Item Memory Test.

The 2002 update: MMPI-2 results for 38 present and former railroad shop workers with chronic toxic encephalopathy due to remote history of mixed organic and inorganic solvent exposure
RoBards MJ, RoBards MA

An empirically-derived neuropsychological screening battery was administered to 69 self-referred (nonlitigating) present and former Louisville railroad shop workers approximately 15 years after the shop closed. All had experienced substantial occupational exposure to mixed organic and inorganic solvents. One was excluded for age and two for failure on validity/effort measures. Fifty-two were selected for further study, as they were most neuropsychologically impaired by stringent criteria. The group was closely matched for age and education. Each passed every validity/effort measure. In addition to the

patients' complaints of attention/cognitive/memory impairment, other prominent symptoms included anxiety (including panic attacks) depression, disinhibition of aggression, social isolation, loss of sexual function, decreased energy/activity, sleeplessness, preoccupation with somatic problems, loss of sexual function and other negative personality changes. A psychodiagnostic screening battery including the MMPI-2 was used to explore those symptoms in the first 38 patients. The composite MMPI-2 Welsh code was found to be 128370′-469/5 F-L/K, with average elevation of 65.95. The derived scales for posttraumatic stress disorder were elevated, with PS at 71.39 and PK at 67.03. The observation that 6 of the 10 diagnostic scales were at or above 70, three essentially tied, confirms our impression: that these people are highly symptomatic, and that their emotional problems are likely attributable to solvent exposure. Endorsement of Gass' 20 MMPI-2 items identified as correlates of other neurological injuries (31-53-101-106-147-149-152-164-165-170-172-175-177-179-180-182-247-249-295-325) contributed to elevations on multiple scales. Taken together, the results of this study confirm appropriate diagnosis of Type 2A/2B toxic encephalopathy for this patient population.

The 2002 update: neuropsychological screening battery results: 66 present and former railroad shop workers for chronic toxic encephalopathy from remote history of mixed organic and inorganic solvent exposure

RoBards MJ, RoBards MA, Pierce S, Share DB

An empirically-derived neuropsychological screening battery was administered to 69 self-referred (non-litigating) present and former Louisville railroad shop workers approximately 15 years after the shop closed. All had experienced substantial occupational exposure to mixed organic and inorganic solvents. They reported cognitive and/or emotional symptoms. One was excluded for age and two for failure on validity/effort measures. The remaining 66 high school educated (*M* 12.45 years, S.D. 1.1) 41–59-year-old (*M* 47.5, S.D. 4.0) males (three females) commenced work in 1974 (S.D. 4.1) and continued for 15.4 years (S.D. 6.7) with 10.7 years of high exposure (S.D. 5.2) and 12.1% experiencing exposure-related incidents requiring medical attention/hospitalization. Scores <5 percentile ($T < 34$) were identified as impaired, and a Binomial Test determined whether the frequency of impairment on a critical selection of 16 (of 20) significant measures was greater than expected by chance (i.e., less than 1%). Tests were: Category, Trails A and B, Symbol Digit Modalities (written/oral), Grooved Pegboard (dominant/nondominant), Stroop Color-Word, Reitan Story Learning, RAVLT (Trials III and/or IV, VII and Recognition), and ROCFT (all measures). All subjects passed validity and effort measures of the Category, RAVLT: Recognition, Victoria Symptom Validity Test and Rey 15-Item Memory Test. NART premorbid IQ estimates were FSIQ 100.91 (S.D. 6.71), PIQ 100.74 (S.D. 6.64), and VIQ 100.97 (S.D. 6.74). Fifty-two subjects were identified as most impaired by these stringent criteria, thus laying the foundation for further research into exposure characteristics/resilience. The Linz Railroad Workers Toxic Exposure Questionnaire was used to estimate solvent exposure magnitude and identify comorbidities and confounding variables.

The effects of decompression sickness on cognitive functioning in sports divers

Simpson RA, Burns WJ

Recreational scuba diving has become a popular sport. When severe diving injury occurs, the nervous system is frequently involved. Decompression sickness (DCS) is caused by the release of inert gas bubbles (usually nitrogen) into the bloodstream and tissues after ambient pressure is reduced. Type I DCS usually involves bubble formation restricted to muscles, joints, and skin. Type II DCS usually

involves bubble formation restricted to the lungs, vestibular apparatus, and the nervous system. Cerebral decompression sickness accounts for 30–40% of cases. Symptoms of cerebral DCS can include: confusion, focal weakness, fatigue, visual loss, diplopia, speech dysfunction, gait abnormality, and headache. Cerebral DCS usually occurs within 30–60 min of surfacing with 90% of cases developing within 6 h. Divers with DCS are given 100% oxygen and recompressed in a chamber using US Navy Table 6 algorithm recompression and supportive care. This study investigates the neuropsychological test data of three recreational scuba divers. Case 1 was a diver who received hyperbaric treatment for DCS and was evaluated with 24–72 h of treatment. Cases 2 and 3 were healthy controls with different levels of experience within scuba diving. The diver in case 1 was found to have deficits in the areas of nonverbal memory and retention for both verbal and nonverbal memory. When all three divers were compared the possibility of deficits in divers with long diving histories and no DCS is explored, given case 3's neuropsychological data. Contributing factors include: alcohol consumption, dehydration, and frequency of dives.

IgG deficiency: a neuropsychological case study

Simpson RA, Holme L, Dull-Baird A

Necrotizing fasciitis is an insidious infection that requires swift diagnosis, surgical debridement, and tissue coverage if the patient is to survive. Patients are susceptible to these necrotizing infections if serum levels in one or more subclasses of immunoglobulin G (IgG) are persistently low. The following is a case study of a 40-year-old male who was referred for a neuropsychological evaluation to assess his cognitive and emotional status 10 months after a prolonged hospitalization during which he developed pneumonia and required intubation. The patient was first admitted to the hospital with pneumonia and subsequently developed necrotizing fasciitis in his arm, thigh, and groin. He was diagnosed with genetically-based hypogammaglobulinemia (IgG deficiency) and had extensive debridement of the affected areas and wounds. Subsequently, he received monthly intravenous immunoglobulin injections to suppress recurrent infection. Since hospitalization and occurrence of the necrotizing fasciitis he reported experiencing anterograde memory loss, lightheadedness, nausea, and incoordination. To some degree, these symptoms fluctuated, but became more severe after monthly gamma globulin infusions. His performance on a comprehensive neuropsychological test battery revealed overall average to low average performance in domains that included word knowledge, verbal fluency, auditory digit span, structured verbal memory, motor skills and some aspects of executive function that measured set shifting. Deficits varying from borderline to mildly impaired were found in areas of unstructured list memory, nonverbal memory and accuracy on some timed tasks of sustained attention and fluency. Complications in interpretation include pain, pain medication, and depression.

Memory operations in reading disordered and attention disordered adults

Struck DM, Bremer BA, Bowers TG

The assessment and diagnosis of attention deficit hyperactivity disorder (ADHD) in childhood have been well documented in past and current literature. More recently, the research community has recognized and supported the diagnosis of an ADHD existing in the adult population. However, comorbidity and differential diagnoses, specifically reading disabilities, often make it difficult to determine whether an individual may be experiencing a pure attention disorder, or whether cognitive difficulties are attributed to an underlying and coexisting reading disorder (RD). This study tested the sensitivity of a profile analysis to accurately differentiate between attention deficit hyperactivity disorder (ADHD) and reading

disorder (RD) diagnostic groups. Results of the study indicated that profile analysis served to identify significant differences between ADHD and RD adult populations on Guilford's structure-of-intellect operation of memory, when applied to standardized assessment WAIS-R protocols. Conclusions support current research that adults diagnosed with reading disabilities will continue to experience academic difficulties on memory functions compared to ADHD individuals, particularly on symbolic memory measures, compromising their ability to effectively learn. The use of memory profile analysis may assist in identifying cognitive characteristics of RD and ADHD groups, and may also provide supportive information for more effective individualized academic planning and remediation in a college setting.

Neuropsychological test performance in Gulf War-era veterans: does referral source matter?
Sullivan K, Krengel M, Honn V, White RF

Gulf War (GW) veterans have reported a number of health symptoms since their return, including memory and concentration difficulties. These symptoms cause treatment providers to refer for objective neuropsychological testing. In this study we compared cognitive functioning in three groups of GW-era veterans to establish the appropriateness of clinical referrals and to establish whether subjective complaints were quantified using objective measures. One group of veterans was referred to our neuropsychology clinic specifically for cognitive concerns (CC) and one group was referred to other services besides neuropsychology (O). These two groups were compared with nondeployed veteran controls (ND). It was hypothesized that GW veterans who were specifically referred for neuropsychological complaints would show cognitive deficits consistent with those complaints, whereas, veterans referred to other services would show similar complaints but to a lesser degree. A one-way analysis of variance with three groups was conducted and results showed that the CC and O groups showed differences in the areas of complex tracking and set switching and spontaneous recall of verbal information. They also differed on the amount of vigor. They did not differ on a measure of response consistency. From these data, it appears that referrals for cognitive complaints were validated by objective measures in that individuals who reported cognitive concerns showed deficits on cognitive tests. However, it should also be noted, that GW veterans who do not necessarily complain of cognitive concerns, also exhibit deficits, albeit more mild, in these functional areas relative to nondeployed controls.

Neuroimaging correlates of Dementia Rating Scale performance at baseline and 12-month follow-up among patients with vascular dementia
Sweet LH, Paul RH, Browndyke JN, Cohen RA

We previously reported that subcortical hyperintensity (SH) and whole brain volume (WBV) each covary with different subscale scores of the Mattis Dementia Rating Scale (MDRS) among vascular dementia (VaD) patients. The present longitudinal analysis examined these relationships for change. We found that SH volume increased and WBV decreased significantly over 12 months. At baseline, SH volume accounted for the most variance in MDRS total score and attention, construction, and conceptualization subscale scores. WBV was unrelated to any MDRS measure. SH volume was unrelated to any MDRS score after 12 months, while WBV accounted for the majority of variance in attention and memory subscale performance, and a trend was evident for the MDRS total score. These findings indicate that while SH volume increases with disease progression, the relative impact of SH volume on cognitive status becomes less critical. Additionally, factors other than SH volume are important correlates of cognitive performance in patients with advanced VaD.

Alzheimer Type 2 gliosis and hepatic encephalopathy: neuropathologic findings in alcoholic liver disease and the Hepatitis C virus (HCV)

Talley M, Safavi-Abbasi S, Masliah E, Tapert S, Anjati D, Hassanein T, Perry W

Liver disease frequently gives rise to portal-systemic shunting of toxic/unmetabolized substances directly to the brain (Jones & Weissenborn, 1997). This gradual accumulation of neurotoxins eventually results in portal systemic encephalopathy (PSE), the most common cause of hepatic encephalopathy (HE). HE, a neuropsychiatric syndrome, is characterized by affective, cognitive and motor changes (Butterworth, 2000). Alcohol abuse presents a dual challenge with regard to comorbidity as it inhibits hepatofiltration, and promotes specific structural damage (e.g., mammillary body atrophy). The characteristic, microscopic neuropathologic finding in HE is the Alzheimer Type 2 (AT2) astrocyte. The basal ganglia (BG) comprise the most common neuroanatomic site of AT2 (O'Carroll et al., 1991). Macroscopic data include certain types of pathological markers. For instance, regional, cerebral hemisphere volume analyses have not found significant differences between nonalcoholic cirrhotics" and controls, but "alcoholic cirrhotics" show significantly more white matter shrinkage (Harper & Butterworth, 1997). We examined gross/microscopic neuropathology reports of 99 alcoholic and nonalcoholic HCV patients. Alcoholic liver disease (ALD) comprised 37%, HC = 15%, HCV + ALD = 25%, and non-HCV etiologies (e.g., idiopathic) = 23%. Males = 68%; females = 32%. Mean age = 51, S.D. = 4.08. Ethnic composition was Hispanic/Latino = 28%; White = 52%; Black = 12%; Other = 8%. Chi-square suggests that HCV + ETOH contributes to the highest AT2 BG counts [$\chi^2(8) = 68.98$, $P = .000$].

Executive attention deficits in sleep apnea patients? A neuropsychological analysis

Verstraeten E, Cluydts R, Pevernagie D, Hoffmann G

Sleep apnea is a sleep-related breathing disorder associated with brief arousals from sleep and intermittent hypoxemia, causing daytime sleepiness and attention dysfunction. In addition, some studies have suggested executive attentional deficits. However, as the effect of cognitive slowing (owing to daytime sleepiness) on higher cognitive function has not been fully taken into account, the reported executive deficits should be regarded as tentative. In the present study, basic attentional performance was statistically controlled for in evaluating possible executive attention dysfunction (i.e., disproportional performance decline in the executive subtask relative to controls). Thirty-six polysomnographically diagnosed patients (mean number of apneas and hypopneas per hour of sleep = 60.5 ± S.D. 31.6) participated, together with 32 age- and education-matched healthy controls. NP tests included Trail Making Part A and B, Symbol Digit Modalities (SDMT), digit span forward and backward, Stroop Color-Word, 5-point design fluency, and an attentional flexibility task. Sleep apnea patients' performance was significantly reduced on the SDMT ($P < .001$; effect size $d = 0.93$), the digit span forward task ($P < .05$; $d = 0.44$), the number of errors on the basic 2CRT subtest of the attentional flexibility task ($P < .05$; $d = 0.74$), and the mean RT on the actual attentional flexibility subtest ($P < .05$; $d = 0.54$). As the latter poor performance was probably due to the working memory storage component of the task, no specific indications for executive attentional deficits were found. In conclusion, neuropsychological performance in even severe sleep apnea seems to be characterized by merely attentional capacity deficits.

An analysis of tactile deficits: in patients reporting visual formaesthesias

Walters R, Beck A, Harrison D

Cerebral trauma, specifically metabolic infarcts, neoplasm, and stroke, may lead to altered sensory perceptions to include the presentation of a form, often with some associated meaning. Preliminary

research has indicated that patients endorsing visual formaesthesia upon clinical interview also have sensory deficits. These sensory deficits have been found to be primarily of a visual, tactile, and/or auditory nature. Review of archival data from 200 patients, from over 3,500 at a tertiary care medical center, revealed a 1 in 5 ratio of patients endorsing visual formaesthesia. From a total of 30 patients who endorsed visual formaesthesia, approximately 50% had a detected tactile deficit. Overwhelmingly, patients with tactile deficits had these deficits within the left hemispace (90%) upon presentation of dual concurrent sensory detection tasks. This finding was consistant regardless of reported visual formaesthesias in the left or right visual hemispace. The current research provides support for differences in tactile deficits in patients who also report visual formaesthesias. These findings are discussed using a functional cerebral systems approach.

Visual and auditory reaction times in adult ADHD

White JN, Snow MM

Measures of attention span and executive control have proven useful in the diagnosis of attention deficit hyperactivity disorder (Barkley, 1997). Such measures include Continuous Performance Tests (CPTs). These instruments involve the presentation of constantly changing stimuli with some clearly defined target stimulus or pattern that occurs at a low frequency relative to the number of stimuli presented over the duration of the task (Riccio & Reynolds, 2001). One CPT that is unique in its construction is the Integrated Visual and Auditory Continuous Performance Test (IVA). It combines both auditory and visual CPTs of impulsivity and inattention. The four parts of the test include (1) warm-up, (2) practice, (3) main CPT, and (4) cool-down (Sandford, 1995). Besides global composite quotient scores and other scales, the IVA also records trial reaction times, reported in milliseconds, for both modalities of stimulus presentation. Reaction times are recorded for the warm-up, CPT task, and cool-down portions, providing a method for investigating potential differences in visual versus auditory processing for these portions. In the present study, adults with ADHD ($n = 18$) were found to demonstrate significantly slower visual reaction times during both the warm-up ($P < .001$) and the cool-down ($P < .006$) portions of the IVA CPT as compared to nonclinical controls ($n = 31$). Significant differences were not found for the auditory modality (warm-up, $P < .06$; cool-down, $P < .07$) despite a general trend for slower reaction times for the ADHD group. Theoretical and potential implications will be explored.

Arousal: a neuropsychological review

Williamson JB, Harrison DW

Functional cerebral systems theory provides a dynamic framework with excellent explanatory value and testability. It promotes the systematic exploration of dynamic functional interactions within the nervous systems. To some extent, this approach has been carried out within the arousal literatures. However, the application of this theoretical approach is incomplete. How the brain processes arousal, and various other processes, is presently an active, cutting edge area of research. Current unresolved issues include the lateralization of autonomic nervous system control within the CNS, anterior–posterior inhibitory and excitatory relationships relative to sensorimotor functions within these constructs, relative activation states both inter- and intrahemispherically, and how cerebral systems interfere and prime other systems. We explored theories of arousal through the application of functional cerebral systems theory. Additionally, anterior–posterior inhibitory relationships are emphasized within the arousal literature. It is evident that this aspect of brain functioning has been somewhat neglected in favor of more holistic theories. These issues are addressed by discussing the arousal literatures including issues of contention, lateralization, and localization.

A neuropsychological comparison of frontal lobe versus right parietal tasks in adults
Wolfe M, Romine C, Lee D, Riccio C

Recent neurobiological and neuropsychological findings suggest involvement of the frontal and the right parietal lobes in symptomology of attention deficit hyperactivity disorder (ADHD). Frontal lobes are associated with planning, problem solving, controlling impulses, and set shifting and maintenance. The right parietal area is involved in guidance of visual–motor activities, spatial attention and perception. Research has primarily focused on ADHD in children while more research with adult samples with ADHD is needed. Many theories of ADHD etiology have been proposed and investigated, however, more literature has examined frontal lobe theories of ADHD while more recent theories of right parietal lobe involvement are less prominent. A neuropsychological approach was used to examine differences in performance of adults with ADHD, other psychopathology (non-ADHD), and controls on tasks purported to assess frontal lobe functioning (Tower of London, Conners' Continuous Performance Test, Wisconsin Card Sorting Test, Trails B, and Stroop Color-Word Test) and right parietal functioning (block design, Trails A, spatial span, and matrices). All participants (18–35 years of age) were consecutive referrals to a research study and participants were given a comprehensive neuropsychological battery. Results examine differences between groups on frontal lobe and right parietal tasks.

A new application for neuropsychologist's in chronic liver disease
Ziegler E, Hilsabeck R, Carlson M, Hassanein T, Perry W

End stage liver disease (ESLD) poses a serious health problem in the US; it is the 7th leading cause of death in persons aged 25–64 (CDC, 2000). A serious complication of ESLD is hepatic encephalopathy (HE). In its least severe form, patients may experience subtle cognitive deficits, mild mood impairment, and sleep disturbance. In its most severe form, patients have significant cognitive deficits, may lapse into coma and die. Currently the only method for evaluating HE is based upon subjective judgment of symptoms (Conn et al.) with a gross estimate of the patient's cognitive status. Recently, Hilsabeck and colleagues (2002) have reported that cognitive status in liver disease (Hepatitis C) is highly related to liver pathology. Therefore, the objective assessment of neuropsychological status may prove to be a necessary and important addition to the diagnosis and grading of HE. In this presentation we report on our efforts to validate a new method for grading using subjective assessment compared to objective neuropsychological measures. Traditional subjective assessment grading of HE was conducted by the attending hepatologist and compared to results of psychometric tests resulting in an objective grade. Preliminary data thus far is showing a positive correlation between the two grades, although refinement of psychometric tests may be evident. Issues related to the implementation of this method will be discussed. In summary, neuropsychology may prove to be crucial in the diagnosis and grading of HE.

MILD TRAUMATIC BRAIN INJURY

Career prevalence and neurocognitive correlates of concussion among high-risk university athletes
Alfano DP, Nicholls MU, Dorsch KU

Most research on the frequency of sport-related concussion has focused on annual incidence, with the likelihood of an athlete sustaining a concussion as high as 20% annually depending on the sport and level of play. In this study, career prevalence and neurocognitive correlates of concussion were

examined as part of an on-going prospective study of sport-related concussion. To date, preseason baseline assessments have been completed on 129 high-risk university athletes (66 male football, 31 male hockey, 32 female hockey) and 60 nonathlete controls. Preliminary findings revealed that the prevalence of at least one career concussion was 71, 90, 47, and 23% for male football, male hockey, female hockey, and the control group, respectively. Number of years of competitive playing and concussion history were not significantly correlated in the athlete groups. In male hockey, concussion history was significantly and negatively correlated with verbal learning and delayed verbal recall. In female hockey, concussion history was significantly and negatively correlated with verbal learning. No significant correlations were found between concussion history and neurocognitive functioning in the male football and control groups. These findings indicate substantial career prevalence rates of concussion in high-risk university athletes. The significant relationships between career history of concussion and measures of verbal learning in male and female hockey is an intriguing finding that clearly underscores the need for further study of the impact of sport-related concussion on neurocognitive functioning.

Likelihood of MRI use in children hospitalized for concussion
Arffa S

One hundred eight-five children admitted with concussion had a CT-scan and neuropsychological evaluation; only 10 received the costly MRI. Binary MRI with correlations suggested relationships with age, seizure, memory indices and mode. Since mode was nominal, it was considered uninterpretable, and discarded. Intercorrelations necessitated use of one memory measure, wide range assessment of memory and learning, verbal memory. Year was poorly correlated but more MRIs prior to 1995, and greater HMO infiltration after, made theoretical sense for inclusion, at least for interactions (dummy-coded 1993–1995; 1996–2000). Model was binary logistic regression: dependent variable MRI use; explanatory variables age, seizure, memory, year-admitted, year × seizure (1, 0, −1), memory × year. Results ($-2.9+0.58$ age $+0.39$ Sz $+0.005$ verblearn $+0.344$ year $+1.38$ Sz × year $+0.088$ Sz × verblearn) were poor in significance (.45, .53, .94, .56, .24, .78, respectively) with no classification utility. However, permutations were explored. The −2 log-likelihood, and R^2 statistics were reviewed. Classification tables were useless as no MRIs were ever predictedas it was a rare event. Both interactions alone (Sz × YRADM; MEM × YRADM) were significant (.04; .08). A seizure prior to 1995 equals 6.04 more likely MRI. A poor score on meory made you four times more likely to get an MRI. MRI use is a rare event, and a much larger sample would have been necessary for classification utility. Results suggest that sick children get less intensive services postmanaged care, and that injury severity (including neuropsychological assessment) becomes less influential in directing medical procedure after managed care becomes prominent in a city. Results such as these signal the need for benefit-cost research in neurospychology.

The number of errors per minute and its relation to mild traumatic brain injury in athletes
Bailey CM, Echemendia RJ

Performance errors on neuropsychological tests have been thought to be clinically relevant indicators for a wide range of injuries and pathologies. Though performance errors are often recorded while assessing the effects of mild traumatic brain injury (mTBI), such errors are rarely examined empirically. To circumvent what may be inherent limitations in performance errors as criteria, performance errors as a function of time was the subject of this study. During five assessments (baseline, 2-h postinjury, 48-h postinjury, 1-week postinjury, and 1-month postinjury), a sample of concussed athletes and yoked controls were administered several neuropsychological measures to assess the effects of mTBI (Trail

Making Test, Symbol Digit Modalities Test, PSU Cancellation Test, Stroop Color-Word Test, Controlled Oral Word Association Test, and Vigil/W Test). Using a Bonferroni correction, five *t*-tests were performed on the number of errors that the participants committed per minute across the battery of tests. No significant differences were found at baseline [$t(65) = .96$; $P > .05$], at 2-h postinjury [$t(99) = -.72$; $P > .05$], at 48-h postinjury [$t(156) = -1.71$; $P > .05$], nor at 1-month postinjury [$t(106) = -1.14$; $P > .05$]. However, concussed athletes made fewer errors per minute than controls at 1-week postinjury [$t(150) = -3.11$; $P < .01$]. Though this evidence does not support the clinical utility of errors per minute in the assessment of mTBI among college athletes, these results may be indicative of the criterion's sensitivity to the effects of motivation, as the athletes made fewer errors per minute than controls during a time when the athletes were being evaluated for return to play.

Factor structure of a brief battery for assessing MTBI in athletes

Echemendia RJ, Bruce J, Rosenbaum A

Brief neuropsychological batteries have become a standard means of assessing MTBI in athletes. Typical batteries include a compilation of measures including tests of verbal learning, sustained attention, working memory, mental flexibility, and speeded information processing. Although these batteries are frequently used, the underlying constructs measured by them have not been explored. Knowledge of the underlying factor structure will aid in evaluating whether the batteries adequately assess brain functions and simplify data analyses. This study examined the factor structure of the 13 core measures employed by the Penn State Concussion Program, a comprehensive multisport concussion program. Three hundred and thirty athletes were tested at baseline as part of the program. Principal components analysis with varimax rotation extracted five factors with eigenvalues greater than 1. The first rotated factor, complex information processing speed, accounted for 15% of the total variance. The second rotated factor, verbal fluency, accounted for 12% of the variance while the third factor, verbal memory and learning, accounted for 11% of the total variance. The fourth factor, automatic processing, accounted for 10% of the variance and the fifth factor, reaction time, accounted for 10% of the variance. The five factors accounted for 58% of the battery's total variance. These findings provide conceptual support for the Penn State battery. Future studies should employ confirmatory factor analysis to assess the stability of the factor structure. The advantages of using factor scores in data analyses are discussed.

The relationship between daily stress and persistent postconcussion symptoms following a mild traumatic brain injury

Ford SM, Swirsky-Sacchetti T, Chute D

The purpose of the present study was to determine the extent to which daily stress predisposes a clinical population of mild TBI patients diagnosed with postconcussion syndrome (PCS) to postconcussive symptoms. Eight individuals diagnosed with PCS and eight nonbrain-injured individuals were matched for age, education, IQ, and race. Daily stress levels and postconcussion symptoms were tracked over a 4-week period using the Postconcussion Symptom Checklist and the Daily Stress Inventory. Measuring symptoms and daily stress over time increased the likelihood of assessing symptoms during low- and high-stress days. Results from the ANOVAs indicated that the PCS group endorsed greater frequency [$F(1, 14) = 19.10$, $P = .001$]; intensity [$F(1, 14) = 28.90$, $P < .001$]; and duration [$F(1, 14) = 33.79$, $P < .001$] of symptoms compared to the nonbrain-injured group. Under high stress conditions, the PCS group reported a greater relative increase in the frequency [$F(1, 14) = 11.74$, $P = .004$] and the intensity [$F(1, 14) = 6.96$, $P = .02$] of symptoms compared to the nonbrain-injured group. When

perceived stress was the independent variable, a significant repeated measures effect was revealed for the frequency [$F(1, 14) = 21.23$, $P < .001$]; intensity [$F(1, 14) = 39.50$, $P < .001$]; and duration [$F(1, 14) = 26.49$, $P < .001$] of symptoms in the PCS group. These findings suggest that individuals with PCS are more susceptible to the effects of daily stress than nonbrain-injured individuals and that stress reduction interventions may be beneficial in managing postconcussive symptoms.

A comparison of GCS and GOAT as predictors of neuropsychological impairment in acute TBI patients

Han K, Burns WN

The Glasgow Coma Scale (GCS) is the most widely used index for categorizing brain injury (BI) severity. However, the GCS has been criticized for its lack of validity and sensitivity to predict outcome at certain ranges within the brain injury spectrum. The Galveston Orientation and Amnesia Test (GOAT) may provide a more accurate measure of BI severity. The purpose of this archival study was to investigate the ability of the GCS and GOAT to predict neuropsycholgical functioning in acute traumatic brain injury (TBI) patients. Data from 203 patients diagnosed with TBI were included in this study. All patients were administered the GCS, GOAT, and neuropsychological tests of global functioning, attention, memory, learning, constructional praxis, motor, and phonemic fluency. Patients ranged from 15 to 81 years of age, with a mean of 33.13. Mean education level was 11.32 years. Seventy-six percent of the patients were male and 24% were female. Two multiple regression analyses were performed using the GCS and GOAT as predictor variables and the results of the neuropsycholgical tests as outcome variables. Results indicate the GCS was not a good predictor of neuropsycholgical functioning ($F = 1.144$, $P < .126$) while the GOAT was a good predictor ($F = 1.278$, $P < .001$). Post hoc univariate analysis revealed the GOAT predicted performances on attention and constructional praxis measures (TMT-A, SDLT, and Rey-O). Findings suggest the GOAT may be a more accurate measure of BI severity, as measured by neuropsychological test functioning, than the GCS.

Increased risk for concussion in female athletes

Hillary FG, Mann, C, Schatz P

The incidence of sports-related concussion in high school and college athletes is high, with 34–97% of athletes reporting one or more previous concussion. Despite the growing sports-concussion literature, there has been greater emphasis on the incidence/prevalence of concussive injuries in male athletes. We analyzed 28 published studies on sports-related concussion/mild TBI over the last 8 years. The incidence of concussion in female athletes was evaluated in less than half of these studies (13) and only three examined females exclusively. For those investigations analyzing concussions in both genders, the incidence per 1,000 athletic exposures (AE) was greater in females (.348 per 1,000 AE) as compared to males (.289 per 1,000 AE). For those studies solely investigating concussions in soccer, the female-to-male concussion ratio was nearly identical (.382 and .364 per 1,000 AE, respectively). However, when considering other sports (baseball/softball, basketball, and field hockey), the incidence of concussive injury was nearly double in females as compared to males (.293 vs. .165 per 1,000 AE). Considering these data, future investigators should not only include female athletes in their research, but should also focus on the factors associated with sports-related concussion in female athletes. We offer two potential explanations for the increased incidence/risk of concussion in female athletes: the skeletomuscular and biomechanical differences between men and women result in greater risk for women to sustain brain injury, and a socio-psychological explanation describing the differences in how males and females approach athletics, and in particular contact athletics.

Cumulative effects of concussion in amateur athletes
Iverson G, Gaetz M, Lovell M, Collins M, Maroon J

The purpose of this study was to examine the possibility that athletes with multiple concussions might show cumulative effects. Amateur athletes with a history of three or more concussions ($n = 19$) were carefully matched (gender, age, education, and sport) with athletes with no prior concussions ($n = 19$). All completed a computerized neuropsychological test battery at preseason (ImPACT), and then within 5 days of sustaining a concussion (mean = 1.7 days). A mixed-model 2 × 2 ANOVA was used to determine if there were between and within group effects on the dependent variables. For total self-reported symptoms, there was a significant main effect for time ($P < .00001$, $\eta^2 = .45$). Independent group *t*-tests revealed a significant difference between groups at preseason, with the athletes who had multiple concussions reporting more symptoms ($P < .05$, $d = 0.71$, large effect). For the memory composite score, there was a significant main effect for time ($P = .001$, $\eta^2 = .27$), and a group effect, with the multiply concussed athletes showing greater decrements in memory functioning than the mildly concussed subjects ($P = .012$, $\eta^2 = .16$). Athletes with multiple concussions obtained significantly lower memory scores during the postinjury assessment ($P = .015$, $d = 0.83$, large effect). Athletes with multiple concussions were 7.7 times more likely to demonstrate a major drop in memory performance than the athletes with no previous concussions. This study provides preliminary, provocative evidence to suggest that athletes with multiple concussions might have cumulative effects.

Validity of ImPACT for measuring the effects of sports-related concussion
Iverson G, Lovell M, Collins M

We examined the validity of ImPACT, a computerized test battery, for measuring the effects of sports-related concussion. The 120 high school and college athletes completed preseason testing and were evaluated within 3 days of sustaining a concussion. Concurrent criterion validity was examined by determining whether the composite scores were sensitive to the acute effects of concussion. After their concussions, athletes reported significantly more symptoms ($P < .000001$, $d = 1.0$), and they performed worse on memory ($P < .000001$, $d = 0.66$), reaction time ($P < .014$, $d = 0.27$), and processing speed ($P < .011$, $d = 0.28$). Divergent validity was examined through an intercorrelation matrix of the composite scores at preseason and at postinjury. The resulting small correlations indicate that the composite scores do not have much shared variance, and thus appear to be measuring different things. Convergent validity was examined by correlating the composite scores with specific items from the postconcussion scale, for the postinjury assessment. There were medium to high correlations (*r*'s from .53 to .83) between total symptoms and selected individual items (i.e., vomiting, balance problems, poor concentration, poor memory, light sensitivity, noise sensitivity, and feeling more emotional). The memory composite score was significantly correlated with the poor memory ($r = -.40$) and poor concentration ($r = -.40$) items, less correlated with the balance problems ($r = -.27$) and light sensitivity ($r = -.32$) items, and uncorrelated with the remaining physical and emotional items.

Relation between fogginess and outcome following concussion
Iverson GL, Gaetz M, Lovell MR, Collins MW

The purpose of this study was to examine the relation between feeling foggy at 1-week postconcussion and neuropsychological outcome. The outcome variables were derived from a computerized neuropsychological screening battery (ImPACT). Participants were 110 high school students who sustained a

sports-related concussion and were evaluated 5–10 days postinjury (mean = 6.8 days). The average age of the sample was 15.9 years (S.D. = 1.2), and 84.5% were male. The breakdown of athletes by sport was as follows: football (63.6%), basketball (12.7%), soccer (11.8%), hockey (3.6%), and other (8.3%). Athletes were divided into two groups on the basis of self-reported fogginess. The first group reported no fogginess ($n = 91$), whereas the second group reported experiencing some degree of fogginess ($n = 9$) on a 6-point scale. The athletes with persistent fogginess experienced a large number of other postconcussion symptoms, compared to the athletes with no fogginess ($P < .0001$; $d = 3.44$, very large effect size). In addition, the athletes with persistent fogginess had significantly slower reaction times ($P < .0002$; $d = 1.0$, large effect), reduced memory performance ($P < .01$; $d = 0.97$, large effect), and slower processing speed ($P < .004$; $d = 0.79$, large effect). Thus, athletes with any degree of self-reported fogginess at 1-week postinjury are likely to have persistent adverse effects from their concussions in multiple domains. Therefore, high school athletes with postinjury fogginess, regardless of severity, will likely benefit from an extended break from participation.

Tracking recovery from concussion using ImPACT: applying reliable change methodology
Iverson GL, Lovell MR, Collins MW, Norwig J

Return to play following concussion is one of the most challenging decisions facing coaches, athletic trainers, and sports medicine physicians. The purpose of this study was to examine the psychometric characteristics of Immediate Postconcussion Assessment and Cognitive Testing (ImPACT), a computerized neuropsychological test battery designed to assess recovery from sports-related concussion. The focus was on the stability of the test scores and the calculation of reliable change confidence intervals for the test–retest difference scores. Participants were 49 amateur athletes who completed the computerized test battery at least twice, with an average retest interval of 14 days (range = 7–21). Their average age was 17.8 years (S.D. = 2.6, range = 14–23). The male–female gender ratio was 78:22. Fifty-four percent were high school athletes and 46% played college-level sport. There were no statistically significant practice effects for the three ImPACT composite scores. Standard error of measurements for Times 1 and 2 were calculated, and from these the standard error of difference was computed for the three composite scores. The 0.80 confidence interval for reliable change was 10 points for the memory composite, 0.10 s for the reaction time composite, and 8 points for the processing speed composite. Applying these confidence intervals allows more precise determinations of deterioration, improvement, and recovery in the initial days following concussion. Three case examples of concussed high school athletes are presented to illustrate the clinical application of this methodology.

Absence of common sense: case studies examining ecological validity of neuropsychological assessment in TBI
Lawrence JA

Ecological validity of neuropsychological assessment remains controversial. In practice, judgments with far reaching psychological, emotional, social, vocational, and legal ramifications are made regarding patients' functioning based on their performance on standardized neuropsychological evaluation instruments. In most cases, scores predict practical functioning reasonably well. Although many situations exist in which there is incongruity between test-based predictions and actual functioning, most can be explained by psychological factors such as secondary gain with pending litigation. There remain, however, isolated cases where neuropsychological evaluation of a TBI patient seems to have little or no predictive validity for "real world" functioning, even when psychological factors are considered.

This presentation describes case studies of patients seen in a hospital-based neuropsychology practice. Each of the patients had recovered from traumatic brain injury to the point that neuropsychological test scores placed well within normal limits, but displayed remarkable deficits in "common sense" judgment, practical reasoning, and organization at home and on the job. The "absence of common sense" despite adequate neuropsychological test scores is discussed within the context of these case studies.

Psychological distress in persistent postconcussion symptom complex—with and without mild head injury

Letsch EJ, Brown LJ, Vanderploeg RJ

The well documented role of psychological distress in the duration of postconcussion syndrome (PCS) and the prevalence of PCS in nonhead injured persons with psychiatric diagnoses warrants this investigation to elucidate the psychological functioning of persons with persistent postconcussion symptom complex (PPCSC; i.e., persons meeting subjective symptom criteria for persisting PCS without necessarily having a history of mild head injury, MHI). Valid MMPIs were examined for clinical scale elevations in two samples of nonreferred, community-dwelling male veterans with PPCSC (MHI with loss of consciousness ($n = 79$) and no-MHI ($n = 585$)) and compared with a demographically similar control group without PPCSC ($n = 561$). MANOVA followed by univariate ANOVAs and Tukey's HSD tests revealed that both samples of persons with PPCSC had higher elevations on all clinical scales (mean *T*-scores ranging from 62 to 72) than the matched control group (mean *T*-scores ranging from 52 to 58). Using group means, the PPCSC MMPI codetype was 2, 8, 7. Standard deviations tended to be larger on those three scales (ranging from 15 to 18 points compared to other scales' S.D. of 10–15). No statistically significant differences in scale elevations were found between the MHI and no-MHI PPCSC groups although the MHI *T*-scores were consistently modestly more elevated than the non-MHI *T*-scores. These findings indicate that PPCSC is associated with psychiatric distress regardless of concussive history and that concussive history does not significantly independently influence psychiatric distress. Considerable variability in the MMPI scale scores of persons with PPCSC suggests a need for additional study of psychological functioning in this population.

Examining the impact of intoxication upon GCS score, posttraumatic amnesia and neuropsychological functioning in an acutely hospitalized mild head injured population

Lovejoy D, Palmer A, Folk-Baron L, Kehoe F, Bullard S, Oakes H

Ambiguity exists as to whether ETOH intoxication at the time of injury significantly impacts the accuracy of acute head injury severity ratings and neurocognitive functioning. The present study examined reports of posttraumatic amnesia, GCS scores and the results of a neuropsychological screening battery in an acutely hospitalized neurotrauma population, with known or suspected mild traumatic brain injury ($n = 166$). Patients were assigned to either an intoxicated group ($n = 64$) or a nonintoxicated group ($n = 102$) based upon blood alcohol level at the time of inpatient admission. The groups were matched on variables such as age, education, gender and presence of positive cranial CT findings. Results indicated no significant differences between GCS scores at the scene or in the ED and self-report of duration of either anterograde or retrograde posttraumatic amnesia. Additionally, no significant differences were observed between groups on a neuropsychological screening evaluation (COGNISTAT, digit span, mental control, COWA, and Trail Making A and B) administered on the Acute Trauma Unit. The results of this study are discussed in relation to current research associated with ETOH intoxication in the neurotrauma population.

Determining a schedule for serial postconcussion assessments: the Philadelphia Sports Concussion Program

McKeever C, Covassin T, Schatz P, Zillmer E, Sachs M

Baseline neuropsychological testing has been universally recommended for comparison with postconcussion data, in order to track recovery and determine fitness to return to play for athletes and recreational sport participants. The hallmark Virginia football studies incorporated serial neuropsychological assessments at 2, 48 h, 1-week and 1-month postinjury, which allowed for the determination of the time when an athlete's concussion symptoms were resolved. Since that time, numerous postconcussion serial assessment schedules and measures have been employed. We reviewed the literature and compared select studies demonstrating various schedules of serial postconcussion assessment and test batteries: 43% of these studies assessed athletes within 1–2 h, 57% within 24–48 h, 29% at 3 days, 71% at 5 days, 57% at 7 days and 29% at 30 days postconcussion. The Symbol Digit Modalities Test, Trail-Making tests, COWAT, and HVLT were the most frequently employed measures, being used in 100, 71, 57 and 57% of the studies reviewed, respectively. While this diversity of test measures and assessment schedules has lent to increased understanding of postconcussion recovery patterns, these between-study differences obviate collaborative data sharing or cross-comparisons at specific time intervals. In developing the Philadelphia Sports Concussion Project, a multicenter study of high school and college athletes, we chose to schedule serial postconcussion assessments at: 12–24 h, 3, 5, and 7 days postinjury, with continued assessments at 10, 14, 21, and 28 days postinjury for those athletes continuing to experience postconcussion symptoms.

Analysis of errors committed by patients with traumatic brain injuries

Perri G, Goldberg K, Prout M, Lambert J, Libon D

We analyzed errors committed during neuropsychological assessment by patients who had sustained a traumatic brain injury, making the assumption that these errors could inform clinicians about the nature of the patient's deficits. Errors committed on the WAIS-III Similarities and COWAT were categorized as either inset or out-of-set errors. Using a series of backward stepwise multiple regression analyses, we sought to explain the variance attributable to each of these computed error scores. Three of these analyses yielded significant models. A one-factor model emerged for inset errors committed during the Similarities Test, consisting of a lexical Retrieval-Word Knowledge Index ($F = 13.6$, adjusted $R^2 = .354$). A two-factor model comprised of the Trails B standard score as well as a computed mental control index was significant for describing the variance attributable to out-of-set errors committed during the Similarities Test ($F = 4.6$, adjusted $R^2 = .239$). For the COWAT, a two-factor model emerged as significant for explaining the variance behind out-of-set errors ($F = 15.835$, adjusted $R^2 = .569$). The identified predictors were the false positive *z*-score from the CVLT and the total number of words recalled (Trials 1–5) on this same measure. Lastly, a set of ANOVAs was conducted to equate severity of injury with inset and out-of-set errors. After excluding patients with a prior history of brain injury, one significant finding occurred during this analysis: out-of-set errors during Similarities were related to the interaction between severity and type of injury ($F = 5.828$, $P = .024$).

Impact of pain on postconcussive symptoms

Smith-Seemiller LH, Fow NR, Kant R, Franzen MD

The etiology of postconcussive syndrome (PCS) has been debated, with research suggesting that PCS symptoms are not unique to people with closed head injury (CHI). In previous research we

compared people with chronic pain (CP) to people with CHI on a measure of PCS and found similarities between these groups. In this study, we sought to further explore the relationship between pain and PCS symptom ratings by (1) comparing people with both CP and CHI to patients with only one diagnosis and (2) studying the relationship between pain ratings, depression, and PCS ratings. Subjects included 67 CP patients with no history of neurological problems, 55 CHI patients, and 38 patients with CHI and a separate CP problem. Patients completed the Rivermeade Postconcussion Questionnaire (RPCQ). Differences in summary scores between the three groups were analyzed using Kruskal–Wallis ANOVA by ranks, correlations between RPCQ scores and pain ratings were computed, and regression equations were used to study the relationship between pain ratings and PCS symptoms after controlling for litigation status and BDI scores. People with both CP and CHI had higher total scores on the RPCQ than either of the other groups. Pain ratings were significantly correlated with total RPCQ scores, even with the effects of litigation and depression controlled. However, pain ratings were correlated only with somatic and emotional symptoms of PCS, and not with cognitive complaints. It is concluded that CP is a significant but often over-looked factor in the maintenance of PCS symptoms.

The effects of reported feelings of depression at inpatient trauma admission on postconcussive symptom report and stability over time

Waxman A, Lovejoy D, Palmer A, Oakes H

1 Previous research (Santa Maria et al., 2001) has found that particular groups are more vulnerable to variability in postconcussion symptomatology over time (e.g., "high responders" and females). The present study was conducted with an acutely hospitalized trauma population ($n = 90$). Patients were assigned to a depressed ($n = 20$) or a nondepressed ($n = 70$) group based upon their answer to a simple question (Do you feel depressed?) during a standardized acute inpatient neuropsychological screening evaluation. Student *T*-tests and Chi-square analyses revealed no significant differences between groups for variables such as prior psychiatric history, substance abuse history, blood alcohol level, cranial CT studies, age and education. Significant differences were observed between groups for gender ($P < .01$), with females representing a large proportion of the depressed group. In addition, total number of postconcussive complaints was significantly greater for the depressed group both at inpatient ($P < .05$) and 1-month follow-up ($P < .01$). However, analysis of group means revealed no significant differences between groups for measures of postconcussive symptom stability over a 1-month period of time. Thus, although the depressed group reported significantly greater postconcussive symptomatology, there were no significant differences between the groups for stability of symptoms over time. This finding suggests that the recovery curve of postconcussive symptoms is not significantly different for depressed and nondepressed groups.

The symptom checklist 90 revised and mild traumatic brain injury

Westcott M, Alfano DP

Traumatic injury involving the head or neck can produce a range of cognitive, somatic, affective, and behavioural symptoms that may include dizziness, headache, reduced concentration and memory, fatigue, mood changes, sleeping problems, and chronic pain. An important clinical diagnostic issue in the assessment of symptoms arising from traumatic injury to the head or neck is the possibility that mild traumatic brain injury (MTBI) might account, in part, for the symptom picture. The symptom checklist 90 revised (SCL90R) is a self-report measure of symptomatic distress that is commonly used

in both clinical assessment and research. The goal of this study was to delineate a unique pattern of symptomatic distress for MTBI using the SCL90R. A combined sample of 93 individuals comprised of 22 with medically diagnosed MTBI, 28 with medically diagnosed whiplash associated disorder (WAD), 27 general medical controls, and 16 nonclinical controls completed the SCL90R. Both the MTBI and WAD groups produced overall significantly elevated mean group profiles that were indistinguishable. Both control groups produced normal-range mean group profiles that were indistinguishable. A pattern of symptomatic distress unique to MTBI was therefore not found in this study, suggesting that the SCL90R had little diagnostic utility in terms of distinguishing MTBI from traumatic injury involving the neck. In contrast, the SCL90R seemed to possess excellent clinical utility as a general indicator of psychological distress following both MTBI and WAD.

Use of the TOVA in assessing the efficacy of psychostimulants in the treatment of mild traumatic brain injury: multiple case studies

Zacharewicz M, Schmitz S

Psychostimulants (e.g., Ritalin, Adderall, Dexedrine, etc.) are frequently used for the treatment of attention difficulties and various neurological illnesses. Psychostimulants have specifically been found to be beneficial in the treatment of ADHD, stroke, coma, the cognitive sequelae of HIV, and the sequelae associated with traumatic brain injury including memory difficulties, attention/concentration abilities, processing speed difficulties, and anger. The use of Continuous Performance Tests (CPTs) have long been shown to be sensitive to brain damage and dysfunction. CPTs have also been shown to be valuable means of assessing the therapeutic response of psychostimulants. This presentation will discuss the efficacy of psychostimulants with patients diagnosed with mild traumatic brain injury (MTBI). A model for assessing medication titration trials will be discussed utilizing the test of variables of attention (TOVA). Specific case studies will be presented. The implications of evaluating and treating patients in this manner will be discussed, including how it may impact the patient's treatment and recovery. These case studies will be presented as part of an on-going study assessing the utility of psychostimulant titration trials on patient treatment.

MODERATE AND SEVERE TRAUMATIC BRAIN INJURY

Regression-based interpretation of delayed verbal recall in TBI patients

Banos J, Sawrie S, Novack T

Delayed memory measures are often criticized for failing to account for initial level of acquisition. One corrective approach is to compute percent savings scores, but this yields an index that is not interval level data (i.e., loss of the same amount of information is more punishing for individuals who perform poorly overall). Initial acquisition has also been controlled by learning to a specified criterion (DeLuca et al., 2000), although this is not feasible for most standardized memory tests. The present study examines a standardized regression-based (SRB) approach using the CVLT, whereby delayed recall is predicted based on acquisition. CVLT scores from 42 nonneurological community volunteers (ages 18–62) were used to develop a simple regression equation in which Trial 5 free recall was used to predict long delay free recall ($R^2 = .71$). An SRB *z*-score can then be obtained (i.e., difference between predicted and observed scores divided by standard error of prediction). Using the control participants as a normative group, standardized scores for CVLT long delay free recall, percent retention, and SRB delayed recall were compared in 47 TBI patients (ages 18–49). Consistent with findings by DeLuca et al., fewer patients (30%) demonstrated impaired delayed recall when correcting for initial recall than when using

traditional standardized recall or savings scores (53 and 49% impaired, respectively). In TBI patients, SRB scores may be useful in differentiating poor acquisition (possibly related to other factors such as attention and processing speed) from impaired delayed recall, providing for more focused rehabilitation interventions and recommendations.

Behavioral interventions to facilitate memory journal use

Boyer CL, Lindgren KN

Memory impairments are among the most common and debilitating problems for individuals with acquired brain injuries. Memory journals/organizers can be used to effectively compensate for these impairments resulting in increased independence. However, due to poor motivation, lack of insight, and other factors, individuals with acquired brain injuries use them inconsistently. The current study utilized behavioral interventions to teach and increase organizer use among twenty clients with moderate to severe acquired brain injuries in a postacute rehabilitation program. The intervention was composed of three phases with increasing complexity. They included carrying the organizer, consulting the organizer for information, and using the organizer to track treatment progress. During Phase 1, individuals were educated about organizer benefits. A weekly random reinforcement procedure resulted in a significant increase in number of individuals carrying the organizer. Phase 2 targeted utilizing organizers to improve independent attendance for therapy appointments. Individuals were educated about procedures for entering the information, structured prompts were utilized, and independent appointment attendance was randomly reinforced. This intervention resulted in a significant increase in utilization of the organizers for a specific functional purpose. The third phase of the study involved utilizing the organizer to facilitate treatment progress. Rehabilitation goals for each individual were entered into their organizers. The participants utilized the organizers to record progress toward goal achievement. Results highlighted the importance of gradually and systematically introducing this compensatory strategy and the utility of behavioral techniques in skill acquisition.

Preliminary evidence supporting the usefulness of the Category Test subtests as sensitive measures of perseveration and memory deficit

Caron J, Allen D, Goldstein G

The Halstead Category Test is a widely used instrument for testing abstraction ability. The instrument is composed of seven subtests requiring abilities such as perceptual organization, set maintenance, and memory. The total number of errors for all seven subtests is typically used as the indicator of performance. However, recent work suggests that some of the individual subtests may reflect the cognitive component processes that contribute to abstraction ability. This study further examines the properties of two subtests. It was hypothesized that subtest 5 would be sensitive to perseverative errors while subtest 7 would be sensitive to memory deficit. Thus, persons with localized frontal lobe damage (FLD) would exhibit increased errors on subtest 5 and patients with temporal lobe damage (TLD) would exhibit increased errors on subtest 7. To test this hypothesis, the Category Test was administered to patients with schizophrenia ($N = 195$), FLD ($N = 7$), TLD ($N = 10$), and a nonbrain damaged patient comparison group ($N = 229$). ANOVA indicated a significant group by subtest interaction [$F(3) = 6.424$; $P < .01$], with the FLD group making more errors on subtest 5 and the TLD group making more errors on subtest 7. The results provide preliminary evidence supporting the usefulness of the Category Test subtests as sensitive measures of perseveration and memory deficit. Further research with larger samples

and quantification of specific types of errors will be required to provide definitive evidence supporting these preliminary results.

Self-awareness of behavioral difficulties following traumatic brain injury

Duchnick JJ, Vanderploeg RD, Curtiss G, Alfano K

Individuals with cognitive impairment may not accurately perceive their areas of deficit; however, research in this area with traumatic brain injury (TBI) patients is limited. To address this question, TBI patients' ($N = 24$) and family members' ratings of pre- and postinjury functioning were compared. The Key Behaviors Change Inventory (KBCI) was used to assess behavioral difficulties typically found with TBI, that is, inattention, impulsivity, unawareness of problems, apathy, interpersonal difficulties, communication problems, somatic difficulties, and emotional adjustment. Patients and families were contacted postdischarge (mean = 28 months postinjury) and completed KBCI ratings of functioning for (1) the time period just prior to injury and (2) the current level of functioning postinjury. A MANOVA examined differences in the level of functioning reported by the patient and the family member, both pre- and postinjury. Ratings showed a significant decline in functioning postinjury in all areas, consistent with expectations. Neither the effect for rater (self/other) nor the interaction between rater and time (pre-/postinjury) was statistically significant ($P = .33$ and .11, respectively), suggesting that patients were aware of and able to identify poorer functioning with the same level of accuracy as family members. However, exploratory examination of the interaction for individual KBCI scales showed a significant interaction ($P < .01$) between rater and time for the communication scale. Although not significant, the pattern of means was similar for four other scales ($P < .10$). This pattern suggests that, with a larger sample size and greater power, conditional relationships between rater and awareness of change postinjury may emerge.

The relationship between verbal learning patterns, injury severity, and employability following traumatic brain injury

Lowry J, Giovennetti T, Schatz P, Nagele D, Chute DL

We examined the differences in verbal learning patterns in employed and unemployed individuals with traumatic brain injury (TBI). Existing records of individuals with mild or moderate-to-severe TBI ($n = 25$) from a regional Community Re-Entry Program were reviewed. The California Verbal Learning Test (CVLT) was used to document verbal learning patterns and employment status and change in employment status following TBI were also documented. The results did not support a relationship between verbal learning patterns and change in employment status following the injury. The lack of group differences on CVLT subscale performance illustrates potential problems involving ecological validity of neuropsychological tests with respect to employment following TBI. In our study, individuals with moderate-to-severe TBIs were more likely to return to work than those with mild TBIs. While this finding was contrary to expectations, these results are not anomalous in a clinical setting, in that the severity of impairment may not always equate to the original injury severity. Individuals with moderate-to-severe TBI and greater subsequent impairment following TBI may be more accepting of their deficits, open to clinical interventions in the form of job coaching, and more willing to entering the work force at a reduced level. In contrast, individuals with mild TBI and more subtle subsequent impairment following TBI may be less accepting or aware of their deficits, which may ultimately thwart rehabilitative efforts. Implications for these findings may be that the individual's reaction to their injury, and level of insight, rather than injury severity variables or neuropsychological testing, mediate employment following TBI.

Convergent and discriminant validity of neuropsychological measures commonly used following moderate to severe brain injury

Mullin JP, Macciocchi SN, Alderson AL, Godsall RE, Orey SA

Neuropsychologists typically complete assessments based on the assumption that independent measurement of common neurocognitive domains such as attention, memory, visuoperceptual skills, and executive functions can be accomplished. Clinicians usually select one or more measures within each domain, administer the tests, and report the results under the appropriate report heading, such as "attention." In most cases, test selection within each domain is based on intuitive classification rather than a data-driven examination of the validity of the theoretical constructs. In this study, multitrait-multimethod (MT-MM) procedures were utilized to examine the construct validity of commonly used neuropsychological measures. Three measures of attention, memory, and executive functions were administered to 78 adult patients with moderate to severe traumatic brain injuries. The MT-MM analysis revealed that memory measures evidenced the most convincing convergent validity. Measures typically believed to assess "executive skills" and "attention" were found to have less convergent validity. None of the administered measures displayed adequate discriminant validity as evidenced by cross-construct correlations, which were typically higher than within construct correlations.

Community integration and TBI day program participation

Perkins S, Benge J, Jecker P

Advances in acute and neurological health care have significantly decreased the mortality of traumatic brain injury (TBI), leading to a rapid increase in the number of treatment programs focusing on positive psychosocial integration outcomes in addition to positive neurological progress. Brain Injury Day Treatment Programs (BIDTP) have emerged to provide an amalgamation of these two goals: focusing on psychosocial adjustment and basic neurocognitive therapies. This study focuses on the impact of a BIDTP on home, social, and productivity integration as measured by the Community Integration Questionnaire. Thirty seven BIDTP graduates and 26 TBI outpatients who did not participate in the program were assessed for length of coma, severity of injury, demographic information, disability status, and the CIQ. Controlling for the effect of demographic and injury characteristics, participation in the BIDTP was found to have significant impact on the total CIQ scores [Wilk's λ $(0.777) = 3.629$, $P < .03$], with between groups differences found to be significant for the total of subscales [$F = 10.799$, $P < .01$], personal subscale [$F = 4.501$, $P < .05$], and the productivity subscale [$F = 6.054$, $P < .02$]. Results indicate that utilization of a BIDTP has a positive effect on some aspects of community integration, primarily those associated with personal and occupational advancement.

Mediators of functional outcome in moderate-to-severe TBI

Rassovsky YU, Satz P, Alfano MS, Zaucha K

Traumatic brain injury (TBI) sequelae typically include physical, cognitive, emotional, and behavioral difficulties. When severe enough, these difficulties often result in significant impairment in social and occupational functioning. Literature exists to suggest that the severity of TBI is positively associated with the severity of functional impairment. However, it remains unclear which of, and how much, the aforementioned areas contribute to this impairment. In the present study, we evaluated a number of models hypothesized to explain the relationship between TBI severity and functional impairment. Eighty-seven patients with moderate-to-severe TBI were studied longitudinally. Using the structural

equation modeling technique, we found that only neuropsychological parameters consistently mediated the relationship between TBI severity (indexed with the Glasgow Outcome Scale and Brain CT) and functional outcome at 12 months postinjury. While behavioral difficulties were associated with functional outcome, they had no significant relationship with TBI severity. Emotional and physical complaints had no significant relationship with either TBI severity or functional outcome. Finally, TBI severity was not, by itself, significantly predictive of functional outcome, thereby supporting the mediation hypothesis. These findings suggest that, of the factors examined here, neurocognitive compromise plays the most prominent role in mediating post-TBI adaptive functioning in moderate-to-severe TBI and have important implications for postinjury interventions.

Pragmatic language skills and frontal-executive functioning following traumatic brain injury
Ryan LM, Bamdad MJ, Warden DL

Individuals sustaining traumatic brain injury (TBI) often demonstrate disturbances in everyday communication despite being able to use basic linguistic processes normally, i.e., deficits in the pragmatic aspects of language. TBI patients have been characterized as over talkative, tangential, lacking in specificity, having impaired turn taking, and having poor topic maintenance. Such pragmatic deficits are thought to be related to frontal-executive dysfunction. The present study sought to examine the relationship between pragmatic language skills and executive functioning in individuals with TBI. Subjects were 197 military health care beneficiaries, the majority being active duty service members, with a history of mild to moderate TBI. As part of a routine evaluation, subjects were administered a comprehensive neuropsychological battery and speech-language battery, including standard executive measures and a modified version of The Pragmatic Protocol. Pragmatic skills were subdivided into verbal (e.g., cohesiveness, organization, topic selection), nonverbal (e.g., body posture, facial expression), and paralinguistic (e.g., intelligibility, prosody) components. Correlational analyses were conducted and revealed significant correlations between frontal-executive measures and pragmatic measure ranging from low to moderate (.2 to .4). Verbal pragmatics were significantly correlated with abstract reasoning (Similarities), verbal fluency (COWA, animals), sequential thinking (picture arrangement), verbal learning-discriminability (CVLT). Nonverbal pragmatics were significantly correlated with information processing (Stroop Color-Word), problem solving and mental flexibility (WCST). Paralinguistic aspects of pragmatic skills were significantly correlated with verbal fluency (COWA), information processing (Stroop Color-Word). These findings lend support for the relationship between pragmatics and frontal-executive functions.

Lateralization of verbal memory using fMRI
Schneider J, Williams JM, Schiehser DM, Mohamed F, Bassam A, Faro S, Koffler S

The introduction of BOLD contrasting in functional magnetic resonance imaging (fMRI) made it possible to examine the organization of neural tissue and functionally map different cognitive and memory operations in the brain. In general, previous studies found that verbal memory processes are lateralized to the left cerebral hemisphere. Studies suggest that encoding and retrieval processes are localized to the left medial temporal lobe. However, some studies of working memory have also found involvement of the frontal lobes. The purpose of the present study is to functionally map verbal encoding and retrieval processes using fMRI techniques. Ten normal subjects were examined using fMRI methods during encoding and retrieval processes of verbal stimuli. During echo-planar imaging, subjects listened to a set of semantically-related words. Following a 30-min delay, subjects listened to a second

set of words silently identifying to themselves whether the word was novel or repeated. Words were presented at 2-s interval using a 20 s on–off block design paradigm. Mean scans were analyzed using statistical parametric mapping (SPM99). Results indicated reliable left temporal lobe lateralization of verbal memory. This suggests that fMRI methods may be a useful tool for the localization of memory in planning surgery in cases of intractable epilepsy.

Violence-related traumatic brain injuries: demographic risk factors and early outcome
Vickery C, Nakase-Thompson R, Sherer M, Yablon SA, Novack TA, Banos J, Brown R, Evans C

The incidence of intentional (violence-related) TBI is higher in the United States than in other countries. Each year approximately 19,000–23,000 deaths are attributed to violence with estimates ranging from 1.9 to 2.3 million violent injuries that are not fatal. Data from the TBI model system indicated that 30% of TBI cases followed were violence-related which was higher than other multicenter studies reports of violent-associated injuries. The higher incidence of violence from one associated center likely influenced the incidence reported from the TBI model system. The purpose of this study was to report incidence, risk factors and early outcomes for people with violent-related injuries. Data from 285 consecutive participants with a primary diagnosis of TBI who were admitted (72% male, mean age = 38(18)) to two inpatient rehabilitation hospitals were analyzed. Thirty-one individuals (11%) had a violent injury. Forty-five percent were assaulted with a blunt instrument; 29% received penetrating injuries, and 26% classified as other. Chi-square analyses indicated risk factors for a violent-related injury included being single and nonwhite ethnicity. No significant differences were found for age, education, gender, employment status, and self-reported alcohol or drug history. Individuals with an intentional injury did not differ on indices of disability and handicap (Disability Rating Scale, Functional Independence Measure) assessed at discharge from rehabilitation from individuals with nonintentional injury. Future studies should address indices of physical, cognitive, and emotional functioning at various time intervals postinjury.

REHABILITATION

Rhythm perception and production in relation to neurocognitive functions: a basis for a neurocognitive music therapy?
Äystö S

Based on the ideas of neurocognitive approach into functional impairments of persons with mental retardation (Äystö, 1996) it is suggested that with the aid of the new musical notation system, called Kuvionuotit (Uusitalo, 1997; Kaikkonen & Uusitalo, 2001), it is possible to create a new form of music therapy, or neurocognitive music therapy. It has been observed by the developers of this new notation system that persons with mental retardation can learn to purposefully play musical pieces following these new notes while not being able to do this from the traditional notes. Also, they can compose music in an understandable way. Compared to the traditional notation system the new notation system is cognitively unidimensional, concrete and relies more on geometric-spatial properties of the notes than on memory and knowledge base which are required in reading the traditional notes. The analyses of a representative sample ($n = 258$) of persons with mental retardation showed a strong relation between one musical element—the rhythm perception and production—with the neurocognitive functions of the person. Correlations were significant in most of the cases (r ranging from .26, $P < .01$, to .58, $P < .01$) and especially high with the neuropsychological variables, providing a rationale to more precisely study the neurocognitive effects of learning to play from the Kuvionuotit, and to extend the study to include such musical elements as rhythm, pitch, timbre, melody and harmony in association

with neurocognitive functions. The contribution of the new notation system for a purposeful music performance despite severe intellectual handicaps emphasizes the role of neurocognitive functions in the learning process. Additionally, it gives hope for a new rehabilitational approach with the aim to increase the overall neurocognitive functioning of the persons with mental retardation.

Awareness of emotional distress after brain injury: comparison of patient and relative ratings on the Patient Distress Scale

Borgaro SR

Disorders of self-awareness are common after brain injury. Several questionnaires have been developed to assess self-awareness, particularly in postacute patients, by comparing patient ratings to some other standard (e.g., relative). The discrepancy between ratings is considered an index of degree of impaired awareness. The Patient Distress Scale (PDS) was developed to measure awareness of emotional functioning in brain-injured patients during the earliest phases of rehabilitation. The PDS is an 11-item self-report questionnaire that asks patients to rate their level of distress on items that reflect emotional and physical symptoms. The relative version of the PDS consists of the same items and asks the relative to rate the patient's emotional functioning from their perspective. A total score is computed, as well as separate scores for the emotional and physical items. The PDS was completed by 43 brain-injured patients from an inpatient neurorehabilitation unit, and their relatives. Results yielded significant differences between patient and relative ratings. Relatives rated patients higher on the total PDS ($P < .001$), emotional ($P < .01$), and physical ($P < .05$) scores. Relatives ratings were also significantly higher for the emotional items compared to the physical items ($P < .05$), with significant group differences on irritability/agitation and frustration items ($P < .01$). Findings highlight the utility of the PDS as an index of self-awareness in acute brain-injured patients during the earliest stages of recovery. Its brevity and simplicity make it a useful/cost effective measure of awarenss that is conducive to patients in an acute rehabilitation setting.

The utility of scaffolding in remediating cognitive deficits in a chronic schizophrenic population

Campbell Z, Young D, Zakzanis K

This study compared the efficacy of two instructional techniques, scaffolding and direct instruction, with a practice control condition in the remediation of Wisconsin Card Sorting Test (WCST) deficits among 45 highly chronic schizophrenic patients. The extent to which learning of the WCST generalized to other cognitive tests, including an object sorting task, the Short Category Test, Trail Making and Stroop Tests, was also examined. The affective experience of the subjects was assessed via Rosenberg's Self-Esteem Scale and the Positive and Negative Affect Schedule (PANAS). Subjects who received scaffolded instruction improved significantly in the number of WCST categories achieved. The improvement was sustained 1 month later. Generalization to other cognitive tests was encouraging but limited. The scaffolded group improved in their self-esteem and maintained a high positive affect. These findings have implications for psychosocial and cognitive rehabilitation.

Are speech errors during naming diagnostically significant?

Davis C, Farias D, Lundstrom S, Osecheck M

Speech errors made in the attempt to name are meaningful prognostic indicators of severity of aphasia. To assess their contribution to prognosis, 30 patients with left hemispheric lesions were assessed using the

Boston Naming Test (BNT) and The Boston Matching Test (BMT). The BMT assesses the individual's ability to word–picture match with three plausible foils. Failure to recognize the word on the BMT is evidence of disruption in the semantic-lexical network, another strong prognostic indicator of severity. A regression equation was derived from these test scores, error codes, age, handedness and months postonset from stroke. Naming errors were coded as verbal, phonological, neologisms, multiword, and circumlocutions. The results revealed that 81% of the variance of scores that predict severity of aphasia on the BNT was significantly associated ($P < .0001$) with four variables. This included two error types: verbal errors and circumlocutions. Verbal paraphasic errors are real words that are semantically related to the target such ascarrot forpumpkin. Verbal paraphasic errors were associated with severity of aphasia and lower scores on the BNT. Circumlocutions are utterances that describe the word and are not considered paraphasic. Use of circumlocutions was associated with higher scores on the BNT. In addition to error types, the ability to word–picture match on the BMT and the ability to accept phonological cues to correctly name the target were associated with higher scores on the BNT. The BNT and the BMT showed an expected correlation.

Drawing: its contribution to naming in aphasia

Farias DM, Davis CP, Lundstrom SM, Osecheck MM

Word-finding difficulties are ubiquitous among aphasics. A goal of rehabilitation is to teach methods of self-cuing strategies to facilitate naming. One approach to improve expressive speech is to recruit intact neural systems to compensate fordamaged language areas. It was hypothesized that self-cuing by writing the name of an object or drawing a picture of it will facilitate naming. We analyzed the scores for 30 words from the Reading Comprehension Battery of Aphasia (LaPoint & Horner, 1998) under the following conditions: on confrontation naming, word–picture matching, naming while writing, and naming while drawing the picture. Scores were obtained for naming the word accurately in the process of using a self-cue strategy. The accuracy of the writing attempt and the quality of the drawing were irrelevant to the scores. The contribution of the patients' ability to write the word or to draw a picture of the word to facilitate naming was found to be significant in the drawing condition only. The possibility of nonlanguage neural systems (i.e., right-hemisphere systems) contributing to the semantic-lexical link is discussed.

Threshold effects of working memory on new learning in persons with acquired brain dysfunction

Howard L, Myron G, Lori J, Laura D

Baddeley (1992, 2000) conceptualized WM as an interface between perception/attention and learning/memory. Theoretically, WM and new learning should be significantly and positively-related across the range of WM ability. This relationship may assume greater significance in a clinical population. The current study examined the relationship between WM and new learning in a clinical sample, using indices from the WMS-III. Subjects were grouped by their standing on the WM Index (WMI) into two groups: high and low WM. A positive correlation was expected between the WMI and the memory indices within both groups. Subjects were 180 individuals with brain dysfunction of mixed etiology. A median split on WMI scores yielded high (>96.5) and low (<96.5) WM groups. Bivariate correlation analyses were used to determine the covariation between WMI score and the WMS-III Memory Index scores in each group. Paired *t*-tests compared the group mean contrast scores derived from the WMI and each WMS-III Memory Index. Modest, but significant correlations were found between the WMI and 6 of 7 WMS-III Index scores for the low WMI group; none were significant

for the high group. All mean contrast scores were significantly lower for the low WMI group. Results indicated that in this clinical sample the theoretically predicted relationship between WM and learning/memory held only for those with poor WM. Thus, there may be a threshold level for working memory above which other factors contribute more to a person's ability to learn and remember novel information.

An intervention to reduce disruptive behaviors in children with brain injury
Mottram L, Beger-Gross P

While there are a number of studies of behavior modification approaches to brain injury treatment, there is disagreement about whether individuals with frontal injuries benefit from reinforcement. A behavioral intervention was introduced to reduce disruptive behaviors in three male children with conduct problems, secondary to severe brain injuries. This intervention included child-specific rules, a token economy with response cost, and mystery motivators. Participants were three male attendees at a medical after-school program. Separate control composites were formed from children who behaved in "normal" or disruptive ways. The BASC-SOS was used for structured observations of disruptive behaviors. Interobserver reliability was conducted throughout the study and had a mean reliability of 96%. Using the BASC parent- and teacher-forms, respectively, parents and counselors rated the three participants' behavior and counselors rated the behavior of the control students. Employing a multiple baseline across subjects design, stable baselines were obtained for all children. Continued observations on the control children provided a basis of comparison for the effect of the behavioral intervention. The three participants entered the intervention in a staggered fashion. The participants' disruptive behaviors decreased during the intervention phase by an average of 69%; the effect size of each participant's improvement was considered "large" (Busk & Serlin's nonassumptions ES). The effects of treatment were maintained in the follow-up phase. Short-term, well-structured behavioral interventions were able to alter important program and social behaviors and were maintained in children with chronic behavioral deficits due to brain injury.

Detecting brain injury in adults with visual impairment or blindness
Nelson P, Dial J, Joyce A

Research is beginning to reveal that different etiologies of visual impairment or blindness (VI/B) are correlated with distinct changes in brain structure and function. Research also suggests that brain injury occurs more frequently among persons with visual impairment or blindness (VI/B). Therefore, an assessment battery that is able to consistently detect neuropsychological dysfunction and neurological differences among persons with VI/B is needed. The current study examined the usefulness of a blind-normed neuropsychological assessment battery, derived from the Comprehensive Vocational Evaluation System (CVES), in detecting abilities among a sample of 120 brain-injured and 394 normal functioning persons with VI/B. Utilizing a backwards elimination multiple discriminant function analysis, findings revealed that particular measures from the CVES battery correctly classified 82% of the adult sample into their appropriate groups (normal or brain-injured). Measures of fine-motor functioning, left-side sensory integration, and vocational aspects of adaptive behavior were found to be the most significant differentiating variables. These findings support the use of the CVES as a valid neuropsychological assessment battery for persons with visually impairment or blindness. Furthermore, the CVES would appear to be a useful battery for measuring functional and vocational capacities related to an individual's ability to work and live independently.

Empirical, convergent and discriminant validity of a new inpatient neurocognitive test battery

Schutz LE

A practical test battery for neurorehabilitation inpatients should be suitable to administer and score at bedside in less than 60 min. Administration to visually and/or motorically impaired and acutely confused patients should be supported. High measurement ceilings and low floors should also promote assessment of intellectually talented, younger patients with relatively mild disorders. Symptom validity measures and age and/or education correction coefficients should be provided. Perhaps most importantly, the battery should address the cognitive skills which will be the focus of outpatient treatment. As existing neuropsychological batteries do not meet these requirements, the SMAC was developed and standardized. The present study reviews validational findings for 20 scales derived from the 12 subtests of this battery for a sample of 225 inpatients residing on a well-established neurorehabilitation unit. One hundred and two of these patients were evaluated after discharge using a modified Halstead–Reitan Battery. Convergent validity coefficients range from .75 for number span and for sentence recall and .70 for ideational fluency to .29 for impersistence and .27 for perseveration. The modal coefficient is .43. empirical validation against coma duration, anterograde or retrograde amnesia for 117 traumatic brain injury patients reveals at least one coefficient in excess of .30 for 44% of scales, with correlation greater than .20 for 90%. Two symptom validity scales correlate .54 with MMPI-2 lie and .59 with MMPI-2 infrequency. Differential sensitivity to radiographically defined lesions in the left frontal, left temporal, right temporal, right parietal and brainstem injuries are strongly demonstrated.

The recovery killer: low levels of long-term adaptive functioning after intensive cognitive neurorehabilitation with radiographically defined right posterior association cortex lesions

Schutz LE

Lesion location frequently performs as a poor indicator of long-term prognosis following neurorehabilitation. However, right posterior focal lesions are associated with longer inpatient stay, lower daily living skills at discharge, and residual dependency at follow-ups even 24 months later. A few small-sample studies and investigations of neuropsychological test predictors also suggest that vocational outcomes may be unusually poor for this group. These patients tend to be uniquely unreceptive to information concerning their deficits, unrealistically optimistic about their capabilities and hence especially difficult to engage in the struggle against deficits. This study examines 48 cognitive rehabilitation outpatients with right parietal and parietotemporal focal injuries (defined by CT or MRI scansor neurosurgical lesions) taken from a group of 237 followed up at least 3 months after discharge (mean interval $= 16.49$ months, S.D. $= 21.41$). All of these patients had suffered significant injuries, with the majority showing both extended coma and multiple focal injuries. Substantial differences were found for maintaining employment (right posterior 16%, other patients 49%), full independence at home and in the community (right posterior 70%, other patients 82%) and for divorce or termination of long-term romantic partnerships (right posterior 52%, other patients 15%). The 48 right posterior subjects were then compared with 48 subjects with focal lesions in other locations matched for diagnosis and indicators of injury severity. Discriminant function analysis revealed that a composite outcome variable was significantly predicted by lesion location [$F = 31.07$; $P < .001$]. A theoretical model of nondominant posterior association cortex function is offered to explain these results.

MMPI-2 indicators of vocational prognosis after outpatient neurorehabilitation
Schutz LE

The MMPI has proved to be an effective predictor of vocational recovery from brain disorders of several kinds. In the present study, it is employed to predict competitive employment at long-term follow-up after intensive cognitive neurorehabilitation. A prior study utilizing a different inventory found this vocational recovery to be a function of the quality of coping skills. Vocational data concerning 106 discharged patients, all of whom had suffered coma in excess of 24 h and/or at least one focal lesion defined by CT, MRI or neurosurgical direct observation, were obtained at no less than 3 months postdischarge (mean interval = 19.67 months, S.D. = 24.43). The MMPI results of the 44 employed subjects and the 62 unemployed were contrasted by a standard discriminant function analysis utilizing four scales (Pd, Ma and composite variables for theneurotic triad and the first three scales of thepsychotic tetrad). The function effectively differentiated the groups, achieving significance at $P < .05$ ($F = 2.49$). The clinical scales and code types that tend to reflect psychotic phenomena and character disorders (emphasizing scales 4, 6, 7, 8 and 9) are indicators of a poor vocational prognosis, save for 9-spike profiles in subjects who accept and follow medication recommendations. Neurotic scales and code types indicate an intermediate prognosis. Normal-range profiles are favorable indicators only for those whose injuries are mild or whose jobs are minimally affected by the injury. For those whose jobs require skills that are compromised, a normal-range profile is a negative indicator.

Preliminary reliability and validity data on an Apathy Scale for use in rehabilitation
Smith-Seemiller L

Problems of motivation are common sequelae of neurological diseases, and can significantly interfere with progress in rehabilitation. While depression is a common reason for poor motivation, neurological dysfunction can lead to an motivational deficits, that is, an apathy syndrome, in the absence of mood disorder. An Apathy Scale has been developed to assess this syndrome, using either self, clinician, or informant reports. However, for a number of reasons this scale cannot be easily used in the inpatient rehabilitation setting. This paper presents preliminary data on a modification of Marin's Apathy Scale for use in rehabilitation patients. Twelve items from Marin's Scale were rewarded to make them more appropriate for the rehabilitation setting. Physical and occupational therapists independently rated patients based on their observations. Ratings were available for 27 patients. Their mean age was 69, and most had neurological diagnoses. Split half reliability was high, and total apathy scores for physical and occupational therapists were significantly correlated ($r = .66$, $P < .0001$). Among individual item scores, interrater reliability was high for 10 of the 12 items. Construct validity was supported by the relationship between apathy scores and improvement in functional status at discharge: a significant correlation was obtained between apathy scores and improvement on the Functional Independence Measure (FIM). It is concluded that the modified Apathy Scale is a promising tool for the assessment of apathy and motivation in rehabilitation.

Examination of differences in the Barry rehabilitation inpatient screening of cognition (BRISC) across discrete samples
Weller JA, Barry PC

The Barry rehabilitation inpatient screening of cognition (BRISC) was developed in 1995 to be used by psychologists for the purpose of evaluating individuals with suspected cognitive problems (e.g.,

severe brain injury due to dementia, strokes, etc.). In the current study, the BRISC was administered to three different groups of individuals as part of a cognitive evaluation. The first group was an intact, controlled, sexual predator sample of men enrolled in a community protection and treatment program ($n = 25$). The second sample consisted of individuals admitted to an acute, inpatient psychiatric hospital ($n = 200$). The third sample included 40 neurologically impaired individuals referred by case managers and primary care physicians who were seen on an outpatient basis. Psychologists administered the BRISC in an un-timed, paper-and-pencil format. The purpose of the study was to identify population differences in the total BRISC score as well as in subtests. Subtests include reading, design copy, verbal concept formation, orientation, mental imagery, mental control, initiation, and memory. In addition, the study explored relations among covariates and BRISC scores. Comparisons were made across samples, and were contrasted with the original 1995 young adult norms. Preliminary analyses suggest that total BRISC scores in sample 1 were higher than total scores in samples 2 and 3. It was also hypothesized that psychiatric diagnosis and age would be significantly related to BRISC scores, while education level and sex would not.

PEDIATRIC AND CHILD NEUROLOGICAL DISORDERS: TRAUMATIC BRAIN INJURY

Acosta LM, Burns WJ, Braaten AB, Sellers A, Aubert MM

Acosta LM, Burns WJ, Braaten AB, Sellers A, Aubert MM

We assessed the frequency with which psychological symptoms occur in traumatic brain injury (TBI) children versus children with psychiatric disorders. The Child Behavior Checklist (Achenbach, 1991) was administered to the parents of 4 groups of children (mean age of 11.08) 25 each (TBI, ADHD, depression and adjustment disorder). Moderate to severe TBI was sustained 1–3 months previous to assessment in the TBI group. The children with psychiatric disorders had a significantly higher total CBCL score than children with TBI. *T*-scores on the CBCL internalizing scale was significantly lower (ANOVA) for the children with TBI (51.72) than for depressed, ADHD, and adjustment disorders (70.36, 66.04, 63.52). TBI patients exhibited less emotional problems in the area of withdrawn, anxious, social, thought and depressed when compared to the psychiatric disorders. However, there was no difference in somatic complaints. Externalizing *T*-score for TBI (ANOVA) was significantly lower (48.24) than for depressed, ADHD, and adjustment disorders (62.20, 71.12, 63.88). TBI patients were lower in the attention, delinquent, aggressive dimensions versus the other groups. These results provide evidence that children recovering from recent TBI do not manifest the degree of psychiatric symptomatology found in groups of children with diagnosed psychiatric disorders. In fact, children recovering from TBI have scores on the CBCL in the normal range compared to children with psychiatric problems, all of whom have elevated scores. This finding is in contrast to the popular notion that children with TBI have increased social-emotional problems.

Longitudinal assessment of children with moderate to severe TBI

Aubert M, Burns W, Braaten A, Widmayer S, Peterson L, Starratt C, Puranik S

We tracked the neuropsychological progress of children during the first year of recovery after traumatic brain injury (TBI). Eleven children (mean age of 11.45 years) who had been hospitalized following a moderate to severe TBI were evaluated at 1 month following injury and at 6–12 months following the initial evaluation. Repeated measures pairwise comparisons were conducted between the two time periods (initial and repeat evaluations) and significant improvement was found for all of the WISC-III indices except for the Processing Speed Index. On the WISC-III, subtests measuring verbal categorization and

abstraction improved the most. Subtests measuring general factual knowledge and long-term memory showed the least improvement. A possible explanation for the slower recovery of processing speed may lie in the nature of the task. The brain must perform a complex series of manipulations in response to the demands of the processing speed task. In addition, significant improvement was found for the WRAML Learning and General Memory Indices. On the WRAML, the Design Memory subtest, which measures visual reproduction, improved the most. Subtests measuring spatial memory and executive function improved the least. The above findings verify recovery in the acquisition and immediate recall of information. Although brain injury after TBI in children is most often diffuse, these findings show that there is considerable variability in the way that specific memory and intellectual functions recover. It is the extent of recovery that differs the most across these functions.

A model for providing neuropsychological services to the juvenile justice system
Gorman P, Johnson MI

Research has shown that many children, who suffer traumatic brain injuries initially make positive recoveries, especially physically. However, secondary to their TBIs, these patients often struggle with self-regulation, resulting in behavioral and emotional difficulties. This behavioral and emotional dyscontrol often becomes more apparent when these patients' peers are beginning to evidence greater impulse regulation and their environment place greater expectations for self-regulation as they progress through adolescence. Thus, there is an increased vulnerability that these patients' impulsivity will result in law violating behaviors, without the contextual sophistication to elude authority. It is the authors' belief that the judicial system needs to understand these children's unique circumstances to properly adjudicate their offenses, and that neuropsychology is uniquely equipped to contribute to this understanding. A model to address these juveniles' needs will be proposed. This model includes: identifying these juveniles through the initial assessment procedures in the detention center, staffing their needs with a multidisciplinary board that is independent from the juvenile justice system, obtaining appropriate neuropsychological evaluation, making meaningful recommendation to the court, and providing neuropsychological treatment as appropriate. Details of each step facilitate implementation of the model.

Personality disturbance in adolescents following childhood TBI
McGee JM, Plotts CA

Personality changes have been identified as typical sequelae of traumatic brain injury (TBI). However, there are a limited number of studies which specifically address the prevalence of diagnosable personality disorders following TBI. To date, no studies have been identified which address eventual development of personality disorders subsequent to a TBI in childhood. The literature related to adults documents that the rate of personality disorders post-TBI is similar to that observed in psychiatric inpatient and mental health settings. In one recent study, the most common personality disorder diagnosed post-TBI was borderline personality disorder (34% in a post-TBI sample, compared to 2% in general community samples). Gender differences were noted, as males were diagnosed with antisocial personality disorder both pre- and postinjury more frequently than females. Narcissistic personality disorder was more likely to be diagnosed in males postinjury. We present two case studies which illustrate patterns of personality disturbance in adolescents who suffered severe TBI in childhood. Both individuals are residents in a postacute rehabilitation facility. A female subject who was injured at age 4, and a male subject injured at age 7, present with features of borderline and narcissistic personality disorders, respectively. The developmental course is presented from the onset of TBI to current patterns of neuropsychological

and behavioral functioning. Each subject exhibits average to above average verbal cognitive, verbal memory, and academic functioning. These case studies are expected to contribute to the understanding of personality development in response to challenges associated with TBI occurring in childhood.

Childhood head injury and neurodevelopmental functioning
Meyer JA, Nemeth DG

Closed head injuries may be associated with language processing deficits, attentional problems, social-behavioral regulation, and added stress to family functioning (Burgess et al., 1999; Holtz, Helm-Estabrokkks, & Nelson, 2001). This report presents neurodevelopmental assessment data on a 5-year-old African-American male who, at the age of 3, had fallen 12 feet from a balcony and suffered a left skull fracture in the parietal region. Medical records indicated a longitudinal fracture at the left temporal bone associated with left hemotympany. His left forehead was slightly bruised and dried blood observed on the left ear. No loss of consciousness, neurologic symptoms, or sign of intracranial injury were reported. This child received a neurodevelopmental battery assessing cognitive abilities, language, adaptive functioning, academic readiness and skills, and emotional/behavioral functioning. Results of this neurodevelopmental evaluation revealed marked difficulties with the acquisition of verbal knowledge and complex language, auditory processing, attention and executive functions, and emotional control. Results will be presented and discussed with regard to the assessment of the impact of closed head injury on language, attention, and social-behavioral regulation, as well as impact on family functioning (Dennie et al., 2001).

PEDIATRIC AND CHILD NEUROLOGICAL DISORDERS: LEARNING DISABILITIES/ADHD

Comparison of results on the Children's Memory Scale and the BRIEF
Cash D, Pizzitola K, Siekierski B, Wolfe M, Riccio CD

Recently, the research literature has examined the relationship between memory and intellectual functioning to provide answers regarding children's academic underachievement in school. The Children's Memory Scale is an instrument used to assess learning and memory functioning of children and adolescents. The BRIEF is a questionnaire completed by parents and teachers designed to assess executive functioning in children, which includes the ability to control attention, plan, and "hold" information in working memory. The purpose of this study was to compare the performance of three groups of children on these two measures. Participants were consecutive referrals to a research study who were between the ages of 9 and 16 and were grouped for the study based on the presence of ADHD, the presence of some other psychopathology, without ADHD, and no diagnosis. All participants were administered a comprehensive neuropsychological battery including the Children's Memory Scale and the BRIEF. Results indicated a moderate correlation between specific scales on the Children's Memory Scale and the BRIEF.

Differential impact of the dopamine transporter gene on inhibition, attentional switching and working memory functioning in children with attention deficit: a neuropsychological perspective
Cornish K, Hollis C

Recent evidence has suggested that the genes responsible for the clinical disorder of ADHD may also be responsible for individual differences in attention and activity levels in the normal child population.

Hence, it may be more appropriate to think of ADHD as an extreme form of a genetically influenced trait distributed on a continuum in the population. The aim of the present research was to examine whether there are separate dimensions of inattentive and overactive-impulsive behavior distributed as continuous behavioural traits in the child population, and whether these separate dimensions show differential associations with genetic markers and cognitive correlates into adolescence and adult life. The present study used a quantitative trait loci (QTL) approach in a population-based sample to examine differential associations between susceptibility genes, neuropsychological functioning and the behavioural traits of inattentiveness and overactivity-impulsiveness. Teachers used the SWAN rating scale (Swanson, 2000) in a screen population of 1,811 primary school children (age 6–11) in Nottinghamshire, UK. From this, a sample of 126 boys were chosen for neuropsychological and genetic testing representing "high" and "low" scorers on the SWAN. Performance was assessed across a wide range of tasks including working memory, inhibition and attentional switching. The results indicated a differential impact of genetics on cognition with increased frequency of the DAT1 allele associated with impaired performance on tasks of response inhibition but not working memory. As predicted, the group most likely to have the high-risk allele were children in the dimension of overactivity-inattention.

Evidence for anomalous lateralization in ADHD subtypes

Cornish K, Hollis C, Dobler V, Manly T, Grant C, Kay C

Individuals with ADHD exhibit a constellation of symptoms, including impairment in inhibition, selective and sustained attention and working memory. One hypothesis is that ADHD is related to fronto-striatal and right hemisphere dysfunction. Indeed, if the syndrome is characterized by such dysfunction then one would expect to see differences in lateralization in those with combined inattention/hyperactivity from those within other dimensions of the ADHD continuum. In the present study, we assessed 126 primary school children in Nottinghamshire, UK who presented at the extreme ends ('good scorers' and 'poor scorers') on the continuum of behaviors as measured by the SWAN rating scale. Performance on a range of laterality measures was examined, including hand preference, hand skill and spatial attention (the line-bisection task and the star cancellation task). The findings suggest a deficit in spatial attention alongside anomalous handedness consistent with the picture of a lateralisated dysfunction of the fronto-striatal and right hemisphere cicuitry in ADHD.

Weaknesses in rapid automatized naming of colors in children with attention deficit hyperactivity disorder (ADHD) without reading disabilities (RD)

Cutting LE, David D, Wilkins J, Sparrow EP, Denckla MB

Rapid automatized naming (RAN), or the ability to quickly name a restricted set of items in a category (colors, letters, numbers), has been shown to predict RD. Nonetheless, it has been reported that children with ADHD without RD (ADHD/NRD) have difficulty with RAN, particularly RAN of colors. It has been hypothesized that deficits in RAN could stem from deficits in response preparation, a component of executive function, and/or deficits in phonological processing. This study tested the hypothesis that children with ADHD/NRD show slow RAN because of deficits in response preparation. Thirty-four children with ADHD/NRD and 40 controls, none of whom had ADHD or RD, were compared on RAN of colors, letters, and numbers and response preparation (reaction time/variability of reaction time on a Go-No-Go test). Groups were matched for age, IQ, and word reading skills. Results showed that children with ADHD/NRD were slower on RAN of colors ($P < .0043$), but not letters or numbers, even when word reading was covaried. No significant differences between groups

emerged in response preparation. Additionally, children who scored at less than the 16th percentile on RAN of colors did not show differences on response preparation measures. However, some significant correlations between RAN subtests and response preparation measures were observed. These results replicate findings that ADHD/NRD groups demonstrate impaired performance specifically on RAN of colors. Some evidence for the relationship between response preparation and RAN was found; however, these findings were limited, suggesting that other sources for slow RAN, particularly colors, need to be considered.

Validity of WISC-III Freedom from Distractibility Index

Fortson BL, Richardson JA, Boone ML

The Freedom from Distractibility (FD) Index of the WISC-III has been used by clinicians as a measure of attention and concentration. Although the FD Index has been compared to a limited number of neuropsychological tests, little is known about the relation of this index to neuropsychological measures of attention and concentration. The present study examined the relation among known measures of attention and concentration (Gordon Diagnostic System, GDS; Stroop Color-Word Test, SCWT; Knox Cube Test, KCT) and the Freedom from Distractibility Index of the WISC-III. Participants were 89 patients (mean IQ = 94, mean age = 11) referred by pediatric medical specialists to our clinic for assessment of ADHD. As part of a larger battery, patients were administered the GDS, SCWT, KCT, and WISC-III. Pearson product–moment correlations were conducted using various measures from each test. Results demonstrated several significant and clinically meaningful relations among variables of attention and concentration (GDS, $r = .50$; SCWT, $r = .63$; KCT, $r = .48$). These results support the validity of the FD Index of the WISC-III as a measure of attention and concentration and suggest that it may be a useful part of an objective test battery in the assessment of ADHD.

Visual–spatial abilities in mathematically disabled adults

Gliko B, Selden J, Katell M, Fogle M, Golden CJ

Previous research has shown that children suffering from mathematics disabilities (MD) evidence visual–spatial deficits. Such disabilities may persist into adulthood. However, little research has examined associated deficits in mathematically disabled adults. This study evaluated the visual–spatial skills in a population of adults diagnosed with mathematics disorder. Fourteen subjects referred for neuropsychological testing and subsequently diagnosed with mathematics disorder were examined. Their average age was 27.79 years (S.D. = 9.43) and their average education was 14.29 years (S.D. = 2.23). The sample was predominately female (78.6%) and Caucasian (71.4%). The mathematically disabled group was compared to a group of 16 subjects also referred for neuropsychological testing but who had no disorder. Block design from the WAIS-III, spatial span from the WMS-III, Trails B, and the Tactual Performance Test (five measures) from the Halstead–Reitan Battery were employed as measures of visual–spatial ability. An ANCOVA with Full-Scale IQ as the covariate was used to compare the groups. Subjects with MD performed significantly poorer than the no-diagnosis group on Trails B, TPT total time, and TPT dominant hand time ($P < .05$), but no differences were found on the remaining variables including TPT location. Looking at only mean scores, the MD group performed slightly better on Trails A, but worse on all other variables. It appears that adults suffering from MD may evidence deficits on more complex visual–spatial tasks but only in a restricted fashion involving quick visual spatialization.

The relation of memory and attention to academic achievement in children
Gsanger K, Wa S, Homack S, Siekierski B, Riccio C

As part of neuropsychological assessment, measures of memory and attention are often included with considerable overlap in the constructs evident. The purpose of this study was to determine the relation between measures of memory and laboratory measures of attention/disinhibition. In order to link the assessment to educational interventions for children, the extent to which the results on these measures are predictive of academic achievement was then examined. Participants were consecutive referrals to a research study who were between the ages of 9 and 15 years. In addition to an assessment of academic aptitude, all participants were administered a comprehensive neuropsychological battery including measures of attention and memory. Results of the various subscales of the Children's Memory Scale (CMS), the variables from the Gordon diagnostic system (GDS), as well as those of the Conners' Continuous Performance Test (CCPT) were of interest as a reflective of memory and sustained attention/disinhibition. Results indicated moderate correlations between specific memory variables and variables of the Continuous Performance Test. Of these variables, attention/concentration and visual delayed of the CMS and response style (β) and sensitivity (d') of the CCPT were the best predictors of academic achievement.

Nonverbal cognitive ability and math performance patterns in children with NVLD features
Guy KL, Nussbaum NL, Wilson KD

We investigated the nature of the relationship between math skills and nonverbal cognitive abilities in children with features of nonverbal learning disabilities (NVLD). Participants included 51 children who had a PIQ $\times$ 1 standard deviation below VIQ on the WISC-III, a feature often associated with NVLD. A series of ANOVA's ($\alpha = .05$) was conducted with three WISC-III scores as independent variables: coding, block design (<7 (low) or >7 (high)) and perceptual organization (<85 (low) or >85 (high)). Dependent variables included math calculation (WRAT-3) and math concepts (Key Math). Results indicated that the low block design and perceptual organization groups scored significantly lower on both math calculation and math concept skills than those in the high group. The low coding group had significantly lower math calculation scores than the high group, but the two groups had similar math concept scores. Correlational analyses revealed that math concept skills were significantly more related to both perceptual organization ($r = .677$) and block design ($r = .628$) than math calculation skills ($r = .443$ and .411, respectively) in our sample. Results indicate it is important to examine the pattern of subtest scores in children with the NVLD feature of PIQ < 0.05), but not visual reproduction ($r = -.058$, n.s.). Complaints were much more strongly associated with level of depression (Scale 2, $r = .608$) and anxiety (Scale 7, $r = .695$, both $P < .001$). The severity of depression and anxiety were not predictive of Memory Test performance ($r < -.14$, n.s.).

Extended time benefits reading comprehension for slow but not faster reading college and medical school students
Hatfield R, Giordani B, Glick R, Trietley G, Middleton EU

Learning disabilities are thought to affect 3% of medical school students. Walters and Croen (1993) speculate that students with LD's can compensate as undergraduates, but medical school exposes their disability. Given that the most common findings in LD students consist of slow reading, poor spelling, and grammatical errors, these students are at a disadvantage, especially with more advanced graduate

work. The Association of American Medical Colleges recommends that LD students be given extra time for exams (Walters & Croen, 1993); however, the question remains that any student may benefit from extra time. Runyan (1991) found that only LD college students indeed benefited from additional time on the Comprehension portion of the Nelson–Denny Reading Test (N–D). We administered both N–D forms H and G to 45 medical students and 46 undergraduate college students. N–D Comprehension and Vocabulary scores were taken for timed and extended time conditions. Slow readers (SR) were categorized as students with a reading rate of less than 250 words per minute on the N–D Reading Rate subtest. Results indicate that the SR group realized significant comprehension and vocabulary gains during the extended time condition ($P < .01$), whereas the faster reading group did not ($P > .10$). Similar results occurred when undergraduate and medical student data were analyzed separately. These results suggest that SR students' performances are optimized by extended time on exams without a significant advantage over their non-SR peers.

The relationship of attention to memory in learning disordered children

Katell M, Chuplis KA, Borosh B, Shockley T, Golden CJ

Children who present with learning disabilities frequently present with problems in short-term auditory memory, attention, and executive functions. The relationship between these functions is complex, raising the question of whether these represent independent deficits or a common factor related to testing procedures. Ninety children, a control group ($N = 10$), one LD group relatively high in digit span (attention and verbal short-term memory) ($N = 40$) and one LD group relatively low in digit span ($N = 40$). Both LD groups had a mean age of 9, with 66% age 9 or above. The groups were 54.8% Caucasian, 28.6% African-American, 16.7% Hispanic, 71.4% male, and 28.6% female. Thirty of each of the LD groups were simultaneously diagnosed with ADHD. The low digit span group was diagnosed 76.2% learning disorder not otherwise specified while only 30.4% of the high digit span LD group was diagnosed with learning disorder not otherwise specified. Seventy-eight percent of the high digit span group was male. Seventy-one percent were Caucasian and 21% were African-American. This control group exhibited no learning disorders. Executive function and memory tests included Trails A and B, WISC-III Mazes, WRAML General Memory, and WRAML Sound Symbol. A series of ANCOVAs were performed and significant differences were found between the two LD groups on tests of executive function, but not on memory. While the high digit span group differed from the low digit span group on tests of executive function, there was no differentiation in performance from the control group.

A neuropsychological comparison of nonverbal learning disabilities (NLD) and IQ discrepant groups

Katell M, Fogle M, Conger C, Mohrland M, Golden CJ

In 1978, Rourke observed a higher frequency of low WRAT arithmetic scores, relative to reading and spelling scores, among VIQ > PIQ subjects, than other IQ discrepant groups, identifying the nonverbal learning disabilities (NLD) syndrome. The purpose of this study was to identify NLD cases in the files of over 350 children, aged 6–16. Subsequently, the NLD cases were compared to other IQ discrepant groups with varying levels of arithmetic performance. The NLD selection criteria included a Full-Scale IQ score of 79 or above, WRAT arithmetic 10 SS points less, relative to minimally average WRAT reading and spelling scores, VIQ of 79+, and VIQ greater than PIQ by 10 points or more. The NLD group of six members (83.3% were age 9 or under, 100% male and Caucasian) was compared to three other groups of six each. Group 2 was VIQ > PIQ, but relatively high in arithmetic achievement (66.7%

aged 9 or under, 100% Caucasian and male). Group 3 was PIQ > VIQ and low arithmetic (50% aged 12 or under, 66.7% male and Caucasian). Group 4 was PIQ > VIQ and high arithmetic (66.7% aged 10 or under, 50% male and Caucasian). Trails A and B, TPT, and block design were administered. The NLD group scored significantly from groups 2 and 3 on block design, from groups 3 and 4 on Trails A, from groups 2 and 4 on TPT (nondominant hand), and from all groups on TPT (both hands).

The relationship between nonverbal learning disabilities and central auditory processing disorders

Keller WD, Tillery KL

Children with nonverbal learning disabilities (NLD) syndrome, a particular learning disability subtype, present with a characteristic pattern of performance on measures of intellectual, academic, neuropsychological, and emotional functioning. Audiologists have described subtypes of auditory processing disorders (APD) that are believed to be related to the development of specific learning disabilities, especially reading and spelling disorders. One specific subtype of central auditory processing disorder is the tolerance facing memory profile (TFM) which is characterized by a specific pattern of performance on the Staggered Spondaic Word Test (SSW), a dichotic listening measure. These children are described as being impulsive, with poor handwriting and reading comprehension, with weaknesses in expressive language, and anxiety; more of the characteristics of NLD. Approximately 50 children from a clinical population (mean age 10) were administered neuropsychological assessments including the Wechsler Scales, measures of memory functioning (WRAML), academic achievement (WIAT), and specific subtests of the Halstead–Reitan Battery most sensitive to discriminating NLD. Over half (56%) of the children with NLD syndrome exhibited comorbid central auditory processing dysfunction, with 54% exhibiting a TFM profile on the SSW. The results are discussed in terms of comorbidity of NLD and APD, as well as the utility of the auditory processing evaluation in predicting NLD syndrome. The result of the study emphasizes the importance of collaborative work in enhancing our understanding of NLD syndrome and its associated features in order to improve treatment.

Gender differences in math and perceptual organization skills among children with nonverbal learning disabilities features

Kimberly DW, Nussbaum N, Guy K

Research in the field of learning disabilities has placed increased attention on disabilities of a nonverbal nature. Although no definitive criteria have been established for a nonverbal learning disability (NVLD), one prominent feature is performance abilities that are significantly lower than verbal abilities. Past research has also linked decreased perceptual and conceptual math skills with NVLD. It has been found that among students referred for NVLD, boys are more likely to receive diagnostic attention. Understanding gender differences within the population of students with NLVD may shed some light on the ways in which gender may differentially effect the diagnosis and manifestation of NVLD. Participants were 51 children referred in a clinic-based setting. Inclusion was based on the presence of PIQ on the WISC-III that was at least one standard deviation below VIQ. Two groups were formed based on the gender of participants: 37 boys, 14 girls. Consistent with previous findings, boys were more than twice as likely to be represented. Analysis of variance was conducted to determine mean differences between the groups. Using an alpha level of .05, no significant differences were found between the groups on PIQ and VIQ discrepancy ($P = .14$) and computational math skills ($P = .77$). Girls were found to perform worse on conceptual math ($P = .03$) as well as perceptual organization

skills ($P = .03$), skills for which lower scores have been found to be linked with NLVD. These findings could indicate a pattern specific to girls.

Verbal memory performance in children with ADHD

Laura SB, Melissa RB

It has been well documented that deficits in memory functioning are strongly related to attention difficulties in children (e.g., Karatekin & Asarnow, 1998; Stevens, 2001). Little investigation, however, has focused on comparing different ADHD subtypes on memory task performance. Recent discussion has suggested that ADHD-combined type (CO) and ADHD-inattentive type (IA) would be best characterized as distinct disorders (Clarke, Barry, McCarthy, & Selikowitz, 2001; Milich, Balentine, & Lyman, 2001), but there is a lack of consensus on a criteria that clearly delineates different types of attentional difficulties (Barkley, 2001; Hinshaw, 2001). If neurocognitive differences between the subtypes exist, differential patterns of performance on memory tasks are likely to exist. The present study compared the performances of children with ADHD-CO and ADHD-IA on different verbal memory tasks, using the California Verbal Learning Test for children (CVLT-C; Delis et al., 1994) and the test of memory and learning (TOMAL; Reynolds & Bigler, 1994). A sample of 73 children aged 6–13 was selected from patient records at a private neuropsychology practice. Results did not indicate group differences comparing the two memory tasks, however both subtypes performed better on the TOMAL task. There was a trend for children in the IA group to outperform their IA counterparts on CVLT-C immediate recall trial. Also of interest is the finding that neither group showed impaired performance on either task, which is in contrast to previous findings for children with ADHD. The implications for academic interventions and contributions to the evolving nosology of ADHD types are discussed.

The effects of sleep problems on sustained attention in children

Leavell JA, Leavell CA, Thevenin HU

This study investigated the relationship between sleep and attention in a heterogeneous clinic-referred population of children, using measures of sustained attention and vigilance from the Connors Continuous Performance Test (CPT). Participants included 65 boys and 25 girls, ages 7–18, with average IQs, no severe emotional deficits, nor neurologic dysfunction. Children were identified as presenting with/without sleep difficulties based upon a combination of self/parent report. Symptoms of attention, anxiety and depression were identified by scales from the behavioral assessment system for children (BASC) self and parent reports. Results indicated that children with sleep difficulties had only a tendency ($F = 2.85$, $P = .09$) to exhibit more attention problems on BASC parent report. On the CPT, children with sleep problems were no more likely to have elevations in omissions, nor commissions, but were more variable in response time ($F = 4.85$, $P = .02$), which is associated with vigilance (Connors, 2000). Covarying for symptoms of depression and anxiety had no impact on these findings. Children with sleep problems were no more likely to have symptoms of anxiety or depression via parent report, but children who self-reported anxiety were more likely to be identified as having sleep problems ($F = 3.87$, $P = .05$). Perhaps because of the small group size (16 children with sleep and attention problems), there was no interaction between those that had both sleep as well as attention problems and their performance on CPT attention measures. These findings offer only partial support that children with behavioral symptoms of attention are likely to have sleep-related attentional disturbance.

Is biology destiny? Neuropsychological evidence for the remediation of reading deficits
Miller CJ, Hynd GW, Craggs J

Developmental dyslexia is present in 2–8% of the school-age population and is hypothesized to be the result of atypical development in the perisylvian region of the brain during the fifth to seventh months of gestation. This case study describes an 8-year-old boy with dyslexia and high cognitive ability who has recently responded significantly to reading intervention. MRI results for the child indicate atypical perisylvian morphological patterns along with evidence for rightward asymmetry in the planum temporale. The literature supports both findings as risk factors for dyslexia. The child had mild developmental language and motor delays and continues to evidence mild dyscoordination. His medical history is significant for infantile colic and severe allergies. His learning problems were first noted in kindergarten, at which point he was retained and his parents engaged a tutor's services. Despite 3 years of individual tutoring, special education intervention, and enrollment in a private school for children with learning disabilities, he made only limited improvement in his reading ability. During this time, the child began working with a speech-language pathologist who uses a combination of phonetics-based approaches. The child's father experienced similar reading problems as a child but was able to develop compensatory strategies and completed a doctoral degree. Although evidence indicates that this child has multiple risk factors for dyslexia, he appears to be developing age-appropriate reading skills with intensive intervention.

Developmental analysis of attention in pediatric neuropsychiatric population: a multidimensional assessment
Mleko A, Borosh B, Proctor-Weber Z, Conger C, Golden CJ

Attentional disturbance has been reported in relation to a number of childhood psychiatric and neurological disorders. The purpose of this study was to investigate developmental changes in performance on the dimensions of attention (i.e., focus/execute, encode, shift, sustain, and stability) proposed by Mirsky and colleagues (1991) in a pediatric neuropsychiatric population at four different age levels (6–7, 8–9, 10–12, and 13–16 years) rather than a normal population. Participants in the study were 312 children referred for a comprehensive neuropsychological evaluation, which included the WISC-III, WRAML, WCST, TMT, and visual TOVA. The overall age and education of the participants was 9.87 (2.9) years and 4.2 (2.6) years. Participants were predominantly male (70.6%) and right-handed (86.6%). Sixty-five percent of the sample was Caucasian. Diagnoses, gender, ethnicity, and reasons for referral were similar across the four groups. A series of ANOVAs revealed that 10 of 13 variables differed between the 4 age groups. Significant differences ($P < .001$) were noted between the groups on arithmetic [$F(3, 312) = 79.42$], digit span [$F(3, 303) = 44.94$], and coding subtests [$F(3, 311) = 40.01$]; WRAML number/letter subtest [$F(3, 255) = 732.12$]; TMT A [$F(3, 239) = 34.49$], TMT B [$F(3, 230) = 29.51$]; WCST errors [$F(3, 156) = 8.28$]; WCST perseverative errors [$F(3, 145) = 8.611$]; TOVA omission [$F(3, 43) = 9.05$]; and TOVA response time [$F(3, 42) = 12.92$].

Neuropsychological and behavioral differences between ADHD and ODD
Mohrland M, Mleko A, Gliko B, Conger C, Golden CJ

Neuropsychological functioning and disruptive behaviors are commonly associated with each other. In addition, the symptomatic clinical presentation of children with attention deficit hyperactivity

disorder (ADHD) and oppositional defiant disorder (ODD) are often similar. This study was conducted in order to help differentiate between ADHD and ODD on neuropsychological and psychological measures most frequently utilized by clinicians. Participants were 68 children (34 ADHD combined type and 35 ODD) referred for a neuropsychological evaluation that included the WISC-III, WRAML, TOVA, WCST, LNNB, Achenbach Behavior Checklist, and Conner's Behavior Checklist. The ADHD group was 8.9 years old (S.D. = 2.29), all male (100%), mostly right-handed (97.1%), and 55.9% White, 29.4% Black, and 14.7% Hispanic. The ODD group was 10.4 years (S.D. = 3.1), 85.3% male, 94.1% right-handed, 41.2% White, 29.4% Black, and 17.6% Hispanic. Scores were analyzed using a one-way ANCOVA, with age and gender as covariates. Significant differences were found at the $P < .05$ level for parental responses on the Conner's Behavior Checklist (learning problems (.003)), and the Achenbach Behavior Checklist indices of: activities (.005), school (.019), delinquent behavior (.023). No significant differences ($P < .05$) were found between the ADHD and ODD groups on intellectual, achievement, and the vast majority of neuropsychological measures. Results suggest that patterns of intelligence, achievement, working memory, attention, and learning are not indicators that differentiate between ADHD and ODD. However, parental ratings of these probands appear to be the most accurate diagnostic indicator to differentiate between ADHD and ODD.

Neurocognitive differences in attention-deficit/hyperactivity disorder in adults with and without reading disability

More S, Nussbaum N

The neurocognitive profiles of adults with attention-deficit/hyperactivity disorder (ADHD) and/or reading disability (RD) have not been well established. In the present study, ADHD adults ($n = 23$) and adults comorbid for ADHD and RD ($n = 31$) were compared on measures of working memory, visuospatial memory, attention, auditory processing, verbal fluency, and reading. Given the paucity of research in this area, an alpha level of .10 was set. The resulting multivariate analysis revealed significant overall group differences in neuropsychological functioning ($P = .001$). Univariate follow-up tests indicated that the ADHD adults had significantly lower visuospatial immediate ($P = .083$) and delayed memory skills ($P = .056$) on the Rey–Osterrieth Complex Figure Design than the ADHD/RD group. The ADHD/RD performed significantly lower in reading comprehension ($P = .001$) and rate ($P = .0001$) on the Nelson–Denny Reading Test. No significant differences were observed between groups on the measures of attention, verbal fluency, auditory processing, and working memory. These results suggest neurocognitive similarities and differences between adults with ADHD alone and combined ADHD/RD.

Neuropsychological profile of a 7-year-old boy with right frontal schizencephaly: suggested support for Barkely's (1997) unifying theory of ADHD

Mueller K

Barkley's (1997) unifying theory of ADHD posits four executive functions as the underpinning of effective inhibition, the core deficit in individuals having ADHD and implicates the right frontal cortex as the neuroanatomical substrate. This 7-year-old boy with right frontal closed-lip schizencephaly with associated heterotopia (as well as agenesis of the corpus callosum) presents with a neurobehavioral phenotype which closely matches that predicted by this theory, with deficits suggested to varying degrees in each of the four defined constructs. This child had additionally been previously evaluated and judged

by a qualified independent provider to meet DSM-IV diagnostic criteria for ADHD, combined type. Neurobehavioral and neurocognitive data will be presented and discussed within the framework of Barkley's (1997) model. In addition, results and implications of a failed double-blind trial of Adderall are summarized.

Parents' experience of beneficial school environments for children diagnosed with attention-deficit hyperactivity disorder: a concept map

Newpol SK, DeFilippis NA, Dsurney J

The study of children with attention-deficit hyperactivity disorder (ADHD) in school settings has tended toward analyses of more unimodal issues (e.g., whether behavioral interventions increase attentiveness). In addition, when parental data was obtained it tended to narrowly concern symptom ratings or checklists aimed at diagnosis. Parents whose school-age children were diagnosed with ADHD ($N = 26$) responded to the phenomenological question "What it was or is currently like to have a helpful teacher and/or classroom experience for your child with ADHD?" These responses were qualitatively reduced to 44 statements and returned to parents with instructions to (a) rate statements according to how well they matched parents' experiences and (b) sort statements according to which ones went together. Multidimensional scaling and cluster analysis produced a concept map, which indicated that parents placed highest importance on interpersonal processes versus higher implementation-cost school interventions and equipment. As school systems are striving to be more cost efficient and competitive, five recommendations were made: (1) expensive training and equipment may not be necessary, as interpersonal processes may be a matter of fit. (2) Identifying existing teachers with the identified interpersonal compatibility characteristics to teach ADHD students may be best. (3) The administration's characteristics related to ADHD issues should be optimal before implementing teacher level changes. (4) A focus on parents may be necessary for success in recruiting ADHD children and teaching them. (5) When teacher training is planned, it should include development of empathy, listening, and communication skills as they relate to parents.

Relation among attention and learning variables in ADHD

Richardson JA, Fortson BL, Boone ML

Attention-deficit/hyperactivity disorder (ADHD) is a common developmental disorder that affects approximately 3–5% of children. It is widely accepted that ADHD can have a negative impact on a child's ability in school; thus, it is important to assess its impact on specific learning variables. The California Verbal Learning Test (CVLT) was developed to allow the clinician to examine the learning and memory process using well-documented principles from cognitive science to quantify multiple components of learning and memory. The present study examined the relation among known measures of attention and concentration (Gordon diagnostic system, GDS; Stroop Color-Word Test, SCWT; Knox cube test, KCT; WISC-III) and learning variables on the CVLT-C. Participants were 89 patients (mean IQ = 94, mean age = 11) referred to our clinic for the assessment of ADHD by pediatric medical specialists. As part of a larger battery, patients were administered the CVLT-C, SCWT, GDS, KCT, and WISC-III. Bivariate correlations were conducted using various measures from each test. Results demonstrated several significant and clinically meaningful relations among variables of attention and learning/memory. These results suggest that attention factors play a role in learning and memory and that measures of learning and memory are important in the assessment of ADHD. Using the CVLT also

could assist the clinician in making data-based recommendations and in maximizing a child's academic performance.

Greater delay in language development in focal lesioned children with left temporal lobe involvement

Seibert L, Reilly J, Jeffries R, Thal D

While language deficits are known to follow left hemisphere lesions far more often than right in brain damaged adults, consistent differences have not been found according to side of lesion in the language skills of children with focal lesions (FL) acquired pre- or perinatally. Parent report studies have suggested that FL children specifically with left temporal lobe involvement experience more persistent delays in vocabulary production and grammatical development. This study attempted to explicate these previous findings by examining the spontaneous language use of FL children at 24-, 30-, and 36-months of age. Thirty FL children and 22 typically developing children (TD) contributed data to one, two, or all three of these samples. Language corpora were analyzed using the index of productive syntax and measures of mean length of utterance (in morphemes) and number of word types. Contrary to expectations, children with (+LTL) and without (−LTL) left temporal damage showed comparable delays relative to TD children in vocabulary development over the 24- to 36-month age range. However, +LTL children showed significant delay relative to TD controls by 30 months of age on both measures of grammatical development, whereas −LTL children did not fall significantly behind on these measures until 36 months of age. These findings, in conjunction with those previously reported (Bates et al., 1997), suggest children with early damage involving the left temporal lobe are at risk for more severe deficits in grammar acquisition than children with focal lesions sparing this region.

Cognitive processing and achievement in children with ADHD: implications for subtype classification

Sujansky R

This study explored relationships between various psychoeducational measures and determined their contribution to subtype identification. Selected clusters of the Woodcock Johnson III (Woodcock, McGrew, & Mather, 2001) were administered to 82 children who were diagnosed with ADHD based on the DSM-IV. The sample included 42 subjects classified as inattentive (IA), 9 as hyperactive-impulsive (HI), and 31 as combined type (C). Subjects were administered the visual–spatial thinking, auditory processing, processing speed, and short-term memory clusters, while achievement measures included broad reading, broad mathematics, and broad written language. A relatively strong correlation was found between STM and BR ($r = .55$) and BM ($r = .60$) for the total sample. There was also a positive relationship between AP and BWL ($r = .45$), and between PS and BR ($r = .45$) and BM ($r = .42$). Discriminant function analysis achieved an overall hit rate of 76.8% in correctly classifying the subjects. The group error rates were 14.2% for IA, 0% for HI, and 41.9% for C. There was not a significant discriminant function, as only 22.5% of the variance was explained by this procedure. One-way ANOVA and the Scheffe' test revealed that the HI group had significantly better processing speed and short-term memory than the other subtypes ($P < .05$). The HI subjects also showed higher achievement in all areas than the C group, while differences between IA and C groups did not reach significance. Results were explained in terms of the overlapping symptoms that comprise the diagnostic criteria for ADHD.

Relationship between the WRAML and the TOVA

Thompson D, Kirsten A, Pospisil T, Miller S, Golden CJ

Attention and concentration have been identified as an important factor on the wide range assessment of memory and learning (WRAML), a popular measure of memory for children between the ages of 5 and 17. A correlational analysis of the WRAML with the test of variable attention was performed to examine the impact of visual versus auditory attention. Thirty-eight children referred for a neuropsychological evaluation between the ages of 6 and 13 with a mean of 4 years of education were examined. For the visual TOVA comparison, 68% of the clinical sample were Caucasian and 74% male while 79% were both Caucasian and male for the auditory comparison. Eight variables from each TOVA (visual and auditory) were correlated with four WRAML indices and nine subtests. On the visual TOVA, the omission errors were correlated with the Verbal Memory Index and Finger Windows at the .05 level and with sentence memory at the .01 level; anticipatory responses with picture memory at the .05 level; and D-Prime with the Verbal Memory Index and number/letter at the .05 level and with sentence memory at the .01 level. On the auditory TOVA, response time was correlated with six subtests and two indices at the .05 level and one index at the .01 level; RT variability with the Learning Index at the .01 level and with verbal learning at the .05 level; and anticipatory responses with picture memory at the .05 level. Further analysis of visual versus auditory attentional factors found on the WRAML is warranted.

Analysis of the relationship between diagnosed learning disabilities and performance on the WRAML

Thompson D, Marsh J, Greene L, Escalona A, Golden CJ

Research has been limited in relation to the wide range assesment of memory and learning (WRAML), focusing on questioning the factor structure and measured constructs. The relationship between children diagnosed with a learning disability and their performance on the WRAML indices has rarely been examined. Subjects were 116 children between the ages of 5 and 17 with an average of 4 years of education referred to the Mental Health Clinic at Nova Southeastern University for a neuropsychological evaluation. About 76% were male, 86% right-handed, 61% Caucasian, 25% African-American, and 11% Hispanic. Subjects were placed in one of four LD groups: reading, writing, aritmetic, and multiple areas (NOS). Those diagnosed with LD-NOS were found to be significantly different on the four WRAML indices and five of the nine subtests at the .01 level, except for the Learning Index which was significant at the .05 level. Subjects diagnosed with LD-reading or LD-writing were significantly different on three of the indices at the .05 level and with the General Memory Index at the .01 level. LD-reading subjects were also different on three subtests at the .01 level while those diagnosed with LD-writing were different on three subtests at the .05 level. The fewest relationships were found for those diagnosed with LD-math, which was found to differ from the other groups only on the visual learning subtest at the .001 level. The patterns of test results and the implications for use of the WRAML are discussed.

Memory patterns of learning disabled children

Valdes G, Escalona A, Golden Z, Mohrland M, Golden CJ

The relationship of learning disabilities and memory is a widely researched topic, but there are disagreements about the memory problems seen in each subtype. The present study compared the performance of different subtypes of learning disabilities on measures of visual and verbal memory, and learning ability. The performance of reading ($N = 33$), writing ($N = 18$), mathematics ($N = 8$), and NOS

learning-disabled ($N = 34$) children was compared on the wide range assessment of memory and learning utilizing the three major summary scores: verbal, visual, and learning indices. Only those individuals whose IQs were at least average were included. The groups were similar in composition with 71% of the overall population male. Average grade was 3.7 and average age was 9.2. clients were primarily Caucasian (71.1%), African-American (15.7%), and Hispanic (13%). It was hypothesized that mathematics- and NOS-disabled children would perform poorly on the visual and verbal subtests whereas writing- and reading-disabled children would perform poorly only on the verbal subtest. A series of ANOVAs indicated that the reading LD children performed significantly better on the visual memory subtest. The NOS-disabled children performed significantly better on the learning subtest. Contrary to expectations, no significant results were found for the math and writing LD group. The implications of this study are directly related to modifications in the educational system. These results can be used to enhance the performance of learning-disabled individuals by identifying and correcting problems with visual–spatial or verbal memory.

PEDIATRIC AND CHILD NEUROLOGICAL DISORDERS: SEIZURE DISORDERS AND TUMORS

Benign focal epilepsy—an oxymoron?

Cerrone P

Historically, and as its name implies, benign focal epilepsy in childhood has been considered to have minimal effects on cognition. The "benign" impact on cognition, however, has been challenged in recent years as more evidence of cognitive dysfunction has emerged in youngsters presenting with this type of epilepsy (Echenne, 2001). The following case involves an 8-year-old boy diagnosed with benign focal epilepsy who presented to our clinic due to chronic academic and behavioral problems. Repeated EEGs indicated bilateral centrotemporal spikes (left > right), but they could not be correlated clinically on EEG video. As such, his neurologist atributed his inattention and academic difficulties to a manifestation of ADHD. The child showed minimal gains on Ritalin. A year later, Tegretol was added and broad improvement in behavior and academics was noted. Our IQ testing results could be contrasted to IQ results obtained before the initiation of Tegretol. His WISC-III similarities and vocabulary scores improved dramatically, and his overall IQ improved by 12 points. Our neuropsychological testing results were highly significant for slowness in processing speed (extreme) and attention and language inefficiencies. The fact that his on-going attentional problems were accompanied by cognitive improvements with the initiation of Tegretol, mild residual language burden and extremely slow processing speed pointed toward an epileptic etiology to his on-going difficulties. This case highlights the importance of recognizing that what is medically termed benign focal epilepsy is not always cognitively benign.

Neuropsychological late effects in pediatric medulloblastoma

Goldfischer HM, Wagner BJ, Johnson A

Neuropsychological and adaptive functioning of 20–25 children and adolescents with medulloblastoma treated in the AFLAC Cancer Center at Children's Healthcare of Atlanta (CHOA) will be presented. The effects of treatment strategies including surgical resection, cranial irradiation, and adjuvant chemotherapy are considered. It is expected that along with the significant recent advances in the treatment of medulloblastoma, the expanse of neuropsychological late effects, while still prominent, has lessened somewhat compared to previous studies. Neuropsychological assessment data will be provided which utilizes the variables of age at diagnosis, and time since treatment. Specific neuropsychological

emphasis will be placed on memory and attention. This sample data will be compared to the current literature in an attempt to further develop a typical profile of children with this brain tumor. It is hopeful that this information will promote remediation and intervention strategies to reduce the incidence of neuropsychological late effects in pediatric patients with medulloblastoma.

Behavioral outcome in pediatric brain tumor survivors

Holmquist L, Scott J

Research has shown that children surviving cancer are at risk for long-term emotional and behavioral problems secondary to the cumulative effects of cranial irradiation and chemotherapy. The purpose of this study was to investigate the emotional and behavioral outcome of children diagnosed with brain tumor and treated with cranial irradiation and chemotherapy by looking at the association between treatment, time, age, and cognitive-related variables on externalizing and internalizing behaviors at 3 years posttreatment. Fifty-four brain tumor survivors we administered a neuropsychological test battery, while the parents filled out the Achenbach Child Behavioral Checklist (CBCL) and Conner's Parent Rating Scale. The results indicate that chemotherapy treatment with vincristine, cytoxan, cisplantinum, and/or bcnu was related to poorer internalizing and externalizing behavioral scores, especially attention, withdrawal, and anxious-depressive symptomatology. Age at time of diagnosis or treatment, time since discontinuation of treatment, type and/or total dose of radiation therapy was not significantly correlated with any of the behavioral outcome scales. Verbal memory and learning problems were associated with withdrawal; whereas, intellectual functioning and verbal fluency was related to disturbances in attention, inhibition, and social functioning. The findings suggest that children treated with certain types of chemotherapy agents who exhibit declines in intellectual functioning and memory are at increased risk for long-term behavioral problems 3 years after treatment. These findings support the importance for early psychotherapeutic and supportive intervention services immediately after treatment cessation, with the goal of circumventing these potentially debilitating emotional problems.

Neuropsychological performance associated with gabapentin in children with benign epilepsy with centrotemporal spikes (BECTS)

Freymuth A, Giordani B, Huffman J, Laughrin D, Sharma U, Trudeau V, Garofalo E

Benign childhood epilepsy with centrotemporal spikes (BECTS) is found in up to 25% of children with epilepsy. Although normal neurologic and psychometric findings are expected with BECTS, our group and others have suggested an elevated risk for difficulties in attention, visuomotor skills, and learning. Gabapentin is an anti-epileptic drug (AED) with minimal side effects and established good efficacy in partial seizures BECTS. The purpose of the present study was to characterize behavior and cognitive performance associated with gabapentin use in pediatric patients with BECTS. One hundred and eight children (mean age $= 8.3$, S.D. $= 2.3$) with BECTS completed a brief neuropsychological battery measuring verbal and visual learning, motor proficiency, attention, and behavior, both immediately, prior to, and 36 weeks following the treatment phase of a double-blind, placebo controlled study of gabapentin in which children received either placebo or gabapentin. Seizure diagnosis was characterized as undetermined, partial complex, partial secondarily generalized, or partial simple. Change scores were calculated for all neuropsychological variables and age was entered as a covariate in all analyses. Overall, there were no main effects for AED use on cognitive or behavioral measures. AED use by time interactions were found for the conduct and hyperactivity subscales of the Connors (both $P < .04$) and two test measures associated with attention ($P < .03$, $P < .05$). For each of these, however, the primary

findings were score improvements for placebo patients in the undetermined seizure group. Results suggest that gabapentin is cognitively well tolerated in this sample of children with BECTS.

Behavioral differences between seizure disordered and traumatically brain injured children/adolescents

Schneider M, Tanner S, Bockewitz L

This study examined clinically and statistically different behavioral patterns of children/adolescents with seizures and TBI using the Achenbach Child Behavior Checklist (CBCL) to measure problematic behaviors. Archival data analyses of 430 patient files, dated 1992–2001, from an out-patient Child/Adolescent Psychiatry Clinic and/or an inpatient Pediatric Rehabilitation Unit from a Level One Trauma Center at a major metropolitan medical center were reviewed. Sixty-seven children/adolescents (71.6% males, 28.4% females; mean age = 11.1 years) met inclusion criteria for a diagnosis of seizure disorder ($n = 18$) or TBI ($n = 49$) and a completed CBCL. Analysis revealed no significant differences between groups on the variables of intelligence, gender, age, or ethnicity. *T*-tests revealed that parents of children/adolescents with a seizure disorder reported significantly more overall problematic behaviors than parents of children/adolescents with TBI (CBCL total, $P = .021$). Additionally, the seizure group had significantly higher scores on acting out behaviors than the TBI group (externalizing, $P = .048$). The groups did not statistically differ on the internalizing scale ($P = .094$). Clinically elevated scores were obtained by the seizure group for total ($T = 68.94$), internalizing ($T = 64.94$), and externalizing ($T = 63.78$) scales. Surprisingly, the TBI group did not obtain any clinically significant scores across the measure. Several limitations of the study were noted; including lack of specificity of seizure type, severity/location of brain injury, small sample size, and lack of cross-informant verification of behaviors. Further research is needed to identify strategies to aid in treatment.

PEDIATRIC AND CHILD NEUROLOGICAL DISORDERS: OTHER DISORDERS

Temporal stability of the WISC-III in a juvenile psychiatric population

Bishop KL, DeFillipis N, Schlossberg A

WISC-III profiles from 42 children in a psychiatric population were examined to investigate the temporal stability and test–retest reliability of the measure, with the expectation that test scores in this population would be less stable over time than those of the standardization sample. As of this date there exists little information on this issue with the WISC-III. Mean test age at first testing was 11.3 years and 12.7 years at second testing. Archival data was collected from 32 male and 10 female subjects who were administered the WISC-III twice within 5 years (mean test–retest interval of 17.9 months). Statistical analyses included Pearson's *r* test–retest correlations, paired samples *t*-tests, confidence intervals (CIs), and descriptive statistics, including mean test scores, mean change scores, standard deviations, standard errors of measurement, standard errors of estimate, and standard errors of difference. Reliable change indices (RCIs) were calculated and presented as alternative/adjunctive measures that clinicians may use to examine test score changes over time. Results revealed test–retest correlation coefficients of .73, .76, and .71 for FSIQ, VIQ, and PIQ, respectively. Mean change scores were generally larger than those reported in the WISC-III manual, and CI and RCI values were markedly larger. Areas for further investigation, such as generalizability of results, measurement error possibilities, practice effects, various methods of calculating reliability indices, incorporation of collaborative data, and other related topics are explored.

Intelligence and Rorschach performance in a child neuropsychiatric population
Borosh B, Marsh J, Kirsten A, Fogle M, Golden CJ

The relationship between intelligence and performance on the Rorschach inkblot test has been largely demonstrated with the adult population. Relatively few studies have investigated how intelligence factors affect Rorschach performance in children and none have looked at neuropsychological populations. This study examined the extent to which intelligence is related to performance on the Rorschach using a child neuropsychological population. Intelligence of the child population was assessed using the Weschler Intelligence Scale for Children-Third Edition (WISC-III). The participants were 69 children who were referred for a comprehensive neuropsychological evaluation, which included the Rorschach and the WISC-III. The average age of the population was 10.28 years (S.D. = 3.18) and the average education was 4.68 years (S.D. = 2.9). The sample was predominantly male (70%) and right-handed (84%). Seventy-eight percent of the sample was Caucasian, 13% was African-American and/or Caribbean Black, 3% was Hispanic and 6% was from other ethnic backgrounds. Diagnostic groups included neuropsychiatric disorders (35%), neurological disorders (55%), with half of the neurological group also getting neuropsychiatric secondary diagnoses. All major Rorschach variables on the Exner summary sheet were compared to Full-Scale IQ (FSIQ) using partial correlations, controlling for the effects of age. Significant direct relationships ($P < .01$) existed between FSIQ and the following seven Rorschach variables: EB (0.51), EA (0.56), active movement (0.49), Zf (0.33), DQ+ (0.51), reflection responses (0.49), and COP (0.32). A significant inverse relationship existed between FSIQ and the λ index (−0.49).

Verbal and nonverbal fluency in 6–15-year-old Spanish-speaking children
Esmeralda M, Monica R, Alfredo A, Guadalupe M

The effect of age and education on verbal and nonverbal fluency tests is not completely understood. One hundred and eighty-two children (87 boys and 95 girls) aged 6–15 were selected in two Mexican cities (Guadalajara and Tijuana). Two verbal (semantic and phonemic) and two graphic (semantic and nonsemantic) fluency tests were included. Verbal semantic fluency increased 58% between the first and the last age range, whereas verbal phonemic fluency increased 101%, graphic semantic fluency 58%, and graphic nonsemantic fluency in 120%. Correlations among the four tests ranged between .35 and .45. Considering that age and education are co-variables current results may be due both to age and education. Mexican test scores are compared with other normative studies. It was concluded that in general our results are congruent with other normative studies carried out in other countries.

Analysis of the direct and indirect effects of prenatal cocaine exposure on 36-month developmental outcome
Eyler FD, Behnke M, Garvan CW, Wobie K, Hou W

Within a prospective, longitudinal design, we identified 154 pregnant women as prenatal cocaine users, matching them to 154 nonusers on socio-economic status, race, parity, and pregnancy risk. Drug use was determined using interviews and urine specimens. Interviewers collected inventories of psychosocial and family functioning and the quality of the caregiving environment at a 24-month home visit. For this study ($n = 226$), developmental outcome at 36 months (development) included the Mental and Psychomotor indices of the Bayley Scales, administered by evaluators blinded to drug exposures, and the four subsets of the Vineland Adaptive Behavior Scales, obtained by caregiver report. Potential perinatal predictors included in a regression model were birth head circumference (HC), adjusted for

gestation; amount of cocaine use; and a latent variable of other substance use, comprised of mean amount of alcohol and tobacco use during pregnancy. Measures of caregiver depression, self-esteem, and subtests of locus of control and parenting sense of competence were retained as factors contributing to the latent caregiver psychosocial variable; five of the six subscales of the HOME scale were retained for the latent environmental variable. In the resulting structural equation model, the environmental variable significantly predicted to development (0.32). Cocaine significantly predicted birth HC which in turn was significantly predictive of development (0.14). In summary, birth HC and environmental factors predicted 36-month outcome ($r^2 = .17$); cocaine had an indirect effect through its significant relationship to HC at birth.

Comparison of the neuropsychological performance of HIV+ adolescents and controls
Haynes J, Mucenic MC, Burns K, Starratt C, Burns W, Widmayer S

The purpose of this study was to document the performance deficits of two groups of adolescents on a neuropsychological battery: (1) HIV-positive adolescents (ages 16 through 19) and (2) HIV-negative adolescents (16–19 years) matched with Group 1 for years of education, socio-economic status and ethnicity. The test performance of the two groups was compared, and the performance of both groups was compared to the normative data for each measure. Thirteen asymptomatic HIV seropositive adolescents (five with CD4 count $>$ 500, and eight with CD4 count 200–499) and 22 SES and ethnicity matched control adolescents were administered measures of intellectual and memory function, executive function, fine motor coordination, and depression. Both the HIV-positive and the matched control adolescents were found to have test scores significantly below that of the norm group samples for subtests of vocabulary, block design, verbal paired associates I and II, visual reproduction II and grooved pegboard dominant hand. However, HIV-positive and matched control adolescents differed from each other only on aphasia screening and depression rating. The HIV-positive adolescents had significantly more errors on aphasia screening and reported significantly more depression. These results provide evidence for the need for matched controls when evaluating adolescents positive for HIV. It calls into question the conclusions of previous studies that have been reported in the literature on neuropsychological findings with HIV-positive adolescents which have not used appropriately matched control groups.

Cognitive development following focal postnatal stroke: evidence for preserved language functioning at the expense of other cognitive skills
Holmquist L, Hartman VL, Scott J

Development of lateralized cognitive functions has been of considerable interest to neuropsychologists for decades. Broca, Wernicke, and others provided invaluable information to current understanding of the relationship between language functioning and brain laterality. Two theoretical positions dominate contemporary thought on the ontogeny of lateralized functioning—acquired/developmental versus innate. Research has argued whether lateralization of cerebral development in infants (birth–2 years) is genetically predetermined or if either hemisphere has an equal potential for serving as the substrate for language functioning if injury occurs before 2 years of age. Case studies of right-handed children diagnosed with left-hemisphere stroke within days after birth and their neuropsychological profiles will be presented. The cases illustrate the preservation of language skills (e.g., memory, fluency, academic, and expressive/receptive language) at the expense of visual–spatial processing skills. The results are intriguing, and provide further evidence and support of the role of neural plasticity early in life, in addition the preservation of skills with a dominant predisposition for development and the impact of

such development on other areas of cognitive functioning. Also discussed will be the medical factors affecting the outcome 8 years postinjury.

Neuropsychological assessment of a young man diagnosed with Sotos syndrome
House AE, Casper EA, Nieminski KK, Padilla MA, Pierson EE, Watson AE

Sotos syndrome (cerebral gigantism) was first described in the medical literature in 1964 and is characterized by accelerated growth during early development. Individuals with Sotos are at risk for a number of medical, psychiatric, and cognitive difficulties; but many basic questions remain regarding the how these risks are mediated as well as the fundamental etiology of Sotos syndrome. The present paper presents the case study of an 18-year-old male diagnosed with Sotos syndrome. This young man agreed to participate in an extended evaluation of his neuropsychological, emotional, and social adjustment and functioning. Special attention was given to assessing the relative level of verbal versus visual–spatial abilities, and the contribution of perceptual and motor factors to the nonverbal difficulties often noted in this population. Both formal and informal measures of executive functioning were collected in order to seek a better understanding of how cognitive processing difficulties might contribute to the interpersonal and psychiatric problems associated with Sotos syndrome.

Transcranial Doppler ultrasonography and behavioral functioning in children with sickle cell diseease
Kral MC, Brown RT

The relationship between cerebral blood flow velocity, as measured by transcranial Doppler (TCD) ultrasonography, and behavioral functioning was examined for a sample of 62 children with sickle cell anemia (HbSS) who had no documented history of stroke. Following the criteria established by the NIH stroke prevention trial in sickle cell anemia (STOP; Adams et al., 1997, 1998), children were classified asnormal if the time-averaged mean TCD velocity (V_{mean}) was less than 170 cm/s; conditional if the TCD V_{mean} was between 170 and 200 cm/s; and abnormal if the TCD V_{mean} exceeded 200 cm/s. The behavioral functioning of the TCD diagnostic groups was compared for parent and teacher ratings of broad-band child behavior problems (BASC) and narrow-band executive functioning (BRIEF). Results of one-way ANCOVAs did not reveal significant effects for composite scores on either the parent or teacher BASC. However, significant group differences were obtained on the BRIEF. Specifically, parents reported greater difficulty with behavioral regulation for children in the abnormal group, as compared to children in the normal and conditional groups (Parent BRIEF Inhibit Scale) [$F(2, 54) = 3.32$, $P < .05$]; Emotional Control Scale [$F(2, 54) = 7.33$, $P < .01$]; and Shift Scale [$F(2, 54) = 3.12$, $P = .053$]. In addition, teachers reported greater difficulty with metacognitive skills for children in the abnormal group, as compared to children in the normal and conditional groups (Teacher BRIEF Working Memory Scale) [$F(2, 55) = 3.08$, $P = .054$]; Plan/Organize scale [$F(2, 55) = 3.02$, $P = .057$]; Monitor Scale [$F(2, 55) = 4.42$, $P < .05$]. Findings support the hypothesis that behaviors subserved by the frontal lobes appear to be the most useful indices of progressive cerebrovasculopathy in children with HbSS disease.

Predictors of infant neurodevelopment: apgar scores and length of hospitalization
Most ML, Natale ML, Valdes JC, Burns WJ

Infants born preterm are often susceptible to a variety of physical and cognitive deficiencies. The aim of the present study was to investigate the role of birth weight, gestational age, apgar scores, and

hospitalization length on the neurodevelopment of infants born prematurely. Cognitive abilities as measured by the Mullen scales of early learning (AGS edition) were studied. A sample of 72 infants delivered between 24 and 36 weeks gestation, were categorized as appropriate birth weight for gestational age (AGA) or small birth weight for gestational age (SGA). All infants were administered the following indices of the Mullen scales of early learning: gross motor, visual reception, fine motor, receptive language, and expressive language. An overall Early Learning Composite Score comprised the average of these indices, excluding the Gross Motor Index. Although there were no significant differences between AGA and SGA scores on the Mullen scales, the Early Learning Composite Scores were found to be significantly related to agpar score at 5 min ($r = .35$, $P < .02$). Neurodevelopmental progress was poorer for infants who were born with lower apgar scores. This thereby indicates the short-term medical impact of their perinatal problem. Neurodevelopmental delay as measured by the early learning composite, was also found to be related to a longer need for neonatal intensive care unit stays ($r = -.27$, $P < .03$), indicating a long-term impact of these medical problems. In both short- and long-term correlations the Mullen accurately characterized the deficits expected with such risk factors.

Mental rotation processes in mathematically gifted boys: an fMRI investigation
O'Boyle M, Vaughn D, Cunnington R, Puce A, Syngeniotis A, Egan G

Current research suggests that the brain of mathematically gifted adolescents is qualitatively different from adolescents of average math ability. Specifically, accelerated development and increased processing reliance upon the right hemisphere, as well as enhanced interhemispheric interaction (perhaps via the corpus callosum) may be unique functional characteristics of the math gifted brain (O'Boyle et al., 1995). In this study we used 3-T fMRI to examine the underlying neural circuitry of math gifted boys engaged in mental rotation, a spatial capacity known to positively correlate with exceptional mathematical ability (Benbow, 1988). Participants consisted of six healthy male adolescents (11–15 years) whose standardized mathematical ability scores (SCAT-MATH) placed them at the 99th percentile. Three right-handed and three left-handed participants viewed 18 individual rotation trials, consisting of a single target stimulus above four test stimuli, each presented for 10 s (ISI = 1 s). Participants selected the test stimulus that matched the target by pressing one of four fibre-optic buttons (two buttons for each hand, spatially compatible with the position of the four test stimuli). The control task consisted of the same procedure but used visual scrambles of the rotation stimuli that were identical in spatial frequency, luminance and contrast, but had no identifiable shape. The results indicate that mathematically gifted male adolescents recruit areas in both hemispheres when performing mental rotation (particularly the right intraparietal sulcus, along with bilateral activation of premotor cortex) but also engage regions not typically found in previous mental rotation studies, namely the anterior cingulate and caudate nucleus.

Correlational analysis of the Rorschach and TOVA visual in a school-age population
Proctor-Weber Z, Pospisil T, Escalona A, Valdes G, Golden CJ

The purpose of this study was to investigate the relationship between a continuous performance measure and the Rorschach inkblot test in recognizing and diagnosing attentional deficits in children. One hundred and eleven children with neurological or psychiatric diagnoses were administered both tests as part of a comprehensive neuropsychological battery. The average age of the participants was 10.4 years (S.D. = 3.15). The sample was 76.6% Caucasian, 13.5% African-American and/or Caribbean Black, and 4.5% Hispanic. It was expected that children with attention and impulse problems would perform equally poor on a test designed to measure overt traits of attention and impulsivity, as well as on one

designed to get at fundamental, underlying problems that effect cognitive perception and processing. Previous research has found that Rorschach variables W:M, *X*%, *D*, Adj.-*D* and sumM:WsumC are related to the ability to attend and control impulses. The TOVA variables, total response time, response time, D', commission errors, omission errors and ADHD Score were used for the analyses. A significant relationship was found between *X*% and TOVA total RT ($r = .553$), RTV ($r = .692$) and D' ($r = -.623$) indicating that perceptual inaccuracy and mediational distortion may be related to problems that cause attentional deficits. The adjusted *D* score was found to be significantly related to TOVA commission errors ($r = -.502$) indicating a child's ability to maintain control under stress may be related to problems of impulsivity and disinhibition. Clinical implications include the convenience of Rorschach cards, to assess for ADHD, when testing in a setting without computer availability.

Differences among data sources in the measurement of children's executive functioning
Silver CH, MacDonald KB, Lane SE, Kulesza KL

Children's executive functioning (EF) is receiving well-deserved attention at the present time. Standardized tests such as the Wisconsin Card Sorting Test are being used to measure EF, but little has been done with respect to collateral information obtained from observation in the natural environment. The Children's Executive Functions Scale (CEFS), developed as a parent-report measure of EF in the natural environment, is attempting to fill that need. This study gathered data from parents and teachers who completed the CEFS. The participants were 19 children with attentional deficits, ages 7–13. IQs ranged from 91 to 130 (mean = 107), and performance on the Wisconsin (perseverative error *T*-score) ranged from 23 to 80 (mean = 55). The correlation between this Wisconsin score and total problem score on the parent CEFS was not significant ($r = .02$), nor was it significant for the teacher CEFS ($r = -.18$). For the 17 participants for whom both parents and teacher CEFS were completed, however, a moderate degree of relationship between the two respondents was obtained ($r = .55$, $P = .02$). A significant difference between respondents' ratings was obtained [$t(16) = 2.36$, $P = .03$], with teachers' ratings generally lower than parents' ratings. These findings suggest that test performance and observational methods may reveal different aspects of EF. These findings further suggest a need to investigate measurement of children's EF using multiple sources of information.

Neuropathogenic birth factors and severe to profound mental retardation with and without autism
Soper HV, Gaier DJ, McWhorder N

To investigate potential neuropathogenic factors prior to or during pregnancy or at birth associated with severe to profound mental retardation either with or without autism, birth questionnaires were sent to the parents of residents of a state hospital and developmental center. The questionnaires were based on the work of Hobel et al., and scored by their criteria. We received questionnaires on 66 probands with autism and 89 without. In addition we collected the same data on 69 people from a sample of otherwise healthy college students or professionals. We asked about 48 factors, 13 prior to pregnancy, 11 during pregnancy, and 24 at birth. Based on clinical observations and our prior research, we expected those with autism to have normal scores prior to and during pregnancy, but distinctly higher at birth. Those without autism were expected to have higher scores for prior to and during pregnancy. In fact, the parents of those with autism reported slightly higher (but not significantly different) scores prior to pregnancy than either group. There was effectively no difference in the during-pregnancy scores for either group with mental retardation. However, those with only retardation, but not those with autism, had significantly higher natal scores. Both mental retardation groups showed significantly elevated rates of maternal

emotional problems during pregnancy, but only the autism group also showed a significantly elevated rate ofviral infection during pregnancy. The results are discussed in terms of uterine stress breaking down the blood brain barrier.

Can the national health and nutrition survey III (NHANES-III) data help resolve the controversy over low blood lead levels and neuropsychological development in children?
Stone B, Reynolds CR

The NHANES-III was designed to provide national estimates of the health and nutritional status of the United States population age 2 months and above. A Youth data subset includes individuals from ages 2 months to 16 years totaling 13,944 individuals. Lanphear, Dietrich, Auinger, and Cox (2000) examined these data and concluded that deficits in cognitive and academic skills associated with lead exposure occur at blood lead concentrations of less than 5 μg/dl. Attempts to replicate and extend these findings reveal serious shortcomings in the NHANES-III data that center around missing data values, odd distributions of blood lead levels as well as cognitive and academic scores, and potential inaccuracies in the data collection itself. A review of these issues is presented along with a series of empirical analyses of the data under multiple sets of assumptions leading to the conclusion that the NHANES-III data are inherently inadequate for use in addressing this issue (and possibly others).

Long-term effects of prenatal cocaine exposure on children's attention and reading abilities
Warner T, Eyler FD, Behnke M, Fennell E, Dede D

With the crack cocaine epidemic of the 1980s, including use among expectant mothers, came warnings from the media about the potential dangers and costs to society of crack babies. Research on the neurodevelopmental effects of prenatal cocaine exposure (PCE) have failed to find many significant differences between children with PCE and appropriate comparison groups. One of the few effects found with some consistency is in the area of attention as measured by infant habituation paradigms (Harvey & Kosofsky, 1998; Lewis & Bendersky, 1995; Mayes & Bornstein, 1997). However, most studies on the effects of PCE have not followed the children into the school-age years, and one of the few studies to do so did not find significant effects (Delaney-Black et al., 1998). The aim of this study is to investigate: (1) whether attentional differences found between a group of neonates with and without PCE continue into early and middle childhood and (2) whether these attentional differences are related to reading ability at age 7. It is hypothesized that significant differences will be found between the exposed and nonexposed groups on measures of attention and that these measures will be related to reading performance after controlling for IQ, the home environment, and phonological awareness skills. Participants ($N = 260$) will be drawn from a National Institute of Drug Abuse-funded longitudinal study. Descriptive and correlational data will be presented along with clinical implications for assessing children with PCE.

PSYCHIATRIC AND MOOD DISORDERS

The effects of depression on neuropsychological test performance
Brown LJ, Letsch EJ, Vanderploeg RJ

Despite extensive research investigating the impact of depression on cognitive functioning, controversy remains as to whether depression results in deficits in specific cognitive domains or impairment in global

performance. This study examined the neuropsychological test performance of depressed Vietnam era veterans to ascertain the extent and the nature of cognitive impairment within this group. The current studies utilized a nonreferred, community-dwelling sample of 4,462 male veterans who received medical, psychological and neuropsychological evaluations as part of the Vietnam experience study. Language, visual and verbal memory, visual–spatial and constructional abilities, attention, speed and coordination, and executive functioning were assessed. IQ was measured at military enlistment and for the study. MANOVAs assessed the relationship of depression to cognitive performance in two samples utilizing different inclusion criteria for depression compared to demographically matched control groups. Participants with depression, as measured by MMPI Scale 2 elevations over *T*-scores of 70 ($n = 97$), demonstrated deficits on tests of attention, memory, and verbal fluency compared to a control group without MMPI elevations ($n = 200$). There was no difference in the cognitive performance of participants with depression, as determined by DSM-III diagnostic criteria paired with elevations on at least Scale 2 ($n = 136$) compared to a control group without a diagnosis of depression ($n = 197$). In both studies the interaction between time and depression was significant in that the depressed groups' IQ declined on repeat testing compared to controls. Depression affects performance in specific cognitive domains as well as intellectual functioning over time. Potential reasons for the different findings in the two studies are discussed.

Review and meta-analysis of neuropsychological findings in PTSD

Dearth CM, Rinaldo JC, Berry DT, Schmitt FA

We present a comprehensive review of neuropsychological findings in PTSD data published in peer-reviewed psychological and medical journals. Data published since 1989 suggest that persons with PTSD demonstrate average intellectual abilities, verbal comprehension and reasoning, and visual–spatial performance. Relative to control samples, persons with PTSD frequently display decreased working memory, complex attention processes, olfactory discrimination, verbal learning, and memory. Although these performances are lower than controls, persons with PTSD typically perform within the average range for these cognitive areas. Meta-analysis of neuropsychological performances among PTSD and control participants in combat veteran samples reveals small to medium effect sizes for PTSD symptoms on cognitive functioning, with largest effect sizes obtained for working memory and verbal memory tasks. As most neuropsychological studies of PTSD focus on combat or POW samples, it is unclear whether relative deficits generalize to other PTSD populations, such as sexual abuse survivors. In many cases, failure to exclude patients with previous neurological injury and previous or current substance use confounds inferences of decreased cognitive functioning based on PTSD symptoms alone. Additionally, few studies administer a test of effort/motivation as an exclusion criterion, despite the possibility of poor motivation in clinical referral streams.

Quantitative electroencephalographic assessment of an individual with comorbid depression and panic attacks

Foster PS, Harrison DW

Considerable research has indicated that anxiety is often associated with dysfunction within the frontal lobes. However, inconsistencies have emerged concerning whether the cerebral dysfunction is characterized by increased left frontal or right frontal activation. Whereas some have found increased left frontal lobe activation with anxiety (Tucker, 1981), others have reported that anxiety is associated with increased right hemisphere activation (Reiman et al., 1984) and lesions within the left frontal lobe

(Heilman & Valenstein, 1993). Heller (1993) has proposed that different patterns of cerebral activation may be associated with anxiety characterized by panic as opposed to excessive worry. Specifically, in contrast to excessive worry, anxiety characterized by panic may be associated with increased right hemisphere activation. The present research presents the case of a 20-year-old, right-handed, female who was referred for a neuropsychological evaluation due to experiencing depression and recurrent episodes of panic attacks that occasionally result in loss of consciousness. The results of standardized testing and syndrome analysis led to the a priori hypothesis of left frontal lobe dysfunction. This a priori hypothesis was subsequently tested using quantitative electroencephalography (QEEG). The results of the QEEG confirmed the a priori hypothesis in that decreased magnitude values across all bandwidths measured (high delta, theta, alpha, beta) were noted in the left frontal and central regions, as compared to the homologous regions. Thus, the present findings support the hypothesis of increased right hemisphere activity and left frontal lobe dysfunction in individuals with anxiety disorders.

Neuropsychological assessment of adults with depression and anxiety

George C, Pizzitola K, Siekierski B, Riccio C, Davis B

Depression and anxiety are frequent complaints of individuals referred for neuropsychological evaluations. Given that these disorders are believed to have links to neurotransmitters in the brain, it would seem likely that neuropsychological evaluations would provided additional information for treatment and case conceptualization. Therefore, to better understand depression and anxiety neuropsychological testing may be warranted. In this presentation, findings will be presented from a research study of consecutive referrals to a community-based assessment clinic. Participants were adults between the ages of 18–35 of mixed race and gender. Participants were administered a comprehensive assessment battery which included neuropsychological, intellectual, academic, and emotional/behavioral measures. To analyze the results, participants were placed into six groups based on diagnosis. The diagnostic groups included depression, AD/HD with depression, depression with anxiety, anxiety, AD/HD with anxiety, and no diagnosis. Based on diagnostic category, participants' assessment results were compared. Results demonstrated that emotional/behavioral measures were the best predictor of diagnosis. Although neuropsychological measures did not serve as an accurate predictor of depression or anxiety in the participants sampled, they were felt to provide additional information that may be helpful in choosing treatment methods.

Verbal learning and memory in pediatric bipolar disorder

Giuliano AJ, Garroway J, Stein N, DeJong S, Beiderman J, Frazier J

Despite the morbidity associated with bipolar disorder (BPD), few studies have investigated the nature of cognitive impairment in BPD. The purpose of this study was to contribute to an emerging understanding of cognition in pediatric BPD. The CVLT-C performance of 59 children (37 bipolar; 22 control) with a mean age of 10.62 (S.D. $= 2.89$) was compared. The groups were statistically equivalent in age and education; however, the control group had a significantly higher WISC-III verbal IQ and freedom from Distractibility Index (FDI). Significant findings using ANCOVA, with VIQ as the covariate, revealed that the groups performed comparably on the first learning trial, but the BPD group showed reduced total learning, recall consistency, List B recall, and semantic learning strategies ($P < .01$). Trends suggested that BPD children produced more perseverative responses and intrusions ($P < .10$). Savings score rates between groups were statistically equivalent. Findings were comparable when FDI was used as a covariate and when gender was included in a factorial ANCOVA. The BPD group's total

learning score was one-half S.D. below the score for the age-appropriate normative group (mean = 45.18, S.D. = 13.03). These findings suggest that pediatric BPD is associated with verbal learning and memory deficits, and the pattern of deficits appears, in large part, due to executive dysfunction (i.e., deficits in organizational/strategic encoding, working memory, sustaining a learning and retrieval plan, and mental control). These findings also highlight the need for metacognitive educational approaches to address learning difficulties associated with cognitive impairment in pediatric BPD.

The effect of anxiety and depression on neuropsychological functioning

Schoenberg MR, Duff K, Adams RL, Beatty WW, Scott JG

While the impact of depression on neuropsychological functioning has received considerable research attention, the role of anxiety on neuropsychological functioning has received less interest (but see Beatty et al., in press; Gibbs et al., 1991; Kizilbash et al., 2001; Ryder et al., 2001; Unkenstein & Bowden, 1991; Wiens et al., 1988). The present study investigated the effects of anxiety and depression on neuropsychological functioning in a mixed clinical sample of 157 patients. Participants were categorized into four groups (high anxiety/high depression, high anxiety/low depression, low anxiety/high depression, and low anxiety/low depression) based on their scores on self-report anxiety (STAI) and depression (BDI) tests. Subjects were compared on measures of attention (Trials A, WAIS-R Arithmetic and Digit Span subtests, WMS-R Attention/Concentration Index), memory (RAVLT 30-min delay, WMS-R General Memory and Delayed Memory indices), and sequencing/mental flexibility (Trials B, COWAT). Results yielded no significant main effects for anxiety or depression on neuropsychological functioning but there was a significant interaction effect ($P < .05$) for anxiety with depression in which high anxiety adversely affected attention (Trials B, COWAT) performances when patients' self-reported high levels of depression. Given the negative effects of anxiety on attention and mental flexibility, clinicians are advised to routinely assess and consider anxiety when interpreting test performances.

The relationship of MMPI-II anxiety and defensiveness to neuropsychological test performance and medication use

Temple RO, Taylor RM, Horner MD

Recent literature has suggested an adverse effect of anxiety on cognitive functioning. Pilot data show that high-anxious high-defensive individuals may have poorer control of their anxiety than high-anxious low-defensive individuals. It follows that these individuals may be more likely to have a prescription for anxiolytic or other psychotropic medication. The purpose of this study was to further delineate the effects of anxiety and defensiveness on neuropsychological test performance and psychotropic medication use. Participants were 143 US veterans referred for neuropsychological evaluation, who also completed an MMPI-II. Four groups were established based on median splits on scales 7 and L of the MMPI-II, approximations of anxiety and defensiveness, respectively. These four groups were low-anxious low-defensive, low-anxious high-defensive (repressors), high-anxious low-defensive, and high-anxious high-defensive. Groups were compared on the Wisconsin Card Sorting Test, California Verbal Learning Test, Controlled Oral Word Association, and Trail-Making Test. Anxiety and defensiveness were unrelated to cognitive performance. High-anxious high-defensive individuals were more likely than high-anxious low-defensive individuals to have a prescription for anxiolytic and narcotic medications. There was also a trend toward low-anxious low-defensive participants being more likely to be prescribed anxiolytics than low-anxious high-defensive (repressor) participants. High-anxious individuals were more likely to have an antidepressant prescription than low-anxious individuals. Thus,

defensiveness appears to attenuate the experience of anxiety in individuals who are low, but not high, in self-reported anxiety. In this sample, cognitive performance did not appear to be influenced by these personality variables.

An examination of executive function in major depressive disorder—a role in recovery?
Withall A, Harris L, Cumming S

We attempted to delineate the executive functions affected by major depressive disorder. One of the criteria for a depressive episode is a diminished ability to think or concentrate, or indecisiveness, nearly every day (DSM-IV, 1994). Patients report these symptoms as frustrating and disheartening and evidence suggests their problems persist postdischarge, making a successful return to employment difficult. Executive function is important for daily life and both neuropsychological and neuroimaging studies support deficits in depression. Previous studies however have not extensively tested the individual domains of executive function affected in depressed patients. A comprehensive psychiatric (HRSD-21, Depression Anxiety Stress Scale, Frontal Lobe Personality Scale) and neuropsychological assessment (NART, reaction time, digit span, CVLT, COWAT, WCST, Stroop, WISC-III mazes, prospective and source memory, six elements test) was administered at admission, discharge and 3-month follow-up to patients and age, sex and IQ-matched controls. Thirty-five patients were recruited from The Royal North Shore Hospital and Northside Clinic, Australia, aged 20–60 years, and with a primary diagnosis of major depressive disorder. Preliminary analyses show patients perform similarly to controls on structured tests, however the six elements test which requires patients to organize, monitor and review their performance shows significant deficits associated with depression. These deficits remain present at follow-up, as do significant levels of depressive symptoms. We conclude that it is necessary to monitor patients' recovery on a long-term basis since depression may not remit and persistent executive deficits may be the best predictor of the ability to return to work for depressed patients.

SUBSTANCE ABUSE

Verbal fluency in alcohol abusers and in concurrent
Ambler C, Williams V, Motipara S, Wisniewski A

Chronic alcohol abuse is associated with cognitive deficits on neuropsychological testing including reduced verbal fluency (Dao-Castellana, 1998). Eckardt et al. (1998) speculated that impairments detected on neuropsychological measures vary on a continuum, depending on severity and duration of abuse, and that neuropsychological deficits could be observed only if the chronicity of alcohol abuse equals or exceeds 10 years. Conversely, Beatty et al. (2000) utilized measures of verbal fluency and found no statistical differences between those who abused alcohol for 4–9 years and those who abused for 10 or more years. Additionally, research suggests that concurrent abuse of alcohol and drugs is potentially more toxic and potent than either substance alone (McCance-Katz et al., 1998). Few studies have systematically investigated the combined effects of concurrent substance abuse on neurobehavioral performance (Bolla et al., 2000). The purpose of this study was to compare the verbal fluency of: (1) those who only abused alcohol for 4–9 years to those who abused alcohol for >10 years, and (2) those who abused alcohol and drug(s) for 4–9 years to those who abused both for >10 years. Participants from an inpatient chemical dependency program ($n = 50$) completed measures of verbal fluency (COWAT). Results indicated that those who abused alcohol for 4–9 years did not differ on COWAT scores from those who abused for >10 years. Additionally, those with both alcohol and

drug abuse for 4–9 years did not differ on COWAT scores from those with >10 years of concurrent abuse.

Trail Making Test and malingering among substance abusers
Horton AM, Roberts C

Trail Making Test (TMT) is often used for screening for cognitive impairment with substance-abusers. A possible limitation of the TMT in clinical settings is that substance abusers may malinger and give poor effort. In this study previously validated cutting scores for malingering are applied to a sample of 7,689 substance abusers (primary drug of abuse number of subjects: alcohol 1,000, marijuana 259, hallucinogen 128, cocaine/crack 4,306, heroin 1,548, narcotics/other opiates 191, sedatives 72, amphetamines 185) in drug abuse treatment programs. A mixed race sample was drawn from electronic files of data from the drug abuse treatment outcome study (DATOS). The DATOS was a naturalistic, prospective cohort study that collected data from 1991 to 1993 in 96 programs in 11 cities in the United States. Data were to determine number of substance abusers that fell beyond the preset malingering cutting scores on the TMT in this very large sample of substance abusing patients in treatment settings. The TMT variables of seconds to complete Part A, Part B and the ratio score of Part B divided by Part A (B/A) ranged from no subjects beyond the preset cutting score for Part B to 2.28% (175 of 7,689 subjects) for Part A to 9.74% (749 of 7,689 subjects) for the ratio score. Most substance abusers fell within preset cutting score ranges suggesting their scores are valid.

Derived Trail Making Test indices in a sample of narcotic/other opiates abusers: demographic effects
Horton AM, Roberts C

Derived indices on the Trail Making Test (TMT), a test often used for screening for cognitive impairment, are examined in a sample of 191 narcotic/other opiates abusers in drug abuse treatment programs. A mixed race sample was drawn from electronic files of data from the drug abuse treatment outcome study (DATOS). The DATOS was a naturalistic, prospective cohort study that collected data from 1991 to 1993 in 96 programs in 11 cities in the United States. Data were analyzed to determine the effects of demographic variables on derived indices of the TMT in this relatively large sample of narcotic/other opiates abusing patients in treatment settings. The variables of age, ethnicity and education were statistically significant for the total score (A + B) and interaction score ((A × B)/100) derived indices of the TMT. In addition, the difference score (B − A) was statistically significant for education. The ratio score (B/A) was not significant for any demographic variable. R^2 values were also lowest (.106) for the ratio score and for the difference (.128) are quite small. By contrast, the derived scores for total (.326) and interaction (.367) scores are of moderate strength. The clear implication is that demographic variables are not importance influences on the ratio and difference derived TMT scores of narcotic/other opiates abusers.

Differences in executive functioning in cocaine abusers with and without alcohol abuse
Justice A, Rosselli M

Cocaine use has been associated with poor performance on neuropsychological tasks, in particular, tasks that measure executive functioning. Previous research has suggested that individuals that use alcohol with cocaine have had poorer performances in executive functioning than pure cocaine users due

to the synthesis of cocaethylene (a detrimental metabolite), whereas other research suggests that the vasodilatation effects of alcohol serve as a protector from the vasoconstriction effects of cocaine. The aim of this study was to determine any differences in executive functioning between individuals using cocaine alone (C) and cocaine with alcohol (CA). A battery of tests measuring executive functioning was administered to 37 cocaine abusers, 38 cocaine and alcohol abusers, and 17 age and education-level matched controls. The following executive functioning categories were analyzed: abstraction (WAIS-R arithmetic and WCST); inhibition of response (Stroop Color-Word Task Score); attention (digit span—backwards); and motor (Trail B). One-way ANOVAs were used to determine differences among groups. There was a group effect in all executive functioning Category Test scores. A Tukey post hoc test identified differences between the control group and the two substance using groups (significant differences between the controls and the (C) group on all tests, significant differences between the controls and the (CA) group on four of the tests). There were no significant differences between the (C) and the (CA) groups in any of the executive function tests. Therefore, this data does not support the finding that alcohol serves as a protector from the effects of cocaine.

Derived Trail Making Test indices in alcohol abusers: demographic effects
Roberts C, Horton AM

Derived indices on the Trail Making Test (TMT), a test often used for screening for cognitive impairment, are examined in a sample of alcohol abusers in drug abuse treatment programs. A mixed race sample of 1,000 subjects was drawn from electronic files of data from the drug abuse treatment outcome study (DATOS). The DATOS was a naturalistic, prospective cohort study that collected data from 1991 to 1993 in 96 programs in 11 cities in the United States that was sponsored by the National Institute on Drug Abuse (NIDA). The current study was designed to examine demographic effects on four derived Trail Making Test indices in a large sample of alcohol abusing patients enrolled in a national sample of treatment programs. Data were analyzed to determine the effects of demographic variables on derived indices created by adding, subtracting, multiplying and dividing Parts A and B of the TMT in this large treatment sample of alcohol abusers. The results quite clearly indicated that the ratio score (B/A) was least affected by demographic variables. The variables of age, ethnicity and education were statistically significant for the total (A + B), interaction ((A × B)/100) and difference score (B − A) derived indices of the TMT. The ratio score (B/A) was only significant for education. R^2 values were also lowest (.019) for the ratio score. The R^2 for the total (.172), interaction (.153) and difference scores (.057) were consistently higher than the ratio score.

Panic disorder can be caused by neurotoxicity
Singer R

Overexposure to 1,1,1,2-tetrafluoroethane, a gaseous fluorocarbon refrigerant, can damage oxygen sensitive tissue, such as brain and heart. A harmful concentration of this gas in the air will be reached very quickly on loss of containment. A 1,000 pound cylinder was leaking in a basement, which setoff an alarm that subject, a maintenance supervisor, investigated. Upon descent into the basement area, she became severely dizzy, with difficulty breathing and weakness. Two months later, she was diagnosed with panic disorder, followed by short-term memory loss, lack of motivation, fatigue, and irritability. Results show that prior to the exposure, the subject had not taken any sick leave for 8 years. Supervisor records showed excellent work. Prior IQ was 131, and similarly elevated prior aptitude testing scores. Upon examination 2 1/2 years postexposure, symptoms consistent with permanent neurotoxicity were

found with the neurotoxicity screening survey. Current IQ was 122; IQ Index scores processing speed, 58th percentile; expanded paired associate test, 5th and 11th percentile, recent and delayed measures; selective reminding test, 13th percentile; Stroop, 54th percentile. Additional cognitive deficits were identified. The subject was also positive for anxiety and depression on Beck's inventories. No psychosis was present on WIST. There was no evidence of malingering in multiple tests. Personality testing found a possibly emerging personality disorder. Examination of the medical record found no alternate explanation of her cognitive and emotional illness. Hypoxic agents can cause panic attacks in some people, depending upon various factors of exposure and the subject.

Examination of the relative contribution of cocaine and alcohol to neuropsychological functioning

Tucker KA, Browndyke JN, Gouvier WD, Beauvais J, Gottschalk C, Kosten T

The purpose of this study was to investigate the relationship between neuropsychological performance and the frequency/duration of cocaine and alcohol use. Cocaine-dependent subjects ($n = 60$) and healthy controls ($n = 13$) were administered a neuropsychological battery yielding the following factors: attention/executive functioning, memory, simple motor, and sensorimotor. Multiple regression was used to evaluate the frequency/duration of cocaine use, alcohol use, and a combination of both substances to specify which contributed the greatest to reductions in each cognitive factor. Longer duration of cocaine use predicted poorer performance on the memory factor. Greater frequency/duration of alcohol use was associated with worse attention/executive functioning. The frequency of alcohol use within the last month also contributed significantly to the sensorimotor factor. The results suggested that reductions in memory functioning in this group of cocaine-dependent subjects was more specifically related to increasing duration of cocaine use, rather than to alcohol, or a combination of the two. Possible reasons for this finding were discussed, including the proximity of brain structures thought to be important in memory to major dopaminergic pathways. Attention/executive and sensorimotor functioning were more related to frequency of alcohol usage, contrary to the previous assumption that declines in these functions were due to cocaine use in studies of cocaine-dependent patients. These findings may reflect the beginning of frontal atrophy that has been found with chronic alcohol abuse.

Relationship between Oral Trail Making (OTM) and Trail Making Test (TMT) in a sustance abusers sample

Verdejo-Garcia A, Orozco-Gimenez C, Lopez-Torrecillas F, Puente AE, Sedo MA, Perez-Garcia M

The Oral Trail Making (Sedó & Sedó, 2000) is a new neuropsychological test of visual tracking which consist on scanning and searching numbers and naming fruits following the order of the numbers (Trial II). In the interference condition (Trial IV) the volunteer have to scan, search and name the fruit associated to the true color in a condition in which the colors are changed. This test has shown correlation with other neuropsychological tests such as the Trail Making Test (Trials A and B). In this study we have examined the correlation between the Oral Trail Making and the Trail Making Test in a clinical population of substance abusers with executive damage. The results have shown a significant correlation between the Trial IV of the Oral Trail Making and the Trial B of the Trail Making Test ($r = .719$; $P < .000$) but not between Trial II and Trial A of the TMT. The performance on the Trial IV was the only measure affected by the consumption of heroin and ecstasy measured in a composite score of severity [$F(1, 36) = 5, 411$; $P < .025$]. Finally, these results suggest that the Oral Trial Making (Trial IV) is an interesting and adequate test to assess the effect of the heroin and ecstasy on the planning ability.

SCHIZOPHRENIA AND OTHER CHRONIC MENTAL DISORDERS

Multimodal working memory deficits in schizophrenia

Bates J, Johnson R, Ehrlichman H, Javitt D, Bilder R

Evidence supports an integral relationship between prefrontal cortex (PFC) function and working memory (WM). Recently, PFC and WM have been implicated as structures and functions, respectively, that may underlie some of the cognitive deficits and symptomatology observed in schizophrenia. The present study employed tests of auditory–verbal WM (Letter Number Span (LN Span)) and visual–verbal WM (Continuous Performance Test (CPT)), in 16 clinically and diagnostically stable schizophrenic outpatients and sixteen well matched healthy controls. Multimodal WM dysfunction in schizophrenia subjects was evidenced in the present study. Auditory–verbal WM (LN Span) showed clear deficits in the patient group. Moreover, in the visual–verbal modality (CPT), patients consistently displayed reduced accuracy and increased reaction times (RT) across tasks. However, patient performance did not worsen when task complexity and delay intervals were increased, suggesting a generalized cognitive deficit, rather than a dysfunction specific to WM processes. Response inhibition, indexed by false alarms in the CPT, was worse in the schizophrenic group at a trend level. Poor response inhibition is suggestive PFC dysfunction and is consistent with other evidence implicating frontal structures in the deficits observed in schizophrenia.

The effects of sleep medication withdrawal and psychological intervention on memory and learning in hypnotic dependent older adults

Christina SM, Kenneth LL, Nancy MW, NA R, Kristin WL

Compared to younger age groups, older adults are disproportionately high users of hypnotic (sleep) medications and are particularly vulnerable to medication side effects, including impaired daytime functioning. Older insomniacs frequently complain of daytime memory and learning difficulties. We administered the California Verbal Learning Test (CVLT) and Rey Complex Figure Test (RCFT) to 22 older adults (average age = 65.95 years; S.D. = 7.89) participating in a study comparing psychological intervention (8 weeks of stress management prior to medication withdrawal) to medication withdrawal alone. Average duration of hypnotic use was 4.17 years (S.D. = 4.42; range 6 months–20 years). Paired samples *t*-tests were used to analyze memory performance from baseline to postwithdrawal for each condition. Subjects who participated in the psychological intervention demonstrated significant improvement in visual ($P = .02$) and verbal memory ($P = .03$) following a delay; subjects in the withdrawal alone and placebo conditions did not. These findings suggest psychological intervention may be a useful adjunct to sleep medication withdrawal in older patients. In addition, future research that examines whether psychological intervention alone will also improve memory following a delay appears warranted, because many older insomniacs are unable to withdrawal from sleep medications.

Informed consent in schizophrenia: differences in understanding using recall versus recognition formats

Combs DR, Gouvier WD

There has been increased interest in methods to improve the informed consent process for persons with schizophrenia. Before a decision about participation is made, the participant should fully understand the requirements of the study. In schizophrenia, the impact of their cognitive deficits and psychiatric

symptoms may preclude understanding the consent process (Schachter et al., 1994). Previous studies have used different methods to improve consent form understanding with only limited success (Stiles et al., 2001; Wirshing et al., 1998). Clearly, other methods to improve the informed consent process are needed. In this study, 20 persons with schizophrenia were asked to read a standard informed consent form before participation in a study on delusional beliefs. Knowledge of the study procedures was assessed using a free recall and recognition test. It was hypothesized that the recognition (vs. recall) format would minimize the prefrontal deficits associated the disorder and lead to improved consent form understanding. Results showed significantly higher scores on the recognition test than the free recall test. BPRS symptom ratings and other clinical variables were examined to determine their relationship with test scores. Recall scores were significantly correlated with BPRS thought disorder score ($r = -.56$) and length of stay ($r = -.46$). Recognition scores were correlated with BPRS disorganization score ($r = -.45$), GAF rating ($r = .42$), and length of stay ($r = -.78$). Implications of these different formats for the consent process in schizophrenia are discussed.

Cross-race facial memory among African-American

Dobel D, Fisher-Irving M, Poole J, Vinogradov S

Previous research has demonstrated that people remember faces of their own race better than faces of other races (the other-race effect). Several recent studies have found that Caucasian subjects recall Caucasian faces significantly better than African-American faces. This effect is not found among African-American subjects, who recognize Caucasian and African-American faces equally well. Our study investigates whether this bias is present in a seriously mentally ill sample. We evaluated 40 clinically stable patients with schizophrenia and schizoaffective disorder (20 Caucasians and 20 African-Americans). Pairs of subjects in each group were matched by age and general cognitive ability. Performance on immediate and delayed recognition trials of the TOMAL Facial Recognition Test was compared across groups; this test uses photos of both Caucasian and African-American individuals to evaluate immediate and delayed recognition memory for faces. Results confirmed the other-race effect among Caucasian patients, but not among African-American patients. African-American patients and Caucasian patients performed equally well on immediate and delayed recognition of Caucasian faces. However, African-American patients performed significantly better than Caucasian patients on immediate and delayed recall of African-American faces. In summary, the pattern of results in this neuropsychiatric population is equivalent to that seen in the healthy population. This phenomenon may be explained by the necessity of minority groups to have greater familiarity with the dominant cultural group in their country.

Cluster analysis of premorbid adjustment, neuropsychological function and symptom profiles in schizophrenia

Frantom LV, Allen DN, Goldstein G, van Kammen D

Researchers have examined heterogeneity of neuropsychological functioning in schizophrenia using cluster analysis. These investigations suggest the presence of discrete clusters that are differentiated by a number of important clinical variables. However, differences in psychiatric symptomatology (e.g., positive and negative symptoms) between neuropsychological clusters have been difficult to demonstrate, which supports the observation that symptoms and neurocognitive function are relatively independent expressions of the schizophrenic illness. Because schizophrenia is a neurodevelopmental disorder, studies have also examined the relationship of premorbid adjustment to neuropsychological function

and symptom profiles, finding significant relationships between these variables. Typically premorbid adjustment is used as a continuous or dichotomous variable (poor vs. good), with few attempts to develop potentially more complex subtyping systems based on premorbid adjustment. The current study used the Premorbid Adjustment Scale (PAS), WAIS-R IQ, and symptom measures to empirically derive premorbid clusters. The sample consisted of 141 male medicated inpatients with SCID diagnoses of schizophrenia or schizoaffective disorder. Cluster analysis of the PAS academic and social factors revealed four clusters. One cluster demonstrated poor premorbid academic and social functioning, a second had relatively normal social and academic functioning, a third cluster had minimally impaired social adjustment and poor academic performance, while a fourth demonstrated normal academic adjustment and poor social functioning. Clusters were differentiated on the basis of symptom profiles and IQ scores. Results suggest that patterns of premorbid functioning may be useful in developing schizophrenia subtypes. Furthermore, premorbid clusters appear to reflect the psychiatric symptom and neurocognitive phenomenology of the disorder.

A case of Munchausen's syndrome presenting in a neuropsychology clinic in a cancer center
Friedman MA, Meyers CA

The objective of this study was to describe a case of suspected Munchausen's syndrome detected in a neuropsychology clinic. Munchausen's syndrome is a factitious disorder in which patients intentionally produce physical symptoms of a general medical condition. This 22-year-old female was referred to identify cognitive impairments and any role of psychological factors in her medical complaints. Comprehensive neuropsychological evaluation, including medical record review, was conducted. Neuropsychological results revealed intact performance across domains, including mood and personality, attention, language, visuoperceptual ability, executive functioning and memory, and average intellectual ability. According to her medical history, initial treatment at this facility included surgery and radiation for an olfactory neuroblastoma. She was subsequently followed for complaints of neurological and endocrine dysfunction, intractable pain, and breast lesions. Medical tests did not substantiate any diagnoses for such complaints, although she underwent invasive procedures for them, including exploratory surgery, spinal tap, facial nerve blocks, and breast biopsy. She reported a history of neurogenic bladder and regular self-catheterization for urination, with bladder studies inconsistent with neurogenic bladder. She presented with snake bite symptoms including fang puncture, finger ecchymosis, pain, fainting, and a red streak from finger to axilla, with lab results indicating no evidence of envenomation. Two years prior to this neuropsychological evaluation, her endocrine profile was interpreted to be consistent with exogenous insulin administration. Neuropsychological evaluation led to the detection of suspected Munchausen's syndrome, and to centralized communication about the case among the treatment team members involved.

Auditory and visual selective attention in schizophrenia
Goddard K, Wass P, Slawinski E

Individuals with schizophrenia exhibit specific neurocognitive deficits that emerge across multiple cognitive domains. Selective attention impairments have been cited as a core deficit, particularly for rapidly presented stimuli. However, it is sustained attention and verbal memory deficits that have been shown to be robust predictors of functional outcome. The purpose of this study is to examine the extent to which auditory and visual selective attention deficits predict sustained attention and memory deficits. Patients ($n = 20$) meeting DSM-IV criteria for schizophrenia were tested on four auditory–verbal and

visual neuropsychological tasks (Rey Complex Figures Test, California Verbal Learning Test; visual and auditory CPT tasks), and two experimental measures of selective attention using rapid serial visual and auditory presentation paradigms (RSVP and RAP). Schizophrenia patients had poorer performance on all neuropsychological tasks when compared with normative data. Auditory and visual selective attention accounted for approximately half of the variance in auditory and visual sustained attention tasks, respectively, and the two selective attention tasks were uncorrelated. Auditory selective attention was unrelated to performance on any other neuropsychological measure. In contrast, visual selective attention further accounted for substantial amounts of variance in the visual learning and memory task (Rey). Unexpectedly, visual selective attention also accounted for a significant proportion of variance in the auditory learning and memory task (CVLT-delayed). Results are discussed in terms of both generalized and modality specific cognitive deficits in schizophrenia, as well as the potential implications for cognitive rehabilitation.

Neuropsychological deficits account for increased nicotine dependence in schizophrenia patients
Poole J, Muggli L, Minzenberg M, Vinogradov S

Cigarette smoking is much more prevalent among people with schizophrenia than in the general population. Several researchers have proposed that schizophrenia patients may use nicotine to temporarily ameliorate neurocognitive deficits associated with their illness or to reduce medication side effects. To test this hypothesis, we administered a comprehensive neuropsychological battery, a structured interview on smoking history, and the Gerlach Dyskinesia Scale to 80 clinically stable schizophrenic outpatients. Half of the patients currently smoked, one-fourth were former smokers, and one-fourth had never smoked. Compared to patients who never smoked, current and former smokers performed significantly worse on multiple measures of attention, processing speed, perceptual organization, working memory, and short-term memory. A smaller subset of cognitive measures was also related to the current number of cigarettes smoked daily. Chlorpromazine and anticholinergic indices of current medication dose, as well as parkinsonian and dyskinetic side effects were unrelated to the current level of nicotine dependence. These findings confirm that schizophrenia patients' elevated risk for nicotine dependence is associated with key neurocognitive deficits, but not with current medications or their side effects. This study supports the hypothesis that psychotic-spectrum patients may use nicotine in an attempt to self-medicate against cognitive deficits that are fundamental to their illness.

Predictors of facial affect processing in schizophrenia
Ross S, Allen DN, Gilbertson MW, van Kamen DP

Individuals with schizophrenia demonstrate impaired ability to recognize and label facial emotion. The current study investigated differences in facial recognition, facial affect recognition, and verbal labeling of facial affect between 43 schizophrenia patients and 16 normal controls. Schizophrenia patients had a mean age of 39.02 years (S.D. = 9.39), stabilized on haloperidol (mean dosage = 9.86 mg, S.D. = 4.20 mg), had an average age of onset of 25.38 years (S.D. = 7.63), and exhibited mild positive symptoms at the time of evaluation (mean Bunney–Hamburg psychosis rating = 4.67, S.D. = 1.74). Controls were solicited via newspaper ads, were physically healthy, and had no psychiatric or neurological disorders. Subjects were administered neuropsychological tests to assess facial affect processing, attention (CPT), cognitive flexibility and abstraction (Wisconsin Card Sorting Test), and recent memory (WMS-R). Facial-affect recognition was assessed using photographs of human faces developed

by Eckman and Friesen (1976) and consisted of four conditions: inverted-face, identity-matching test; standard facial (upright) identity-matching task; affect matching task; and affect-labeling task. MANCOVA using group as the independent variable, age and years of education as covariates, and verbal memory, visual memory, abstraction and attention as the dependent variables indicated controls performed better than patients with schizophrenia on visual memory, attention and abstraction ($P < .05$). However, ANCOVAs indicated no significant differences between groups on the four conditions of the facial affect test. The lack of significant differences on the facial affect tests was an unexpected finding. Results are discussed in light of the current literature regarding facial-affect processing in schizophrenia.

Prospective memory impairment in individuals with long-term schizophrenia
Shum D, Ungvari G, Leung J

Individuals with schizophrenia are commonly found to have retrospective memory impairment, or difficulties in learning and recalling previously presented information. This study aimed to examine if these individuals have prospective memory impairment, or difficulties in remembering to perform intended actions in the future. Three prospective-memory tasks (time-, event-, and activity-based) were administered to 60 individuals with schizophrenia and 60 matched controls. These three tasks involved remembering to perform an action at a specific time, when an external cue appeared, and at the end of an activity, respectively. Although all the participants were able to understand and recall the instructions and requirements of the three tasks, participants with schizophrenia performed significantly worse than the controls on all three tasks. In particular, participants with schizophrenia group were found to have more difficulties with the time-based task, a task that required a prefrontal lobe process called self-initiated retrieval. To examine the relationship between prospective memory and prefrontal-lobe functions, the participants were administered three neuropsychological tests, namely, Design Fluency Test (DFT), Tower of London (TOL), and Wisconsin Card Sorting Test (WCST). For participants with schizophrenia, performance on the event-based task was found to correlate significantly with performance on the DFT and performance on the time-based task was found to correlate significantly with performance on the TOL. Results of this study support the importance and contribution of prefrontal-lobe processes in prospective remembering and have implications for the assessment and treatment of individuals with schizophrenia.

Facial and auditory affect recognition errors in schizophrenia
Thompson N, Poole JH, Minzenberg MJ, Vinogradov S

Prior research has shown that schizophrenic patients have difficulty identifying facial and vocal expressions of emotion. It is also known that poor affect identification by schizophrenic patients covaries across visual and auditory sensory modalities. However, it is unclear whether schizophrenic patients misidentify specific emotions in a predictable manner or if errors are generalized and not specific to emotional category. Previous studies have suggested that people with schizophrenia may specifically misidentify negative emotions of fear, anger and disgust. At the same, affect recognition deficits in outpatients with schizophrenia covary across sensory modality. The present study analyzes the profile of errors by emotion category in schizophrenic outpatients and healthy controls. Subjects performed tests of facial and prosodic emotion identification and completed a battery of neuropsychological and clinical measures. The profile of affect identification errors will be determined in terms of both misidentification of specific emotion (stimulus discrimination errors) and tendency to make specific erroneous judgments

(response biases). Preliminary analyses suggest that more often than healthy controls, outpatients with schizophrenia are expected to incorrectly identify neutral emotions as emotion-laden and confuse negative emotions with one another. The relation of errors to other cognitive and clinical measures are examined.

Neuropsychological assessment of individuals at high-risk for schizophrenia
Warnick E, Allen DN

Cognitive deficits in individuals with schizophrenia and their biological relatives are thought to represent behavioral markers of genetic risk. However, individuals with no family history, who are considered to be at high-risk for developing schizophrenia based on their endorsement of deviant cognitive and perceptual experiences, have also been found to demonstrate cognitive deficits. Because differences in the cognitive profiles of schizophrenic individuals who are family history positive and those who are family history negative have been reported, it stands to reason that similar differences may exist between high-risk groups with different etiological origins of liability. The purpose of this study was to clarify the cognitive deficits that characterize groups at high-risk for schizophrenia. High-risk was defined as (1) genetic relatedness to an individual with schizophrenia, or (2) extreme scores on a measure of schizotypy (i.e., Chapman Scales of Psychosis Proneness). Over 1,300 students recruited from psychology 101 and 210 classes participated in a screening procedure, which included a family history and demographic questionnaire, and the Chapman Scales. Twenty-six subjects, who qualified and agreed to participate in the second portion of the study, were administered the following tests: California Verbal Learning Test, Finger Tapping Test, Trail Making Tests, Controlled Oral Word Association, Stroop, Wisconsin Card Sorting Test, subtests from the WAIS-III and WMS-III, and the degraded stimulus version of the CPT. ANOVA revealed significant between group differences on a measure of working memory, with the family history group performing worse. Results are interpreted within a neurodevelopmental framework.

The relation of schizophrenic patients coping strategies to neurocognitive functioning
Williams H, Poole J, Vinogradov S

Schizophrenic subjects experience high stress under ordinary circumstances. They also use a reduced set of strategies to cope with stresses and demands of life. The Coping Response Inventory (CRI) is a measure of coping strategies that individuals employ to deal with stressful life events. It has typically been used in hospital settings for general medical conditions, substance use, and mood disorders. However, it has not been used with psychotic disorders. We administered the CRI to 106 clinically stable schizophrenic outpatients, to investigate the relation between patients' coping strategies to neurocognitive functioning. Coping strategies may be classified into two categories, approach and avoidant, which are based on the cognitive, emotional, and behavioral responses to stressors. Overall, the approach strategies were associated with better performance on neurocognitive measures of attention, executive functioning, and affect recognition. Specifically, logical analysis, positive reappraisal, seeking guidance/support, and problem solving were associated with higher general intelligence, perceptual organization, attention, processing speed, and executive functioning. Conversely, avoidant strategies, such as cognitive avoidance, active resignation, and emotional discharge were associated with lower verbal, visuospatial, attentional, and executive resources. In general, coping mechanisms were moderately correlated with individual neuropsychological test scores; however, these associations were quite consistent across numerous indices of patients' neurocognitive resources. Schizophrenic patients who had

more neurocognitive resources utilized additional coping strategies more often. Results are discussed in terms of the eight coping strategies.

FORENSICS

Psychiatric malingering of cognitive symptoms

Baser RE, Rinaldo J, Wasson M, Berry DT

Persons who feign psychiatric disturbances also frequently feign cognitive impairment. This occurs so frequently in clinical practice that it seems probable that many persons feigning psychiatric problems purposefully incorporate cognitive symptoms into their clinical presentations. The present study investigates this hypothesis. Several diverse indicators of psychiatric malingering were administered to 800 introductory psychology students who were asked to answer the questions under honest, fake mild, fake moderate, and fake severe instructions. A group of 100 psychiatric outpatients were also administered the malingering indicators. Administered scales include: the F, Fb, and Fp scales from the MMPI-2; the negative impression (NIM) scale from the Personality Assessment Inventory (PAI); the Negative Presentation Management Scale, developed for research purposes, from the NEO Personality Inventory-Revised (NEO-PI-R); the structured inventory of malingered symptomatology (SIMS), which contains 85 true/false questions organized on five scales; and the Miller Forensic Assessment of Symptoms Test, a brief structured interview designed to screen for psychiatric malingering. The correlations among these indicators of psychiatric malingering are reported. The amnestic disorder (Am) and the low intelligence (LI) scales from the SIMS are of particular interest, as they purport to measure the inflation of self-reported cognitive symptoms. The correlations between these scales and the other indicators are highlighted. Also highlighted are the mean group differences on the Am and LI scales between the psychiatric group and the student groups.

The Miller Forensic Assessment of Symptoms Test (M-FAST): validity of a brief structured interview assessing malingering

Baser RE, Wasson M, Rinaldo J, Berry DT

Neuropsychologists are frequently asked perform evaluations in which psychiatric, as well as cognitive, malingering is a possibility. Although an excellent structured interview exists for assessing psychiatric malingering, its long administration time is often impractical for clinical use. The present study evaluates the validity of the Miller Forensic Assessment of Symptoms Test (M-FAST; Miller, 2001). The M-FAST is a structured interview designed to assess malingering that takes less than 15 min to administer. In the present study, the M-FAST was administered to 800 introductory psychology students who were asked to answer honestly, or to fake either a mild, moderate, or severe level of psychological disturbance according to illustrative vignettes. The student groups are compared to a group of 100 psychiatric outpatients who were instructed to answer the M-FAST questions honestly. Results indicate that the mean M-FAST total score for the psychiatric group was significantly different in the expected directions from all of the student groups except for the group asked to fake a mild level of psychological disturbance. A cutting score that optimally distinguishes between bonafide psychiatric patients and student simulators is reported, along with sensitivity and specificity. These results are compared with the classification accuracy obtained by applying the M-FAST cutting score recommended by Miller (2001) to the current sample. Results support the validity of the M-FAST and suggest that it is a promising and practical new instrument to screen for malingering.

So You're going to testify: what every young neuropsychologist should know about tests and the courts

Bloomer RH, Hurwitz BA

The acceptability of expert evidence in courts has recently changed from the Frye standard to the Daubert rules. This change in rules impacts the acceptability of neuropsychological evidence. Tests, acceptable under Frye, may not meet the more stringent Daubert criteria. This poster explores a number of neuropsychological instruments for their acceptability under Daubert rules. Frye 1923: a test must have general acceptance in the field to be considered admissible as evidence. Daubert, 1993: Supreme court sets four standards for the trial judge to determine admissibility, and ruled that they replace the Frye standard. While most neuropsychological tests may pass Daubert Test #1, Tested Scientific Method; Test #2, Peer Review; and Test #4 Scientific Acceptance, it is Daubert Test #3. The actual or potential rate of error in the expert's methodology where two types of problems may occur. The first is clarity of measurement. IQ and other global tests presume to activate large portions of the brain, make it difficult to parse out neuropsychological truth.What portion of the brain is responsible? Hence, wide error potential in testimony from 'g' model tests Since newer neuropsychological instruments focus on specific cortical areas or neural circuits; reliabilities of specific tests indicate the potential for truth. The tests ability to focus on simple behavior, and reliably relate to activation of a neural process or circuit, is the signature of neuroscience. We explore neuropsychological instruments for these criteria.

Third party observation during neuropsychological evaluations: when the third party is a tape recorder

Constantinou M, Ashendorf L, McCaffrey R

The presence of third parties during neuropsychological evaluations is an issue of concern for contemporary neuropsychologists. Previous studies have reported that the presence of an observer during neuropsychological testing alters the performance of individuals under evaluation. The present study sought to investigate whether audio recording affects the neuropsychological test performance of individuals in the same way that third party observation does. In the presence of an audio recorder the performance of the participants on memory tests declined. Performance on motor tests, on the other hand, was not affected by the presence of an audio recorder. The implications of these findings in forensic neuropsychological evaluations are discussed.

How common is malingering in litigated cases?

Hartlage LC, Johnson DJ

The issue of malingering in neuropsychological assessment involving litigated cases represents an area of controversy and importance. Estimates of malingering—using diverse criteria—have ranged from below 10% to greater than 50%. Often, 'malingerers' have been individuals instructed to feign neuropsychological impairments rather than individuals empirically demonstrated to be malingering in a natural setting, so that such studies do not clarify incidence questions. This study compared 42 individuals referred for neuropsychological assessment who were actively involved in litigation with alleged traumatic brain injury (i.e., high malingering risk, with focus on impairments); with a matched group of individuals seeking vocational rehabilitation assistance to pursue schooling (i.e., low malingering risk, with focus on educational potential) who had been referred for neuropsychological assessment of CNS

functional status. Comparisons of *t*-tests on MMPI 2 validity scales and $F - K$ ratio; Rey 16-Item Test; and HRNB scales demonstrated sensitive to malingering were computed, for total of seven *t*-tests. There were no differences ($P < .05$) on any of these seven tests, although the two groups did differ on other measures (i.e., Depression, Impairment Index) not necessarily indicative or suggestive of malingering. There was good congruence among measures of malingering and clinical estimates of malingering on qualitative basis. Findings suggest incidence of malingering in litigated cases may be lower than many estimates.

Wechsler Memory Scale-III Faces subtest performance in head injured and probable malingering patients

Mittenberg W, Zieman SF, Legler W, Patton C, Azrin R

Forced choice recognition memory tests are often useful in the identification of insufficient effort or symptom exaggeration. These measures are typically evaluated to determine if scores are lower than those obtained by patients with cognitive impairment or if scores are less than would be obtained by chance. This study compared the WMS-III Faces subtest performances of 48 nonlitigating head injured patients to that of 25 probable malingerers to determine the diagnostic utility of various cut-off scores. Patients were examined an average of 9.5 months after mild ($n = 15$) or moderate ($n = 33$) head trauma. Litigants scored below probable malingering cutoffs on the TOMM or portland digit recognition an average of 24 months after minor or mild head trauma. Probable malingerers obtained significantly lower scores on the Faces subtests than head injured patients. No head injured patient scored below 24/48 on Faces 2 or 49/96 on the total of the Faces 1 and 2 trials. 20% of probable malingerers performed below these cut-off scores. 95% of head injured patients scored above 26/48 on the Faces 1, 28/48 on Faces 2, and 56/96 on the total of the Faces trials. Twnty-four percent of probable malingerers performed below one or more of these cut-off scores. Application of the binomial theorem to the faces subtests indicates that scores of 18 or less on Faces 1 or 2 and 39 or less on Faces total fall significantly below chance at the .05 level. Eight percent of probable malingerers scored significantly below chance on one or more of these measures.

Comparing litigants suspected of malingering and simulators on the Memory Assessment Scales

O'Bryant SE, Duff K, Fisher JM, McCaffrey RJ

A common practice in research examining symptom exaggeration/malingering is the use of simulators. In these research paradigms, participants, typically undergraduate students, are asked to feign symptoms associated with brain injury. Although there is considerable question as to the generalizability of these research findings, few investigations have explicitly compared simulators to TBI patients suspected of malingering. The purpose of the present study was to compare litigants suspected of malingering to simulators on the Memory Assessment Scales. The litigants suspected of malingering (based on TOMM and/or Rey-15 performance) consisted of 29 mild TBI patients referred to a private neuropsychological practice due to MVA or work-related accidents. The scores obtained by the litigant groups were compared to those obtained by the simulator group utilized in Beetar and Williams (1995). Multiple, Bonferroni-corrected *t*-tests were computed, and the simulator group scored significantly higher than the litigants suspected of malingering on all 4 of the MAS Summary Scores and 8 of the 12 subtest scores. The present results indicate that simulators may provide an underestimation of how suspected real life malingerers may perform on the Memory Assessment Scales and shed further doubt on the utility of simulator research.

Neuropsychology in the forensic evaluation of parenting competence in neurologically compromised patients

Ryan P

The expertise of clinical neuropsychologists is being called upon in increasingly diverse forensic settings. Experienced neuropsychology practitioners are being asked for expert opinion in child custody matters where one parent has a neurological condition such as multiple sclerosis, epilepsy and traumatic brain injury. In many, though not all cases, one party is alleged by the other party to have brain-based cognitive and affective deficits directly relevant to parenting competence. Although well positioned to assess and treat these patients, clinical neuropsychologist may not be fully conversant with the complex vicissitudes of "parenting evaluation" within the legal system. Several representative cases are presented in detail from the legal, neuropsychological and parenting perspectives. The goal is to inform with regard to conceptual approach in this unfamiliar and arcane area of clinical practice. An annotated review of parenting tests such as the adult–adolescent parenting inventory, the child abuse potential inventory, and the parent–child relationship inventory is included, along with a detailed bibliography of custody evaluation instruments.

The increasing prominence of forensic neuropsychology: content analysis of ACN, JCEN, and TCN from 1990 to 2000

Sweet J, King J, Malina A, Simmons A, Bergman M

Numerous authors have opined that forensic activities have become more prominent within clinical neuropsychology. To investigate the merits of these claims, the entire contents of archives of clinical neuropsychology (ACN), journal of clinical and experimental neuropsychology (JCEN), and the clinical neuropsychologist (TCN) from 1990 through 2000 were reviewed and cataloged. These three journals were selected because they are the highest-ranking clinical subscription journals according to surveys of practitioners. Prior to rating journal contents, various categories of interest were delineated and practice ratings were obtained until the two raters reached 94% agreement. Each of the raters visually analyzed and recorded content ratings for half of the journal issues under review. Results of the 8,323 ratings demonstrated increases across time in the absolute numbers of articles related to forensic neuropsychology, although amount of increase and variability across years differed for each journal. Forensic articles in the three journals combined increased from 1% in 1990 to 11% in 2000, with the majority of that proportional increase having occurred by 1993. An annual peak in absolute number ($n = 26$; 13%) of forensic journal articles occurred in 1997. Forensic presentations at annual NAN meetings ranged from 3.9 to 11.3% (mean = 8%) of the program, whereas within Division 40's program at the APA meeting, the average percentage ranged from 2.3 to 11.7% (mean = 6%).

Cluster analysis of the Halstead–Reitan Neuropsychological Test Battery in a sample of first-degree murders

Warnick E, Schmidt DL, Allen DN

Because neuropsychological test performance reflects underlying brain function, cognitive tests have been used to characterize a number of psychiatric and neurological conditions. However, attempts to develop a replicable neurocognitive profile that characterizes serious forms of criminality have been relatively unsuccessful. In this study, cluster analysis was used to develop subgroups of first-degree murderers based on neuropsychological test performance. Subjects included 45 individuals who had been convicted of first-degree murder. All subjects were administered the Halstead–Reitan

Neuropsychological Test Battery (HRNB), Wechsler Adult Intelligence Scale-III (WAIS) and the Minnesota Multiphasic Personality Inventory II (MMPI). HRNB and WAIS data were subject to cluster analysis in order to identify potential neuropsychological subtypes. The MMPI validity and clinical scales were used as external validation variables. The results of the study provide tentative support for neuropsychological subtypes of first-degree murderers.

TEST CONSTRUCTION AND STANDARDIZATION, PROFESSIONAL ISSUES

Culturally fair, 15-item versions of the Boston Naming Test in the assessment of English- and Spanish-speaking elderly

Acevedo A, Loewenstein D, Tzaberry S, Stoerger Z, Duara R

The Boston Naming Test (BNT) is widely used in the assessment of dementias, language disorders, and other neurodegenerative diseases. Several studies have shown lack of equivalence in the frequency of occurrence of words and limited cultural relevance of some of the BNT items when used with individuals of different socio-cultural/linguistic backgrounds. We selected 30 items of the BNT that had previously shown similar levels of difficulty in cognitively intact English- and Spanish-speaking elderly and evaluated the degree to which they could be divided in two parallel 15-item versions of the test. Forty-six normal elderly English speakers (ES, mean age $= 74.29 + 5.0$) and 43 normal elderly Spanish speakers (SS, mean age $= 72.38 + 5.0$) with similar levels of education (mean $= 13.1 + 2.2$, $12.7 + 1.9$, respectively) were used in the study. Similar scores were obtained by ES and SS, respectively, in Naming Form A ($13.35 + 1.5$ and $13.67 + 1.2$) and in Naming Form B ($13.14 + 1.6$ and $13.49 + 1.8$). Further, performance on Naming Forms A and B did not significantly differ within each ethno-cultural/linguistic group. These culturally fair, 15-item alternate versions of the BNT may be particularly useful when repeated administration of the test is required or when time constraints preclude the administration of the longer test. To our knowledge, this is the first report of short, alternate, equivalent, and culturally fair versions of a well-known confrontation naming test that demonstrate equivalency in both English- and Spanish-speaking cognitively normal elderly.

Mediating free recall variables within the Rey Auditory Verbal List Learning Test in a sample of inpatient rehabilitation TBI participants

Adams RA, Sherer M, Vickery C, Nakase-Thompson R, Brown R, Gaines C

Verbal list learning tasks are commonly used measures in neuropsychology. However, little is known regarding if or how variables within list learning tasks mediate each other. This study used path analyses (EQS) to explore the relationships among the free recall (FR) variables within the R-AVLT, particularly with regard to mediation. Participants included 50 TBI rehabilitation inpatients. The sample's mean age and education were 36.1 (S.D. $= 18.0$) and 11.4 (S.D. $= 1.8$), respectively. The variables included FR after initial list presentation (FR-IP; obtained via the score on Trial I), FR after repeated list presentation (FR-RP; obtained via the aggregate scores of Trials II through V), FR after a brief distraction list (FR-BD; obtained via the score on Trial VI), and FR after a 30 min delay (FR-30D; obtained via the score on Delayed Recall). The basic model included the following paths: FR-IP predicts FR-RP, FR-RP predicts FR-BD, and FR-BD predicts FR-30D. Alternative models involved the middle two variables (i.e., FR-RP and FR-BD) mediating the impact of the preceding variable(s) upon the subsequent variable(s), which allowed for seven competing models. As hypothesized, the best fitting, most parsimonious model was the following: FR-IP predicted FR-RP, FR-RP predicted FR-BD and FR-30D, and FR-BD predicted-FR-30D (CFI $= 1.00$, $\chi = 1.49$, df $= 2$). The results indicated that FR-RP

completely mediated the impact of FR-IP on FR-BD and FR-30D, and that FR-BD only partially mediated the impact of FR-RP on FR-30D. These findings have implications for expectations and interpretations of R-AVLT performance in both research and clinical settings.

The effects of acculturation level on verbal learning in a sample of Hispanics of Mexican-American extraction

Anita SB, Leonardo MM, Wayne VA, Leah BS

This study measured the relationship of acculturation to performance on verbal learning tasks. We hypothesized that as acculturation to Anglo-American culture approaches assimilation, total recall scores on the California Verbal Learning Test-II (CVLT-II) will increase and performance on a nonsense word task will not significantly correlate with acculturation level. A review of the literature on acculturation and test bias in Hispanic populations is followed by research on bilingual performance on memory tasks. As the independent variable, acculturation is examined on three levels: Mexican oriented, bicultural oriented and Anglo oriented using Scale 1 of the Acculturation Rating Scale for Mexican-Americans II (ARSMA-II). The dependent variables include total recall performance scores on the CVLT-II and the nonsense words. Subjects were 57 research volunteers from a rural Washington State community and the Portland, Oregon area. A 3×8 (group $\times$ test scores) multivariate analysis of variance (MANOVA) was performed to assess differences between mean scores for subjects in the three acculturation groups on the CVLT-II and on the nonsense word list. The results of the study did not support a significant difference in means by acculturation level on the CVLT-II recall scores or on the nonsense word list. Performance by this bilingual Mexican-American sample was comparable to data from the standardizing sample of the CVLT-II and supports its use as an accurate measure of verbal learning.

Web-based neuropsychological assessment in the US army

Baggett MW, Christensen DW, Kelly MW, Korenman LW, James LW, Gahm GM

Web-based neuropsychological screening procedures may dramatically reduce the cost of neuropsychological assessment and allow for the development of unique applications. The ability to assess cognitive status remotely through web-based computerized neuropsychological tests potentially allows for worldwide availability of neuropsychological assessment. In our current research studies we have developed web-based computerized neuropsychological measures that can be used to perform research remotely with a centralized data collection system. Research data is encrypted, transmitted and stored utilizing security features from our website via a secure server. These neuropsychological tests reside within the password-protected webpage on a secure server behind the firewall maintained by the Telemedicine Directorate at the Walter Reed Army Medical Center, Washington, DC. Two separate studies, investigating the validity of these procedures, are being conducted at Fort Campbell, KY and Fort Rucker, AL from our research website at Walter Reed. This new research paradigm is discussed in the context of its future potential in neuropsychology.

Exploring the validity of a computer-based neuropsychological assessment test for aviators

Baggett MW, Christensen DW, Korenman LW, Kelly MW, Larry JW, Leso JW, GoodlettGeorgie FR, Gahm GM

Over the last decade the FAA and NASA have begun to utilize neuropsychological assessment techniques to assist in aeromedical decision-making requirements. The decisions have often included fitness

of duty and flight status examinations. While the automated neuropsychological assessment (ANAM) test battery has been used by NASA to evaluate Astronauts (Kane et al., 1999), CogScreen (Kay, 1995) has been the FAA's accepted standard for evaluating aviators. The US Air Force currently establishes cognitive baselines on all of its pilot trainees using CogScreen (Callister, King, & Retzlaff, 1995). The low cost of this approach allows for mass collection of baseline cognitive functioning data that could improve medical evaluation of aviators should neurological compromise occur. To date, the army has not adopted a standardized procedure for evaluating the neuropsychological abilities of its aviators, therefore providing a unique opportunity for the army to explore the benefits of different computerized neuropsychological test batteries. The present study was designed to explore the validity of ANAM as compared to CogScreen, a previously validated computer-based test of cognitive functioning. For this purpose we compared the individual subtests included in ANAM to those from CogScreen. Results showed several high correlations between ANAM subtests and CogScreen subtests, indicating that ANAM may assess the same aspects of cognitive functioning that are currently tested by CogScreen.

An oral Trail Making Test: a validity investigation
Barncord S

The Trail Making Test (TMT) is a well-established measure, commonly employed in neuropsychological assessment. The TMT has been readily adapted into several alternate forms providing for varied administrations considered appropriate for populations with motor or sensory deficits and varied linguistic backgrounds. One mode of adapting the test involves an oral paradigm that effectively removes the motor and visual components of the task. The present study involved administering an oral version of the TMT to 200 healthy, community dwelling subjects to establish a normative base. Findings suggest a significant gender effect on time to completion and the ratio of time to completion to simply reporting the alphabet and numerical sequence without set shifting. The second component of the present study involved administering this oral TMT to 200 patients with documented organic damage, referred for neuropsychological evaluation. The findings revealed strong discriminate ability and confirm the sensitivity of the oral paradigm as an alternate application of the trail-making task. These findings are discussed in relation to the utility of the measure with clinical populations.

Validation of a short form version of the Ruff Figural Fluency Test
Barr W, Zaroff C, Wasserstein J

The purpose of this study was to validate a short-form, three-trial version of the Ruff Figural Fluency Test (RFFT). The standard five-trial format was administered to 121 subjects, including 36 healthy controls, 61 patients with temporal lobe epilepsy, and 24 patients with adult attention-deficit disorder. Mean age of the sample was 29.1 years (range, 17–56). There were 52 men and 69 women. Mean education level was 14.2 years (range, 9–20 years). Scores for the short-form were computed from Trials 1, 3, and 5. The total was adjusted to obtain a prediction of the original five-trial score. Strong correlations were obtained between short-form predictions and original scores for unique designs ($r = .987$), total perseverations ($r = .968$), and error ratio ($r = .948$). A total of 79% of the sample obtained predicted unique design scores falling within five points of the original scores. Total perseveration scores within this range were observed in 93% of the sample. Hit rates for classification of impairment, as defined by the test manual, were 96.7% for unique designs and 95.9% for error ratio. The results indicate that the three-trial format holds potential as a valid short form of the RFFT.

Should psychophysiological measurement (QEEG) be part of the neuropsychological evaluation?
Beck A, Harrison D

Neuropsychological testing primarily uses standardized testing procedures, occasionally uses syndrome analysis, but only infrequently uses QEEG to better understand and to document or follow a patient's brain disorder. As gathering additional information may increase the validity of an examiner's conclusions, it logically follows that employing the QEEG as a neuropsychological test may have beneficial results. Hence, utilizing the QEEG as a tertiary method of testing can be beneficial in neuropsychological testing in clinical practice (for diagnosis and treatment), in litigation and forensics, and finally in educating health professionals, caregivers, and the patient. It has been proposed that QEEG comparisons be used to better assess the location and extent of brain dysfunction. Comparison of cases from a clinical practice reveals statistically reliable discrepancies in homologous comparisons of recordings over the left and the right cerebrum, in homologous comparisons across lobes, and in comparisons along the anterior and posterior axis within each cerebrum. To support the use of QEEG in a neuropsychological testing environment, a clinical case study is provided with results drawing from each of these three neuropsychological assessments methods (e.g., standardized testing, syndrome analysis, and QEEG results). Support is provided for the advantageous properties of the QEEG in the clinical neuropsychological setting.

Practice effects over rapid-interval serial assessments on standard neuropsychological instruments in patients with schizophrenia
Beglinger LJ, Ahmed S, Crawford-Miller J, Derby MA, Siemers E, Fastenau PS, Kareken DA

The benefit of practice on neuropsychological (NP) test performance is well-studied, but there is little research examining practice effects (in controls or patients) on the rapid interval, serial cognitive assessments common to clinical drug trials. Simulating such methodology, wherein subjects are tested repeatedly to examine drug effects on cognition, we explored practice effects and performance stability in subjects with known neurocognitive impairment. Six schizophrenic outpatients, stabilized on antipsychotic medication at enrollment, were administered a 2 h battery of standard NP tests weekly for 8 consecutive weeks utilizing alternate forms created for this purpose (Fastenau et al., 2001). Patients represented a range of functional status, education (10–17), age (35–68) and years with diagnosis (5–41). For most tests, scores improved from baseline across 8 weeks. However, week-to-week intrasubject variability was high. Although repeated measures ANOVAs were generally nonsignificant, post hoc comparisons for Trails A and B, Digit Symbol, Stroop, and CPT ($P = .006$–$.05$) were significant, while PASAT, Letter Number Sequencing, and AVLT were marginal ($P \sim .06$). Results showed that extensive testing simulating drug study conditions restricted sample size. Subjects showed mixed retest effects on alternate forms tests; performance generally improved in psychomotor speed, attention, and memory, although three tests showed no stability. Given high intrasubject and intertest variability in reaching learning plateau (the ideal time to begin experimental treatment) modifications to this methodology are needed (e.g., less frequent administration of some tests). Potential explanations for variability include: diagnostic subtype, baseline cognitive ability, medication adherence, sleep quality and sustained motivation over multiple sessions. (Supported by Eli Lilly and Company).

Reliability of telephone administration of neuropsychological tests
Berns S, Davis-Conway S, Jaeger J

Telephone administration of neuropsychological (NP) tests, if reliable, could be extremely useful for clinicians and researchers. It reduces sampling bias caused by patients withdrawing from studies because

they are unwilling or unable to travel to the testing site; and it reduces associated transportation costs. While studies have supported the reliability of telephone NP testing, they have only been conducted in healthy elderly and Alzheimer's samples. In this study, 44 subjects with schizophrenia were administered a small battery NP tests selected for their adaptability to telephone administration (e.g., tests calling for both oral administration and oral responding and requiring no materials in front of the patient). The battery contains measures of short-term memory span, working memory, ideational fluency, and verbal learning. All tests were administered to each subject on two occasions, approximately 1 month apart, using alternate forms: once in-person and once over the telephone. Subjects were counterbalanced by test form (alternate or original first) and administration order (telephone vs. in-person first). Multivariate analysis of variance revealed no significant differences between administration order or test form for any NP test. There were also no significant differences between administration type (telephone vs. in-person) for tests of working memory, semantic fluency and short delay free recall. However, there were differences between telephone and in-person administration on measures of phonemic fluency and immediate attention and recall. Overall, this supports telephone NP testing as a useful option in this population for studying selected NP domains.

The Boston qualitative scoring system as a measure of executive functioning in pediatric Rey–Osterrieth Complex Figure performance

Borgos M, Holler K, Podolanczuk AB

The Rey–Osterrieth Complex Figure (ROCF) is a commonly used neuropsychological test for both children and adults in varied settings. Although this test was developed originally as a measure of complex visuospatial construction and nonverbal memory, aspects of executive functioning also have been found to contribute to ROCF reproductions. Over the years, several scoring systems have been developed for the ROCF, including the original 36-point global score and qualitative scoring systems. As a more extensive scoring system for adult ROCF performance, the BQSS (Stern et al., 1999) was developed to provide comprehensive qualitative information and quantitative summary scores, including several purported measures of executive functioning (e.g., organization, planning, and overall strategy). The current study aimed to assess the BQSS as a measure of executive functioning with a pediatric clinical group ($n = 139$), replicating an earlier study with adult patients (Somerville, Tremont, & Stern, 2000) and following exploratory BQSS research with children. Male and female participants, ages 8–17 years old, represented diverse diagnostic categories. Preliminary analyses found age-related group differences when comparing levels of executive dysfunction by selected BQSS variables and by the 36-point global score. These levels were defined by performance on three executive functioning tasks. Additional analyses are planned to explore the utility of the BQSS with this pediatric sample. Furthermore, implications of these findings will be discussed toward potentially extending this scoring system's use beyond adults.

Sex-related difference on a judgment of Line Orientation-Based Test

Caparelli-Dáquer EM, Schmidt SL

This study was aimed at analyzing gender differences on visuospatial performance. Our sample was composed of 438 men and 395 women (age ranging from 18 to 61 years and educational level ranging from elementary to graduate). The subjects were submitted to the Lines Test(c) (Cognição Ed.-Rio de Janeiro). The test is composed of three plates to be performed in 3 min each. Each plate is divided into a left, a right, and a central zone. The central zone is composed of 1 column and the left and right

zones have 5 columns with 11 lines each (0.7 mm thick and 11.5 mm long). The lines are oriented according to 10 different possible angles (15, 30, 45, 60, 75, 105, 120, 135, 150, 165°). Each column has one particular line orientation to be matched, which is encircled, at the top and also at the bottom of the column. The tests were scored by the number of hits (*H*), number of commission errors (*E*), and difference (*D*) between total number of hits and total number of errors (*E* plus the number of correct lines missed by the subject). The mean gender differences reached significance for all scores, consistently favoring men (*H*: mean = 4.4, S.D. = 0.9, $t = 5.1$, df = 772.1, $P < .001$; *E*: mean = −7.4, S.D. = 1.5, $t = -4.8$, df = 795.1, $P < .001$; *D*: mean = 16.2, S.D. = 2.7, $t = 6.1$, df = 792.9, $P < .001$). We concluded that men performed better than women on the line orientation task.

Divergent validity of continuous performance paradigms

Cernich AN, Short P, Kane RL, Kabat MH

Continuous Performance Tests (CPTs) are assumed to measure sustained attention. However, CPTs have been implemented in various ways. While they require individuals to perform relatively simple tasks over sustained intervals, variations in these tasks may significantly alter their cognitive demands. This hypothesis was tested by comparing two continuous performance tasks: the Connors Continuous Performance Test (Connors et al., 1995), and the Running Memory CPT from the automated neuropsychological assessment metrics (ANAM; Reeves and Kane, 1992; Reeves et al., 1992). While both tasks require sustained performance, they differ in length and in their response paradigm. The Connors requires continual response to a stimulus and response inhibition to the letter *X*″. The Running Memory CPT employs a one-back paradigm, where subjects select their response depending on the preceding stimulus. Data from Persian Gulf Veterans exposed to depleted uranium and matched controls ($N = 67$) were used in this study. Using structural equation modeling, we hypothesized that the measures did not represent a single sustained attention factor. A two factor model in which the two measures were specified as latent variables with loadings only from their own indices [$\chi^2(13) = 39.15$; $P = .0001$, RMSEA = 0.175] best fit the data. Despite a small correlation between the two tests ($r = .16$), the model reflected separation of the measures. While both measures putatively require vigilance, their neurocognitive demands are distinct. CPTs may require reassessment of their latent demands to ensure that they are accurately applied in clinical settings.

Cognitive processing gender differences in planning, attention, simultaneous and successive processing

Davis AS, Bardos AN, Petrogiannis K

This study used a neuropsychologically-based intelligence theory to explore gender differences in cognitive processing in college students. A more modern approach to the measurement of intelligence is instrumental, since traditional intelligence tests have been unable to explain the significant gender discrepancy that exists in academic performance, brain functioning, and special education placement. This study used 16 experimental tasks that are based on the planning, attention, simultaneous and successive (PASS) cognitive processing theory. Studies in the last 10 years using the PASS theory have found that adolescent girls have superior cognitive processing abilities in the areas of planning and attention. The gender differences found in processing abilities may not be related to environmental factors, but to different rates of cortical growth, or the hormonal effects of earlier puberty. In this study, multivariate analysis of variance indicated female superiority in two measures of attention. Females also

demonstrated a marked global difference in attention ($P < .06$). While females also obtained a higher mean score on planning ability, the difference was not found to be significant. These results seem to indicate that the adolescent female superiority in planning may be a function of earlier prefrontal lobe development, and the planning gender differences diminish as we progress into adulthood. However, the finding that females are superior in attention processing ability seems consistent from adolescence into adulthood. Implications of these results for neuropsychological assessment, psychoeducational assessment, and treatment interventions are discussed.

Concurrent validity of the general ability measure for adults with the WAIS-III
Davis AS, Bardos AN, Petrogiannis K

The demographic changes in the US have necessitated the development of new tests of cognitive ability that do not take language, cultural background, or educational opportunities into account. It has been demonstrated that traditional intelligence tests are often confounded by academic achievement or expressive language skills, which adversely affect scores for individuals from non-English speaking backgrounds or cultures. The general ability measure for adults (GAMA) was designed to address this problem as well as to provide a brief, efficient assessment of an individual's general cognitive ability. The GAMA is a self-administered test that uses nonverbal abstract designs and shapes to minimize the effects of education, verbal expression and verbal comprehension. Although there are studies comparing the performance of clients with traumatic brain injuries, learning disabilities and other special populations on the GAMA and Wechsler Adult Intelligence Scale-III (WAIS-III), a review of the literature revealed only one study with the WAIS-III limited to college age populations. This study compared the performance of 65 adults on the GAMA and the WAIS-III. Pearson product moment correlations revealed moderate to high correlations between the GAMA IQ score and Verbal IQ, Performance IQ, Full-Scale IQ, Verbal Comprehension Index, and the Perceptual Organization Index of the WAIS-III. The results of this study will be discussed in terms of the inclusion of the GAMA as part of a comprehensive neuropsychological battery for individuals from diverse backgrounds, or when a brief measure of cognitive ability is appropriate.

Using the Dean–Woodcock neuropsychological battery with the Woodcock Johnson III
Decker S

We reviewed the factor structure of the Dean–Woodcock neuropsychological battery (DWNB). The DWNB is used as a supplement to the Woodcock Johnson III (WJ III) when used in neuropsychological assessment. The poster will display how the DWNAS simple sensory, complex sensory, cortical motor and subcortical motor constructs relate to the WJ III constructs that correspond with the Cattell–Horn–Carroll (CHC) theory of human intelligence. Relations between these constructs were primarily explored with a factor analysis and a joint-confirmatory factor analysis. Data was analyzed for 800 individuals that ranged in age from 3 to 90. Results from these analyses support the theoretical basis of the DWNB as a four-factor measurement of cortical and subcortical sensory and motor constructs; however, substantial overlap was found between sensory and motor constructs. Additionally, significant factor loadings between constructs of sensory and motor functioning and CHC constructs were found that ranged from .2 to .8. These results suggest a substantial relationship between sensory/motor constructs and the constructs in the CHC theory of intelligence. The results are important for clinicians who use traditional measures of neuropsychological assessment (DWNB) with more contemporary measures of cognitive ability (WJ III) that are based on CHC theory.

Factor analysis of attention: continued exploration of Mirsky's factors of attention
Dixon DR, Denning JH, Chidester T, Roberts D, Gouvier WD

Based on the idea that attention is not a unitary construct but a multifaceted cognitive domain, researchers have created tests and self-report instruments to explore the components of attention. Researchers have factor analyzed specific tests of attention in an attempt to show how various aspects of attention can be differentiated from one another. The present investigation explored the factor structure of a battery of attention measures in an adult population in an effort to explore the factor structure. Participants were 85 college students (mean age = 22.18, S.D. = 7.12) self-referred for evaluation of attention or academic problems. Participants were given several commonly used tests of attention within the context of a comprehensive psychoeducational test battery. Measures of attention included the d2 test of attention, CPT-II, Trail Making Test Parts A and B, WAIS-III: Let num sequencing, Digit Span, Digit Symbol Coding, Symbol Search and Arithmetic. A principle components factor analysis with varimax rotation showed that a five-factor solution provided the best fit for the data. The five factors can be best characterized as being (1) psychomotor processing speed, (2) vigilance, (3) visual attentiveness, (4) internal response consistency, and (5) working memory. The present investigation provides further evidence that attention is a complex construct that requires the administration of diverse tests in order to more fully characterize the nature of an individual's attentional strengths and weaknesses.

Dissociation between list learning and story recall in a clinical sample
Duff K, Adams RL, Schoenberg MR, Scott JG

Comprehensive neuropsychological assessment will often contain multiple measures that purportedly tap common domains of cognitive functioning. For example, more than one verbal memory measure may be used within an assessment. When these common measures yield similar results, the interpretation is straightforward; but when these common measures yield disparate results (i.e., dissociate), the clinician must explain these differences. The present study investigated the frequency of dissociations between verbal memory measures in a clinical sample of 626 patients. Performances on the Logical Memory subtest (LM) of the Wechsler Memory Scale-Revised and Rey Auditory–Verbal Learning Test (RAVLT) were converted to age- and education-corrected standard scores, and then difference scores were generated (e.g., LM-RAVLT). The distribution of difference scores resembles a normal curve, where 74.3% of the patients showed no dissociation (i.e., LM-RAVLT = ±1 standard deviation), 22.5% showed borderline dissociation (i.e., LM-RAVLT = 1–2 S.D.), and only 3.2% showed significant dissociation (i.e., LM-RAVLT > 2 S.D.). Although additional investigations are needed with other verbal memory measures, as well as with healthy controls, the results of the present study might help clinicians interpret dissociations among neuropsychological measures.

Poor visual memory or executive dysfunction? The relationship between visual memory and executive functioning
Duff K, Schoenberg MR, Scott JG, Adams RL

Given the broad definition of executive functioning, it is not surprising that these abilities exert significant influences on other cognitive processes. Recently, Tremont et al. (2000) demonstrated the impact of executive dysfunction on several measures of verbal learning and memory. The present study sought to extend this work by investigating the impact of executive functioning on measures of visual learning and memory in a mixed clinical sample. Several measures of executive functioning (COWAT, WCST,

Similarities, Trail B) were used to classify patients as either having minimal executive dysfunction (MED, $n = 110$) or significant executive dysfunction (SED, $n = 108$). These groups were then compared on several measures of visual learning and memory (WMS-R Visual Reproduction and Visual Paired Associates, ROCFT 30 Delay). Consistent with Tremont et al., SED patients performed more poorly than MED patients on all visual memory measures. Canonical correlations between executive function measures and visual memory measures indicated that the two share 48% of their variances. Although the directionality of influence cannot be determined, clinicians are cautioned when interpreting poor performance visual memory measures, as they may be due to impaired executive abilities.

Normative data for Saudi Arabian language sample
Escandell VD, Sandridge A, Al Kawi Z, Al Shail E

In order to analyze language competence in intractable epilepsy patients (before and after surgery), normative data for specific language tests were acquired from the Saudi Arabian population. These controls consisted of 300 right-handed subjects, 16–69 years of age, without neurological or psychiatric diagnoses. The tests were stratified by age, sex, education, geographic region, urban/rural, and occupation. The tests selected included measures of fluency, repetition, comprehension, reading, math and intellect. The language battery included the Multilingual Aphasia Examination Sentence Repetition Test, the Controlled Word Association Test (re-defined to six Arabic letters), Wechsler Adult Intelligence Scale (WAIS-III) Digit Span and Similarities subtests, the multiple choice Vocabulary subtest of the WAIS-NI, Camel Reading Test, Boston Diagnostic Aphasia Exam Reading Comprehension, Boston Naming Test and the Arithmetic subtest from the Wide Range Achievement Test. Raven's Progressive Matrices, WAIS-III Matrix Reasoning and Arithmetic subtests provided measures of intellect. Instruments were back translated to an efficiency of greater than 98%. The mean, mode, standard deviation, percentile, and standard error are provided for the group as a whole and for each aggregate. Education was found to be a significant covariate. A correlation matrix partialed for education is presented. Each test's distribution of scores with percentiles comparing control participants with left hemisphere lesion patients, right hemisphere lesion patients and globally disordered patients is presented. This study shows that these measures are significant for the clinical assessment of language in this population.

Stratified normative data for the Saudi Arabian Arabic reading comprehension test
Escandell VD, Sandridge A, Al Kawi Z, Al Shail E

To analyze language performance of Saudi Arabian intractable epilepsy patients, a reading comprehension test (Dervish and the Missing Camel Test) was created with a right-handed Saudi Arabian ($n = 300$) adult normative data base (without neurological and psychiatric diagnosis). Data were stratified by age, sex, education, occupation, urban/rural and geographic province. Age ranges were 16–19 and by decades to 69. The 1996 census provided the base rate for each cohort. Separate results for illiterate persons are presented. The test is divided into four parts. Participants identified the main characters from a set of eight (four foils); numbered the sequence of character introduction; answered 10 dichotomous questions of detail; wrote one sentence each for detail, main ideas, and summary. A copy of the test (English/Arabic) and scoring sample are provided. The mean, mode, percentile, standard deviation, kurtosis and standard error are presented for each cohort and the sample as a whole. The same statistics are presented for a group of neurosurgical candidates ($n = 700$) by region of lesion (left, right, anterior, posterior, and global). The hemisphere lesion patients have

epilepsy or tumor diagnoses. The global disorder patients have a diagnosis of mild cognitive decline. A correlation matrix for 300 controls, partialed for education, comprised of the Ravens Progressive Matrices, Wechsler Adult Intelligence Scale-III Matrix Reasoning subtest, the Wide Range Achievement Test-3 Arithmetic subtest and the Camel Reading Test is provided. The Camel Reading stratified normative data is significant for the clinical assessment of reading comprehension in this population.

Exploratory factor analysis of the WMS-III in a heterogeneous neuropsychological population

Espe-Pfeifer P, Mahrou M, Devaraju-Backhaus S, Greene L, Golden CJ

The Wechsler Memory Scale (WMS) has long been the major instrument used for the assessment of memory within the field of neuropsychology. Historically, revisions to the WMS have been met with increasing attempts to statistically explore and clinically understand the underlying structure of the test. The purpose of the study was to examine the factor structure of the Wechsler Memory Scale-Third Edition (WMS-III) in a heterogeneous neuropsychological population. Participants were 125 adults referred for neuropsychological evaluation. The average age was 37 years (S.D. = 14.9) and average education was 13 years (S.D. = 2.8). The sample was predominantly female (56%), right-handed (90%), and Caucasian (74%), with the remainder of the population classified as Hispanic (12%), African-American (10%), or other (4%). Diagnoses included 25% psychiatric disorders, 61% neurological disorders, and 14% with no diagnosis. A principal component factor analysis with varimax rotation was calculated on subtest scaled scores from the WMS-III. The analysis revealed that a three-factor model, including visual memory, auditory memory, and working memory, accounted for 71% of the total variance. Similarities and differences between the results of this analysis and prior factor analyses are examined in terms of sample characteristics and test versions.

Criterion-related validity of five alternate forms for five neuropsychological tests: correlations with original test

Fastenau PS

Five alternate forms were designed for WAIS-III Digit Span (DSp), Digit Symbol (DSy), and Letter-Number Sequencing (LNS); Trail Making Test (TMT); Paced Auditory Serial Addition Test (PASAT); and Rey Auditory–Verbal Learning Test (RAVLT). Content validity has been previously described (Fastenau et al., 2001). In this study, criterion-related validity was examined. Participants were 102 nonclinical adults (79% female, 88% right-handed; 78% Caucasian, 14% African-American, 8% other/multiracial) ranging in age from 18 to 60 (M = 36.9, S.D. = 12.5). Education ranged from 10 to 21 years (M = 15.3, S.D. = 2.7). WRAT-3 Reading SSs ranged from 53 to 123 (M = 104.5, S.D. = 12.0). Participants completed the above tests (Time 1); after a 10-min break, they repeated the battery in the same order (Time 2). By random assignment, half of the participants completed the original form at Time 1; of those, each person was randomly assigned to complete one of five alternate forms at Time 2. The other half completed the original form at Time 2 and one of the five alternate forms at Time 1. Each form was correlated with the original test. Excellent validity was achieved for all forms of DSy (validity coefficients ranging 0.88–0.93) and three forms of TMT-B (0.90–0.94). Coefficients were good (>0.80) to moderate (>0.70) for at least two forms for all tests except TMT-A, before correcting for unreliability. Several forms showed acceptable (if not exceptional) validity and will provide solid alternate forms for repeat testing. (Supported by a grant from Eli Lilly and Company.)

Examination of the appropriateness of 30–50-year-old ECFT norms for younger adults: supporting evidence

Fastenau PS

The Extended Complex Figure Test (ECFT, Fastenau, 1996), an extension of the Rey Complex Figure Test, has strong norms for adults from age 30 to age 85 (Fastenau, Denburg, & Hufford, 1999). Recently, norms were added for children ages 6–17 (Fastenau & Sasher, 2001). In the present study, data were collected on adults ages 18–29; this sample was compared to the published norms to determine whether separate age-appropriate norms are warranted. Participants were 28 nonclinical adults (82% female, 89% right-handed; 86% Caucasian, 7% African-American, 4% Asian, 4% other/multiracial) ranging in age from 18 to 29 ($M = 23.4$, S.D. $= 4.4$). Because many in this sample were still in school, parent's education was used for demographics; 25% had high school or less, 11% attended some college, 29% completed college, 32% completed postgraduate work. Participants completed the ECFT as part of a brief battery of tests. The results from this sample were compared to the mean values for the youngest age group (ages 30–50) published in The Clinical Neuropsychologist (Fastenau, Denburg, & Hufford, 1999) using a one-sample *t*-test. Results: This sample scored slightly (1-point) but significantly lower than the middle-aged normative group on the copy trial ($t = -2.25$, $P = .03$). On immediate recall, delayed recall and recognition, there were no differences ($t < -1.68$, $P > .10$). The published Rey and ECFT norms for 30–50 years old should be applicable to younger adults, with only slight distortion on the copy trial.

Time-to-completion on the Rey–Osterrieth Complex Figure Test: norms for copy, immediate recall, and delayed recall trials

Fastenau PS

The Rey–Osterrieth Complex Figure Test is well normed for accuracy ratings, but norms are lacking for the time it takes to draw the figure. Time to completion (TTC) data for the Rey were analyzed from the Extended Complex Figure Test (ECFT) normative sample (Fastenau, Denburg, & Hufford, 1999). Participants were 211 adults with no neurological history. Age ranged from 30 to 85 years ($M = 62.9$, S.D. $= 14.2$), education ranged from 12 to 25 years ($M = 14.9$, S.D. $= 2.6$), and 55% were women. IQ was estimated to be in the upper half of the average range based on reading or vocabulary. The sample was predominantly Caucasian (over 95%). Effects of sex, age, and education were investigated using multivariate analysis of variance. Results showed an age $\times$ education interaction on the copy trial [$F(15, 195) = 2.50$, $P < .001$]. Differences were observed only for the oldest cohort (ages > 80) with the most education (>15 years). All other scores were comparable across age groups and across levels of education for both men and women ($P > .10$). Results were tabulated for ages 30–79 (excluding oldest cohort) for easy conversion of TTC to scaled scores ($M = 10$, S.D. $= 3$, similar to ECFT and WAIS-III conversion tables). TTC norms complement published Rey and ECFT accuracy norms, permitting the practitioner to quantify the degree of slowing in patients with psychomotor impairments. Similarly, practitioners can quantify the speed of impulsive individuals when describing their performances on drawing trials of the Rey and ECFT.

Practical considerations for designing, administering, scoring, and analyzing Continuous Performance Tests

Fleck DE, Shear PK, Strakowski SM

The Continuous Performance Test (CPT) is highly sensitive to various forms of neuro- and psychopathology, and has been recently cited as the most frequently used measure of attention in both practice

and research (Riccio et al., 2002). Unfortunately, many previous investigations indicate that the CPT lacks specificity. Recent evidence suggests that either decreased sensitivity or specificity may result when certain practical considerations are overlooked in clinical and research applications. The present retrospective study was conducted to compare experimentally obtained data based on the application of four specific practices hypothesized to increase CPT sensitivity and specificity. These four practices encompass CPT design, administration, scoring, and analysis and included: (1) collecting performance measures across the entire course of the vigil, (2) not redirecting the subject's attention during test administration, (3) scoring both typical and atypical performance measures (e.g., RT measures; Fleck et al., 2001, 2002), and (4) analyzing group × time interactions (Corkum & Siegel, 1993; Nuechterlein, 1991) and conducting follow-up trend analysis. Results indicated that these practices qualitatively increase test sensitivity, increase etiological and cognitive specificity, and facilitate interpretation by strengthening associations with the psychological construct of sustained attention, which the CPT is purported to measure. It is hoped that these considerations will provide a perspective on the CPT as a theoretically meaningful test of sustained attention, as opposed to a simple index of gross attentional impairment.

Re-examining the meaning of surprise
Forrest TJ, Allen DN, Hall MD, Corral I

The labeling of facial affect has received growing attention in the neuropsychological and cognitive literature. To examine the cognitive labeling of surprise, a set of auditory–visual emotional stimuli depicting joy or sadness were developed on a sample of 120 individuals. Subsequently, 30 additional participants were asked to categorize these auditory–visual stimuli as best representing one of the eight emotions represented on Plutchik's emotion circumplex (joy, acceptance, expectancy, surprise, anger, disgust, fear, or sadness). These stimuli portrayed either joy or sadness in both the auditory and visual modalities (emotionally congruent) or else portrayed joy in one of the modalities and sadness in the other (emotionally incongruent). Results indicated that participants seldom misidentified emotionally congruent auditory–visual stimuli. Emotionally incongruent stimuli were perceived as being part of one of two groups. When a sad face was paired with a joyful voice, participants identified the stimuli as representing a primarily negative emotion (anger, disgust, fear, or sadness). In contrast, when a joyful face was paired with a sad voice, participants identified the incongruous stimuli as either representing a primarily positive emotion (surprise, joy, acceptance, or expectancy). Contrary to research that supports the idea that surprise is typically categorized as a negative emotion, results of the current study suggest that surprise was associated with positive rather than negative emotional states. Implications for the neuropsychological application of emotion labeling are discussed.

Blazing trails with the right hemisphere: a homologous version of Trail Making Parts A and B
Foster PS, Harrison DW

Parts A and B of the Trail Making Test are often included in neuropsychological evaluations due to their sensitivity in detecting brain dysfunction. However, since the test is comprised of numbers and letters it may preferentially involve the left hemisphere in many individuals. Hence, the present investigators sought to develop a homologous version of the test that would preferentially involve the right hemisphere. To accomplish this objective, figures were used in place of numbers and letters. The resulting test, referred to as Trail Making Parts C and D, used the same principles in that the examinees are instructed to connect sequentially a series of figures according to specific guidelines.

It was hypothesized that, for individuals with no history of cerebral dysfunction, a significant positive correlation would be found between Trail Making Parts A and B and the new Trail Making Parts C and D. Significant positive correlations with the Ruff Figural Fluency Test (RFFT), a measure of right frontal lobe functioning, were also hypothesized. Results from administration of the new Trail Making Test to 20 right-handed males indicated significant correlations between performance on Parts C and A ($r = .51$, $P = .011$) as well as the number of perseverative errors on the RFFT ($r = .38$, $P = .049$). Further, performance on Part D was significantly correlated with Part B ($r = .59$, $P = .003$) as well as the error ratio of the RFFT ($r = .41$, $P = .038$).

The Design Learning Test: assessment of learning using the right hemisphere
Foster PS, Williamson J, Harrison DW

The Rey Auditory–Verbal Learning Test (RAVLT) has often been used to assess verbal learning deficits resulting from head injuries as well as lesions arising from other sources. However, as this test involves the use of words, it may be more sensitive to lesions localized within the left hemisphere. Indeed, research has found that patients receiving left temporal lobe resections evidence severe forgetting of words (Majden, Sziklas, & Jones-Gotman, 1996). Hence, the purpose of the present investigation was to develop a homologous test of the RAVLT that would be more sensitive to lesions localized within the right hemisphere. To accomplish this objective, designs comprised of combinations of simple geometric figures (circles, triangles, and rectangles) were used in place of words. Specifically, two geometric figures were combined in such as way as to limit the verbal strategy that may be used to memorize the designs. The administration of the new test, referred to as the Design Learning Test (DLT), was similar to that of the RAVLT in that a total of 15 designs were presented at a rate of one every 2 s over a total of five trials. It was hypothesized that, for individuals with no history of head injury, a significant positive correlation would be found between the total number of words recalled from the RAVLT and the total number of designs recalled from the DLT. The results supported this hypothesis in that a significant positive correlation was found ($r = .42$, $P = .007$).

The Trail Making Test and its neurobehavioral components
Gass CS

This study investigated component skills comprising performance on the Trail Making Test. Part A requires numeric sequencing, visual scanning, and graphomotor speed, whereas Part B includes the additional requirements of letter sequencing and mental double tracking in shifting between number and letter series. Low scores on either test can be due to graphomotor slowness alone or in combination with visual scanning and sequencing difficulties. Trails Speed is a relatively new test that is administered just prior to Trails A and B, and measures graphomotor speed without requiring visual search, letter sequencing, or mental double tracking. The circled numbers on the test form (1–25) are arranged in columns such that the correct path alternates predictably from one column to the other, creating a simple zig-zag design. In this study, the performance of 100 consecutive neuropsychological referrals was investigated, including measures of working memory, processing speed, and perceptual organization (WAIS-III indexes), and Finger Tapping speed. A principal components analysis followed by a varimax rotation yielded four orthogonal factors accounting for 81% of the total variance: intelligence (34%), motor speed (19%), visual scanning (15%), and alternating attention (13%). Motor speed accounted for 42% of the variance in Trails A performance, and 17.7% of the variance in Trails B scores. Visual scanning accounted for an additional 30% of the variance in Trails B performance.

These findings support the utility of the Trails Speed Test in interpreting scores on the Trail Making Test.

Exploratory analysis of the attentional component of the Comprehensive Trail Making Test
Graves ME, Leark RA, Reynolds CR

The Comprehensive Trail Making Test (CTMT) is a recent measure designed to enhance strengths of the original Trail Making Test. The CTMT measures components of visual search and sequencing, visual motor, and attentional functions. This study was designed to assess the CTMT's relationship to attention. Thirty-two adolescents (mean age = 14.84, S.D. = 1.5 years) were given the CTMT and the test of variables of attention (TOVA). Comparisons between Q1 and Q3 measures from the TOVA were made to the six CTMT scores. Pearson correlations indicated significant positive relationships between the CTMT composite score and the TOVA response time variability quarter three (.362) and the RTVQ3 to CTMT Trial 4 (.380). Positive correlations ranging from .248 to .344 were obtained across the remainder of the CTMT scaled scores and the RTVQ3. Due to the sample size, these correlations only neared (*P*-values of .06–.08) conventional levels of significance. The pattern and relative magnitude of the relationships were all within the realm of expectations given other literature regarding the measurement of attention. The TOVA and the CTMT use discrepant methods of assessing attention. The CTMT contains a stronger component related to set-shifting and to visual–motor speed, yet results from the two measures are significantly related. These results provide information on the attentional component of the CTMT and on the relationship of method variance to measuring overlapping constructs through multiple means. Discussion is provided on the relationship between these two instruments and the need to assess attention in clinical settings via more than one method.

Cognitive and perceptual-motor indicators of lateral versus diffuse brain damage in adults
Gregory EK, Dial JG, Nelson PA

Among the goals of the neuropsychological assessment are to detect the presence of brain damage, localize which areas of the brain may be dysfunctional and describe subsequent functional impairments. The sensitivity of neuropsychological instruments in carrying out these functions is a question of some debate. It has been widely accepted that observed difficulties in language and right-sided perceptual-motor difficulties indicate the presence of left hemisphere damage, while problems with spatial processing and left-sided perceptual-motor abilities are pathognomonic of right-hemisphere dysfunction. This study utilized portions of the McCarron-Dial System (MDS), including the Haptic Visual Discrimination Test (HVDT) and the McCarron Assessment of Neuromuscular Development (MAND), as well as the Wechsler Adult Intelligence Scale-Third Edition (WAIS-III), to evaluate the sensitivity of the MDS to differentiate lateralized versus diffuse brain injury. Thirty-seven normal and 130 brain-damaged adult participants were evaluated. Statistical analyses using ANOVA procedures revealed the MDS to be highly sensitive in determining the presence of brain injury versus normal controls in all areas assessed ($P < .0001$). The MDS was also sensitive to lateralization of dysfunction versus diffuse damage on measures of performance IQ, left HVDT, and a composite measure of left side motor speed, strength and coordination ($P < .0001$). These findings validate the utility of the MDS in detecting normal versus brain injured persons and lateralized versus diffuse brain dysfunction and point to the system's usefulness in the diagnosis, rehabilitation, and treatment planning of persons with brain injury.

The Verbal N-Back Test, the Waters and Caplan Reading Span Test and the WAIS-III Letter–Number Sequencing subtest: how do these measures of verbal working memory compare?
Grigorova M, Barbara SP, Alina K

This study investigated weather the assumption that different tests of working memory (WM) tap the exact same function is valid. Performance on three widely used measures of Verbal WM, the Verbal N-Back Test, the Waters and Caplan Reading Span Test and the Wechsler Adult Intelligence Scale-III (WAIS-III) Letter–Number Sequencing subtest were compared in healthy women between the ages of 60 and 73 years (mean = 65.8 years). Performances on the Verbal N-Back Test and WAIS-III Letter–Number Sequencing subtest were significantly correlated. However, tests scores of these women on the Waters and Caplan Reading Span Test were not correlated to the results of the other two tests. These findings suggest that different measures of verbal working memory may differentially recruit the various components of this cognitive function. In addition, performance on the Waters and Caplan Reading Span Test was correlated to the Energetic/Tired scale on the POMS-BI questionnaire.

Dynamic effects of menstrual phase and hostility on verbal fluency
Higgins D, Harrison D

Sixty-three right-handed undergraduate women were classified using the Cook–Medley Hostility Inventory (21 high-hostile, scoring 25 or more; 21 mid-hostile, scoring 18–24; and 21 low-hostile, scoring 17 or less). Participants were administered a standard verbal fluency task, the COWAT. Dynamic functional cerebral laterality was assessed, specifically, the influence/interaction of hormonal levels and hostility on frontal lobe functioning. Twenty-eight women were identified to be in the follicular phase of their menstrual cycle (identified as equal to or less than Day 13), and 35 women were identified to be in the luteal phase (identified as equal to or greater than Day 14). A general linear model, or GLM ANOVA was performed on women's verbal fluency scores, using menstrual phase (phase) and hostility level (group) as between subjects factors. Data were analyzed for overall group effects and interactions with menstrual phase across trials. No main effects of group were found for verbal fluency; however, a main effect of phase was found for verbal fluency [$F(1, 57) = 4.73$, $P < .0339$], wherein women in the first half of their menstrual cycle (follicular) generated an average of 12.3 words per trial, while women in the second half of their menstrual cycle (luteal) generated an average of 14.0 words per trial. In addition, a group by trial interaction effect was found on verbal fluency [$F(4, 114) = 12.44$, $P < .0001$]. Furthermore, a phase by group by trial interaction effect was found on verbal fluency [$F(4, 114) = 3.01$, $P < .021$], as groups were differentially affected on each verbal fluency trial by their current menstrual cycle status.

Using the Bicycle Drawing Test with adults
Hubley AM, Hamilton L

The Bicycle Drawing Test (BDT) was first developed as a measure of children's higher conceptual reasoning (Piaget, 1930; Taylor, 1959), but has since been described as a measure of visuographic functioning and mechanical reasoning (Lezak, 1995). The BDT is currently used in clinical settings with both children and adults. Greenberg, Rodriguez, and Sesta (1994) presented a standardized administration and scoring system for the BDT and provided reliability and validity evidence to support its use with children. Using the administration and scoring system developed by Greenberg et al., the present study provides preliminary reliability and construct validity evidence with respect to the use of the BDT with adults and introduces a copy trial to supplement the free drawing portion of the test. In a sample of 50 community-

dwelling men and women ages 20–79 years, interrater reliability and 1-week test–retest reliability coefficients are computed, mean performance on the BDT is described, and correlations of the BDT with age, visuospatial measures (i.e., Rey–Osterrieth Complex Figure, WAIS-III Block Design, Hooper Visual Organization Test), and a verbal measure (i.e., Rey Auditory–Verbal Learning Test) are examined.

The Memory Test for older adults (MTOA): a new assessment tool
Hubley AM, Tombaugh TN

The Memory Test for older adults (MTOA; Hubley & Tombaugh, in press) is a brief set of measures for assessing verbal and visuospatial learning and memory performance in older adults. The MTOA may be used in the identification of various types of memory deficits for the purposes of diagnosis, placement, development of intervention strategies, or to establish baseline performance prior to clinical or medical interventions such as surgery or drug administration. There are two versions of the MTOA. The MTOA-long was designed to be used with individuals who have been referred for evaluation of a possible memory deficit whereas the MTOA-short was designed to be used when impairment is obvious or has already been diagnosed. Both versions of the MTOA consist of one verbal task (i.e., a word list) and one visuospatial task (i.e., a geometric figure). The MTOA can be administered on its own or as part of an extensive neuropsychological battery. Normative data for the MTOA are available for men and women ages 55–84 years (MTOA-long: $N = 187$; MTOA-short: $N = 213$). Data from a series of studies are presented to provide information about the psychometric properties of both versions of the MTOA, including internal consistency, interrater reliability, factor structure, as well as performance comparisons among cognitively intact, depressed, and dementia samples.

Verbal explicit memory performance among Japanese-Americans and European-Americans: gender and ethnic differences
Isomura A, Wisniewski A

This study investigated gender and ethnic differences in verbal explicit memory performance among Japanese-Americans and European-Americans. It was hypothesized that: (1) females perform better than males on verbal memory tasks and (2) European-Americans perform better than Japanese-Americans on verbal tasks. Thirty Japanese-Americans (15 males; 15 females) and 30 European-Americans (15 males; 15 females), aged 18–35 years old, were administered the California Verbal Learning Test (CVLT). Total words Trails 1–5, long delayed recall, semantic cluster ratio, and serial cluster ratio from the CVLT were examined. In addition, Japanese-American participants were administered the Suinn–Lew Self-Identity Acculturation Scale (SL-ASIA), and information on generational status in the United States was collected. The data partially supported the hypothesis that females perform better than males on the CVLT. However, additional analyses revealed that gender differences on the CVLT Total Words Trials 1–5 was significant only for Japanese-Americans and not for European-Americans. Further, the hypothesis that European-Americans perform better than Japanese-Americans on the CVLT was not confirmed. In fact, Japanese-Americans performed better than European-Americans on the CVLT serial cluster ratio.

Normative performance in the Digit Cancelation Test (D-CAT)
Ito Y, Ito E, Hatta T, Yoshizaki K

The importance of pragmatically valid neuropsychological assessment (e.g., attention) has been recognized. However, available tests did not meet this requirement because of the time necessary to administer

the assessments, or there is not appropriate normative data. For this reason, we developed the Digit Cancelation Test (D-CAT), which can evaluate attention ability in brief time. In the D-CAT, participants are asked to search for target digits (one, two or three digits) in the printed digit sequences sheet. The D-CAT includes three type of indices, total performance (TP) which is the number of total searched digits, omission rate (OR) which is the number of missed target digits per number of targets that should be canceled, and reduction ratio of performance (RRP). In the last report of this meeting (Ito et al.), we indicated the usefulness of D-CAT for evaluating the attention disorder of traumatic brain injury (TBI) patients by comparing normal subject ($N = 356$) with TBI patients ($N = 42$). In the current study, we administered the D-CAT to a larger sample ($N = 908$) between 18 and 95 years of age in order to establish normative data. The results for each index were analyzed by target size (one, two, three) by age (18–29 [$N = 362$], 30–49 [$N = 95$], 50–59 [$N = 127$], 60–69 [$N = 209$], more than 70 [$N = 115$]). The results showed that TP and OR related with age. TP was decreased as age increasing, while the reverse was true in OR Index. However, RRP did not correlate with age.

Validation of the WAIS-III General Ability Index in inpatient neuropsychiatry
Iverson G

The purpose of this study was to provide preliminary validity data for the new WAIS-III General Ability Index (GAI) in a sample of 33 neuropsychiatric inpatients, most of whom had serious brain injuries or diseases. The GAI is comprised of the six subtests that form the Verbal Comprehension and Perceptual Organization indexes. In this sample, the Verbal Comprehension Index was significantly greater than the Perceptual Organization ($P < .02$; $d = 0.39$), Working Memory ($P < .006$; $d = 0.37$), and Processing Speed indexes ($P < .0001$; $d = 0.91$). In addition, the Perceptual Organization ($P < .002$; $d = 0.58$) and Working Memory indexes ($P < .007$; $d = 0.47$) were both greater than the Processing Speed Index. The GAI, although highly correlated with the FSIQ (i.e., $r = .96$), was, on average, 5.6 points higher ($P < .0001$; $d = 0.44$). The GAI was significantly higher than the Perceptual Organization ($P < .005$; $d = 0.24$), Working Memory ($P < .05$; $d = 0.25$), and the Processing Speed indexes ($P < .0001$; $d = 0.85$). The GAI appears to be a more refined measure of so-called omnibus crystallized and fluid intelligence than the FSIQ, when applied to patients with known acquired brain damage. Certainly, this new index is an appropriate measure for use in day-to-day clinical practice in neuropsychology. To facilitate clinical use, statistically reliable difference scores between the GAI and the four index scores, for the 95% confidence interval, are presented.

ImPACT normative data for high school and college athletes
Iverson G, Podell K, Lovell M, Collins M

The purpose of this study was to develop normative data for Immediate Postconcussion Assessment and Cognitive Testing (ImPACT), a computerized neuropsychological test battery designed to assess recovery from sports-related concussion. Preliminary analyses were based on 2,142 high school and university students. The 1,277 university students performed better than the 865 high school students on the memory, reaction time, and processing speed composite scores. However, within the high school and the college groups, there were no differences on the three composites that were attributable to grade or year. There was a gender effect, especially among the high school students, with males showing faster reaction times and processing speed than females. Importantly, self-reported learning problems were clearly related to test performance. When the students with any form of self-reported learning problem were combined into a single group (e.g., reading, spelling, math, or special education placement), they

performed more poorly on all three composites, across both levels, with effect sizes ranging from 0.24 to 0.39. Therefore, students with any form of self-reported learning problem were removed from the final normative data set. Demographic analyses were rerun on the final sample, and the significant differences attributable to level and gender remained. Again, there were no differences attributable to grade or year within the levels. The final normative tables were based on 588 high school males, 119 high school females, 803 college males, and 236 college females. Normative data are based on the natural distributions of scores within these four samples.

Current trends in the practice of clinical neuropsychology: practice patterns, referral sources, and effects of managed care

Kanauss K, Schatz P

We pilot-surveyed practice patterns, referral trends, and effects of managed care among professional neuropsychologists. Forty-two neuropsychologists responded to a posting on the neuropsychology list-serve. The average respondent was a 44-year-old, licensed, doctoral-level psychologist. Respondents most frequently delegated their time to clinical practice (45.7%), test administration (31.3%), and research (21.3%). Respondents ranked neurology as the most frequent referral source, followed by pediatric/physiatric medicine, general medicine, psychiatry, neurosurgery, and lawyers. Respondents ranked determination of diagnosis as the most frequent activity performed for referral sources, followed by treatment planning, documenting baseline functioning, and forensic activities. Evaluation for attorneys required the most time (462 min per evaluation), followed by evaluations for neurologists, physicians, and other psychologists (364 min), and private practice evaluations (348 min). Forensic evaluations were the most consistently reimbursed activities (94% of billed time), followed by treatment and therapy (88%), professional referrals (82%), and diagnostic interviews (76%). When asked if managed care had an adverse effect on their practice, 67.6% of respondents reported in the affirmative. Specifically, while respondents report an average cost per patient per hour at $178, only 38.9% of the respondents receive full compensation for each patient hour, and only 59% of their hourly rate is reimbursed. These results suggest that, despite the constraints imposed by managed care, neuropsychologists continue to provide highly desired and reimbursable services to a wide variety of referral sources.

Construct validity of the Universal Nonverbal Intelligence Test

Kane H

The Universal Nonverbal Intelligence Test (UNIT) is a standardized, norm referenced measure of intelligence. The salient feature of the UNIT is that administration and response formats are entirely nonverbal, requiring only universal hand gestures from the examiner and examinee. The UNIT was constructed in order to measure the cognitive abilities of children who may be disadvantaged by more traditional intelligence tests, which typically emphasize receptive and expressive language abilities. In addition, the nonverbal administration and response format of the UNIT may offer a more comprehensive measure of intelligence for children who are hearing impaired or possess language-based disabilities. In sharp contrast to existing language-free tests, which tend to be unidimensional in their assessment of a single general factor (i.e., Spearman's *g*), the UNIT also assesses multiple facets of intelligence. Therefore, the UNIT attempts to fill a large void in the nonverbal assessment of cognitive abilities. Beyond those studies executed in its development, relatively few studies have examined the psychometric properties of the UNIT. Insofar as psychometric validity is requisite for clinical and interpretive validity, such independent analysis is critical, especially in the consideration of new instruments. The purpose of

the present study is to independently substantiate the proposed factor structure of the UNIT. Independent confirmatory analysis affirms the proposed factor structure, as well as two competing theoretical models. Recommendations for clinical interpretations are presented.

Construct validity of the WISC-III for Blacks and Whites
Kane H

The Wechsler Intelligence Scale for Children-Third Edition (WISC-III) is the most widely used intelligence test for children 6–17 years of age. The WISC-III provides a measure of general intelligence (e.g., Spearman's *g*), as well as index scores related to specific abilities. In particular, the WISC-III offers indices of neural efficiency and attention. Despite its wide acceptance among clinicians, relatively few studies have examined group differences between Blacks and Whites in light of the WISC-III constructs. Using the standardization data of the WISC-III, confirmatory analyses were conducted across the Black and White subsamples. While the factor structure is identical in both groups, we noted significant group differences in subtest and indices performance. Follow up analysis of subtest scatter identified a distinct pattern in which the magnitude of group differences on subtests varied as a function of subtest loadings on Spearman's *g*. Implications for diverse and minority populations are discussed, along with guidelines for clinical interpretation.

Assessing premorbid cognitive functioning for Hispanics: options and considerations
Krueger KR, Puentes GP, Huerta AR, Wilson RP

Hispanics make up a substantial portion of the United States population. It is estimated that the number of Hispanics in this country will continue to increase, with a large proportion of Hispanics speaking primarily Spanish. Despite their growing influence, few neuropsychological measures have been adapted for this linguistically and socio-politically distinct group of people. The assessment of premorbid cognition (PMC) for Hispanics is an area that has remained undeveloped, perhaps because Latin America lacks a legal system that uses this variable in a litigious way. Conversely, assessing PMC is an important aspect of neuropsychological assessment of Hispanics living in the United States. This presentation addresses the task of determining PMC among predominantly Spanish speaking Hispanics living in the United States. The information in this presentation is based on the clinical experience of the authors, in conjunction with a review of prior research in the areas of assessing PMC and cross-cultural neuropsychology. Many of the currently used methods, such as life history/clinical judgment, regression equations, and present abilities approaches, either need adjustment or are inappropriate when used with Hispanics. In many cases using these conventional methods results in underestimation of PMC among Hispanics. The specific difficulties of applying these methods to Hispanics will be discussed. Suggestions will be made for accommodations and alternatives to these methods that will help clinicians more reliably estimate PMC among Hispanics. Finally, future research directions for adapting or creating measures will be proposed.

A Stroop alternative for non-English speakers: investigation of the clinical utility of an automatic-controlled processing model applied to the Five Digit Test
Lang JA, Drexler ML, Riley N, DeCristoforo L, Sedo MA

The Stroop Color-Word Task (SCWT) is believed to tap important dimensions of neuropsychological processing. However, it may not be appropriate for patients who have poor color perception,

reading skills, or are unfamiliar with the language of the dominant culture. The Five Digit Test (FDT) is a Stroop analog that bypasses these limitations using achromatic stimuli and universally recognized symbols rather than English Words. Important to theoretical understanding of FDT performance are neuropsychological models of attention that distinguish between automatic and controlled attentional processing, relating to anterior and posterior mechanisms, respectively. This study investigated the application of an automatic-controlled processing model for interpreting the performance of neurologically impaired individuals on the FDT. Forty adult participants with cerebrovascular accidents (CVAs), localized in either anterior (ACVA, $n = 20$) or posterior (PCVA, $n = 20$) brain regions were studied. Comparison of performance of ACVA and PCVA groups across FDT subtests revealed parallel and coincident profiles with trends for both groups to perform worse on more complex subtests comparable to Stroop interference trials. Therefore, performance on the FDT was not specific to CVA location along an anterior–posterior dimension. This finding questions the use of an automatic-controlled processing model for interpreting FDT subtest scores. Nevertheless, the trend toward poorer performance on subtests similar to Stroop interference conditions indicates the FDT is sensitive to neurological damage and may be useful in special clinical contexts; when poor color perception, cultural and language differences, or reading difficulties prohibit administration of the traditional Stroop.

Understanding hemodynamic issues when using event-related fMRI in studies of healthy aging

Langenecker S, Nielson K

Continuing debate exists over whether hemodynamic measures of neuronal activity are equivalent in healthy younger and older adults. Several studies now exist demonstrating a significantly lower hemodynamic response within visual cortex to visual stimuli. However, hemodynamic differences in primary motor cortex during finger movement are typically similar between younger and older adults, although outliers exist in both groups. Finally, it has been suggested that a hemodynamic response be ascertained for each individual separately from motoric responses so that a person-specific model can be used to map hemodynamic responses. Two separate studies were conducted to ascertain whether the hemodynamic response is similar for older and younger adults. In the first study, 14 older and 14 younger adults are compared during both target (Go) responses and inhibition trials (No-Go) using a nonlinear regression model. Differences in activation were present on one parameter in two thalamic clusters for inhibitory trials, but there were no differences for target trials. Older adults had significantly greater activation compared to younger adults in absolute magnitude in numerous clusters for inhibitory trials. Only one large bilateral subcortical cluster was of greater magnitude for younger adults compared to older adults. These data suggest that the nonlinear regression model is equivalent in ascertaining hemodynamic shape parameters for older and younger adults and that the differences in absolute magnitude are reflective of underlying neuronal activation. In a second study, 11 younger and 11 older adults are compared using a similar task in an attempt to verify our initial findings.

Oh, !@#$&!!; an event-related study or error-based activation during a conditional Go-No-Go task

Langenecker S, Nielson K

Event-related functional MRI (ER-fMRI) designs are a relatively new technique that allows one to determine activation that corresponds specifically to corresponding events of interest. Deconvolution

procedures have aided in the ability to separate activation from discrete types of events. A conditional Go-No-Go task was used during ER-fMRI with 11 healthy younger adults to determine if activation during errors, both commissions and omissions, resulted in distinctly different patterns of activation compared to correct targets responses and correctly inhibited lure trials. It was expected that there would be less activation in important inhibitory areas when participants made commission errors. Likewise, it was expected that there would be less activation in primary and supplementary motor areas during errors of omission, but not during correct inhibition. These findings indicate the need to distinguish the functional anatomies of successful and unsuccessful task performance and demonstrate the superiority and specificity of event-related fMRI designs compared to subtraction-based designs, particularly when errors have the potential of distorting group differences and adding noise to studying the constructs of interest. Results of comparisons between target responses and omissions will also be presented.

Standardized test administration: why bother?
Lee D, Reynolds CR, Victor LW

The 1999 test standards adopted by the American Psychological Association, the American Educational Research Association, and the National Council on Measurement in Education requires examiners to make reasonable accommodations for individuals with disabilities when administering psychological tests to such persons. Changes in test administration may be required but the standards also require the examiner to provide evidence associated with the validity of changes in administration. In various forensic applications of neuropsychological tests, the current authors have encountered multiple modifications of testing procedures to accommodate large scale testing of toxic tort claimants or even group administration of individual tests. Departures from standard procedures during test administration may change the meaning of test scores because scores based on the test norms may not be appropriate. There is a significant body of literature, but one scattered among many venues and journals addressing modifications of standardized procedures. This paper reviews this extensive literature on the effects of various forms of departure from standardized procedures on test performance. Effects will be discussed in the areas of (1) cognitive/neuropsychological testing; (2) achievement testing; and (3) personality/emotion testing. The literature documents that even small or what appear logically to be minor modifications in testing procedure can produce substantial changes not only in test score distributions but test score reliability.

Asymmetric activation of the amygdalar region during positive emotional processing
Lee G, Meador K, Loring D, Allison J, Lavin T

Recent investigations into the neural underpinnings of emotional processing involving limbic and specific cortical regions of the brain have been guided by a distinction between positive and negative emotions. Data have suggested positive, approach-related emotions are more associated with left cerebral hemisphere regions whereas the negative, withdrawal-related emotions appear to be more aligned with right hemisphere mechanisms. The amygdala nuclear complex is considered an important brain region in emotional processing. Research has stressed the amygdala's role in negative emotion. Little evidence exists linking the amygdala with positive emotions. To examine the amygdalar region's role in positive and negative emotion, we presented 10 healthy controls with 20 negatively- and 20 positively-valanced photographs during functional magnetic resonance imaging using a 1.5 T scanner and computerized video goggles. Interspersed among the emotional photographs were 20 control

photographs consisting of nonsense line drawings. Emotional photographs resulted in increased blood flow in the amygdalar region bilaterally during presentation of both positive and negative (relative to control) emotional photographs. Total activation was significantly greater during the negative, relative to positive, emotional photographs. Further analysis revealed essentially equal activation of amygdalar regions bilaterally during negative photographs while there were significantly more activated voxels in the left amygdalar region during the positive photographs. Results are consistent with theories emphasizing the importance of amygdalar circuits in emotional processing and with that part of the valance model of emotion which posits lateralized cerebral specialization for positive emotional experiences.

Right hemisphere advantage in a computerized Visual Attention Test
Manhães AC, Schmidt SL

Reaction times (RTs) in tasks involving hand movements in response to visual stimuli may be affected by hemispheric asymmetries in visual attention. Here, a sample of 29 left-handed and 210 right-handed women and 35 left-handed and 231 right-handed men (average age = 34 year, S.D. = 12 years) were tested with a computerized testing system to evaluate the effects of the position of visual stimuli (left or right visual hemifield) in hand RT. Subjects were required to press the keyboard space bar with the preferred hand as fast as possible whenever the correct set of stimuli appeared on the screen. Each testing session consisted of 50 sets of stimuli (interstimulus interval time: 1.5 s). A set consisted of a central stimulus (star, square or hexagon; 25 mm wide; displayed for 200 ms) and 0, 1 or 2 (one in each hemifield) circles (8 mm diameter; displayed for 100 ms) as peripheral stimuli. The peripheral stimuli were placed either on the right or left visual field while the subject was paying attention to the central stimulus. The correct set consisted of a central star and one circle (irrespective of side). RTs for left visual field (LVF) stimuli were significantly faster than for right visual field (RVF) stimuli for both right (LVF: mean RT = 454 ms; S.D. = 67 ms; RVF: mean = 463 ms; S.D. = 69 ms; $P < .001$) and left handers (LVF: mean = 456 ms; S.D. = 72 ms; RVF: mean = 468 ms; S.D. = 63 ms; $P < .01$). These results suggest that the right hemisphere plays an important role in the visual attention component of the performance.

Reliable change in daily repeated neurocognitive evaluations
McCoy KJ, Dotson CD, Bauer RM

Hospital-based protocols for carbon monoxide (CO) poisoning typically call for neuropsychological testing at short intervals (1 day) to measure the effect of hyperbaric oxygen treatments. Clinical decisions are made based on measured changes in these serial assessments, yet, currently, there is no information available regarding the short-term stability of cognitive measures over a relevant test–retest interval. Twenty-eight healthy, cognitively-intact individuals, ages 18–56 (mean age 23; mean education 13.5 years; 86% Caucasian), were administered a neuropsychological assessment battery on 3 consecutive days in order to provided a normative standard necessary for the computation of reliable change indices (RCI; Jacobson & Truax, 1991) for each measure. The assessment battery reflected domains and measures relevant for assessment of CO poisoning cases and included: WAIS-R Information, Digit Span, Similarities, Digit Symbol, Block Design, Vocabulary; WMS-R Logical Memory, Visual Reproduction; CVLT; HVLT-R; BNT; Grooved Pegboard, Trail-Making Test, and COWA. Temporally contiguous testing sessions were analyzed (sessions 1 vs. 2 and 2 vs. 3). Calculated RCI were of varied magnitudes reflecting the scale used for each measure (e.g., RCI sessions 1–2: information = ±1.78 scaled score

points; Trails B = ±19.21 s), and generally of smaller magnitude for sessions 2–3 (e.g., RCI sessions 2–3: information = ±1.67; Trails B = ±17.47). RCI provides a measure of expected change in scores due to practice effects, chance and measurement error. In a clinical setting, any change outside of the upper and lower bounds of the RCI is considered to be true change, and may reflect treatment response.

Prediction of premorbid IQ with Wechsler Test of Adult Reading demographic estimates
Mittenberg W, Patton C, Canyock EM, Gass CS

Estimates of premorbid intelligence are typically necessary to determine if a patient has sustained intellectual reduction as a consequence of traumatic brain injury. Estimates of premorbid IQ based upon patient demographic characteristics can be made by means of the Barona, Reynolds, and Chastain (1984) prediction equation (derived using the WAIS-R standardization sample) or from tables published with the Wechsler Test of Adult Reading (2001), derived using the WAIS-3 standardization sample. The accuracy of WTAR demographic predictions has not been examined. The current study compared the accuracy of Barona and WTAR predictions in a sample of 81 head injured patients and 68 psychiatric controls. Head trauma patients were an average of 10.3 months postinjuries characterized by a mean GCS of 9.5 (S.D. = 4.1), had abnormal CT scan findings in 86% of cases, and obtained a mean WAIS-3 FSIQ of 85.6 (S.D. = 14.1). Barona and WTAR demographic FSIQ predictions were significantly higher than obtained IQs (M = 98.0, S.D. = 7.6 and M = 97.0, S.D. = 6.7, respectively). Length of posttraumatic amnesia correlated with extent of intellectual decline using the WTAR (r = .29) and Barona (r = .25) estimates. Neurologically normal psychiatric patients with diagnoses of mood or anxiety disorders obtained a mean WAIS-3 FSIQ of 99.0 (S.D. = 13.4). Barona (M = 103.2, S.D. = 8.3) and WTAR (M = 100.6, S.D. = 7.7) predictions each correlated r = .59 with obtained FSIQ. Obtained and WTAR predicted IQs did not differ significantly. Barona predictions were significantly higher than obtained FSIQ. Extent of intellectual decline using WTAR or Barona estimates discriminated head trauma and psychiatric patients with 72.5 and 63.8% accuracy, respectively.

The evaluation of divided attention in older aviators using the CogScreen-AE
Moore JL, Ambrose MR, Dolgin DL

Divided attention has been shown to decrease with age, while vigilance is more robust. Multitasking skills are highly relevant in aviation and current regulations ending a commercial aviator's career at age 60 reflect safety concerns associated with potential cognitive decline. The CogScreen-AE was designed for use with aviators and the current study was conducted to assess the effect of age on dual-task performance among healthy older aviators. One hundred eighty-three retired military aviators completed the CogScreen-AE as part of a medical follow-up program. All measures from the Divided Attention Test (DAT) and the Dual Task (DTT) were selected for analysis. Ten single–dual difference scores/ratios were also calculated. The subjects were divided into two groups based on age: Group 1 (n = 93); ages 50–54, Group 2 (n = 90); ages 60–64. Significant multivariate group differences were observed on DTT measures (Wilk's λ = 0.896, P = .04, η = 0.104) but not on DAT measures (Wilk's λ = 0.902, P = .056, η = 0.098). MANOVA also revealed insignificant group differences for the single-dual task comparisons (Wilk's λ = 0.940, P = .384, η = 0.060). The effect size range (Cohen's d) for age was 0.01–0.52 and the logistic regression correct group classification rate was 69%. Although reliable age group differences were observed on several CogScreen-AE measures, the effect

sizes of these differences were small and there were sizeable overlaps in score distributions. Many Group 1 subjects performed at a level characteristic of Group 2, and vice versa. In addition, single–dual task comparisons in this healthy aviator sample failed to reveal specific deleterious of effects age on divided attention.

Bedside screen of language disturbance among acute care admissions: initial psychometrics of the Mississippi Aphasia Screening Test

Nakase-Thompson R, Manning E, Sherer M, Yablon SA, Vickery C, Harris C, Dickson S

Individuals with significant brain injury due to trauma, stroke, or tumor may demonstrate communication impairment in early periods of recovery. For patients with severe language impairments, lengthy aphasia batteries are inefficient for serial evaluations during brief inpatient hospitalization and may be excessive for patients with severe aphasia or poor endurance. A brief instrument that surveys a broad array of language abilities is better suited to tracking patients' progress through their early clinical course. The purpose of this study was to develop a 10 min screen of an array of language abilities to quantify communication abilities in patients with severe language impairment. The screening test (Mississippi Aphasia Screening Test (MAST)) includes subscales to measure naming, automatic speech, repetition, yes/no responding, object recognition, auditory comprehension, reading comprehension, spelling/writing, and verbal fluency. Receptive and Expressive Index Scores can be derived. An initial validation study was conducted with 34 consecutive acute care hospital inpatients referred for neuropsychological consultation (mean age = 58 [S.D. = 16], mean education = 11 years; 78% right-handed; 46% male). Patients' diagnoses included traumatic brain injury, stroke, epilepsy, and brain tumor. Significant differences were observed for both the Receptive Index Score ($t = 2.1$, $P = .04$) and the Expressive Index Score ($t = 2.9$; $P = .007$) when comparing individuals with unilateral left-hemisphere ($n = 30$) versus unilateral right-hemisphere lesions ($n = 6$). This aspect of criterion validity suggests that the MAST does differentiate language abilities from other types of cognitive dysfunction in patients with a variety of neurologic disorders.

Reliability and validity of neuropsychological testing of older adults via teleconferencing

Nelson MP, Hildebrand RM, Williams C, Wass P

This study examined the reliability and validity of neuropsychological tests when administered to seniors via videoconferencing. In addition, the psychological impact of videoconferencing was explored. Twenty-nine participants from central Alberta volunteered for the study. All were 60 years of age or older and were without neurological or psychiatric disturbances. The participants were tested face to face and via videoconferencing. The cognitive assessments measured attention, memory, verbal fluency, expressive word knowledge, visual–spatial processing, and reasoning. Following the final testing session, participants were given a questionnaire, which explored their reactions to the technology. The results showed that there was no statistically significant difference in the test scores between the two modes of administration except for the Brief Test of Attention. The majority of participants preferred the face-to-face mode (40%) while 17% preferred videoconferencing, and 39% did not have a preference. All participants were comfortable with the technology and only 10% of participants felt their performance was better in the face-to-face mode. The only area of difficulty was the quality of the sound for some people. Consequently, videoconferencing appears to be a potentially valid and acceptable method of conducting a cognitive assessment in older adults. However, further research is needed to determine applicability to other populations.

The effects of acculturation level on the Boston Naming Test and the Controlled Oral Word Association Test in a sample of Hispanics of Mexican-American extraction
Nicoloff MD, Marmol LM, Adams WV, Schock LB

This research measured the relationship between acculturation and performance on verbal fluency tasks in a sample of 57 Hispanics of Mexican-American extraction. We hypothesized that as acculturation to Anglo-American culture approaches assimilation, facilitation of word fluency on the Boston Naming Test (BNT) and the Controlled Oral Word Association Test (COWA) will increase. A review of the literature on acculturation and test bias in Hispanic populations is followed by research on bilingual performance on fluency tasks. As the independent variable, acculturation is examined on three levels: Mexican-oriented, balanced, and Anglo-oriented using Scale 1 of the Acculturation Rating Scale for Mexican-Americans II (ARSMA-II). The dependent variables were verbal fluency scores on the BNT and COWA. The hypothesis of was strongly supported by the data. A 3×2 (acculturation group $\times$ raw test scores) multiple analysis of variance (MANOVA) was performed to assess differences between mean scores for subjects in the three acculturation groups on the BNT and COWA. A post hoc analysis (*t*-test) was used to determine which acculturation groups yielded significant differences. Finally, a multiple regression analysis was conducted to determine overall how well acculturation level might predict scores on the BNT and COWA. Moderator variables such as gender, age, education, and IQ were then examined in an analysis of covariance (ANCOVA). An important clinical application of the study are preliminary norms for the BNT and COWA for Mexican-Americans.

The utility of the Children's Memory Scale in predicting lateralized impairment in brain function
O'Leary SD, Burns TG, Merritt RK, Taylor LM

The Children's Memory Scale (CMS) is a standardized and comprehensive instrument that evaluates verbal and visuospatial aspects of memory in children 5–16 years of age. The purpose of this study is to assess memory in children with lateralized brain injury, including a variety of neuropsychological disorders (epilepsy, traumatic brain injury, brain tumor). Archival data collected from medical records included lateralized findings on various neuroimaging measures (EEG, MRI, CT). Memory functioning was assessed using the CMS, and only subjects who completed the CMS core battery were included ($n = 143$). Based on previous research (Cohen, 1992), we hypothesized that subjects with left-hemisphere insults would have significantly lower performance on verbal memory, while subjects with right-hemisphere insults would have significantly lower performance on visual–spatial memory. Statistical analysis using a one-way ANOVA revealed no significant differences in verbal versus visual–spatial memory based on lateralization of insult. Significant differences were found within the sample for Word Pairs subtest scores ($P = .032$). Scheffe's post hoc analysis revealed that the Word Pairs subtest was sensitive to left hemisphere insults ($P = .033$). These findings suggest that the Word Pairs subtest of the CMS may be the best predictor of left-hemisphere damage. Continued addition of cases to the database should increase the sample of subjects with lateralized brain insults, allowing additional research regarding the utility of the CMS to detect lateralized findings in patients with brain injury.

Effects of subculture on neuropsychological memory tasks
Parra E, Soper HV

The effects of culture on test performance are now more widely being recognized. However, it is common to include all members of several distinct subcultures into heterogeneous groups, such as Asian,

Hispanic, and African-American. Even within one nationality it would appear absurd to lump members of subcultures together, let alone lumping quite distinct cultures together all because they all have, for example, Asian origins and are a distinct minority in the United States. It would appear ill-advised to use normative data from a heterogeneous population, such as those labeled Hispanic, to determine neurocognitive status of individuals within a distinct subgroup of that population. Therefore, cultural effects on performance on a modified series of memory tasks were assessed through administration to 50 people in each of three diverse groups with Mexican backgrounds. Though these three groups differed along many dimensions, there is no reason to believe that there might be any significant genetic difference between the groups. Substantial differences were found between each of the three groups on overall performance on the memory task as well as almost all of the subtests. In many cases these differences were so large as to cause misdiagnosis of intellectual integrity if the normative data from one group were applied to individuals from other groups. Clearly, many cultural factors, including socio-economic ones, contributed significantly to these group differences. The implications of using normative data from one subculture to an individual from another, even within the same language and/or ethnic origin, are discussed.

Subject and stimulus variables that effect performance on the Block Design subtest of the Wechsler Intelligence Scales

Salimpoor VN, Joorderns S

The Block Design Test, a subtest of the Wechsler Intelligence Scale, is a task utilizing spatial ability, on which subjects are required to arrange red and white blocks in a pattern similar to one presented on a stimulus card. The aim of the present study was to investigate the effect of subject variables and stimulus variables on subjects' performance on the Block Design task. The two subject variables that were tested were the cognitive problem-solving strategies used by the subjects and the subjects' gender. The stimulus characteristics that were tested were the number of solid pieces in the design and the cohesiveness of the design. Forty-eight university students, 24 male and 24 female, were tested with 16 designs from the WAIS and the WASI intelligence tests. The results, based on the time taken to construct each design, indicated significant gender differences favoring males on the four-block designs. Other significant factors that effect performance on the Block Design task are the number of solid blocks and the number of interior edges in the design. Although there was a consistent interaction between gender and stimulus variables in a direction that showed better performance for males over females, the results were not statistically significant.

Sensitivity and specificity of the 7-min screen among dementia, mild cognitive impairment, and cognitively normal subjects

Salimpoor VN, Joorderns S

With the advent of new and improving treatments for Alzheimer's disease (AD), early detection of the disease has become a major topic of clinical research. The 7 min screen (7MS) is a brief screening instrument that purports to assist in the early identification of dementia. This study examined the discriminative ability of the 7MS and examined its ability to correctly classify individuals with dementia, mild cognitive impairment (MCI) and cognitively normal individuals. Seventy-six (15 demented, 22 MCI, and 39 normal) subjects were assessed with the 7MS and a brief neuropsychological battery as part of a community-based free memory screening program. Diagnosis of probable dementia was made using NINCDS/ADRDA neuropsychological criteria (McKhann et al., 1984), while diagnosis

of MCI was based on the Petersen criteria (2001). Subjects were classified as cognitively normal if their performance on neuropsychological tests was within or above the average range. The sensitivity of the 7MS was found to be 66.7%, while specificity was 100% for normal versus demented subjects, but sensitivity was only 13.6%, with a specificity of 100% when discriminating between MCI versus cognitively normal subjects. Although showing excellent specificity, the 7MS does not appear to be sensitive to dementia or mild cognitive impairment in this community-based sample. In light of these results, the use of the 7MS may not be sufficient to correctly identify those patients who are demented or at risk for developing a dementing illness.

The limited utility of the BARONA regression formula: a case in point
Sari D, Ball J, Nogues CE

Neuropsychological assessment within inpatient psychiatric settings serving indigent populations is often complicated by a myriad of factors affecting cognitive functioning (e.g., severe mental illness, substance abuse, brain injuries and other factors directly impacting cortical integrity and/or affecting neuropsychological test results). Of particular difficulty is determining premorbid intellectual functioning due to the fact that background information is often scant and patients themselves may not be reliable historians. Prior research by Basso et al. (2000) has indicated that the Revised Barona formula (Barona & Chastain, 1986) overestimates premorbid intellectual ability, especially when actual intelligence in either significantly above or below average. The current study compared premorbid IQ estimates from the Wide Range Achievement Test-3 (WRAT-3; Wilkinson, 1993) Oral Reading subtest with the Revised Barona formula in a group of inpatients in a state psychiatric facility. Results indicate that the Revised Barona formula tended to produce inflated IQ estimates and a restricted range relative to the WRAT-3. Scores on this latter task appeared to be more consistent with limited available historical information regarding patients within this population. The current study lends support to the previously demonstrated weakness of the Revised Barona formula for predicting premorbid IQ estimate in low functioning populations.

Use of reliable change indices, correlation coefficients, and dependent samples *t*-tests to document stability of computerized assessment measures over a 1-year period
Schatz P, Putz B

We documented stability of scores on three custom-developed computer-based neurological assessment measures over a 1-year period, Trails A and B and the Digit-Symbol subtest of the WAIS-R. Thirty-eight student athletes participated in preseason assessments during the 2000 and 2001 athletic seasons. Using traditional Pearson's correlation coefficients, test–retest scores were low for the Trails A ($r = .10$), Trails B ($r = .30$), and Digit Symbol ($r = .11$). Dependent samples *t*-tests revealed significant improvements over the 1-year interval on the Trails B (51.8 s vs. 42.3 s) [$t(37) - 3.43$, $P = .001$] and the Digit Symbol subtest (127 s to complete all items vs. 102 s) [$t(37) = -7.13$, $P = .001$]. Reliable change indices (RCI) were used to determine the percentage of scores that had changed significantly over the 1-year period. RCI equations revealed significant change indices for 11% of participants completing the Trails A, 23% on the Trails B, and 27% on the Digit Symbol. Results suggest that a relatively low percentage of individual scores changing over an assessment period of 1-year can significantly decrease test–retest coefficients. While it is not clear why such task improvements occurred over this 1-year period, the computer-based nature of the tasks may have contributed to these improvements, secondary to widespread computer ownership and use by college students.

Normative data for the Rey Auditory–Verbal Learning Test for a mixed clinical sample
Schoenberg MR, Duff K, Adams RL, Scott JG, Doyle PE

The RAVLT (Rey, 1941) is a widely used neuropsychological test to assess encoding, consolidation, and retrieval of verbal information. Normative data for neurologically intact individuals has recently been compiled (Schmidt, 1996). When evaluating an individual suspected of having brain dysfunction, a useful measure to clinicians is not only the degree that the individual deviates from a neurologically intact group but also how closely the subject's performance matches those with known brain injury. This study provides the means and S.D. for the RAVLT in a sample of 573 individuals with documented brain dysfunction (e.g., MRI, CT) and 47 neurologically intact psychiatric patients. Participants were classified by diagnosis (head injury ($N = 140$), neoplasms ($N = 56$), stroke ($N = 63$), Alzheimer's disease ($N = 120$), vascular dementia ($N = 21$), Other dementia ($N = 30$), Parkinson's disease ($N = 35$); and seizure disorder ($N = 108$)), age (16–39; 40–56; 57–69; and 70–98), and gender. Data was presented for each learning Trial (I–V), List B, postinterference list immediate recall, 30-min delayed recall, as well as recognition. The results indicated that elderly subjects with documented brain atrophy performed significantly worse than healthy age matched peers (Schmidt, 1996). For practicing clinicians, the normative data provided for clinical populations offers an additional method by which to evaluate the performances of subjects with suspected brain dysfunction.

Neuropsychological contributors to poor performance on a test of decision-making in healthy older adults
Schwarze N, LaVoie D, Gfeller J, Oliveri M, Sharland M

Declining performance on measures of executive functioning is commonly associated with old age. However, few researchers have investigated decision-making, one aspect of executive functioning, in healthy older adults. The gambling task (Bechara, Damasio, Damasio, & Anderson, 1994) is a recently developed decision-making measure that is sensitive to ventromedial prefrontal cortex functioning (Bechara et al., 1994). The authors of the gambling task believe this test measures real-life decision-making, creating a more ecologically valid assessment of difficulties often exhibited by patients with ventromedial prefrontal cortex functioning than traditional neuropsychological tests which are more sensitive to dorsolateral prefrontal cortex functioning. This study determined whether other measures of executive functioning (WCST, Stroop Color-Word Test, FAS, category fluency, FLOPS, and Go-No-Go Test), rate of new learning, and memory contributed to poor performance on the gambling task. This study also attempted to determine if age-related group differences were found on this task. A total of 54 healthy older adults free from neurological disorders participated in the study. Over 40% of the sample performed in the defective range on the gambling task. A measure assessing inhibition significantly contributed to performance on the gambling task. No overall age effect was found on this task. It was concluded that poor performance on the gambling task was related to disinhibition rather than age. It was also concluded that tests associated with ventromedial prefrontal cortex functioning were more highly associated with the gambling task than tests associated with dorsolateral prefrontal cortex functioning.

Validity of the gambling task and the FLOPS in a sample of healthy older adults
Schwarze N, LaVoie D, Gfeller J, Oliveri M, Sharland M

The Frontal Lobe Personality Scale (FLOPS; Paulsen et al., 1996) and the gambling task (Bechara, Damasio, Damasio, & Anderson, 1994) are recently developed measures designed to assess frontal lobe functioning. Minimal research exists using the FLOPS and the gambling task. This study provided

convergent validity for these two measures in a sample of 54 healthy, highly educated older adults. Participants with a history of head injury, major neurological disorder, or other risk factors for cognitive impairment were excluded from the study. The FLOPS, gambling task, and other measures of executive functioning were assessed. Specific subtests from the FLOPS significantly correlated with measures of perseveration, cognitive inflexibility, and memory, whereas scores on the gambling task significantly correlated with disinhibition and cognitive inflexibility. The FLOPS and the gambling task were not significantly correlated with one another. The results provided convergent validity information for the FLOPS and the gambling task; however, these two measures appear to provide unique information that is not fully assessed with traditional measures of executive functioning. One explanation for these findings is that the gambling task assesses ventromedial prefrontal cortex functioning, whereas many traditional measures of executive functioning likely assess dorsolateral prefrontal cortex functioning. This also might be true of the FLOPS; however, results from this study are preliminary and require further replication.

The Mattis DRS in a psychiatric population: a neuropsychological screen
Shope CB

Psychometric properties of the Mattis Dementia Rating Scale (DRS) were investigated to assess the appropriateness of using the test as a neuropsychological screening instrument in an adult, nongeriatric, psychiatric population. The DRS was chosen over other available screening measures because of its comprehensiveness in measuring cognitive abilities, including its emphasis on measuring executive functioning, and its relatively brief and nontaxing design. It consists of 36 items divided into five subtests: Attention, initiation/perseveration, construction, conceptualization, and memory. The DRS was modified slightly (by expanding the digit span item) for use in this population. Participants included 50 volunteers recruited from new admissions to a large, urban, state-funded psychiatric facility. Four-week test–retest reliability was satisfactory and decision consistency for two cut-off scores was good. Concurrent validity was supported by correlations between DRS scores and scores on a criterion battery of neuropsychological tests (WAIS-R, WMS-R, WRAT3, WCST, Bender, COWAT, Stroop, Trail Making Test). Total DRS scores below 131 and above 139 were excellent predictors of need for further neuropsychological evaluation as indicated by scores on the criterion battery. The results support the use of the DRS as a neuropsychological screening measure in a nongeriatric, psychiatric population.

Encoding and focus: separate attention factors or assessment artifact?
Short P, Cernich A, Kane RL, Kabat M

Although encoding and focused attention have been modeled as components of attention (Mirsky et al., 1991), exploratory (EFA) but not confirmatory factor analysis (CFA) has supported the heuristic (Strauss et al., 2000). The failure of CFA to support these putative factors, places the basic model in question. The lack of construct validity as specified may be an artifact of an analytical technique (EFA) that pools variance regardless of source. We hypothesized that the two constructs were better modeled as a single factor with method variance accounting for the apparent divergence. Our CFA of one and two factor models with a clinical sample of male Persian Gulf Veterans exposed to depleted uranium and matched controls ($N = 67$; mean age $= 32.8$; mean education $= 13.2$) indicated the single factor model best explained the observed data. Moreover, when we tested whether the assessment method accounted for the residual variance, we found that distinguishing tasks requiring verbal output (e.g., digits backward) from those requiring visual–motor output (e.g., trail-making tasks) improved the fit of the single-factor model dramatically. The present analysis suggests that attention might be better characterized as a fundamental discrete process with residual variance related to specific task requirements.

CFA of the WAIS-III in a clinical sample
Smerz J, Osmon D

The factor structure of the WAIS-III intelligence test was examined using confirmatory factor analysis (CFA) of seven models. Most factor-analytic studies have analyzed standardization data. These studies supported the 4-factor model related to the currently-used factor scores, but evidence for the verbal and performance composite scores has been mixed. This study was designed to examine if these results can be generalized to a clinical population. Data were analyzed from 175 patients, with a variety of diagnoses, referred for a neuropsychological evaluation at a Veterans Administration hospital. When a patient was not administered a subtest, the mean score of that subtest in the sample was imputed (6.2% overall). Seven models (1-factor to 4-factors) were tested using EQS to run maximum likelihood CFA. Errors from the factors and several subtests were allowed to covary. The best fitting model was a 3-factor model consisting of verbal comprehension, perceptual organization, and freedom from distractibility (including Digit Symbol and Symbol Search). This fit insignificantly better than the current 4-factor model, although both demonstrated good fit statistics. The traditional verbal and performance distinction was not a good fit to the data, and was a significantly worse fit than the other multifactor models. This study suggests that factor scores are appropriate when used in this population, and Digit Symbol and Symbol Search may be measuring an attentional factor more than originally thought. Finally, the verbal and performance composite scores currently used may not be good estimations of a patient's ability.

Right hemisphere visual and auditory abilities
Soper HV, McWhorter N

We reviewed the results of various standard tests of right hemisphere functioning in addition to various aspects of prosody among 60 undergraduates who partook of the research as a part of course requirements. We developed an assessment tool for expressive and receptive prosody. Clinical experience tells us that people with disorders such as autism, pervasive developmental disorder, and borderline and antisocial personality disorders have difficulties with various aspects of prosody and pragmatics. The receptive discrimination prosody task consisted of discriminating whether stimulus pairs expressed the same or different prosody. For receptive comprehension trials the participants were asked to determine which of four alternatives best describe the meaning of the stimulus. On expressive repetition the participants repeated each of 16 variations of the phrase "Mary hit Tom." For expressive formulation each subject was asked to recite each of four sentences as a statement, and then in a happy, sad, angry, and questioning tone of voice. We looked at how well aspects of prosody intercorrelated with each other as well as with results from the Street Completion Test, Benton's Judgment of Line Orientation Test, Seashore Rhythms Test, and the Object Decision and Silhouettes from the Warrington and James' VOSP Battery. The results indicate that the visual and auditory purported right hemisphere abilities, as assessed here, are quite different. Over half the visual, a third of the auditory, but less than 5% of the cross-modal correlations were significant.

Visuospatial learning and memory: a promising new test
Spina L, Poole JS

Many tests of visuospatial memory have been criticized for being verbally encoded. The Serial Visuospatial Learning Test (SVLT) was designed to be relatively unhindered by verbal encoding of stimuli. The individual is presented with a 6×6 grid with 12 circles in various places, is given 10 s to

memorize them, and then is asked to reproduce them on a blank grid. The format of the test follows that of the California Verbal Learning Test (CVLT), with five learning trials, an interference trial, a short delay-free recall trial, a long delay-free recall trial, and a recognition trial. A Spearman–Brown formula yielded a split-half reliability of .75. Factor analyses revealed that the SVLT factor structure appears to be comprised of a learning component and a recall component and that the SVLT loads completely separately from the CVLT. Other visuospatial tests (Rey Complex Figure, Ruff Figural Fluency, TOMAL Facial Memory, and WMS-R Spatial Span) had low loadings with the SVLT but all loaded on the verbal factor). The authors conclude that these tests are susceptible to verbal encoding, whereas the SVLT is less susceptible to verbal encoding since it does not share loadings with the verbal memory factor. The SVLT appears to be a valid and reliable measure of nonverbal learning and memory. It may also have clinical usefulness in the assessment of individuals with language disorders, or those for whom English is a second language. Further suggestions for future research are offered.

An investigation of the relationship between personality traits and executive functioning
Tsanadis J, Suhr JA

While personality and cognitive changes associated with frontal lobe damage (i.e., executive functioning) have been well documented, there has been little research on the association of executive functioning to normal variation in personality traits. Many of the traits measured by personality tests (i.e., tough mindedness, self-control) describe qualities consistent with those measured by tests of executive functioning. In this study, 142 undergraduates completed the Sixteen Personality Factor Questionnaire (five global factors), the Wisconsin Card Sorting Test (WCST), the Wechsler Abbreviated Scale of Intelligence (WASI), and Bechara's Gambling Task. Principal component factor analysis with varimax rotation revealed four factors. The first factor, consisting of executive functioning measures, validates the gambling task as a measure of executive functioning. The second factor consisted of loss of set (WCST), gambling task, and VIQ and PIQ. This indicates the expected relationship between intelligence and executive functioning in the normal population. The third factor consisted of the personality traits tough mindedness, self-control, and loss of set (WCST) and VIQ, suggesting a relationship between personality traits related to a person's openness to new things and ability to restrain themselves with aspects of executive functioning involving a person's ability to maintain a mental set. The fourth factor is made up of several personality traits (extraversion, anxiety, independence, self-control), as well as VIQ and gambling task. These findings support the relation of cognitive measures of executive functioning and normal variations in behavior that are part of personality differences.

Age-related changes in working memory
Uttl B

A number of measures have been devised to measure working memory. However, it is still unclear whether various indexes of working memory measure the same or different constructs/abilities. If various indexes of working memory measure the same construct, they ought to be highly correlated and show similar age-related pattern of declines. To examine this prediction, we administered several tests of working memory including digit span forward, digit span backward, alpha span, operation span and sentence span to a large sample of 351 normal healthy adults, ranging from 18 to 91 years of age. In addition to working memory measures, all participants completed a large battery of neuropsychological tests. Our results showed substantial age-related declines on all working memory tasks. However, we found only minimal support for the notion that various working memory measures index the same underlying construct.

Neuropsychological screening: a comparison of the RBANS and the BNI screen for higher cerebral functions in a psychiatric population

Wass P, Goddard K, Campbell T, Pachet A

In recent years a number of neuropsychological screening tools have been developed. Cognitive screening measures have enjoyed increasing popularity partially due to their ease of use and acceptance by clinicians and patients, as well as their ability to aid in the correct determination of any given patient's clinical needs. The RBANS and the BNIS are unique as screening measures in that they provide summary scores in a number of cognitive ability areas, rather than just a single global indicator of cognitive functioning. The purpose of this study was to explore the relationship between the BNIS and the RBANS. Method: both the RBANS and the BNIS were administered to a heterogeneous sample of 30 patients from an inpatient psychiatric hospital. Results: Global indicators for the BNIS and the RBANS were significantly correlated. Significant correlations were found between the Memory Index and Language Index Scores, providing evidence of convergent validity. However, the Attention Index and Visual–Spatial Index Scores were not significantly correlated, thereby providing little evidence of convergent validity within those domains. At a general level, both measures demonstrated reasonable concordance for the discrimination of impaired or not impaired. However, there was limited agreement between the two measures in regard to the degree of impairment. Implications in regard to the use of these two instruments are presented.

Examination of a four subtest short-form of the WAIS-III in a community sample

Wetterneck C, Smerz J

The primary purpose of this study was to investigate a four subtest short-form of the WAIS-III in a community sample. Two hundred twenty-six participants received psychological evaluations for use in a forensic setting, mainly related to custody placements or treatment concerns excluding depression. The sample characteristics were 50.5% male, 89% Caucasian, with a mean age of 37.1 (S.D. = 10.7), and a mean education of 14.0 (S.D. = 3.1). The Full-Scale IQ (FSIQ) of the sample was 103.4 (S.D. = 15.3). A confirmatory factor analysis revealed that the four traditional factors of the WAIS-III were a good fit for the data. Subtests with the highest loadings on the four factors were used to test a four-subtest short-form. A correlation between the four subtests and the FSIQ of at least .90 was predicted. The four subtest short-form achieved a correlation of .94, suggesting a good estimate of FSIQ. Implications of these findings, including the comparison with other short-forms, will be addressed. Future research should examine the generalizability of this short-form to clinical populations.

ASSESSMENT OF EFFORT/MOTIVATION

Effect size comparisons between analogue simulators and patients failing CARB or the WMT effort measures

Allen IL, Rohling ML, Dunn TM, Green P

Analogue experimental designs are frequently employed to validate symptom validity tests, investigate crucial aspects of test design, or explore the effectiveness of strategies intended to avoid detection of exaggeration. These paradigms typically utilize students or other normal volunteers due to the difficulty of conducting research with actual patients. It is generally assumed that these groups will closely approximate one another in Symptom Validity Test (SVT) performance. The present investigation was

undertaken to test this assumption using CARB and the Word Memory Test (WMT) effort measures. Simulator data was obtained from a published study that included 100 volunteers asked to fake CARB and the WMT, who were either entirely naïve, or given up to two different strategies for defeating SVTs. The real patient (reference) group was comprised of 357 disability claimants with heterogeneous diagnoses who failed either CARB or the WMT. The entire simulator group performed far worse than real patients, producing a large effect size difference ($d = 1.1$). Normalized scores for simulators on CARB and the WMT were nearly identical, but real patients performed better on CARB relative to their WMT scores ($d = 0.57$). The results of this study raise concerns regarding the external generalizability of analogue malingering research designs.

Failure rates on the computerized assessment of response bias in 32 North American assessment practices

Allen IL, Rohling ML, Green P

Various estimates have been made regarding the incidence of malingering and suboptimal performance during neuropsychological assessment. Many of these reports are based on studies of clinical patients in single locales, and a number of widely varying factors has been associated with Symptom Validity Test (SVT) failure. This research summarizes 4,943 CARB protocols gathered from 32 North American neuropsychology practices. With each practice equally weighted and contributing a minimum of 20 cases, failure rates on CARB ranged from 2 to 76%, and averaged 35% (median 33%). In one practice that contributed over 900 cases the incidence of CARB failure was only 18%. However, adding data from the Word Memory Test (WMT) to the analysis increased the detection of suboptimal performance in this subsample by an additional 40%. Patients in this practice who failed either CARB or the WMT effort measures evidenced 4.5 times as much neuropsychological "impairment" as a subgroup of patients with moderate to severe traumatic brain injury. In the whole sample, exaggeration accounted for over 50% of the total variance in neuropsychological test scores. Other implications related to these findings will be discussed.

Beyond symptom validity: accounting for domain-specific variance amid the ruins of your post 9–11 test data

Allen IL, Rohling ML, Green P

Recent work has demonstrated that performance on trivial symptom validity measures (SVM) can account for 50% of the variance in a comprehensive neuropsychological battery that was administered to 904 disability claimants with heterogeneous diagnostic claims. In this follow-on investigation, four SVM scores from CARB and the WMT were used to develop a composite index of symptom validity that explained 49.4% of overall test battery variance. The battery also contained an average of 34 performance scores per patient. These were heuristically arranged into seven separate cognitive ability domains, and hierarchical multiple regression (HMR) revealed that these accounted for 92% of total variance. However, when SVM scores were repeatedly paired with the cognitive domains scores, their unique contribution to the test battery averaged only 14% and overlapped 25% with the variance explained by the SVM composite measure. The highest overlaps with the SVM were observed for verbal memory, attention and working memory, and perceptual organization domains (49–52%). The largest unique contributions to the cognitive performance were observed for psychomotor and processing speed (9%), verbal comprehension (4%) and executive functioning (2%). In patients demonstrating good effort by passing all four SVM measures, a 20% overlap was observed between the SVM and performance measures. This suggests that the current SVM cut-off scores may be somewhat conservative, or that

small demographic normative adjustments may better explain battery performance and hence increase the accuracy of judgments concerning symptom validity.

Cross-validation of CARB: efficacy to detect malingering
Anderson CD, Leark RA, Allen LM

There has been increased interest in the measurement of response bias in neuropsychological instruments. Approaches have included analysis of individual test performance compared to overall performance on test batteries. The computerized assessment of response bias (CARB) has been designed to assist in this process. This study represents an initial investigation into direct instructions to malinger. The study consisted of 63 college students (mean age = 19.92, S.D. = 2.13). Counterbalancing of instruction was done to test for order effects. Each person completed CARB twice, with a randomly assigned variable of test order. An univariate ANOVA was conducted to compare the four instruction groups over the three key variables on the CARB. The analysis yielded significant mean score differences between the normal and malingering instruction groups [$F(3) = 47.259$; $P < .01$]. Post hoc analysis found significant differences between normal and fake instruction groups. There were no order differences found between the two instruction groups. There were significant differences for order between both fake instruction groups on the CARB response time and response time variability scores. These differences did not result in any failure on the CARB to detect the malingering performance. All fake instruction tests were detected as nonnormal on the CARB. The CARB was able to detect differences of those subjects who were instructed to malinger and also correctly identified the normal instructions as normal. There were order differences for the fake groups. Neuropsychologists who use the CARB are encouraged to review whether or not subjects had prior knowledge of the test when interpreting test scores.

An evaluation of the specificity of the Wisconsin Card Sorting Test for the detection of malingering
Ashendorf L, Constantinou M, Weber M, McCaffrey RJ

The use of divergent patterns of performance on established neuropsychological tests for the detection of suboptimal effort or malingering is of increasing interest to neuropsychologists. It has been suggested in the literature that the Wisconsin Card Sorting Test (WCST) can be used for this purpose. Bernard, McGrath, and Houston (1996) proposed a discriminant function method using number of categories and perseverative errors. Suhr and Boyer (1999) later suggested another classification equation, this time using number of categories and failure to maintain set as the variables. The present study set out to examine the specificity of the proposed formulae. A population of community-dwelling older adults (55–75), screened for major medical and psychiatric conditions, were administered the WCST as part of a standard battery. All participants also passed symptom validity testing, scoring at least 48 of 50 on the Test of Memory Malingering. Neither published formula yielded a specificity in an acceptable range (Suhr & Boyer specificity = 38.3%; Bernard et al., specificity = 54.3%). The use of these equations to identify possible malingering or insufficient effort in an older population is therefore not supported by the present data.

An evaluation of the specificity of the CVLT in the detection of malingering
Ashendorf L, Constantinou M, Weber M, McCaffrey RJ

The use of divergent patterns of performance on established neuropsychological tests for the detection of suboptimal effort or malingering is of increasing interest to neuropsychologists. One test which has

received considerable attention in the identification of suspected malingerers is the California Verbal Learning Test (CVLT). Millis, Putnam, Adams, and Ricker (1995) developed a discriminant function equation consisting of Trials 1–5 total, long delay cued recall, and recognition discriminability, which correctly identified a high proportion of their sample. They also identified four CVLT cut-off scores, but only recommend using cutoffs for recognition hits and recognition discriminability (Scott R. Millis, personal communication, 2002). The present study examined the specificity of the formula and cutoffs in a sample of community-dwelling older adults (55–75), all of whom had been screened for major medical and psychiatric disorders, and all of whom passed symptom validity testing (all achieved a score of at least 48 out of 50 on the Test of Memory Malingering). A low false negative rate was achieved for the formula (specificity = 93.4%) as well as for the recognition hits (specificity = 89.8%) and discriminability (specificity = 92.9%) cutoffs, thus supporting Millis et al.'s claims regarding the specificity of the discriminant function equation and cut-off scores, and their utility in the detection of possible malingering.

Intelligence and successful malingering on forced-choice tests: an initial investigation
Carruth D, Perkins S, Crosby J, Andrade I

Malingering is reported to be common in forensic and compensation-seeking samples, with estimates of faked or exaggerated symptomatology ranging from 14.5 to 60%. Findings have also indicated that subjects are capable of producing response profiles on standard batteries which are not routinely detected by clinicians. This dilemma has led to increased efforts to identify patterns which suggest malingering and develop specific procedures which indicate malingering. Forced-choice tests are believed to accurately indicate malingering by comparing correct response rates to chance or predetermined levels based on normative and patient samples. This study investigated the subject's intellectual ability and sophistication in simulating believable cognitive deficits. Undergraduate student participants completed the WASI and a forced-choice task and correlations between intelligence and presented cognitive deficit levels were compared and a significant relationship was observed between Full-Scale IQ and the number of correctly-answered trials ($r = .326$; $P < .043$). Dichotomous analysis of groups means (correct trials) between groups of subjects classified as high or low in intellectual ability were also calculated for clinical utility and those classified as high intelligence showed a significantly higher mean of correctly-answers than did low subjects [$F(1, 24) = 5.553$; $P < .027$]. Analyses of mean scores for each group were also compared to chance performance rates and high intelligence participants were found to more often pass detection at this level [$\chi^2 = 4.887$, $P < .027$]. The clinical relevance of the findings are discussed in addition to limitations of this study and directions for future research.

The association between the TOMM and the WAIS-R in a sample of mild TBI litigants: cross-validating past findings
Constantinou M, Ashendorf L, O'Bryant S, Weber M, McCaffrey R

Neuropsychologists have been increasingly concerned with suboptimal effort, which is exhibited by some individuals under neuropsychological evaluation. Suboptimal effort is considered to be a threat to the validity of neuropsychological test scores. Thus, numerous measures have been developed for the detection of suboptimal effort. The Test of Memory Malingering (TOMM) is one such measure, which follows the Symptom Validity Test (SVT) model. Several studies showed that the TOMM is capable of detecting suboptimal effort, and it has been proposed that a score below 45 on the TOMM is suggestive of suboptimal effort. The present study sought to cross-validate past research which revealed that a poor

performance on the TOMM could be linked to a pseudo-poor performance on the WAIS-R. The data from the present study, from 51 mild traumatic brain injured (TBI) litigants, replicated past findings by demonstrating that performance on the TOMM was indeed significantly correlated to the WAIS-R performance of the litigants. In order to investigate this finding further, the participants were divided into two groups. The first group was consisted of all the litigants that scored above 45 (TOMM $>$ 45) and the second group was consisted of all the litigants that scored below the cut-off score (TOMM $<$ 45). As expected, the TOMM $>$ 45 group performance was better than the TOMM $<$ 45 on the WAIS-R. The above findings propose that a poor performance on the TOMM can be suggestive of a generalized poorer performance on other tests, the WAIS-R in this instance.

Age-related effects in children taking the computerized assessment of response bias and Word Memory Test

Courtney JC, DinkinsJP, Allen LM, Kuroski K

The assessment of effort is an important component of test performance in determining whether a psychological evaluation is valid. The assessment of effort in children has proven problematic, however, likely in part due to the variable and inconsistent nature of children's developing self-regulatory systems. The measures commonly used to assess effort have typically been standardized on adults. Their use with children, while compelling, would presume that effort in children is comparable to effort in adults. Because children's executive functioning, including their abilities to self-regulate, attend, and to concentrate, improve with time (Barkley, 1997), our hypothesis is that that the supposition that a young child's effort regulation is similar to that of an adult is implausible. Therefore, the purpose of this study was to determine whether age is a significantly influential variable upon young subject performance on the CARB and WMT. The results suggest that quality of effort is an age-related factor and that the use of current adult-based norms provided for measures of effort is ill advised with children.

Does test anxiety impede neuropsychological test performance?

Gass CS

Experimental research findings suggest that many individuals perform more poorly on tests because they exaggerate and personalize inordinately the threat of evaluation. Relevant research in neuropsychology has focused on psychopathology without regard to the specific impact of the testing context. The present study used the Test Anxiety Profile (TAP; Oetting & Deffenbacher, 1980) in a format adapted specifically to the neuropsychological testing context. A sample of 253 male neuropsychological referrals (average age $= 52.5$, education $= 11.9$, FSIQ $= 95.9$) were administered the modified 12-item TAP immediately following completion of an expanded Halstead–Reitan neuropsychological test battery. These examinees were judged to be neurologically intact by staff neurologists independent of neuropsychological test results. The sample's diagnostic composition included depression (43%), generalized anxiety (20%), and PTSD (17%). Test anxiety scores were significantly related to average impairment rating ($r = -.304$), WAIS-R Full-Scale IQ ($r = -.351$), and WMS-R Logical Memory-II scores ($r = -.32$, all $P < .001$), but not to scores on the WRAT-R Reading ($r = -.049$, n.s.). TAP scores were also related to scores on MMPI-2 Scale 7 ($r = .456$, $P < .001$). Examinees were classified as high- versus low-test anxious based on TAP scores. Mean scores in the high-test anxious group were significantly poorer on eight out of nine performance measures. These results are consistent with a hypothesized impact of anxiety on test performance. However, they do not demonstrate a causal direction. Further research is warranted.

The effects of assessment context on state anxiety and a neuropsychological model of attention
Greher MR

This study investigated the effects of assessment context on state anxiety and attentional processes according to the Mirsky (1996) model of attention. Context varied in the physical testing environment, demeanor of the assessor, and explanation of the purpose of testing. A high stress condition (HSC) and low stress condition (LSC) distinction was made prior to data collection, and the two contexts were designed to reflect contrasting practices of neuropsychologists. Elements of attention evaluated included encoding (Digit Span), focusing/executing (Digit Symbol-Coding, Visual Search and Attention Test), Shifting (Wisconsin Card Sorting Test: Computerized Version-2), Sustaining, and Stabilizing (Continuous Performance Test-Identical Pairs). Eighty healthy adult females participated in the study. HSC participants reported significantly greater state anxiety and lower valence than LSC participants. Participants in the HSC also committed more false alarms on the CPT-IP shapes task. This indicates reduced sustained attention and decreased inhibition in response to visual information, and supports the existence of a reciprocal relationship between cognition and emotion specific to right hemisphere activity. Conversely, WCST-CV2 perseverative responses were higher for the LSC, which may suggest differences in frontal activity required for shifting attention, or levels of motivation specific to the demands of this task. The results are consistent with previous research indicating increased rate of error on attentional tasks in a high stress context (von Kluge, 1992), although the effects on shifting attention are unique.

The test of time: does the Rey 15-Item Memory Test still work?
Greiffenstein MF, Baker JB

The Rey 15-Item Memory Test (RFIMT) is one of earliest and also best-recognized neuropsychological symptom validity tests. The test's years in service, its ease of administration, and its easy recognition may make it vulnerable to coaching by unscrupulous plaintiff attorneys and their neuropsychologist proxies. Some believe it has outlived its usefulness for this reason. The present study examined Rey 15-Item performance as a function of calendar year in large groups of litigating head injury patients. If coaching has become pervasive, data should a gradient of improving performance across time. A decreasing gradient would show increasing naiveté among plaintiffs and a flat function would rule out pervasive coaching. A pool of 387 litigating head injury claimants was divided by calendar year of testing. Between 1991 and 2000, the range of mean RFIMT scores was narrow, from 11.90 to 12.14. There was also no calendar trend in standard deviation. Using nine or less as the invalid range, the percent of invalid protocols from 1991 to 2000 in 2-year intervals was 26.1, 25, 21, 24, and 22%. In summary, chronological analysis of RFIMT performance may show a slight reduction in sensitivity but does not show any substantial trend across time. The data does not disprove RFMIT coaching, but it seems to rule out pervasive coaching.

Response consistency on the test of memory malingering
Johnson C, Moelter S, Ford S, Tombaugh T, Moberg P

A consistency index was developed to aid clinicians in discriminating between individuals feigning memory difficulty and those with genuine cognitive impairment on the Test of Memory Malingering (TOMM). We hypothesized that students simulating impairment and suspected malingerers would show greater degrees of inconsistency (i.e., missing an item previously answered correct) relative to

improvement (i.e., responding correctly to an item previously missed) across Trials 1 and 2 than individuals with verified cognitive impairment. Participants included 24 students simulating cognitive impairment (SS), 18 cognitively impaired patients (CI) who performed below a Trial 2 cut score of 45, and 12 medical legal clients suspected of malingering (SM). Each of the groups performed well below expected levels (Trial 1 mean = 31.54 ± 5.7, Trial 2 mean = 36.25 ± 7.2, and retention = 34.23 ± 7.2), with the CI group outperforming the others. Across groups, performance improved by a mean score of 11 between Trials 1 and 2; the difference between groups was significant at a trend level ($P = .07$), with the SM group demonstrating greatest improvement between trials. In contrast, the ratio of inconsistency to improvement was significantly different between groups [$F(2, 53) = 4.91$, $P = .01$]. The SS and SM showed more inconsistency relative to improvement than the CI group. These results indicate that analysis of response consistency can further distinguish patients with known brain injury from those feigning impairment.

Traumatic brain injury and effort on the Wisconsin Card Sorting Test
King J, Sweet J, Vanderploeg R, Curtiss G, Sherer M

In the first of three studies examining the use of the Wisconsin Card Sorting Test (WCST) to assess effort, 27 patients with insufficient effort (IE) performed significantly worse on all WCST variables than 33 chronic traumatic brain injury (TBI) patients with good effort. Discriminant function analysis (DFA) and logistic regression (logit) were reasonably efficient in differentiating the groups. Similarly, prior DFA (Bernard, McGrath, & Houston, 1996) and logit (Suhr & Boyer, 1999) equations demonstrated reasonable classifications. In Study 2, these equations were applied to 75 moderate-severe, acute TBI rehabilitation patients whose posttraumatic amnesia had just resolved. Results indicated the IE group of Study 1 performed significantly worse than acute rehabilitation patients for failures to maintain set, trials to complete first category, and categories completed. However, logit and DFA classification accuracy varied considerably. Our DFA classified only 45% of these patients correctly, whereas our logit correctly classified 96% of the sample. The Bernard equation correctly classified 73% and the Suhr equation correctly classified 75% of the sample. In Study 3, 130 mild-severe TBI patients in the VA system were studied. The Study 1 IE group performed significantly worse than the VA group on all 10 common WCST variables of interest. Application of the four multivariate procedures resulted in good to excellent classification rates: Study 1 DFA 84%, Suhr logit 85%, Bernard DFA 85%, and Study 1 logit 99%. Implications and limitations of the studies are presented.

The role of perceptual bias in Rey–Osterrieth Memory performance
Kramer JH, Wells A

Although recall of the Rey–Osterrieth is widely used for measuring visual memory, poor copy accuracy and reduced visual organization (and not just poor memory, per se) can adversely affect memory performance. The purpose of this study was to determine if basic visuoperception also influences memory scores. Subjects were 119 normal adults (98 men, 21 women; mean age = 49.5). Subjects were administered the Rey–Osterrieth Complex Figure (ROCF) and a visuoperceptual task in a fixed order. The ROCF administration included copy, immediate recall, and delayed recall conditions scored according to the Taylor system. The visuoperceptual measure was a global–local similarity judgment task in which subjects selected which of two comparison figures most resembled a target figure. Data were analyzed with multiple regression, with ROCF delayed recall as the dependent measure. Age and

gender were entered into the model in the first step, followed by copy score. In the final step of the model, the number of responses on the perceptual task that matched the target at the global level was entered. The number of global responses explained a significant increase in ROCF recall [$F(1, 113) = 7.8$, $P < .01$]. Results indicate that even after controlling for copy performance and demographic variables, perceptual bias predicted memory performance, with global bias predicting better recall. Findings are consistent with research correlating global processing and spatial ability, and suggest that in addition to copy ability and organization, visuoperceptual bias must be considered as a moderator variable when interpreting ROCF recall.

Failure of the Trail Making Test-B errors to detecting symptom exaggeration/malingering: a cross-validation

O'Bryant SE, Hilsabeck RC, Fisher JM, McCaffrey RJ

One of the most commonly utilized tests in neuropsychological evaluations is the Trail Making Test (Guilmette, Faust, Hart, & Arkes, 1990). While errors on the Trail Making Test (TMT) are frequently recorded, little is known about the meaning and interpretability of these errors. Ruffolo, Guilmette, and Willis (2000) found TMT Part B errors to be significantly higher for head-injured individuals suspected of malingering and individuals instructed to feign memory impairments when compared to mild head-injured, moderate/severe head-injured, and control groups. However, O'Bryant et al. (2001) failed to replicate these findings in a sample of mild head-injured litigants suspected of malingering. The purpose of this study was to cross-validate the findings of O'Bryant et al. in a sample of 51 mild head injured litigants from a private practice who were either suspected of malingering (Group 1; $N = 20$) or not suspected malingering (Group 2; $N = 31$) based on their performance on the Test of Memory Malingering (TOMM) and/or the Rey 15-Item Memory Test (REY-15). TMT-B errors did not discriminate between individuals suspected of malingering versus those not suspected of malingering. Therefore, caution is warranted when using TMT-B errors as indicators of symptom exaggeration/malingering in litigants with mild head injuries.

An examination of the relationship between MMPI Depression Scale and performance on the Halstead–Reitan Test Battery

Pospisil T, Kirsten A, Chuplis KA, Conger C, Golden CJ

Given the prevalence of the administration of both the MMPI-2 and various tests from the Halstead–Reitan Neuropsychological Test Battery, it is important to recognize patterns of performance while interpreting the results. The purpose of the following study was to examine the relationships between the Depression Scale from the MMPI-2 and selected tests from the Halstead–Reitan Test Battery. Participants were 155 adults referred for a full neuropsychological evaluation assessing for possible psychiatric and/or neurological disorders. The average age of the participants was 37.71 (S.D. = 15.44), they completed on average 13.12 years of education (S.D. = 2.91), 57.4% were female, and the majority of them were right-handed (87.7%). The sample was predominantly Caucasian (72.9%), with 13.5% African-American and 9.7% Hispanic. Pearson's product correlations were performed between Scale 2 from the MMPI-2 and The Finger Tapping Test, Trails A and B, Tactual Performance Test (TPT), and the Category Test. Significant correlations ($\alpha = .05$) were found between the Depression Scale and The Finger Tapping Test (Dominant, $r = -.244$; and Nondominant, $r = -.242$), Trails A ($r = -.256$), Trails B ($r = -.327$), and the TPT Both Hands ($r = -.222$). The apparent psychomotor retardation present in patients endorsing items from the Depression Scale needs to be recognized while interpreting

poor performance on neuropsychological measures. While the relationships are mild, they can influence results especially when client's performance are near "cutoff" scores. These results highlight the importance of identifying the relationship between personality and neuropsychological performance while interpreting test results.

Detecting feigned memory impairment for test and symptom coached simulators with the test of memory malingering

Powell MR, Gfeller JD, Sharland M, Salazar N, Capps A, Oliveri MV, LaVoie D

The current investigation explored the ability of the Test of Memory Malingering (TOMM, Tombaugh, 1996) to detect feigned memory impairment. The TOMM was administered to participants randomly assigned to one of three experimental conditions: (1) a normal control (NC) group instructed to perform optimally ($N = 21$), (2) a symptom-coached (SC) group asked to feign cognitive deficits ($N = 27$), and (3) a test-coached (TC) group instructed to feign cognitive deficits ($N = 25$). Preliminary analyses revealed that with respect to the number correct on each trial of the TOMM, the NC group performed significantly better than both simulation groups, while the TC group performed significantly better than the SC group. Using the recommended cut-off score of 45/50 correct on both Trial 2 and the retention trial of the TOMM to detect suboptimal performance, the TOMM correctly classified 100% of the NC group as performing optimally (specificity), 92.6% of the SC group as malingering (sensitivity), and 96% of the TC group as malingering (sensitivity). A discriminant function analysis (DFA) exploring optimal versus suboptimal performance using Trial 2 of the TOMM yielded an overall classification accuracy of 91.8%, demonstrating 100% specificity and 88.5% sensitivity. A DFA exploring the same group classifications (optimal vs. suboptimal performance) was conducted with the TOMM's retention trial, yielding an overall classification accuracy of 89% (100% specificity and 84.6% sensitivity). A discussion of the effects of different coaching paradigms and the ability of the TOMM to detect poor effort will be provided.

The Test of Memory Malingering (TOMM): a study of depressed and nondepressed individuals in simulated malingering and best effort conditions

Schiehser DM, Dickson AL, Duplantis A, Paterson C, Cole J

The Test of Memory Malingering (TOMM; Tombaugh, 1996), a forced-choice visual recognition test, has been found to be sensitive to exaggerated or deliberate faking of memory impairment, while remaining insensitive to genuine memory impairment in a wide range of neurological disorders. However, the effect of depressive mood in both a best effort (performing at one's best ability) condition and a simulated malingering (deliberate faking) condition has yet to be systematically evaluated. The present study examined the scores of the three TOMM trials in 30 inpatients with a diagnosed mood disorder (major depression, depression NOS, adjustment disorder with depressed mood, and bipolar disorder most recent episode depressed) and 30 nondepressed controls. Half of the participants in each of the depressed and nondepressed groups were randomly assigned to either a simulated malingering or a best effort condition. The three TOMM trials were subjected to a 2 (depressed, nondepressed) $\times$ 2 (best effort, simulated malingering) $\times$ 3 (Trial 1, Trial 2, retention trial) mixed ANOVA. Analyses revealed a significant main effect for simulated malingering. No other significant effects were indicated. The results support the use of the TOMM as a sensitive measure of suboptimal effort in depressed and nondepressed individuals and suggest that the TOMM is insensitive to the effects of depressive symptomatology.

The influence of legal referral source on performance of the Test of Memory Malingering (TOMM) in adults with traumatic brain injury
Stott HD, Black FW

Effort and motivation have been important factors in neuropsychological test performance. The importance of detecting malingering is particularly important within patients involved in litigation cases. The impact of various neurological conditions and emotional conditions have been investigated using the Test of Memory Malingering (TOMM), although the effect of referral source on test performance within litigating cases has not been examined. The present study investigated 115 participants (62 defense; 53 plaintiff) with closed head injury referred for comprehensive neuropsychological evaluation. A one-way ANOVA on the participants indicated that plaintiff referrals showed significantly higher scores on all three trials of the TOMM. These results demonstrate that individuals with a legal referral source of plaintiff performed significantly better on the TOMM than those with a referral source of defendant, suggesting the importance of legal referral source as an additional factor in measures of effort and malingering. Implications and ideas for future research are discussed.

Poster twins: a profile of two malingerers
Wymer J, Gouvier WD

Although testing observations and objective measures are commonly used to identify probable malingerers, rarely do neuropsychologists receive absolute confirmation that their probable diagnoses are correct (as malingerers are not likely to admit their impression management). Two brain injured patients, one mild and one severe, were evaluated in a medicolegal context to determine the effects of their brain injuries, strengths, and residual deficits. Both patients were identified as malingering with the use of forced choice tests (Warrington Recognition Memory Test (RMT), Test of Memory Malingering (TOMM), and Word Memory Test (WMT)), easy measures designed to have high face valid difficulty (Memory for 15-Item Test (MFIT) and WMT), aberrant intrasubtest scatter, and discrepancy between identified injuries and test findings. Both patients received a session of values clarification by their attorney designed to engender more honest and full participation. The severely head injured patient confessed to exaggerating her deficits, while the mildly injured patient denied exaggeration. Both patients are scheduled to be reevaluated using some parallel and some identical measures, and their pre–post profiles will be discussed in light of their recanting versus not.

ERRATUM

Following are abstracts of posters presented at the 2001 Annual Meeting of the National Academy of Neuropsychology that were wither inadvertently omitted or have since undergone revision.

Validity of the Mullen scales of early learning
Gordon S, Burns TG

There are few available developmental instruments with neuropsychological perspectives. The Mullen scales of early learning (MSEL), a newer diagnostic instruments intended for use with children 0–68 months, makes specific adaptations for sensory and motor impairments. However, to date, only two independent studies have attempted to validate this instrument. The present study compared the MSEL with the Vineland Adaptive Behavior Scales (VABS) and the Child Development Inventory (CDI).

The sample included 54 children (15–62 months) with suspected communication and motor delays. The MSEL Receptive Communication, Expressive Communication, Gross Motor, and Fine Motor Scales correlated highly with appropriate VABS and CDI scales, with correlations ranging from .99 to .77. The MSEL Early Learning Composite correlated highly with the CDI General Development Scale ($r = .83$) but not the VABS Adaptive Behavior Composite ($r = .52$). The two communication scales of the MSEL correlated highly with the VABS Communication Domain Scale ($r = .77$ and $r = .88$) as did the two motor scales with the VABS Motor Domain Scale ($r = .83$ and $r = .79$). A principal components factor analysis of the communication and motor scales and the Early Learning Composite using varimax rotation suggested two factors. The receptive and expressive communication scores loaded highly on one component whereas the gross motor loaded highly on the second component. The Fine Motor scale loaded moderately on both components. The early learning composite loaded more strongly on component 1 than on component 2. Results of these analyses provide support for the validity of this instrument.

Relationship between a new measure of prospective memory and clinical neuropsychological measures

Hannon R, Masuda A, Cabral K, Patalano J, Svec L, Zadeh S

The purposes of this study were to develop normative data for young adults on a new, more ecologically valid measure of prospective memory, and to study the relationship of prospective memory performance with clinical neuropsychological measures theoretically related to prospective memory (attention/concentration, retrospective memory, and executive functioning) and with prospective memory self-rating. Participants were 47 undergraduate students who completed the Hannon and Cabral Test of prospective memory performance (PMP) (based on the work of Sohlberg & Mateer, 1989). The PMP includes three time-cue tasks and three associative-cue tasks with measurements at 2, 10, and 24 min for short-term tasks and one at 24 h for a long-term task. Participants also completed a 45-min battery of neuropsychological tests of attention/concentration, memory, and executive functioning, followed by two self-rating scales (Prospective Memory Questionnaire, Metamemory in Adulthood Questionnaire). PMP short-term scores were significantly positively correlated with performance on measures of attention/concentration (Symbol Digit Modalities Test, $r = .43$), retrospective memory (Logical Memory delayed recall, $r = .39$), and executive functioning (Stroop Color, $r = .38$). PMP long-term scores correlated significantly with only one measure of attention/concentration (Trails A, $r = -.35$). PMP short-term scores did not correlate significantly with scores from either self-rating scale. The relatively high PMP scores obtained by these college students suggests that that PMP is of appropriate difficulty for establishing normal versus impaired performance. Future research is needed to study the sensitivity of the PMP to the effects of brain-injury and/or aging.

Cognitive deficits in asymptomatic HIV+ individuals? An old question revisited using a novel computerized assessment

Levine A, Bruce A, Rothlind J, Quigley R

Research examining cognitive impairment during asymptomatic HIV has yielded inconclusive results. Some have suggested computerized testing formats for detecting subtle impairments in early HIV. In this study, we both re-examine the notion of deficits in asymptomatic HIV+ individuals, and explore the utility of a novel computerized instrument verses traditional tests in detecting cognitive deficits in these individuals. Eighty-three individuals (46 asymptomatic HIV+ (PA), and 37 HIV− controls (NC))

were administered a comprehensive neuropsychological battery as part of a larger study examining the effects of alcohol use on HIV progression. The battery included numerous well-standardized traditional neuropsychological tests and a computerized assessment called MicroCog. The utility of MicroCog for assessing those with HIV has not been examined. The two groups did not differ in lifetime drinking amount, education, or depression. The HIV+ individuals were slightly older (43.7 vs. 38). Although neither the one-way MANOVA using the traditional neuropsychological tests nor the one utilizing MicroCog Index scores were able to differentiate the PA and NC groups ($P = .06$ and $P = .579$, respectively), the NC group received significantly better scores on five of the nine MicroCog indexes. However, a factor analysis revealed only one factor for all nine indexes, which we believe to be associated with processing speed and accuracy. These results do suggest that asymptomatic HIV+ individuals exhibit depressed processing speed compared to their HIV− counterparts, and that MicroCog is useful in detecting this.