Ethics Questions Raised by the Neuropsychiatric, Neuropsychological, Educational, Developmental, and Family Characteristics of 18 Juveniles Awaiting Execution in Texas

Dorothy Otnow Lewis, MD, Catherine A. Yeager, MA, Pamela Blake, MD, Barbara Bard, PhD, and Maren Strenziok, MS

Eighteen males condemned to death in Texas for homicides committed prior to the defendants' 18th birthdays received systematic psychiatric, neurologic, neuropsychological, and educational assessments, and all available medical, psychological, educational, social, and family data were reviewed. Six subjects began life with potentially compromised central nervous system (CNS) function (e.g., prematurity, respiratory distress syndrome). All but one experienced serious head traumas in childhood and adolescence. All subjects evaluated neurologically and neuropsychologically had signs of prefrontal cortical dysfunction. Neuropsychological testing was more sensitive to executive dysfunction than neurologic examination. Fifteen (83%) had signs, symptoms, and histories consistent with bipolar spectrum, schizoaffective spectrum, or hypomanic disorders. Two subjects were intellectually limited, and one suffered from parasomnias and dissociation. All but one came from extremely violent and/or abusive families in which mental illness was prevalent in multiple generations. Implications regarding the ethics involved in matters of culpability and mitigation are considered.

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The first well-documented case in America of executing a child antedates the American Revolution. In 1642, a 16-year-old boy, Thomas Graunger, was hanged for the crime of bestiality, having sodomized a horse and a cow.[1] Over the next 200 years, only 18 juveniles in the entire country were executed. However, long after the United States broke from England, it continued to base many of its laws on English common law.[2,3] In the late 18th century, Blackstone argued that if it appeared to the court and the jury that he [the child] was 'doli capax' and could discern between good and evil, he could be convicted and sentenced to death.[4] In accordance with this principle, the New Jersey Supreme Court, in the case of *State v. Aaron*,[5] overturned the death sentence of an 11-year-old slave convicted of murdering a younger child. The Court held that the presumption of innocence had not been refuted by "strong and irrefutable evidence that he had sufficient discernment to distinguish good from evil." However, despite this developmentally sophisticated ruling, between 1850 and 1860, six juveniles were put to death in the United States. Among them was an 11-year-old slave who was condemned to die for hacking to death a 4-year-old.[6] Covered with the blood of his victim but unable to appreciate the evidence of his act, the child blamed the assault on imaginary Indians. This implausible explanation was interpreted by adults as a lie and thus that the child knew right from wrong.

Over time we have created a paradoxical system of justice, the juvenile justice component of which recognizes the emotional and intellectual immaturity of

Dr. Lewis is Clinical Professor of Psychiatry, and Ms. Yeager is Research Associate, Yale University Child Study Center, New Haven, CT. Dr. Blake is Assistant Professor, and Ms. Strenziok is Research Assistant, Department of Neurology, Georgetown University Hospital, Washington, DC. Dr. Bard is Professor Emeritus, Department of Special Education, Central Connecticut State University, New Britain, CT. Address correspondence to: Dorothy Otnow Lewis, MD, 10 St. Ronan Terrace, New Haven, CT 06510. E-mail: dorothy.lewis@yale.edu

juveniles in contrast to adults. On the other hand, under certain circumstances (i.e., serious violent crime), emotional and cognitive immaturity are ignored and juveniles can be tried and sentenced as adults. Over the past two decades, the Supreme Court of the United States has wrestled with these paradoxes, trying to determine at what developmental age or stage a child's thinking has matured sufficiently to be considered equivalent to that of an adult. For example, in 1988, in the case of *Thompson v. Oklahoma*,[7] the Court ruled that Thompson, 15 years old at the time of his crime, was too young to be sentenced to death for murder. A year later, however, in the case of *Stanford v. Kentucky*, the same Court decided that 16-year-olds were sufficiently mature to be tried as adults and sentenced to death.[8]

Today, 15 years after *Stanford v. Kentucky*, medical technology has advanced sufficiently to shed light on the matter of brain maturation. We know, for example, that certain areas of the brain (e.g., the temporal lobes and prefrontal cortex), essential for mature reasoning and self-control, are not fully myelinated during late adolescence.[9,10] Furthermore, a consensus exists that a mature, well-functioning prefrontal cortex is essential for judgment, for the modulation of strong internal stimuli, and for measured reactions to internal and external stressors. When the prefrontal cortex is immature, dysfunctional, or damaged, the abilities to think ahead, plan, control the expression of emotions, and learn from the consequences of one's behavior are compromised. With the advances in medical technology has come an increased interest in the neuropsychological assessment of prefrontal cortical function as it relates to aggression. Can this knowledge increase our understanding of juveniles who commit murder and are condemned to death? To this end, our study was directed.

The purpose of this article is fourfold: (1) to present the biopsychosocial characteristics of 18 young men condemned to death as juveniles and awaiting execution in the State of Texas in 2004; (2) to clarify the ways in which the immaturity of their central nervous systems, traumas to their brains, predispositions to psychiatric illness, and chaotic, violent, and abusive upbringings may have diminished their judgment and self control; (3) to call attention to the failure of previous clinicians to obtain, either from the juveniles or from outside sources, their medical, educational, and family histories—data potentially relevant to culpability and/or mitigation; and (4) to raise the question of whether the justice system will be able or willing to integrate into its codes the current neuropsychiatric understanding of the relationship of brain development and function to violent behavior.

Methods

Sample

Our sample consisted of 18 males who had been condemned to death for homicides committed prior to their 18th birthdays. At the time of sentencing, death could be imposed in Texas on any juvenile 17 years of age or older who had committed a murder classified as a "capital felony."[11] These individuals were part of a cohort of 26 condemned juveniles in the State of Texas in 2004. Attorneys assisting the 18 inmates and their individual lawyers in their appeals requested comprehensive neuropsychiatric, neuropsychological, and educational evaluations. The evaluations were requested because of the inmates' youth at the times of their offenses and not because of any known or suspected neuropathology or psychopathology. Only 4 of the 18 juveniles had undergone pretrial psychiatric evaluations, two of which were performed for the court and two for the defense. As far as could be ascertained, none had received pretrial neurologic or neuropsychological examinations. To the best of our knowledge, no presentencing neuropsychiatric evaluations were conducted. Therefore, attorneys wanted to determine the existence, if any, of mitigating factors that had not been introduced at trial or sentencing. In Texas, such factors were defined as "any matter that the court deems relevant to sentence, including evidence of the defendant's background or character or the circumstances of the offense that mitigate against the imposition of the death penalty." A major aggravator in Texas was the likelihood of future dangerousness, the criteria for which were not stipulated.[12]

Our services were made available to all 26 condemned juveniles. The reasons why eight inmates did not participate could not be determined. However, in the course of our work at the prison, four of these eight condemned juveniles expressed a desire to be evaluated by the clinical team. In these cases, for reasons that were not shared with the team, they were not permitted to do so. No known demographic differences existed between participants and nonparticipants.

All 18 subjects were 17 years of age at the time of the murders for which they were condemned to death. The average age at the time of the present evaluations was 26.6 years (SD = 2.5 years; median = 27.0 years). Subjects' time on death row ranged from 2 to 14 years (M = 6.9 years, SD = 3.0 years). Forty-four percent of the subjects were Latino, 29 percent African-American, 22 percent European-American, and 5 percent other. Seventeen of the group came from families in socioeconomic Classes IV and V, based on Hollingshead and Redlich's Two Factor Index of Social Position,[13] and one came from socioeconomic Class III.

IRB Approval and Confidentiality

The protocol was approved by the Institutional Review Board of Physicians for Human Rights. Time constraints precluded obtaining a Certificate of Confidentiality from N.I.M.H. However, attorney-clinician privilege prohibited the release of any identifiable data regarding individual inmates to parties other than lawyers and their clients. As part of the protocol, both attorneys and their clients gave the clinical team informed consent to present findings in scientific settings and/or in scientific publications as long as the anonymity of individual inmates was preserved. Furthermore, to this end attorneys insisted that no data regarding the nature of offenses for which individual juveniles were condemned be presented.

Setting

Evaluations took place at the Texas Department of Corrections Livingston facility, where all of Texas's condemned juveniles are held. Each clinician was afforded a private area in which to interview and assess subjects. Only the psychiatrist and neurologist were permitted contact visits.

Nature of the Evaluations

Diagnostic evaluations consisted of psychiatric, neurologic, neuropsychological, and educational examinations and assessments. Because of time constraints imposed by the prison, each member of the clinical team had a maximum of 3.5 hours with each subject.

Psychiatric and Neurologic Evaluations

Psychiatric and neurologic examinations were conducted by a board-certified psychiatrist (D.O.L.) and board-certified neurologist (P.B.), both of whom were experienced in the neuropsychiatric assessment of violent juveniles and adults. The nature of the psychiatric evaluation and the ways in which symptoms were classified have been described.[14] Briefly, it consisted of a semistructured interview based on the Bellevue Adolescent Interview Schedule and the Dissociative Disorders Interview Schedule.[15–17] Topics included histories of neuropsychiatric symptoms, psychiatric treatment, medical history, characteristics of temper, family mental health histories, and histories of child physical and sexual abuse and family violence. An examination of scars on the face, head, and body was also performed.

In addition to a standard neurologic examination, including examination of mental status, cranial nerve function, and motor, sensory, and cerebellar functions, subjects were assessed carefully for the presence of frontal lobe deficits. Specific frontal lobe tests included evaluation of visual fixation, smooth-pursuit eye movements, antisaccade eye movements, motor tone (for paratonia), and testing for prefrontal release signs, including grasp, snout, and suck reflexes.

Neuropsychological Assessments

Intellectual and neuropsychological assessments were conducted by a research psychologist experienced in evaluating violent individuals and trained in cognitive and neuropsychological assessment (C.A.Y.). Malingering, or the purposeful exaggeration of symptoms, was assessed at three points during the evaluation. At the beginning of testing, the Test of Memory Malingering (TOMM[18]) was given. Later, the Forced Choice Recognition subtest of the California Verbal Learning Test-II (CVLT-II[19]) was administered as part of that test protocol. At the completion of testing, subjects were given several clinical self-report measures to complete, one of which was the Personality Assessment Inventory (PAI[20]). This personality measure contains a set of validity scales, the purpose of which is to assess response style and the likelihood of exaggerated responding.

Intellectual functioning was assessed with the Wechsler Adult Intelligence Scale-III (WAIS-III[21]). All 11 standard subtests plus an optional subtest, Letter-Number Sequencing, were administered.

Tests of frontal lobe functioning incorporated both structured instruments, which are thought to assess dorsolateral prefrontal functioning, and an unstructured test of decision-making, which purport-

edly reflects orbitomedial prefrontal functioning. Specific frontal functions that were assessed included:

- *Attention and mental tracking:* tests included the WAIS-III Digits Forward and Digit-Symbol Coding subtests, the Trailmaking Subtests 1 (Number Cancellation), 2 (Number Trailmaking), and 3 (Letter Trailmaking) of the Delis-Kaplan Executive Function System (D-KEFS[22]), and Trial A_1 of the California Verbal Learning Test-II (CVLT-II[19]).
- *Working memory*: tests included the WAIS-III Digits Backward and Letter-Number Sequencing subtests.
- *Executive functions:* tests included the Booklet Category Test[23] to assess concept formation and conceptual flexibility; the D-KEFS Trailmaking Subtest 4 (Number-Letter Switching—an analog of Trails B) to assess cognitive flexibility in the visual-motor domain; the D-KEFS Letter Fluency, Category Fluency, and Category Switching subtests to assess verbal fluency and verbally mediated cognitive flexibility; the Rey-Osterrieth Complex Figure (ROCF[24]), using color markers, to assess organizational strategy[25]; and the Iowa Gambling Task,[26,27] a test of real-life decision-making in terms of uncertainty, reward, and punishment (described in detail below).

The Iowa Gambling Task

Clinicians and researchers have long been aware that individuals with frontal lobe lesions can appear to be neuropsychologically intact on IQ tests and perform normally or nearly normally on traditional tests of executive function. However, in daily life, these individuals routinely make impulsive, imprudent, and often self-destructive decisions.[28–31] Their social decision-making is equally poor. They often make high risk/instant reward decisions despite the potential for aversive consequences and, because of their frontal dysfunction, are unable to learn from the penalties that result from bad decisions. Bechara and colleagues[26] created the Iowa Gambling Task to capture in the laboratory the decision-making deficits that have been reported clinically about individuals with frontal lobe damage. In this task the player chooses from any of four decks of cards to win fake money, the object of the game being to maximize winnings and minimize losses. The player is told at the outset that some decks are more disadvantageous than others and are to be avoided. Healthy control subjects learn to avoid the disadvantageous (high wins, higher losses) decks. In contrast, patients with lesions in the orbitomedial region of the prefrontal cortex fail to adopt this conservative decision-making strategy and are pulled to the high-stakes decks, incurring substantial losses by the end of the game. Bechara and colleagues[26,32] concluded that these individuals exhibit "myopia for the future"—that is, they are insensitive to the future consequences of current behavior. In the present investigation, we used the computerized version of the Iowa Gambling Task. (See Bechara *et al.*,[27] for details regarding game parameters and specific instructions to subjects.) When the game concluded, subjects were asked to describe their decision-making strategies. To ascertain subjects' performances on this game (i.e., whether subjects learned the optimal conservative strategy to avert significant losses), cards chosen from the disadvantageous decks were tallied in quartiles of 25 cards each, and the proportion of disadvantageous choices from the first quartile were compared with those of the last quartile, using Student's *t* test for proportions (small sample size).

Criteria for Determining Impairment on Executive Function Tests

Tests were scored in a standard manner, according to instructions in examiner manuals. The ROCF Copy was scored using the Taylor[33] scoring criteria. All test scores were recorded either as age-corrected scaled scores (mean = 10, SD = 3), age, education, and ethnicity-corrected *T* scores (mean = 50, SD = 10), or as standard deviations from the mean for normal individuals, based on the examiner manual's instructions. All test scores were then converted to *T* scores to facilitate intertest comparisons. Determination of impaired performance on a given test was made based on the following conventional scoring criteria (e.g., Ref. 34): Mildly impaired performance: *T* score of 32 to 41; Moderately impaired performance: *T* score of 22 to 31; Severely impaired performance: *T* score below 22.

Educational Assessments

Educational assessments were conducted by a certified speech language pathologist and special educator (B.B.). In addition to taking a school history, the Word Reading, Reading Comprehension, Pseudoword Decoding, Math Reasoning, Spelling, Listen-

ing Comprehension, and Oral Expression subtests of the Wechsler Individual Achievement Test-II (WIAT-II[35]) were administered. Unfortunately, the Numerical Operations and Written Expression subtest stimuli of the WIAT-II, though ordered from the test manufacturer, were not delivered in time. We were able to substitute the Test of Written Language[36] for Written Expression; however, we were unable to acquire an appropriate substitute for Numerical Operations and had to rely on Math Reasoning only, to estimate proficiency in that area. Articulation and language use were assessed clinically.

Gathering Historical Data from Interviews

Detailed medical histories were obtained from subjects by both the psychiatrist and neurologist, and attempts were made to corroborate serious accidents, injuries, and physical abuse by making a careful examination of scars on the subject's head and body. Detailed social, family, and school histories were obtained by the psychiatrist and educational specialist. In just over one third of the cases, these data could be corroborated by materials furnished by attorneys.

Gathering Data on Abuse, Neglect, and Family Violence from Interviews

Information regarding physical and sexual abuse and/or family violence was gathered by the psychiatrist and supplemented by other members of the clinical team. As in our previous studies, a subject was considered to have been the victim of physical abuse if he had been punched, burned, choked, cut, or thrown into walls; made to kneel or stand for long periods; beaten with a stick, board, pipe, belt buckle, or other object; beaten repeatedly on the bare buttocks, back, and/or legs; or beaten on the buttocks for long periods of time with a belt or switch or if Child Protective Services had intervened or the police had been summoned to protect the child. A subject was also considered to have been physically abused if he had been threatened by a caregiver with knives, guns, or other weapons; neglected if he had been abandoned by caregivers for days at a time or longer, or if Protective Services deemed him neglected; and sexually abused if he had been directly involved with an adult or older child for purposes of the adult's or older child's sexual gratification or had been forced to perform sexual acts on an animal or peer by an adult or older child. Witnessing sexual activities was not categorized as sexual abuse. Because of the unique nature of sexually abusive experiences, specific age differences between victim and perpetrator were not used.

Finally, a subject was considered to have witnessed family violence if family members had attacked each other physically and/or threatened with or attacked with weapons. Verbal altercations were not counted as evidence of family violence.

Review of Records

Comprehensive neuropsychiatric evaluations should include reviews of medical, educational, psychological, social service, criminal, and other relevant records. Unfortunately, despite efforts to obtain these materials from subjects' attorneys, only 12 lawyers sent any records at all. Several provided excerpts of trial transcripts and court documents, the usefulness of which varied. Some materials contained school records that included academic and behavioral information. Others contained witness statements and affidavits regarding previous psychiatric signs, symptoms, behaviors, and treatment of subjects and their families and information regarding abuse and family violence. In the end, however, evidence of subjects' early psychopathology, family mental illnesses, and abuse/family violence could be corroborated objectively in just over one third of our cases. Thus, we were forced to rely primarily on our own clinical evaluations. Although there was a paucity of records documenting past accidents and injuries, an examination of scars during the evaluations confirmed physical traumas reported by 14 subjects.

Findings

Assessment of Malingering

On the TOMM, which was administered before formal testing began, 17 subjects achieved a perfect score and one made a single error on Trial 2. On the Forced Choice Recognition subtest of the CVLT-II, which was administered in the middle portion of testing, all but three subjects attained perfect scores. The other three each missed one item. Finally, on the PAI, which was given to all but one subject (Subject 9 could not read) at the end of the neuropsychological testing session, validity scales of 16 subjects showed no evidence of response distortion. One subject, who was about to be executed and therefore on death watch at the time of the evaluation, and was severely depressed, scored in the moderately elevated range on the Negative Impression Management

(NIM) scale ($T = 77$). Concomitant scores on the Rogers Discriminant Function ($T = 55$) and the Malingering Index ($T = 57$), however, established that the elevated NIM score reflected this subject's severe psychopathology rather than the purposeful distortion of symptoms.

Current Intellectual and Academic Functioning

As can be seen from the WAIS-III scores in Table 1, 16 inmates were of average intelligence, one demonstrated superior intellectual functioning, and one was mentally retarded. Another subject (no. 18), tested in the borderline-to-low average range of intellectual functioning. Subject 12 was not tested during this study because the results of a WAIS that had been administered two years before our evaluations was to be made available to us by the psychometrician who performed it. Unfortunately, after our clinical work was completed, we learned that those data were missing. We therefore present in Table 1 Subject 12's WISC-R index scores from early adolescence as an indication of his intellectual functioning, which was in the average range.

Table 1 also presents inmates' academic achievement scores in reading and mathematics. As can be seen, the WIAT-II reading composite scores of six individuals were significantly lower than would have been predicted from their overall IQs. Even more striking was the finding that 12 subjects (including Subject 12) demonstrated at least 20-point discrepancies between overall intelligence and mathematical reasoning ability. Of note, according to academic achievement tests performed on Subject 12 at age 13 years, despite his average intelligence, his mathematics skills placed him in the third percentile of children his age, thus documenting early math impairment, a finding consistent with his current mathematics achievement score. Reasons for the large math score discrepancies were unclear (e.g., lack of formal education versus learning disability or organic impairment). None of the subjects had completed regular high school. On average, the last year attended was 8th grade (range, 7th to 11th grades). Two individuals subsequently attained GED certificates, and a third obtained a diploma through a vocational program. Thus, most may never have learned high-school-level math concepts.

Table 1 Current Intellectual and Academic Functioning of 18 Juveniles Condemned to Death

Subject	WAIS-III VIQ	WAIS-III PIQ	WAIS-III FSIQ	WIAT-II Reading Composite	WIAT-II Math Reasoning
1	108	90	100	91	85
2	102	100	102	81†	90
3	93	91	91	98†	40
4	86	109	95	83	75
5	111	104	108	109	87
6	102	99	101	98†	77
7	100	111	105	82	80
8	108	91	101	87	73
9	60	70	61	40	40
10	95	98	97	102	90
11	95	100	98	80	73
12*	(94)	(89)	(91)	99	60
13	95	114	103	73†	75
14	94	107	100	92	102
15	124	114	122	95	106
16	97	84	91	97†	105
17	108	98	104	109	92
18	73	87	78	40	56

WAIS-III, WIAT-II, and WISC-R Index Scores: mean = 100, SD = 15.
*Subject 12's VIQ, PIQ, and FSIQ Index Scores are from previous testing with the WISC-R.
†English was subject's second language.

English was the second language of five of the inmates. Of these, three read on levels commensurate with their IQs, and two scored more than 20 points below the score expected, given their intellectual abilities. Of note, several of our subjects, for whom early reading disabilities were documented and who told examiners they were virtually illiterate when they came to Death Row, had improved their reading skills during incarceration. Whether these improved skills reflected frontal lobe maturation, improved diet, drug abstinence, environmental structure, or other factors could not be determined. What can be said is that, at the time of our evaluations, most of the inmates bore little resemblance to the wild, confused, uncontrolled adolescents described in available court documents and records. Whatever the explanation for their improved adaptation, they appeared to be behaviorally and cognitively more mature at the time we tested them.

Among the most surprising and important findings to emerge from the educational evaluations was that, despite most of our subjects' being of average to low-average intelligence as juveniles, they repeatedly were not passed to the next grade level in school, were placed in special education classes, and/or were sent to alternate school settings. Data from subjects and records showed that one subject repeated five grades, one repeated four grades, four repeated three grades, and two repeated two grades. All the remaining 10 subjects were placed in special education classes

and/or were transferred to alternate school settings at some point during their school careers.

That most of these individuals were having difficulty with both academic skills and social adaptation was recognized early in their school careers. In fact, by second grade, seven (39%) of our subjects either did not progress in grade level or were placed in special education classes. By sixth grade, 14 (78%) of the 18 condemned juveniles had been identified as needing special assistance, all but one for emotional rather than intellectual problems. The behaviors that precluded normal functioning in a regular classroom (e.g., overtalkativeness, disruptiveness, and clowning around) were typical precursors of the types of severe mental illnesses from which they subsequently were found to suffer. However, because these juveniles often manifested their pathology through aggressive, sometimes bizarre, behavior, they tended to be regarded at best as hyperactive and conduct disordered—at worst as antisocial and psychopathic.

Histories of Central Nervous System Trauma

It is impossible to make sense of the neurologic and neuropsychological findings that follow without having an appreciation of the effects of brain trauma on cognition and behavior. It has long been known that actual physical damage to the brain by virtue of trauma at birth, accidents, injuries, and illnesses can derail normal brain development and impair cognition, intelligence, judgment, emotional stability, and impulse control.[37–40] These functions are especially sensitive to frontal lobe injury, the most common type of brain injury incurred in motor vehicle and similar high-velocity accidents.[41,42]

Table 2 presents the known medical histories of our 18 subjects that are relevant to brain function. As can be seen, three subjects were born prematurely. Of these, one was delivered by Cesarean section because of the mother's internal hemorrhaging; another was born two months early, weighing but three pounds, and requiring several hospitalizations during his first two years of life; and one, also born two months early, was of unknown birth weight. A fourth subject was delivered by Cesarean section because the umbilical cord was wrapped around his neck; a fifth subject, whose mother reportedly tried to abort him, was born with respiratory distress syndrome; and a sixth was born with a cleft palate and lip, an abnormality often associated with other central nervous system problems.[43] A seventh, one of our most neurologically and neuropsychologically impaired subjects, knew only that, at birth, he "gave [his] mother a rough ride." Thus, six (33%) of the group began life with potentially compromised central nervous system functioning, and a seventh reportedly was the product of a difficult delivery.

Again, as shown in Table 2, in all but one case, subjects experienced numerous head injuries, many of which resulted in loss of consciousness. Although subjects tended to minimize the effects of blows to the head and car accidents (e.g., "No, I wasn't knocked unconscious"), when asked to describe what happened after the injury, responses included such accounts as, "I woke up in my grandmother's house," and, "After [the accident], my leg would twitch and I blacked out." These accounts bespeak loss of consciousness of which subjects themselves were unaware. Although objective confirmation from actual hospital records was rarely available because caregivers avoided taking children to doctors and/or attorneys failed to obtain whatever records existed, interviews with relatives, affidavits, trial witness statements, and signs of head injuries (e.g., scars, lumps, or skull indentations) were consistent with the histories as supplied.

Frontal Lobe Functioning at the Time of Evaluations

As far as could be ascertained, none of our subjects had undergone neurologic evaluation or neuropsychological testing prior to trial. Two eventually had neuropsychological screenings as part of their appeals. Thus, for the majority of subjects, the findings from the present neurologic and neuropsychological evaluations provided the first documentation of central nervous system dysfunction.

Neurologic Indicators of Frontal Lobe Function

The neurologic examination, as described earlier, was conducted on 17 of the 18 subjects. As can be seen in Table 2, the most common findings on neurologic examination were signs of prefrontal cortical impairment. Eight (47%) of the 17 subjects had impaired performances on the antisaccade task, two subjects had impaired visual fixation, and three showed impairments in smooth-pursuit eye movements. Paratonia was present in four subjects. Seven subjects had a suck reflex, and two had a snout reflex. Three subjects were unable to complete Luria two-step hand movements, and four were unable to complete Luria three-step hand movements. In brief, 5

(29%) of the 17 subjects had one abnormal prefrontal finding, 3 (18%) had two abnormal prefrontal findings, 2 (12%) had three abnormal prefrontal findings, and 3 (18%) had four or more abnormal prefrontal findings. Four (24%) subjects had no prefrontal abnormalities on neurologic examination. It should be noted that most normal individuals have no signs of frontal lobe impairment on neurologic examination.

In addition to exhibiting prefrontal abnormalities, three (18%) subjects also had impairment of motor systems. One subject, who was mentally retarded, had bilateral hemiparesis with diffuse spasticity and hyperreflexia. He was also dysarthric. Another subject had diffuse spasticity, hyperreflexia, and a left Babinski sign. A third subject had motor overflow and choreiform movements.

Neuropsychological Indicators of Frontal Lobe Function

In addition to neurologic assessment of prefrontal cortical function, all 18 subjects underwent neuropsychological testing of prefrontal functioning. As described earlier, tests included assessments of nonexecutive prefrontal functioning (attention, mental tracking, and working memory), as well as assessment of the executive functions. As can be seen in Table 3, the majority of subjects performed within normal limits on tests of nonexecutive prefrontal functioning. In contrast, 10 (55%) of the 18 subjects demonstrated impaired performances on at least two of the traditional structured tests of executive functioning. Twelve of the 18 subjects produced flawed drawings on the ROCF because of poor planning, deficient organizational strategy, and impaired visual integration. On the other hand, Subject 1 produced a poor copy of the ROCF as a result of his careless, impulsive approach to the task rather than because of poor executive abilities.

Most striking was the finding that the majority (84%) of subjects exhibited significant impairment on the unstructured test of executive function, the Iowa Gambling Task, measuring the ability to anticipate future consequences and modify behavior in response to negative feedback. Unlike normal individuals, our subjects did not learn from experience and tended to select cards from decks A and B, the disadvantageous decks, with about the same frequency at the end of the game as at the beginning (first quartile = 0.53, fourth quartile = 0.44; $t(17) = 0.5171$, p = NS (one-tailed)). Only three (16%) of the 18 subjects applied the kinds of decision-making strategies characteristic of normal individuals and chose significantly fewer cards from decks A and B by the end of the game. The impaired decision-making strategies of the other 15 subjects were similar to those of patients with damage to the orbitomedial prefrontal cortex, who can conceptualize the right route to take but are unable to follow it.

In sum, every subject demonstrated signs of prefrontal cortical dysfunction on neurologic examination, neuropsychological testing, or both. Neuropsychological testing was more sensitive to frontal dysfunction than was the neurologic examination.

Psychiatric Findings

As can be seen in Table 4, eight (44%) subjects had histories and psychiatric signs and symptoms consistent with early-onset bipolar spectrum disorder, and four (22%) had histories, signs, and symptoms consistent with early-onset schizoaffective psychosis. Subject 1 provided an especially clear example of early-onset severe bipolar spectrum disorder. He had been treated as a young child for emotional withdrawal. In contrast, during adolescence, he was hospitalized in a psychiatric facility three times because of "hypomatic" [sic], "euphoric," and "possibly schizophrenic" signs and symptoms. At other times, he "became glassy-eyed and thought he was God." But his grandiosity and euphoria never lasted long, and, as a teenager, he periodically became sad, lost interest in everything, and wore only black. Thus, he manifested both manic and depressive signs and symptoms. During our interviews, he was hypomanic; his speech was pressured, and he could not stop talking. Evidence of bipolar signs and symptoms was found to exist in members of both sides of his family. His father, a charismatic cult leader, allegedly "kidnapped" Subject 1's mother, taking her into the cult, and the subject was conceived when his father raped her. Furthermore, the father had a second family that he kept secret from the first. After escaping from the cult, the mother reportedly married and divorced several times and changed religions repeatedly. According to court records, she had had psychiatric treatment, but the nature of her treatment was unclear. She was described as loud, drunk, histrionic, and needing to be the center of attention. This mother admitted that during times of intense emotional states, "I took my anger out on [my son]." She beat him with a "Sam Brown thick brown belt,"

Table 2 Nature and Objective Evidence of Central Nervous System Trauma in 18 Juveniles Condemned to Death

Subject	History of Birth Trauma	Nature of Accidents and Injuries	Objective Evidence of Physical Trauma	Prefrontal Abnormalities on Neurologic Examination	Nonprefrontal Abnormalities on Neurologic Examination
1	Subject unaware of problems	Hit with bat (LOC*) in childhood; assaulted (LOC) in adolescence; multiple blows to front and back of head age 15–16 years	Scars on face, back, and buttocks	Abnormal antisaccades	None
2	Subject unaware of problems	Car accident age three years; run over by car, "hurt back," ambulance to hospital; punched in childhood (LOC)	Multiple head and face scars	Suck reflex present	Choreiform movements; motor overflow
3	Was told he "gave my mother a rough ride"	Multiple blows to head with bat (LOC) in childhood; bike accident at age five years, hit head; hit by car age nine years; car accident, hit windshield age eight years; motorcycle accident in adolescence, hit head	Multiple head and face scars; two large lumps on back of head	Abnormal antisaccades; suck reflex present; abnormal Luria 2 step and Luria 3 step	None
4	Subject unaware of problems	Many skateboard and bike accidents with LOC two to three times; hit in head with ashtray in adolescence	Scars between eyebrows and on head; scars all over back	None	None
5	Subject unaware of problems	Fell and hit head, age 5 years; hit with belt buckle in face by father in childhood; fell and hit head on concrete at age 17 years	Multiple scars on head and back from beatings; scar over left eyebrow from being hit with belt buckle; scar on lip from father's assault with knife	None	None
6	Umbilical cord around neck; emergency C-section	Fell off jumping ramp on bike and rolled down street age 12 years; rolled car over in adolescence, denied LOC	No noticeable scars	Abnormal antisaccades; Luria 3 step slow on right	None
7	Mother attempted to abort fetus; perinatal respiratory distress syndrome	Near drowning age 4 years; hit with bat (LOC) age 8 years; fell out of moving car, hit head on curb (LOC) in childhood; fell off dirt bike (LOC) age 15 years; car accident with tractor-trailer (LOC) in adolescence; snake bite (LOC) in adolescence	Scars on top and side of head, scars on face	Abnormal antisaccades; suck reflex present; paratonia present in arms	None
8	Mother drug addicted during pregnancy; premature by 2 months	Head injury while skateboarding in adolescence; hit with a bat, pistol whipped in adolescence; motorcycle accident with broken nose in adolescence	Scars on forehead, upper lip, top and back of head, displaced nasal cartilage from motorcycle accident	Severe paratonia in arms and moderate in legs	None
9	Product of a rape; born to 13-year-old mother; subject unaware of problems at birth	Hit by car on bicycle in childhood; fell off horse twice and hit head in childhood; hit in head with bottle (LOC stitches), broken nose	Scars on face and head	Visual fixation and smooth pursuit abnormal; Luria 2 step and Luria 3 step abnormal; suck and snout reflex present; paratonia in arms and legs	Bilateral hemiparesis with hypertonia and hyperreflexia; dysarthria

Table 2 (continued)

Subject	History of Birth Trauma	Nature of Accidents and Injuries	Objective Evidence of Physical Trauma	Prefrontal Abnormalities on Neurologic Examination	Nonprefrontal Abnormalities on Neurologic Examination
10	Birth reported as normal	Hit in mouth with brick in adolescence; car accident; hit head in adolescence	Multiple scars on head, lip, over left eye	Abnormal antisaccades; suck reflex present	None
11	Premature birth with C-section; mother hemorrhaged	Overdose on pills at 18 months; bike accident, age 13 years; hit (LOC) by cousin at age 13 years; flipped and rolled cars twice (recurrent headaches) in adolescence	Scar over right eye	Abnormal visual fixation	None
12	Subject unaware of problems	Dropped on head in infancy; hit in forehead with jar (dizzy, five staples) in childhood; recurrent punches in face by father (dizzy, dazed); two car accidents, hit head in adolescence	Scar on head from staples	None	None
13	Subject unaware of problems	Fall (LOC) at age 10 years; flipped car (dizzy) in adolescence; LOC from fight in adolescence	No noticeable scars	Smooth pursuit abnormal; paratonia present in arms	None
14	Very premature birth, weight 3 lb.; multiple hospitalizations first 2 years of life	Fell on back of head while skateboarding during adolescence	Burn scars on arm	Abnormal antisaccades	None
15	Subject unaware of problems	Hit in face (LOC) at age 12 years	Scars on face and head, reportedly the result of injuries after the offense in question	Not done	Not done
16	Born with facial defects	Car accident age five years, hit by tractor-trailer (LOC), hospitalized; hit by car in childhood; blacked out twice, hitting head; stomped in face in adolescence	No noticeable scars, body covered with tattoos	Antisaccades and Luria 3 step abnormal; suck and snout reflex present	Diffuse hypertonia and hyperreflexia; left Babinski sign
17	Subject unaware of problems	Fell out of car (LOC) at age 4 years; fell into 16-ft-deep ditch at age 6 years; truck accident (LOC) at age 10 years; hit in face (LOC) just before offense; multiple blackouts huffing Freon and fasting	Scars on back of head; indentation on head; scar over left eye and under chin	None	None
18	Subject unaware of problems	Fell off monkey bars in childhood; hit with pole at 12 years of age	Scar on nose	Smooth pursuit and antisaccades abnormal; suck reflex present	None

*Loss of consciousness.

bruising and cutting him with its buckle. In addition, a great aunt had received a bipolar diagnosis, and a cousin had been in a psychiatric hospital (diagnosis unknown). Clearly, there was a strong genetic contribution to Subject 1's signs, symptoms, and behaviors.

Another bipolar subject was ebullient and loud and could not stop talking in interviews. He acted

Table 3 Numbers of Frontal Abnormalities on Neurologic Examination and Degree of Impairment on Specific Tests of Executive Dysfunction of 18 Juveniles Condemned to Death

Subject	Number of Prefrontal Abnormalities on Neurologic Exam	D-KEFS Letter Fluency (*T* score)	D-KEFS Category Fluency (*T* score)	D-KEFS Category Switching (*T* score)	D-KEFS Trailmaking: Letter-Number Switching (*T* score)	Booklet Category Test (*T* score)	ROCF Copy (*T* score)	Iowa Gambling Task Decision-Making Strategy
1†	1 Abnormality	43	47	37*	43	35*	10***	Impaired
2	1 Abnormality	53	60	60	37*	44	56	Normal
3	4 Abnormalities	37*	67	53	20***	32*	35*	Impaired
4	0 Abnormalities	37*	37*	30**	43	28**	53	Impaired
5	0 Abnormalities	60	63	37*	50	60	43	Impaired
6	2 Abnormalities	60	50	53	57	44	23**	Impaired
7	3 Abnormalities	43	33*	53	60	39*	3***	Normal
8	1 Abnormalities	53	50	27**	43	51	0***	Impaired
9†‡	7 Abnormalities	20***	33*	40*	20***	—	0***	Impaired
10	2 Abnormalities	47	43	40*	37*	41*	16***	Impaired
11	1 Abnormalities	47	53	57	27**	60	23**	Impaired
12	0 Abnormalities	50	47	40*	37*	47	10***	Impaired
13	2 Abnormalities	40*	50	57	47	28**	43	Impaired
14‡	1 Abnormalities	67	53	60	53	52	30**	Impaired
15	(not done)	50	47	47	57	48	0***	Normal
16	4 Abnormalities	47	50	60	47	51	3***	Impaired
17†	0 Abnormalities	57	43	43	53	39*	50	Impaired
18†‡	3 Abnormalities	47	47	43	50	47	30**	Impaired

*Mildly impaired performance.
**Moderately impaired performance.
***Severely impaired performance.
†Impaired attention/mental tracking.
‡Impaired working memory.

out his stories, punctuating his feats with the periodic expletives "Wham!" and "Pow!" As he put it, "I thought I was Evel Knievel. . .the road was my playground." He described himself as a "daredevil", driving 100 mph at age 13 years. He was grandiose and boasted, "I had magnetic appeal. . .seven women in one day." He reported but one episode of depression, after his arrest, when he attempted to hang himself and was treated by the jail doctor with an antidepressant. This subject's mother, apparently as manic as he, rode with him during robbery sprees. According to the subject, they would "hit 20 stores a day." He added, "We would ride together like Bonnie and Clyde!" His father died of cirrhosis, the result of alcoholism, and hepatitis C. Sexually abused at six years of age, this subject said that he subsequently had sex with his mother's "stripper friends." Eventually, he was removed from her care by Child Protective Services.

Three subjects were diagnosed as schizoaffective because their thought disorders were both striking and intimately intertwined with their affective symptomatology. For example, Subject 14, who at first appeared to be logical and coherent, became increasingly disorganized and hard to follow during the course of the interview. After volunteering that he never went to church, his thoughts became idiosyncratic and tangential. Excerpts of his thinking are as follows:

> I'm figuring if what claims to be right is wrong in itself preaching about something wrong if it's not right then what they are preaching against must be right. . . . Spiritual must be wrong. It's what you do naturally—it doesn't make sense. They set it up; no matter what you do is wrong. Sex, eating too much, being angry. They tell you that's wrong. They set you up to fail. . . .

When asked about the meaning of his numerous tattoos, he shared his belief that the occult "gives you more truth and wisdom." He then continued:

> When we say we worship Satan we're worshipping ourselves using metaphor of representations. We're bringing out those traits in ourselves like power, success, vision. True mastery is inborn. . . . Everybody can worship yourselves.

Eventually, this subject revealed that he held a service in his cell every Friday in which he "open[ed] up with an invocation to Satan. . .call[ed] on different demons from different religions. . .[to] keep out unwanted forces. . .then close[d] with an Enochian key and announce[d], 'I've closed the chamber,' put everybody back." It was unclear to what extent he

Table 4 Psychiatric Symptomatology, Substance Abuse History, and Family Psychopathology in 18 Juveniles Condemned to Death

Subject	Subjects' Psychiatric Signs and Symptoms	History of Substance Abuse	Family Mental Illness
1	*Bipolar spectrum disorder:* childhood diagnosis of ADHD, treated with Ritalin; three psychiatric hospitalizations in adolescence and one residential treatment placement, called "hypomanic" and "euphoric"; also a diagnosis of psychosis with "propensity to schizophrenia" when evaluated subsequently; diagnosis R/O "dissociative"; "clowning at school," "spurts of vibrant energy"; awake 30 hours; wants to be one with the poetry of life; episodically depressed; wore black when depressed in adolescence	Mother gave subject alcohol from age three years; got him "high" with marijuana; inhalant and LSD use in adolescence	Mother's bipolar signs: loud, often drunk, drug-addicted, "histrionic," "needs to be center of attention," multiple brief marriages; father's bipolar signs: "charismatic" cult leader; had second family unknown to the first; maternal cousin had psychiatric hospitalization; maternal great aunt had been diagnosed bipolar disorder
2	*Schizoaffective disorder:* history of jumping from roofs and climbing highest trees; "on an emotional roller coaster," going and going with little sleep; hypergraphia; practices many different religions; grandiose, illogical, and rambling on interview; considers self a "truth-sayer," idiosyncratic and bizarre beliefs about religion, numbers, and signs	Marijuana abuse in adolescence	Mother psychiatrically hospitalized; father alcoholic; uncle ?suicide; uncle with panic attacks; uncle with seizures
3	*Bipolar spectrum disorder:* diagnosed bipolar mood disorder by TX Youth Commission and refused lithium, awake two to three days at a time, grandiose: "I killed 39 Latin Kings!," claimed to be mafia kingpin, raced police at 110 mph; has been sad for no reason; on interview: paranoid, extremely disinhibited, pressured speech, illogical, flooded with ideas, hysterical laughter	Denied	Mother had children by many men; paternal uncle committed suicide
4	*Bipolar spectrum disorder:* history of extreme risk-taking, hypergraphia, hypersexual between ages 15 and 17 years; episodically depressed since age 8 years; mute and banged head as child; history of auditory hallucinations; played suicidal games in adolescence (Russian roulette) and attempted suicide age 16 years; psychotic, paranoid reaction on SSRIs; given Elavil at trial for severe depression; on interview: alternately morose and peppy, energetic	Given marijuana age six years; inhalant abuse starting at age nine years, cocaine at age 10 years, PCP and LSD starting at age 14 years	Mother's bipolar signs: "wild," many sexual liaisons with men and a woman; tattoos all over body; alcoholic; attempted suicide by running onto highway; father shot self in head; maternal grandfather alcoholic
5	*Schizoaffective disorder:* excessive risk-taking (roof jumping), flooded with grotesque thoughts, "waves of happiness," 48-hour periods without sleep; hypergraphia; loose, rambling, illogical; sees meaning in what radio tells him; believes special references to Bible are transmitted through clock; paranoid ideation	Alcohol and cocaine starting at age 15 years; inhalant use daily at age 17 years	Mother self-mutilates; brother slashes self; two uncles alcoholic and committed suicide
6	*Bipolar spectrum disorder:* upbeat, loud, energetic; too many ideas fill head, unable to sit still; "life is one big party"; also depressed periods with decreased activity; decreased appetite and weight loss; paranoid preoccupations: "people have to know the consequences . . . "	Marijuana daily since age 14 years; cocaine and Ecstasy starting age 16 years	Brother hospitalized for suicide attempt, diagnosis of bipolar mood disorder; father made a "shock machine" and shocked bipolar son to "cure him, to destroy bacteria inside him"; sister is hyperactive and loud, said to have ADHD
7	*Bipolar spectrum disorder:* animated in interviews with booming voice; pressured speech; talks incessantly; boasts of hypersexuality; called hyperactive as child; prescribed Ritalin; "hypertalkative" in childhood; also, depressed periods with inability to get out of bed	Marijuana and inhalant use since age eight years; addicted to pain medication after car accident	Father had signs of mania: "charismatic Christian leader"; multiple marriages, each lasting only months; mother had severe mood swings, violent behavior, many sexual liaisons; brother took psychotropic medication; multiple family members with drug addiction

Table 4 (continued)

Subject	Subjects' Psychiatric Signs and Symptoms	History of Substance Abuse	Family Mental Illness
8	*Bipolar spectrum disorder:* ebullient, talks incessantly in interviews; dramatically acts out situations; "I thought I was Evil Knievel . . . the road was my playground", describes episodes of "seven broads a day" for consecutive days; currently masturbates more than eight times a day; also attempted to hang self in jail; given antidepressants in jail; currently has "down times" lasting about two weeks	Injected cocaine and heroin with mother throughout adolescence; huffed gasoline and ingested LSD daily for three months in adolescence, causing seizures	Mother's bipolar signs: "wild child," subject removed from mother's care by child protective services because of wild behavior, rode with subject on 10+ robberies per day "like Bonnie & Clyde," drug addicted, encouraged subject to use drugs with her, numerous sexual liaisons, alleged prostitution; father alcoholic with hepatitis C, died of cirrhosis of liver
9	*Mentally retarded:* occasional sadness, unintelligible speech	Occasional marijuana and alcohol use starting age 12 years	No information available
10	*Hypomania:* loud forceful voice; laughs throughout interviews; talks incessantly; awakens on death row thinking, "I know something fun will happen!"; needs only three hours sleep; enjoys provoking guards	Marijuana use since age 13 years; heroin use since 15 years; occasional inhalant and cocaine use	Mother's bipolar signs: "moodswings," "wild," "violent," hypersexual, several husbands; father had more than 10 children with different women; uncle "charismatic" and "violent"; maternal grandfather had many marriages
11	*Hypomania and parasomnia:* excited speech, needs little sleep, exuberant; "likes to make people laugh"; also, long history of sleepwalking, acting out dreams, thrashing and hitting in bed; awakens to find self dressing; offense committed without motive after awakening in a peculiar state; slept after offense with distorted memory of behavior	Frequent alcohol use starting age 11 years; occasional marijuana use	Father awakened in aggressive state (?sleep disorder)
12	*Bipolar spectrum disorder:* Mood swings, flooded with ideas, "there's a carnival in my head"; early childhood mania: provoked teachers, urinated in class, mother noted sudden extreme mood fluctuations; also extreme weight gain and loss associated with mood swings, periods of excessive sleep and apathy, periodically illogical and idiosyncratic thinking on interview	Heavy crack cocaine use starting age 11 years; marijuana use starting age 12 years; LSD, mescaline, and heavy inhalant use in adolescence	Father's signs of mania: multiple lovers, videotaped own sex life, extremely violent; mother, history of depression; maternal aunt diagnosed with "paranoid schizophrenia"; paternal grandmother diagnosed as "psychotic" and given medication
13	*Hypomania:* Goes three to four days without sleep, speeds and flips cars, likes to crash cars, boasts of hypersexuality, uses cocaine to increase energy; denies depression	Heavy cocaine use in adolescence	Father's signs of mania: "rolls into town"; flashes money and cars, violent and bizarre; sister psychiatrically hospitalized after suicide attempt; paternal uncle history of depression
14	*Schizoaffective disorder:* reported previous diagnosis "schizoid"; in interviews: idiosyncratic thinking, bizarre reasoning re: wrong is right and right is wrong; loose, illogical thought processes, consumed with Satan and demons; paranoid ideation "They set it up . . . no matter what you do is wrong . . . they set you up to fail"; also episodic speeding at 120 to 130 mph, high-speed police chase in early teens (police shot out tires of car); boasts of wanting sex four to five times a day as a teen	Marijuana daily starting at age 14 years, occasional alcohol use	Father had seven brief marriages
15	*Bipolar spectrum disorder:* "I'm boisterous with my opinions . . . I'll jump out and just say it"; performed at karaoke bars as teen with mother several times a week; serious relationship with mother's friend two decades his senior; also, significant weight gains and losses, has "ups and downs"; psychiatrically hospitalized as teen for depression and suicidal thinking; rehab for alcohol addiction	Treatment for alcohol abuse in adolescence	Mother had mood swings, treated for depression, went to karaoke bars and performed with son; father had history of depressions and job loss, does not work for years at a time

Table 4 (continued)

Subject	Subjects' Psychiatric Signs and Symptoms	History of Substance Abuse	Family Mental Illness
16	*Schizoaffective disorder:* in interviews paranoid thinking, "I'm aggressive if I feel threatened . . . I'm mad if disrespected"; preoccupations with power "need to consolidate your power"; grandiose, "I can take care of my enemies"; feels he is the "Puppet Master"; also, suicide attempt age 13 years; enjoys dares; ran down street naked on dare, "I get my moods if people around me are ignorant"	Denied	Father has mood swings; mother is brain damaged with history mood swings and suicide attempt
17	*Parasomnias and dissociative symptoms:* in interviews relates well, hypnagogic hallucinations, sleep paralysis, sleepwalking, long history of encopresis; also, out of body experiences, does "astral projection," cannot tell a dream from flashback of sodomy (had been raped)	Marijuana use starting age 13 years; addicted to huffing Freon starting at age 15 years	Father alcoholic
18	*Psychosis-NOS:* loose, rambling, illogical thinking, idiosyncratic reasoning, no insight, paranoid misperceptions "it click in my head they talking about me"; severe speech impediment	Frequent marijuana use starting at age 15 years; occasional cocaine use	No information available

realized that his thoughts were fantasies and to what extent he believed in the reality of his experiences. This subject's mood disorder was manifested by "always doing two or three projects at a time," "doing tricks on snowboards and skateboards," and stealing U-Haul trailers "just for fun." He stole his father's car and drove so fast that the police had to shoot out his tires before he would stop. He considered his acts, "living life to the fullest." His father, a wheeler-dealer who drank to excess and had been arrested more than once for domestic violence, was reportedly away on his seventh honeymoon at the time we evaluated his son.

Another schizoaffective, paranoid, delusional subject thought of himself as a highly placed gangster, "quick to get mad if I think I'm disrespected. . . . I'm aggressive if I feel I'm threatened. I get my mood swings. I get agitated when people around me are ignorant." He muttered:

> It's on a need-to-know basis. . . . Sometimes you do something . . .play chess. Like a pawn you can sacrifice. . .when [he] started talking, that made him the weak link—the pawn. . . . I knew what was going on in the inner circle. . . . I position myself a certain way when I'm around them. . . . To be head is too much responsibility. You can be the puppet-master. . .pull the strings.

This subject's moods ranged from periods of high energy when he slept little, took dares, and even ran down the street naked to low periods during which, for example, he attempted suicide. This subject's father, a former army officer, would "beat me until my father got tired," a behavior the son considered character-building. Child Protective Services saw this kind of treatment differently and tried, without success, to monitor the boy's upbringing.

Of the six subjects whose symptoms did not fully meet the criteria for a bipolar diagnosis or a schizoaffective diagnosis, three were clearly hypomanic. For example, one subject laughed throughout the psychiatric evaluation. When the psychiatrist (D.O.L.) asked about his moods, he described days when, "I get up. . .I want to get up. I know something fun will happen." (He had been on Death Row for seven years.) The psychologist (C.A.Y.) described him as "One happy camper" who "laughed uproariously at times and talked to the computer during the gambling task." The second hypomanic subject reported periods when he could go without sleep for three to four days. He enjoyed racing cars with his father, going over 100 mph. He claimed to have abundant energy, with or without cocaine (which, prior to incarceration, he had used frequently). He also boasted of his sexual prowess and spoke of having "sex with six girls and their mother." This subject had numerous relatives with signs of mood disorders, including a father who would "roll into town" with cash, get the local toy store to open after hours, and treat his children to whatever toys they wanted. He gambled for high stakes and, reportedly, shot and wounded a man who had lost his car to the father on

a bet and refused to hand it over. The father then drove the man's Lincoln Continental home to show the family. Manic symptoms and behavior could be traced to this subject's maternal and paternal grandparents, and the subject's sister had had a psychiatric hospital admission after attempting suicide. Yet another subject suffered from hypomanic symptoms and apparent parasomnias manifested by complex sleepwalking behaviors and the acting out of dreams. Before his incarceration, his partners complained of his nighttime thrashing and motiveless violence toward them on awakening. It is noteworthy that this subject committed his capital offense in the middle of the night when, on awakening, he stared out the window, then wandered outside, fell asleep, awakened, then raped and murdered a person he did not know. Although he did not deny the act, his memory for aspects of his behavior that night was impaired. To what degree his behavior was the result of dissociation in contrast to parasomnia could not be determined in the time available. Of interest is that this subject's father also had symptoms of a sleep disorder (unprovoked violence on awakening). Another subject also experienced parasomnias that included sleepwalking, sleep paralysis, and hypnagogic hallucinations.

Many subjects, in addition to their other psychopathologies, periodically experienced dissociative symptoms. The most common dissociative experiences were "spacing out" for long periods, experiencing complex out-of-body sensations (e.g., "We enter the supernatural"), and having the ability to block pain. Two subjects, during interviews, referred to themselves in the third person, a practice often observed in patients with dissociative identity disorder. In fact, the only subject who received a pretrial psychiatric evaluation by an expert for the defense was diagnosed by that clinician as Dissociative Disorder-Not Otherwise Specified. Unfortunately, time constraints precluded investigating the full scope and severity of dissociative experiences in our sample.

Two subjects were intellectually limited. One had a Full Scale IQ of 61, dysarthria, and a stutter that made him barely understandable. He also had numerous signs of severe frontal lobe dysfunction. His father had been killed, and his mother was but 13 years old when she gave birth to him; therefore, little was known about his family. The other subject had a Full Scale IQ of 78, a score categorized as "borderline intellectual functioning" and associated with poor judgment and impaired social and occupational functioning. This subject's thinking was loose, rambling, illogical, and almost incomprehensible. He, too, had a severe speech impediment. He was paranoid (e.g., "It click in my head they talkin' about me," and, "They try to change their voice," to trick him). Abandoned by his parents and raised by "godparents" for whom he expressed no affection, he told one examiner that he felt closest to a dog he had once owned.

Table 4 shows the degree of subjects' alcohol and drug abuse prior to the time of their arrests at age 17 years. As can be seen, 16 (88%) subjects had a substance abuse disorder prior to arrest, yet only one subject had ever received treatment for it. Six (33%) subjects began abusing street drugs, inhalants, and/or alcohol before age 13 years, and three of these, in early childhood, were plied with drugs by caregivers. Six subjects were heavy inhalant users, and another "huffed" occasionally. Inhalants are known to be highly toxic and, in some cases, may cause permanent brain damage and even death. Indeed, Subject 8 experienced frequent seizures and clouded consciousness during a three-month binge of LSD ingestion coupled with huffing gasoline. In several cases, subjects reported that they were either under the influence of drugs and alcohol or "coming down" from substances at the times of their capital offenses. None, however, claimed that their intoxicated conditions excused their violent behavior. Several others insisted that they were not intoxicated when the offenses occurred. Given the already compromised neurologic functioning of our subjects, drugs and alcohol would have had an even more disinhibiting effect on them than on normal adolescents.

In summary, in addition to the frontal lobe dysfunction characteristic of the majority of subjects in this sample, 12 suffered from bipolar and schizoaffective spectrum disorders. The remaining six were hypomanic, retarded, dissociative, psychotic, and/or sleep disordered. Finally, 16 had also had substance abuse disorders during adolescence.

Histories of Child Abuse and Family Violence

Table 5 presents data regarding abuse and family violence experienced by our subjects. These data must be considered in the context of their other vulnerabilities. Clearly, all abused children and all children exposed to violence do not necessarily become violent. However, study after study has revealed that

Table 5 Findings of Abuse, Family Violence, and Family Psychopathology in 18 Juveniles Condemned to Death

Subject	Abuse and Neglect	Family Violence
1	Mother beat subject severely with belt buckle; she said, "I took my anger out on him"; first stepfather whipped subject severely age three to four years, second stepfather beat subject without clothes, "30 lashes" with bleeding; sexual abuse in childhood by several adults	Mother raped by biological father; stepfather "stomped" subject's puppy
2	Father "hit me harder than he hit my mother"; mother died of HIV age 13 years and father deemed unfit by Child Protective Services	Father violent with mother; father broke his own arm punching ?telephone; mother tried to stab father
3	Father abandoned family before subject's birth; "The entire family tore my ass"; stepfather(s) beat him severely; uncles hit him in head; sexual abuse age seven years by 15-year-old girl	Maternal grandfather incestuous with daughter; maternal grandmother reportedly committed murder; uncle is pedophile
4	Mother was 15 years old when subject born; neglected subject; subject beaten by maternal uncle; sex with mother's adult friends at age 15 years	Subject witnessed father shoot himself in the head; numerous alcoholic and violent relatives
5	Stepfather beat subject with belt and switches, threatened subject with broken glass; cut subject's lip with knife when preschooler	Father killed in barroom fight; father beat mother with belt; stepfather beat mother; mother stabbed stepfather; mother burned son's arm at his request; paternal aunt and cousin murdered
6	Denied	Parents and grandparents encouraged children to fight each other
7	Mother tape recorded while shouting at subject (as infant) "[I] want to throw him out"; mother whipped subject and hit with a bat; maternal grandmother wanted subject dead and threatened to shoot him; maternal great grandmother beat subject with yardstick; stepfather beat subject while subject was naked, grandmother photographed bruises; family members believe subject was sexually abused	Father beat mother; stepfather violent and bizarre toward family members
8	Removed from mother by Child Protective Services; sexual abuse age six years by 14-year-old girl; sexual intercourse age 15 years with mother's adult friends	Denied
9	Mother and stepfather whipped subject; sexually abused by many men	Father killed when subject was a baby
10	Maternal grandmother whipped subject with rod; sexually abused in early adolescence by 45-year-old woman	Maternal uncle was murdered; mother allegedly "beat up men"
11	Stepfather whipped subject while subject was naked in early childhood; maternal grandmother whipped subject in childhood	Mother violent toward others; mother and stepfather assaulted each other
12	Father beat subject to the ground; punched subject until "dazed"; beat him with a belt, and "fought subject like an adult"; police called because of abuse and offered to press charges	Father was "brutal" ex-marine, physically violent
13	Subject denied physical, sexual abuse; family encouraged violent behavior; maternal grandfather encouraged subject to shoot people	Maternal grandfather allegedly killed two of wife's children by other men and kidnapped a wife, also shot at people; father shot and injured a man; family involved in drug running
14	Denied	Father beat all seven wives, kicked down doors, arrested for domestic violence
15	Stepfather beat subject with belt and switches	Stepfather beat mother; mother pulled knife on stepfather and subject intervened with a bat to protect mother
16	Father beat subject "until he got tired"; intervention by Child Protective Services	Denied
17	Subject severely beaten by father, mother, maternal grandmother; sexual abuse starting at age eight years by 14-year-old boy; because of bowel problems, multiple enemas throughout childhood; raped anally in childhood	Father violent to mother; father's brother raped mother; mother raped by own brother; sister stabbed subject with pencil
18	Mother rejected subject at birth, kept two other siblings; abandoned by father; raised by godparents who beat him with a belt; saw mother occasionally, and she also beat him	Denied

if children with neurologic and/or psychiatric vulnerabilities are victims of violence and/or live in extremely violent households, they are especially likely to manifest their impairments through aggressive acts.[14,44–48]

As can be seen in Table 5, the families in which our subjects were raised were extraordinarily violent, and some family members evidenced signs of mental illness. To cite but a few examples: Subject 3 was beaten severely by numerous family members and

sexually abused at seven years of age. He never knew his father, moved from place to place with his mother, and lived with several different stepfathers, a maternal grandmother, and uncles, one of whom committed suicide and another of whom was a known pedophile. His maternal grandfather committed incest with Subject 4, at about 1.5 years of age, and this subject witnessed his father shoot himself in the head, an experience that resulted in recurrent flashbacks and for which he felt responsible. His mother, a manic woman with tattoos all over her body, had affairs with numerous men and at least one woman and attempted suicide by running into traffic on a highway. Subject 5 was the victim of the most grotesque abuse suffered by anyone in our sample. When he was three or four years of age, his stepfather caught him eating chicken meant for the adults. The stepfather thereupon held a knife to the boy's neck and then proceeded to slice the child's lower lip. The scar was still visible at the time of our evaluation.

These examples of family violence differ little from many of the other cases in this sample. They were chosen as examples because, in these cases, records indicated that, at the time of trial, the court was presented with false information that stated that these subjects came from stable families. In fact, the prosecutor referred to Subject 5's family as "a model family." Especially shocking were instances in which experts for the defense and family members who knew or should have known about the abuse and violence to which a subject had been exposed testified to the contrary. For example, in the case of Subject 12, whose father beat him so severely that the police were called, a defense expert reported, "Family life was stable."

Tables 4 and 5 show the pervasiveness of indicators of mental illness and violence in parents and relatives. In fact, in six (33%) cases, violence and/or severe mental illness could be traced back to grandparents. Unfortunately, in most cases, the diagnoses of disorders in relatives could not be made with certainty because the families were not available for evaluation, and none of their records had been collected between the time of the subjects' arrests and the time of our evaluations. However, in many instances, the nature of the behaviors (e.g., a mother's rapid changes of partners and religions and a father who was a "charismatic Christian leader" and who had a series of four brief marriages, each lasting only months) suggested to the researchers the existence of mood disorders in numerous close relatives. Because of space constraints, only the most striking examples of psychiatric instability are presented in the tables. Again, the reader is cautioned to keep in mind that most individuals with severe psychiatric disorders, such as bipolar mood disorders and schizophrenia, are not violent, much less homicidal. However, studies have reported that, among juvenile delinquents, those who have inherited a vulnerability to such disorders and who have been raised in chaotic, violent, abusive households, are significantly more violent than their nondelinquent peers. Furthermore, this constellation of vulnerabilities has been found to distinguish the more violent from the less violent delinquents.[44–46]

Discussion

We are aware that we had neither a comparison sample of demographically similar nonhomicidal adolescents nor a comparison sample of condemned adults. Thus, it was not possible to demonstrate the existence of a causal relationship among neuropsychiatric impairment, abuse, and murderous adolescent behavior, and the data must therefore stand on their own.

In summary, the clinical team discovered that 15 (83%) subjects had signs and symptoms of early-onset bipolar spectrum disorders, schizoaffective spectrum disorders, or hypomania and that all had been raised in violent, pathological households. Our findings provide a window into the experiential as well as the genetic contributions to the intergenerational transmission of violence. In addition to the psychiatric vulnerabilities of our subjects, 15 (83%) evidenced the kinds of executive dysfunction characteristic of patients with damage to the orbitomedial prefrontal cortex. One must ask why these serious disorders and vulnerabilities were previously overlooked or ignored.

The diagnostic evaluation of a violent person is a weighty responsibility, but the evaluation for purposes of determining guilt, innocence, or mitigating factors in murder cases is weightier still. The heaviest burden of all is the diagnostic evaluation of a violent juvenile who has become involved with the adult criminal justice system. Too immature to appreciate the seriousness of his or her situation and the possible factors contributing to it, the accused juvenile must rely on the wisdom of adults, usually parents, for help.[49–51] Studies have shown, however, that the

parents of violent juveniles often are ill equipped to act in their children's best interests.[47,52] Therefore, it falls to the juveniles' attorneys to ensure that a thorough evaluation is performed by competent clinicians. Most of our subjects had no such evaluation, even though study after study has revealed a multitude of biopsychosocial vulnerabilities characteristic of violent juveniles.[14,44,46,47,52–57] Four subjects had received pretrial assessments of one sort or another, but they were incomplete. Unfortunately, in cases like these, a clinician's failure to investigate thoroughly the psychiatric, neurologic, and environmental factors influencing behavior can literally mean the difference between life and death.

Extreme violence, except in war and, perhaps, in certain gang-oriented environments, is not normal. Most healthy adolescents are not violent. However, almost every kind of psychiatric illness in children and adolescents can manifest itself in antisocial, even violent, behavior. Brain dysfunction, attention deficit-hyperactivity, schizophreniform disorders, substance abuse, depression, and bipolar spectrum disorders all can express themselves in violent acts, especially during adolescence. This is not news. In 1959, Lauretta Bender described what she termed "pseudopsychopathic schizophrenia" in adolescents whose disorders were first diagnosed as psychopathic but later were recognized to be psychotic. Similarly, more recent studies have shown that behavioral disorders in children and adolescents go hand in hand with severe mood disorders.[58,59] Psychomotor agitation, poor school performance, aggression, and inappropriate sexual behavior have been observed in manic children and adolescents.[60] Even drug and alcohol abuse, especially early-onset substance abuse, are characteristic of children and adolescents with bipolar disorders.[58] Unfortunately, such children are often dismissed as conduct disordered or, simply, as antisocial. Indeed, some researchers have tried to develop new measures based on adult psychopathy checklists to identify early in life the "fledgling psychopath"[61,62] without taking into account the myriad of reasons that a child may behave in aggressive, antisocial ways. Clinicians who rely on such measures to diagnose psychopathy fail to recognize that 50 percent of the criteria on the Psychopathy Checklist and Psychopathy Checklist-Revised[63] are signs of mania, hypomania, and frontal lobe dysfunction (e.g., glibness/superficial charm, grandiosity, poor behavioral controls, promiscuous sexual behavior, and irresponsibility).

A question to be addressed is whether the severe psychopathology documented in our evaluations developed subsequent to our subjects' offenses and in response to lengthy incarceration. Table 4 illustrates the early manifestations of severe psychiatric symptomatology, some indicators of which occurred in early childhood (e.g., hyperactive and hypertalkative in childhood, depressed and episodically mute since age eight years, and extreme mood fluctuations, noted by mother). Because of the brevity of our assessments, the lack of access to psychiatric records, and the inability to interview family members, we avoided making hard and fast DSM-IV diagnoses of bipolar or schizophrenic disorders. However, the nature of subjects' signs, symptoms, and behavior suggested that they, and many of their first-degree relatives, suffered psychopathology that fell within the schizoaffective or bipolar spectrum of disorders. The term *bipolar spectrum disorder* has been used to indicate fluctuating severe mood disorders, the signs of which may not necessarily conform exactly to Bipolar I or Bipolar II criteria.[64–66]

Undiagnosed, misdiagnosed as antisocial, and/or untreated, the outcome for early-onset bipolar spectrum disorders is grim. Social maladaptation, substance abuse, suicide attempts and successful suicide are common outcomes.[67,68] Furthermore, consistent with the behavioral characteristics of our sample, aggression is common. As early as 1988, McGlashen,[69] in his comparison of adult-onset and adolescent-onset bipolar disorder, reported that the earlier the onset of the disease, the greater the likelihood of coming in conflict with the law. In fact, he found that 70 percent of his subjects who had bipolar disorder diagnosed in adolescence later exhibited psychotic assaultiveness. Such behavior is similar to those of several of our juveniles who had no idea why they had committed the violent acts for which they were condemned to death.

Tables 4 and 5 reveal the longstanding bipolar and/or schizoaffective nature of our subjects' disorders and the extraordinary prevalence of violence and signs of severe mental illness, especially mood disorders, in their parents and in other family members. In a large, multicenter study of the genetics of psychiatric illness, investigators found that the probability of development of bipolar disorder in a child or adolescent was associated, not only with parental mental

illness, but also with the number of extended family members (e.g., siblings, aunts, uncles, or cousins) suffering from either bipolar or unipolar psychopathology.[70]

When adolescent bipolar illness manifests itself as aggression, it is rarely the result of genetic factors only. Parents with bipolar disorders have difficulty managing their own moods and behavior. It is virtually impossible for a parent experiencing episodic manic rages and suicidal depressions to provide the quality of parenting that psychiatrically vulnerable children require to adapt normally.[71] Many of our subjects were abandoned early by their mothers, depriving them of the basic sustained nurturing so vital to the kind of brain stimulation that causes bonding and the eventual ability to interact empathically with others.[71] From infancy onward, our subjects were shuttled from one disturbed, violent household to the next. In just about every setting, they were the victims of and witnesses to violence.

How does exposure to violence affect a child? Not only does it provide a model of behavior, but it also results in abuse and concomitant central nervous system injury, especially to the frontal lobes, which are so important in rational judgment and self-control. Magnetic resonance imaging has shown marked differences between the very structure of the brains of abused and nonabused children.[72] The accidents, injuries, perinatal traumas, and deliberate battering of the heads and faces of our 18 condemned juveniles, the consequences of neglect as well as abuse, made our subjects especially vulnerable to the behavioral dyscontrol typically associated with histories of abuse and family violence.

Our subjects were adolescents when they committed their crimes, a developmental period when, as mentioned in the introduction, the frontal lobes are not yet fully myelinated.[10,73] Because of frontal lobe immaturity, all adolescents have some difficulty making sound judgments and reining in impulses and emotions. In addition to their frontal lobe immaturity, many of our subjects had also received numerous insults to their central nervous systems throughout childhood and adolescence. In fact, we discovered evidence in our subjects of ongoing frontal lobe impairment at the time we conducted our neuropsychological evaluations. Especially revealing were the results of the Iowa Gambling Task. Some subjects (not all) could actually describe reasonable winning strategies (i.e., avoiding card decks A and B) but, as a result of frontal lobe impairment, they seemed unable to control their immediate impulses and act in accordance with their intellectual understanding. One subject's comment captured the behavior of many. Subject 8 said, "[Deck] B was paying so good it was hard to get off. . . . C and D paid chump change, but they weren't losing that much. . . . A and B, they were really snatching me!" Other studies of delinquents also have shown that they can often conceptualize moral principles but are unable to behave in accordance with them.[74,75] Several other subjects, by virtue of brain damage, intellectual limitations, psychiatric illness, or all of these, were unable to conceptualize a logical game plan, much less resist their immediate impulses to grab cards from the obviously losing decks. When clinicians encounter frontal lobe damage or dysfunction in violent adolescents, it is often impossible to determine with certainty the relative influences on behavior of brain immaturity compared with brain dysfunction.

Further compromising our subjects' behavioral adaptations during adolescence was their long-standing, well-documented severe psychiatric impairment, the commonest manifestations of which were manic and hypomanic signs and symptoms. Because of their bipolar and schizoaffective symptomatologies, it is fair to conclude that, during adolescence, they had to cope with stronger emotions and impulses than did their ordinary, healthy, yet immature adolescent peers. Brain damage and/or severe psychopathology compromise the emotional stability, judgment, and impulse control of adults—that is, of individuals with mature, fully developed brain structure and function. Therefore, one can conclude with a reasonable degree of medical certainty that such brain dysfunction and mental illness will present even greater social adaptational challenges to adolescents because of their incompletely myelinated frontal lobes.

The findings reported herein bring us back to the final purpose of our paper, namely the exploration of their ethical implications for the U.S. justice system. Bioethicists and philosophers[76] have maintained that true autonomy—that is, the ability to make reasoned choices—requires the capacity, not only to identify and reflect on basic, instinctual desires and impulses, but also to control them and thereby to do the right thing (i.e., act virtuously). Part and parcel of that precept, of course, is the capacity to avoid doing the

wrong thing. Unfortunately, not all brains have the same capacity to judge consequences and monitor and control behavior. Some children, because of birth trauma, emotional neglect, brain injury, predisposition to mental illness, and exposure to abuse and violence—by virtue of what Rawls[77] has called "the natural lottery"—are more vulnerable to emotional lability, distortions of reality, and loss of impulse control than are those who, by chance, have drawn a better card.

Our study asks the question posed by Beauchamp and Childress[76]—that is, did the 18 condemned juveniles, at the time of their violent acts, "have the capacity to rationally accept, identify with, or repudiate a lower order of desire or preference in a manner that [was] independent of the manipulation of desires"? Virtue, as conceptualized by Aristotle in *Nichomachean Ethics*,[78] may spring from an innate capacity to do the right thing. However, according to Aristotle, for a person to make use of this potential for moral action, this capacity must be cultivated actively. It must be exercised with the same perseverance, intensity, and training that are necessary to perform well athletically. Aristotle recognized that virtue also requires mentors—models of controlled behavior. The question of ethics our data poses is whether our subjects, at the time of their capital offenses, could have acted virtuously or whether the combination of psychopathology, frontal lobe dysfunction, and ongoing exposure to models of violent behavior prevented them from thinking once, much less twice, about what they were doing. As one of our subjects observed, "Ain't no thinkin' anymore. . .it's a reaction."

Today, our justice system wrestles with the question of whether normal adolescents, with as yet immature, poorly insulated frontal lobes, should be held as accountable for their violent acts as normal adults. Psychiatrically ill, neurologically impaired, and abused adolescents are even more handicapped than their normal peers. The question of ethics that their conditions pose is to what extent these impaired juveniles should be held accountable for their violent acts. We can be certain that, before our evaluations, no one had identified their bipolar and schizoaffective disorders. Nor had anyone evaluated the function of their frontal lobes. No one had even taken adequate medical, family, or social histories, information that may have shed light on their genetic, medical, and environmental vulnerabilities. Such factors would have been relevant to mitigation, if not culpability, but failed to be raised, even at the time of sentencing.

Neuroscience, neuropsychiatry, and neuropsychology have taught us that such impaired youths may possess a theoretical understanding of right and wrong and still lack the capacity to reflect on and manage their aggressive feelings. We know that when frontal lobe immaturity is complicated by brain dysfunction, predispositions to severe mental illness, and abusive, violent upbringings, they interact. This constellation diminishes judgment, increases emotional lability, and impairs impulse control.[46] And yet our justice system tends to ignore these facts. Our data thus raise a question of ethics: to what degree does it behoove our justice system to modify its criteria for mitigation and culpability and adopt rules consistent with the findings of early 21st century neuroscience?

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