

Violence: A Product of Biosocial Interactions

Frank A. Elliott, MD, FRCP

All behavior is seen to be a result of interactions between the brain on the one hand and environmental challenges and endogenous drives on the other. Intergenerational transfer theory fails to explain cases of habitual aggression that have no identifiable social origin, and there is compelling evidence for the existence of brain-environmental interaction. The key roles that may be played by age, gender, neurological factors, and biological defects in aggressive and antisocial behavior are reviewed.

The Social Roots of Violence

The rising tide of human destructiveness that has done so much to impair the quality of life in recent years has triggered much investigation into the origins of collective and individual aggression. In criminology most of the research has focused on the psychosocial roots of antisocial behavior and little attention has been paid to genetics, neuropsychological defects, and other biological variables. The prevailing idea, enunciated in China by Mencius in the second century BC and emphasized by Jean-Jacques Rousseau 19 centuries later has been that humans are born good, or at least neutral, but are prone to corruption by a faulty environment.

Frank A. Elliott, MD, FRCP, is Emeritus Professor of Neurology, University of Pennsylvania, and Former Director of Neurology, Pennsylvania Hospital, Philadelphia. Address correspondence and requests for reprints to Dr. Elliott, 3339 Schoolhouse Lane, Philadelphia, PA 19144.

This paper was presented at the Seventeenth Annual Meeting of the American Academy of Psychiatry and the Law, Philadelphia, October 18, 1986.

This theory proved to be a popular alternative to the doctrine of original sin and was eagerly embraced by nineteenth century socialists and Marxists. The doctrine was strengthened by sociologists who reported actuarial correlations between violent behavior and environmental adversity, notably poverty, overcrowding, broken families, unemployment, lack of education, inequitable class structures, and racial discrimination. The implication was that misbehavior could be eliminated by improvements in social and economic conditions, but this theory has not proven true. Over the past 45 years both individual and collective aggression have increased despite unprecedented improvement in the material conditions of life for most people in the Western world.^{1,2} For instance, in England between 1950 and 1976 physical violence by 14- to 16-year-old adolescents against other persons increased almost 24-fold and was accompanied by a 19-fold increase in

nonviolent crimes such as theft, fraud, and embezzlement.³ That is, there were parallel increases in violence and loss of personal integrity. Moreover, the meticulous studies of Wolfgang et al.⁴ have disclosed that *chronic* delinquency, which accounts for some 70% of serious crime, is not related to socioeconomic status.⁴

The escalation of physical violence has not been an isolated phenomenon but has been accompanied by widespread social regression in this and previous periods of anomie, as witnessed by the spread of narcissism, a drying up of compassion and altruism, erosion of commercial honesty at all levels of society, widespread dehumanization and disregard for life (including an increased number of suicides), corruption in high places, a lust for cruelty and sexual perversion in public entertainment, and recourse to torture as an instrument of policy.^{5,6} The present association between violence and other social pathologies⁴ was seen in the fourteenth century after the Black Death had wiped out an estimated one third of the population in India, the Middle East, Europe and Britain⁵; this association was also seen in the city-state of Munster in the sixteenth century, in London after the Napoleonic wars, in America after the Civil War, and in Germany after World War I and World War II.⁶ There is also the recent example of complete social disintegration of the IK people in Uganda who, in the words of Margaret Mead, "have become monstrous almost beyond belief" as a result of civil chaos and near starvation.⁷ Historians will recall other examples.

It is reassuring to know that, in the past, these cycles have come to an end, probably as a result of the revival of social constraints—what Eibl-Eibesfeldt⁸ has called "the cultural corset." It helps to explain why small secular and religious communities that have been able to maintain rules of acceptable behavior, including limited alcohol consumption, have escaped the current pandemic and why, at the national level, the Swiss and the Japanese—who have not relaxed their standards—have avoided the worst of the malaise. In Japan the extent of this escape is illustrated by the fact that in 1980 there were 48 deaths from handguns in that country as opposed to 10,728 in the United States, and the risk of being mugged in an American city was estimated at 200 times greater than in Tokyo, despite the violent quality of much of the Japanese popular literature, television programs, and movies.⁹ In Switzerland, death by shooting is rare, although all men of military age are supplied with arms and ammunition, which they keep at home.

There is evidence from anthropological and many other sources that child-rearing practices and education, especially respect for authority and the rights of others, may be more important in fashioning human behavior than the material conditions of life that have been so much stressed in the sociological literature. The need for a cultural corset is no new discovery—witness the Commandments that Moses brought down from the mountain to control his unruly people and the teachings of Confucius and Buddha.

The Biological Roots of Violence

Although environmental factors contribute to violence, they are seldom its sole cause because behavior is a biosocial affair,¹ the result of interactions between the brain, environmental situations, and endogenous drives. Thus, the nature of the brain's response to a stimulus depends on the confluence of both biological and environmental variables at a particular moment. An unfavorable environment often operates selectively to produce antisocial behavior in certain individuals who are especially vulnerable by reason of inherited or acquired neurophysiological traits. Exclusively sociological theories fail to explain why hard-core criminal violence runs like a scarlet thread through the fabric of all societies, *in good times and in bad, and affects all classes*. Nor do they explain why even in times of anomie, when violence spreads, it still involves only a relatively small portion of the population or why it is that many individuals who are exposed to criminogenic influences in early life do not become violent as adults, or why a significant number of people who have not been exposed to such influences do become pathologically aggressive. Neurobiological research has provided answers to some of these questions.

Genetics

The relationship of genetics to criminality in general and violence in particular are discussed by Dr. Mednick, in this volume and elsewhere,^{1, 10} but I venture to add some observations that have a bearing on the subject.

The XYY chromosomal anomaly was

thought to predispose to violent criminal behavior and to be associated with high levels of plasma testosterone, but the correlations are not consistent and some geneticists consider that the issue is unsettled. A more important development is the discovery that a structural abnormality of the X chromosome is often associated with mental impairment¹¹ from retardation to low normal intelligence, with learning difficulties, and with behavioral problems such as hyperactivity, violent outbursts, and autistic symptoms. Males bearing the fragile X chromosome may exhibit large ears and other stigmata. Mental impairment has been found in about 80 percent of the boys and about 30 percent of the girls with this defect. Yet about one fifth of the boys and two thirds of the girls who inherit the chromosome appear normal although they can act as carriers and may therefore have children or grandchildren with clinical symptoms. Recent estimates suggest that the abnormal chromosome, although not necessarily accompanied by symptoms, may be found in about one in 1,000 of the general population.

Heredity appears to have a significant role in three other organic syndromes that contribute to pathological aggression: episodic dyscontrol, minimal brain dysfunction (the attention deficit disorder), and the antisocial personality disorder.^{10, 12-14} Second, Davenport¹⁵ has reported pedigrees involving two or more generations in which repeated attacks of rage afflicted about half the progeny in each generation, and I have encountered similar families. When violence "runs in the family," it is too

often concluded that it is necessarily something that has been learned from parents, peers, or television. This cannot be the whole explanation, for why are only some of the offspring of violent households so affected? The popular intergenerational transfer theory fails to explain cases of habitual aggression that have no identifiable social origin and has been criticized by several observers, including Stacey and Shupe¹⁶ who report that in a sample of over 500 male spouse batterers, 40 percent did *not* witness physical violence between their parents, 60 percent had *not* been physically abused in childhood, 60 percent had *not* been neglected by their parents, and 50 percent did *not* have an alcoholic father.

Unfortunately, there are still strong prejudices among many social scientists against genetic and phylogenetic determinism in human behavior, perhaps because it implies that human weaknesses are unalterable. However, this pessimism ignores the great power of social forces to mold behavior in both normal and abnormal personalities. In any event, to deny the genetic contributions to aggression is to disregard not only the human evidence, but also the results of generations of selective breeding of fighting bulls, pit bulldogs, and fighting cocks, and the production of highly aggressive lines of dogs, dingoes, guinea pigs, and even rabbits in the laboratory.

Age and Aggression

The peak of physical violence in the home or in the streets is in late adolescence and early adult life, after which aggressive individuals usually become

less so as they approach the fourth and fifth decades; even after the age of 50, however, pathological violence can occur for the first time in a formerly unaggressive individual as a result of an organic brain insult, intoxication, or psychosis. One link between youth and violence is related to androgen levels in both males and females,^{17, 18} but there are other factors to be considered. It is a matter of common observation that some people mature faster than others and that some do not acquire an adult level of self-control, foresight, judgment, and social conscience until middle age. These functions are largely mediated by the associational neocortex of the frontal and temporal lobes, which is the last to mature in terms of myelination; the process may not be complete until the third or fourth decade.^{19, 20} There is no information as to the rate of maturation in neurotransmitter systems, but there is evidence that the formation of new synaptic connections, which are necessary for learning, can continue in the human brain until advanced age. The persistence of the bilateral slow waves of childhood in the electroencephalograms of many aggressive adult psychopaths is consistent with the notion of a maturational lag ("circumscribed infantilism") advanced by Kraepelin²¹ and by Hill and Watterson²² to explain sociopathic behavior of this type.

Gender and Aggression

Males are more given to violence than are females in primates and other animals; this difference can be modified by cultural influences¹⁷ but, to the writer's

knowledge, it is never completely reversed except as a result of neurobiological abnormalities. There are gender-determined differences in brain anatomy, cognitive skills, speed of maturation, and behavior, and males are also more liable to conditions that can be warning signs of pathological aggression: episodic dyscontrol syndrome, attention deficit disorder, and antisocial personality disorder (psychopathy).

The aggressiveness of the normal male is not solely a matter of learned behavior or cultural indoctrination but is apparent from birth onward in goats, monkeys, dogs, and humans, and seems to be the result of prenatal differentiation of the brain under the influence of androgens.¹⁷ If a pregnant monkey is given a large dose of testosterone the week before parturition, and the baby is female, it will have all the anatomic equipment of a female but will usually behave more like a male regarding aggressive and exploratory behavior, and later on it may be unresponsive to males and may be sterile. This phenomenon is familiar in animal husbandry: if a cow is carrying twins, one of each sex, the female offspring will look like a female but may behave like a male and will usually be sterile, thanks to the effects of testosterone from the male twin which reaches the female via the maternal circulation and puts the male imprint on her hypothalamus. The same phenomenon is seen in sheep. In both sheep and cattle the defective female offspring used to be called a freemartin. It seems that in mammals the brain is inherently female, and differentiation depends on ex-

posure to gonadal hormones at a critical period of prenatal development.¹⁷

A common form of aggression is verbal abuse, which does much to fuel the fires of domestic strife.²³ It is more common in women than in men, perhaps because the average woman has a higher verbal IQ than the average man and is therefore better fitted for verbal warfare than the man, who finds it easier to hit than to talk. In Rodale's dictionary of synonyms there are 27 synonyms for abusive women and none for abusive men. Be that as it may, many children who have been exposed to verbal assaults recall them with horror and suffer from poor self-esteem that can last a lifetime.

Another gender-related contribution to domestic and criminal violence is the premenstrual tension syndrome, characterized by depression, hostility, impatience, and (especially in those with inadequate self-control) verbal and/or physical aggression. A study in the United States found that 62 percent of violent crimes committed by women occurred in the premenstrual week.²⁴ The figure in England was 49 percent.²⁵ The syndrome is associated with a fall of blood progesterone and a rise of estrogens, and some cases respond to the premenstrual administration of *natural* progesterone.²⁵

Both in humans and in animals, the administration of testosterone increases aggression in *both* sexes, and castration reduces sexual and irritable aggression in males. In one study higher levels of testosterone were found in violent female felons than in nonviolent control

subjects.²⁶ Yet another pointer to the role of androgens is the fact that androgen-suppressing drugs can reduce male urges to commit sexual offenses against children.^{17, 18}

Neurological Factors

It has been known for many years that damage to certain specific areas of the brain can lead to recurrent violent behavior in previously equable individuals. This can follow severe head injuries, viral infections of the brain, appropriately situated tumors, stroke, and so on,²⁷ but these obvious brain insults do not greatly add to the total sum of human destructiveness, and their chief importance lies in the fact that they demonstrate that the response of the brain to environmental or endogenous stimuli can be profoundly altered by quite small lesions *at specific sites, whatever the nature of the lesion*. How does this come about?

In humans and other vertebrates the capacity for aggression is vested in a genetically ordered, built-in system of neurons and chemical neurotransmitters extending from the prefrontal cortex on both sides to the lower brainstem and cerebellum.^{18, 28, 29} Most of this equipment is situated in the deep central portions of the brain, which we have inherited, almost unchanged, from our reptilian and early mammalian ancestors.³⁰ The extent and disposition of this phylogenetically ancient system is hardly surprising inasmuch as a capacity for defensive and offensive aggressive reactions was essential for the survival of both self and species in most vertebrates. It consists of interconnected assemblies

of neurons, some excitatory and some inhibitory, which enable the organism to initiate or inhibit aggressive responses to both environmental and endogenous stimuli.

In animals electrical stimulation at certain specific sites within this circuitry can provoke either angry aggressive behavior or coldblooded predatory attacks, while stimulation of inhibitory neurons can abruptly terminate an attack that is already in progress.^{18, 28, 29} Angry responses to electrical stimulation have been obtained in humans, albeit with less regularity, and in both animals and humans bilateral damage to excitatory areas can suppress aggressive responses. Loss of the capacity for anger has been seen as an early symptom of the destruction of such areas by a tumor, and the same result can be obtained by focal surgical excisions. On the other hand, lesions at several points in the human inhibitory system can impair the controlling mechanism, thus giving rise to three clinically distinct types of aggression: recurrent attacks of explosive rage; the cold-blooded, predatory, and often gratuitous violence of the antisocial personality³¹; and less common compulsive acts of violence. In many cases of episodic dyscontrol and in some compulsive individuals all control is not lost, and enough remains for the aggressor to vent his or her anger on a surrogate victim, be it a person, a pet, or a piece of furniture. Psychopaths seldom exhibit such scruples. Parenthetically it is prudent to remember that, whereas according to Freud compulsives are not supposed to act out their violent fantasies, they sometimes do so when their inhib-

Violence and Biosocial Interactions

itory mechanisms are depressed by alcohol, drugs, or disease.

Aggressive behavior does not occur without an exogenous or endogenous stimulus; however, the response depends to some extent on the emotional or mental "set," the environmental setting, the identity and behavior of the victim, and a variety of metabolic factors, all of which can influence the thresholds of excitation and inhibition. Thus, electrical stimulation of the ventrolateral hypothalamus or the amygdala may cause rage in a caged monkey but not when the same animal receives the same stimulus via radio signals when running free, out of doors. People in whom extreme violence can be precipitated by a fall of blood sugar if it occurs in a social setting do not do so when the blood sugar is lowered in a laboratory, and the violent behavior often associated with pathological intoxication may *or may not* appear when alcohol is administered to the same individual in a hospital setting. Again, it is relatively difficult to produce rage by stimulation of the brain in humans, even in those who are liable to episodic rages, but it is easier to do so if the patient has been irritable before the experiment. These examples illustrate the subtle interplay of biological and environmental "causes" of aggressive behavior, which is seen so often in clinical practice.

Under normal conditions the inhibitory system, which extends from the prefrontal cortex through the limbic system, brainstem, and cerebellum is available to control our aggressive responses to external and internal stimuli, so that as a result of training from infancy onward

most of us learn to inhibit violently aggressive behavior, socially unacceptable degrees of predatory aggression, inappropriate sexual behavior, and excessive material acquisitiveness—all of which are contagious. The learning process involves imitation, which is apt to be unselective and indiscriminating in the young, in the mildly retarded, and in people with developmental or acquired prefrontal defects³² who, like some psychopaths, unflinchingly gravitate toward undesirable companions.

The threshold of excitation can be lowered by head injury and other structural lesions at certain sites, by hormonal disorders, and by alcohol and drug withdrawal. An unusual combination, which can be of forensic interest, is seen in the individual who as a result of brain damage is subject to attacks of intense inward rage over minor provocations but retains the ability to prevent it from surfacing so long as alcohol is avoided.

However, even in normal subjects, the inhibitory mechanisms are fragile and can break down in the face of powerful sexual drives, overwhelming rage, panic, or mental illness or in the competition for food during famine, as a result of organic damage to certain sites in the brain, or from intoxication by alcohol or drugs. Of these the most common in both normal and brain-damaged individuals is alcohol, which suppresses inhibitory systems before it depresses activating mechanisms. And it also happens to some apparently normal people when cultural restraints are too suddenly removed, as portrayed in Golding's *Lord of the Flies*.

It seems that humans require environmental assistance to buttress the fragile internal controls that they are supposed to exercise on their primitive drives.³¹ This is thought to reflect an inadequate inhibitory system—a constitutional weakness with an anatomical and physiological basis which can be compensated for, to some extent, by the cultural corset of social, religious, and legal restraints.

Neurological Correlates of Pathological Violence

When recurrent attacks of violence occur for the first time in a formerly equable individual following a severe brain insult, the causal relationship is clear and is consistent with what is known about the neurological substrates of aggression. However, in recent years improved diagnostic techniques have uncovered a large number of subtle and often unsuspected neurological and neuropsychological defects dating from early life, which are far more common in pathologically aggressive people than in the population at large and are more common in men than women. This applies to recidivist violent criminals,³³⁻³⁵ violent juvenile delinquents,³⁶⁻³⁸ the episodic dyscontrol syndrome at all ages,^{12, 29, 39, 40} borderline syndromes,⁴¹ atypical schizophrenics,⁴² the antisocial personality disorders,^{33, 39, 40, 43} and “difficult” children referred to child guidance clinics because of antisocial behavior. This group of children is important because prospective and retrospective studies disclose that many of them with developmental or acquired neuropsy-

chological handicaps become psychiatric or social casualties in adolescence or later^{14, 39, 44-48} and some of them will grow up to be violent. There is evidence that the outcome in terms of acceptable social behavior depends, to some extent, on the IQ of the subjects and the affection and support they receive from family or caretakers in their formative years.

The neurological finding in these people, whether children or adults, cover a wide spectrum of defects including cognition, perception, speech, language, specific learning disabilities, abnormalities of the special senses, defects of the motor system including incoordination and apraxias, emotional control, and social adaptability.^{12, 13, 29, 36, 39, 42, 44, 49, 50}

There is almost always more than one defect in any given case, and they appear in many combinations, implying a patchwork of defects within the brain. It is implied, but seldom proven, that when pathological violence is present it is the result of appropriately placed lesions that either impair the inhibitory circuits or increase the physiological irritability of excitatory neuronal assemblies (such as the ventromedial hypothalamic nucleus).

The causes are heterogeneous and include genetic factors, developmental abnormalities due to maternal illness or intoxications, natal and perinatal disasters, and postnatal illness, trauma, and intoxications. There is also experimental and clinical evidence that in animals and humans postnatal brain development depends to some extent on appropriate environmental stimulation; consequently, emotional and social develop-

ment can be slowed or impaired by physical and emotional deprivation, as in the early history of some psychopaths.

Most of the abnormalities found in overly violent individuals have been identified in children by pediatricians, but they are also to be found in juvenile and adult delinquents *if they are looked for carefully*. The routine adult form of examination is insensitive to many of them, as are routine x-ray films, electroencephalograms, and standard IQ tests. The courts should be aware that to uncover this covert evidence may require an expanded clinical examination,^{12, 48, 50} modern refinements of electroencephalographic techniques, neuropsychological tests designed to detect organic defects, and a computed tomography or magnetic resonance imaging scan. Inevitably many of these handicapped people experience difficulty in coping with situations that are less of a problem to the normally endowed, and the result is a sense of helplessness and frustration, which provides an explosive mixture when combined with impulsivity and feeble inhibitions.

Three conditions deserve special notice because of their forensic implications. The most common—and most ignored—is the group of developmental and acquired defects dating from birth or early life and covered by the terms attention deficit disorder and minimal brain dysfunction; I found these disorders in 40% of 286 adults referred for neurological examination because of recurrent violence in the home and out of it,¹² including eight of 16 murderers. Secondly, *severe* closed head injuries in-

volving prolonged unconsciousness is sometimes followed by a change of personality, and of those who are thus affected about 10% become liable to episodes of abnormally aggressive behavior. The emphasis is on the word *serious* because it takes more than a bump on the head to produce deviant behavior. If trauma is to explain subsequent violent behavior, criminal or otherwise, it is necessary to produce positive evidence of brain damage at the time of injury and deviant behavior from that time onward. An injury that does not lead to hospitalization is extremely unlikely to produce any permanent behavioral effects. The courts should also understand that whether injury is to produce pathologically deviant behavior or not depends both on its severity and on the precise location of the lesions within the brain. Smart individuals are quick to use a head injury in the past as an excuse for antisocial behavior when in fact it was their propensity for violence that led to the head injury. Epilepsy, too, is often used as an alibi for violent behavior. Although many aspects of this subject are controversial, there is agreement on one point: violent crime carried out for profit or revenge is not consistent with what is known about epilepsy, although unplanned and undirected senseless violence can occur during an epileptic discharge as recorded by implanted electrodes. In addition, for over a century physicians have noticed that some epileptics, *and also some people who are violent but have not had episodes of typical epilepsy, give a history of brief episodes in which there has been a change*

in the content or quality of consciousness. These are sometimes referred to as “epileptoid” attacks, “epileptoid equivalents,” or “larvate seizures.” It can be difficult to distinguish between these incidents and some psychotic symptoms, but in Monroe’s³⁵ classic study of the subject carried out on violent criminals in the Patuxent Institution (1978) he established that some of these episodes do have a physiological basis and should be taken as evidence of a physical disorder beyond the control of the individual. This borderland between neurology and psychiatry is plentifully strewn with booby traps for the courts and for physicians.

Portraits of Aggressors

Judge Spaeth writes, “consider any criminal case—put yourself on the bench and read the pre-sentence report. Not always, but nearly always, the defendant standing before you, awaiting sentence, will not be a free man; he will be a social cripple; illiterate; poor; undisciplined; resentful; and otherwise disabled in conforming to the norms the law imposes on him” (this issue, p. 126).

The reports on convicted murderers by Lewis³⁷ convey a similar picture of inadequacy, consonant with the Glueck’s⁵¹ opinion of 500 women parolees: “On the whole, a sorry lot.” Some recidivists share this opinion. Malcolm Braly,⁵² after many convictions, reflected that “I’m a good-hearted and rational man who does irrational and harmful things. . . . It’s as if I was born with a crippling birth defect. . . . from the beginning I was a liar, a sneak, a showoff, a thief. . . . To this day there

are lacunae in my basic skills” (pp. 261, 363).

But Janus has another face—that of the intelligent, educated, and sometimes charismatic antisocial personality, whose mask of normality conceals a callous, conscienceless, and essentially loveless character whose career may be anything from that of the entrepreneurial “con” man in business or politics to the violent psychopathic criminal recidivist. The Diagnostic and Statistical Manual of the American Psychiatric Association estimates that 3 percent of Americans suffer from this organically determined personality disorder. They are to be found at all social levels, from the highest to the lowest. At best they can be creative, and at worst they are the piranhas of society, but in neither case do they respond to punishment, rehabilitation, or psychoanalysis, although middle age often reduces their violence.^{2, 27, 31, 33, 34, 43}

Remedies

Sir Leon Radzinowicz,² doyen of British and European criminologists, wrote,

Today we have a much better understanding of the complex social and individual elements in crime, but there is no evidence to demonstrate that advancement in prosperity, wealth and education has reduced its incidence or even restrained its rise. Nor has it been shown that more elaborate devices in the classification and treatment of offenders have made any impact upon the rates of recidivism over the past century. . . . There seems to be a remarkable stability about recidivism regardless of social conditions and penal practice (pp. 346–347).

This applies to recidivists but not necessarily to the large numbers of people who are arrested and sentenced for a

single act of criminal violence, especially during periods of anomie, and the fact that the prevalence of violence is so much lower in some nations and small communities that have retained the cultural corset than in their more permissive neighbors illustrates the overall power of environment in molding human behavior. In countries in which the upbringing of the young is often disrupted by broken homes and by the twin scourges of television and substance abuse, the home has become the incubator and cradle of violence,²³ and the reimposition of social constraints will depend on a vast swing of public opinion. Some are saying that this swing is starting to happen in the United States. In the meantime, however, there is a need to identify children who are given to persistent antisocial behavior and to provide the mechanics for multimodal intervention—social, educational, psychological, and medical. Satterfield et al.³⁸ and many other teams are showing benefits from broad-based, long-term treatment of some juvenile delinquents, including those with organic neuropsychological handicaps.

Does medical treatment help the incorrigibly violent individual with or without identifiable organic defects? It is true that there are pharmacological methods to reduce violence, but to be effective they require collaboration from a willing patient and close supervision by a responsible individual. All too often the habitually violent macho type resents taking pills and either “forgets” to take them, says they are too expensive, or complains unreasonably of mild side effects. Moreover, medication should be

nonaddictive, safe, and free of side effects if properly used. Drugs are available which can reduce psychotic hostility in schizophrenics and certain types of depression, violence and impulsivity of the aggressive psychopath, recurrent episodic rages that occur in a wide range of organic brain defects, compulsive aggression, explosive violence of premenstrual syndrome, interictal violence in epileptics, tantrums sometimes associated with attention deficit disorder, and pedophilic urges in child molesters. In addition, intractable rages can be controlled by the surgical removal of scars and small tumors from specific sites in the brain.

Incarceration of the incorrigibly violent individual has several advantages from a public health point of view. It protects other individuals in the home and on the street. It removes an undesirable role model from circulation, and it limits propagation. Also, even the possibility of incarceration may have a deterrent effect on certain individuals, such as spouse batterers and child abusers. There is no moral reason that somebody should be excused of acts against a spouse or child which, if done to somebody outside the family, would land that person in court.

The role of psychotherapy is beyond the scope of this paper and this neurologist.

Summary

1. The capacity for individual aggression, and its control, is vested in a built-in and genetically ordered system of neurons and chemical neurotransmitters—much of which is located in the deep

portions of the brain—which we have in common with reptiles and early mammals and which is under the *relative* control of the more recently acquired neocortex.

2. Individual acts of violence are the result of interactions between the brain and the environment or between the brain and its own innate drives. Our responses to challenges and temptations are therefore dependent not only on the social milieu, but also on multiple biological variables: age, gender, environmental factors, and intoxications. To ignore either the biological or the environmental factors is to invite error.

3. Improved examination techniques disclose that developmental and acquired defects of the brain are far more common in recurrently violent individuals than in nonviolent populations. This has significant forensic and therapeutic implications.

4. Epidemic escalations of violent behavior during periods of anomie are obviously not caused by an explosion of brain damage but are related to a relaxation of the social constraints which, like a cultural corset, are needed to hold in continuous check the innate drives of the brain, in both health and disease.

5. The neurological defects that contribute to endemic violence are seldom treatable, but reduction of both aggression and impulsiveness can often be secured by medication in conjunction with talk therapies and social interventions.

References

1. Herrnstein RJ, Wilson JQ: *Crime and Human Nature*. New York, Simon & Schuster, 1985
2. Radzinowicz L, King J: *The Growth of Crime: The International Experience*. London, Pelican, 1977
3. Rutter M, Giller H: *Juvenile Delinquency*. New York, Guilford, 1983
4. Tracy DE, Wolfgang MF, Figlio RM: *Two Birth Cohorts*. Washington, DC, US Department of Juvenile Justice and Delinquency Prevention, 1985
5. Tuchman BW: *A Distant Mirror: The Calamitous 14th Century*. New York, Ballantine, 1978
6. Cohn NRC: *The Pursuit of the Millennium*. New York, Secker & Warburg, 1957
7. Turnbull CM: *The Mountain People*. New York, Simon & Schuster, 1972
8. Eibl-Eibesfeldt I: *The Biology of Peace and War*. New York, Viking, 1979
9. Goldstein SB, Ibaraki T: *Japan: Aggression and aggression control in Japanese Society, in Aggression in Global Perspective*. Edited by Goldstein AP, Segall MH. New York, Pergamon, 1983, pp 313–24
10. Schulsinger R: Psychopathy: heredity and environment, in *Biosocial Bases of Criminal Behavior*. Edited by Mednick S, Christiansen KO. New York, Gardner, 1977, pp 109–27
11. Turner A, Robinson H, Laing S, Purvis-Smith S: Preventive screening for the fragile X chromosome. *N Engl J Med* 315:607–9, 1986
12. Elliott FA: Neurological findings in adult minimal brain dysfunction and the dyscontrol syndrome. *J Nerv Ment Dis* 170:680–7, 1982
13. Wender PA: *Minimal Brain Dysfunction in Children*. New York, Wiley Interscience, 1971
14. Cantwell DP: *The Hyperactive Child*. New York, Spectrum, 1975
15. Davenport DB: The feebly inhibited: violent temper and its inheritance. *J Nerv Ment Dis* 42:493–528, 1915
16. Stacey WA, Shupe A: *The Family Secret: Domestic Violence in America*. Boston, Beacon, 1983
17. Beach FA: *Human Sexuality in Four Perspectives*. Baltimore, Johns Hopkins, 1976
18. Moyer KE: *The Psychobiology of Aggression*. New York, Harper & Row, 1976
19. Kaes T: *Die Grosshirnrinde des Menschen in ihren Wassen und in ihren Fassengehalt: Ein gehirn anatomische Atlas*. Jena, Fischer, 1907
20. Yakovlev R, Lecours R: In *Regional Development of the Brain in Early Life*. Edited by Minkowski A. Oxford, Blackwood, 1967
21. Kraepelin E: *Psychiatrie*, 8th ed, vol 4. Leipzig, Barth, 1915

Violence and Biosocial Interactions

22. Hill D, Watterson D: EEG studies of psychopathic personalities. *J Neurol Neurosurg Ment Dis* 5:47-65, 1942
23. Gelles RJ: *The Violent Home*. Beverly Hills, CA, Sage, 1972
24. Morton JH, Addison H, Addison RG, *et al*: A clinical study of premenstrual tension. *Am J Obstet Gynecol* 65:1182-91, 1953
25. Dalton K: *The Premenstrual Syndrome*. Springfield, IL, Thomas, 1964
26. Ehlers CL, Rickler KC, Hovey JE: A possible relationship between plasma testosterone and aggressive behavior in a female out-patient population, in *Limbic Epilepsy and the Dyscontrol Syndrome*. Edited by Girgin M, Killoh L. New York, Elsevier/North Holland, 1979
27. Elliott FA: Neurological factors in violent behaviour. *Bull Am Acad Psychiatry Law* 4:297-316, 1976
28. Valzelli L: *Psychobiology of Aggression and Violence*. New York, Raven, 1981
29. Elliott FA: Episodic dyscontrol and aggression, in *Neurologic Clinics*. Edited by Green JB. Philadelphia, Saunders, 1984, pp 113-25
30. MacLean R: A triune concept of the brain and behavior. Lectures 1,2,3, in *Hincks Memorial Lectures*. Edited by Boag TJ, Campbell D. Toronto, University of Toronto Press, 1973
31. Elliott FA: Biological roots of violence. *Proc Am Philosoph Soc* 127:84-94, 1983
32. Lermite F, Pillon B, Serdaru M: Human autonomy and the frontal lobes. Imitation and utilization behavior. A neuropsychological study. *Ann Neurol* 19:326-43, 1986
33. Monroe RR: *Brain Dysfunction in Aggressive Criminals*. Lexington, MA, Lexington Books, 1978
34. Yeudall LF, Fromm A: Neuropsychological impairment in various psychopathological populations, in *Hemisphere Asymmetries of Function in Psychopathology*. Edited by Gruzelier J, Flor-Henry P. New York, Elsevier/North Holland, 1979, pp 401-27
35. Monroe R: *Episodic Behavioral Disorder*. Cambridge, Harvard, 1970
36. Lewis DO, Shamok SS, Pincus JH, *et al*: Violent juvenile delinquents. *J Am Acad Child Psychiatry* 18:307-19, 1979
37. Lewis DO, Moy E, Jackson LD: Biopsychosocial characteristics of children who later murder: A prospective study. *Am J Psychiatry* 142:1161-7, 1985
38. Satterfield JH, Hoppe CM, Schell AM: Prospective study of delinquency in 110 adolescent boys with attention deficit disorder and 88 normal adolescent boys. *Am J Psychiatry* 139:795-8, 1982
39. Berman A: *Minimal Brain Dysfunction: Factors Leading to Breakdown in Adulthood. A Developmental Approach*. Edited by Denhoff E, Stern L. New York, Masson, 1979, pp 125-32
40. Bach-Rita G, Lion JR, Climent CF, *et al*: Episodic dyscontrol: A study of 130 violent patients. *Am J Psychiatry* 127:1473-8, 1971
41. Andrulonia PA, Glueck BC: Organic dysfunction and the borderline syndrome. *Psychiatr Clin N Am* 4:47-66, 1980
42. Bellak L: *Psychiatric Aspects of Minimal Brain Dysfunction in Adults*. New York, Grune & Stratton, 1979
43. Flor-Henry P: *The Cerebral Basis of Psychopathology*. Bristol, UK, Wright, 1983
44. Quitkin F, Rifkin A, Klein DF: Neurological soft signs in schizophrenic and character disorders. *Arch Gen Psychiatry* 33:841-53, 1976
45. Robins L: *Deviant Children Grown Up: Sociological and Psychiatric Study of the Sociopathic Personality*. Baltimore, Williams & Wilkins, 1966
46. Rochford JM, Detre T, Tucker F, *et al*: Neuropsychological impairment in functional psychogenic diseases. *Arch Gen Psychiat* 22:114-9, 1970
47. Milman D: Minimal brain dysfunction in childhood: Outcome in late adolescence and early adult years. *J Clin Psychiatry* 20:371-380, 1979
48. Mark V, Ervin R: *Violence and the Brain*. New York, Harper & Row, 1970
49. Anderson C: *Society Pays: The High Cost of Minimal Brain Dysfunction in America*. New York, Walker, 1972
50. Clements SD, Peters JE: Minimal brain dysfunction in the school age child. *Arch Gen Psychiatry* 6:188-97, 1962
51. Glueck S, Glueck ET: *Five Hundred Delinquent Women*. New York, Knopf, 1939
52. Braly M: *False Starts*. Boston, Little, Brown, 1976