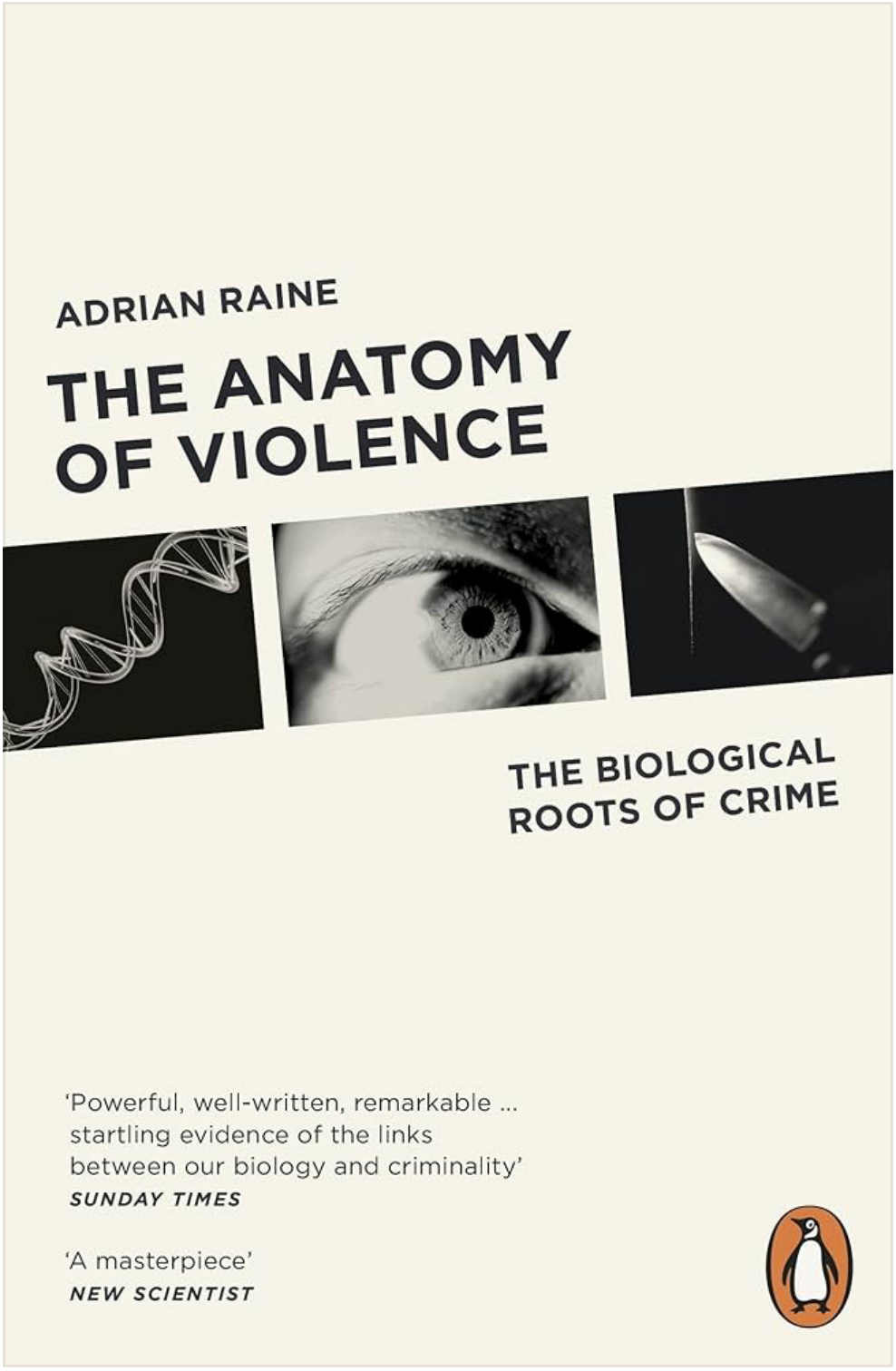
Anatomy of Violence (2013) - Adrian Raine



About Adrian Raine

British psychologist and leading expert on the causes of antisocial and violent behavior. His work focuses on the biological factors—brain structure, function, and neurochemistry—that contribute to criminal behaviour. He also incorporates a social and environmental lens. Known for his pioneering use of neuroimaging techniques to study the brains of violent offenders.

[What follows are quotes from the book above. These quotes stood out to psychotherapist Emil Barna in his reading of the book. They are not meant to be exhaustive nor representative of the entire book. All quotes are to be read in this context and must not replace medical and/or other professional advice. Note: Any typographical errors occured through the transcription process and do not reflect what may be found in the book.]

Blurb

Why do people kill? Are some criminals born, not made? What causes violence and how can we treat it? In An Anatomy of Violence *Adrian Raine draws on his own scientific research into the brains of murderers, psychopaths and serial killers to give a new perspective on these perennial questions. He reveals that, while anti-social behaviour is based on the complex interaction of genetics and environment, we can no longer ignore the evidence of strong links between biology and behaviour. Exploring how this could change the way we treat criminals in future, this revelatory book alters our understanding of our minds.*

Preface

"Is there a significant biological contribution to the causes and cures of crime? It turns out that that idea was all the rage 150 years ago, when an Italian doctor named Cesare Lombroso broke with intellectual tradition and, taking a novel empirical approach to studying crime, tried to persuade the world of a basis to crime residing in the brain. But **as the twentieth century progressed, what was once an innovative viewpoint quickly fizzled out and sociological perspectives took center stage**."

"Even the world's premier sociology journal, *American Sociological Review*, is beginning to publish molecular genetic research on crime and violence. Nobody would have dreamed that just fifteen years ago. Now the new subdiscipline of neurocriminology is quickly sweeping us back to the future."

Introduction

Information from the senses reaches the amygdala twice as fast as it gets to the frontal lobe.

"[Raine's own traumatic experience of being assaulted] had a powerful effect on me. It broke through my outer façade of liberal humanitarian values and put me in touch with a deep, primitive sense of retributive justice. From an assured English-bred opponent of the death penalty, I became a person who could no longer be ruled out of a jury pool for a capital crime in the United States. An evolutionary instinct for vengeance was triggered inside me, and it has stayed with me for years."

Chapter 1 - Basic Instincts: How Violence Evolved

“Lombroso's theory had two pivotal points: that there was a basis to crime originating in the brain, and that criminals were an evolutionary throwback to more primitive species.”

“Most criminal acts can be seen, directly or indirectly, as a way to take resources away from others. The more resources or status a man has, the better able he is to attract young, fertile females. These women in turn are on the lookout for men who can give them the protection and the resources they need to raise their future children. [...] Aggression is used to grab resources from others, and resources are the name of the evolutionary game. [...] **Gaining a reputation for aggression not only increases status in one's social group and allows more access to resources but also deters aggression from others**.”

“If you accept acts of altruism from others, but fail to reciprocate in the future, you're cheating. There is room for a bit of cheating—truth be told, many of us do it from time to time. But a small number of us cheat a lot—and in this group we find the psychopath. [...] Fortunately for the psychopath there is a slippery way out. After he's been spotted by reciprocal altruists he leaves this social network and migrates to a new population”

“The !Kung Bushmen live in a relatively inhospitable desert environment. Due to the extremely difficult living conditions, cooperation is prized. Men need to hunt together in search of food, and game is shared in the camp. There is also a high degree of parental investment in children, who are highly supervised and weaned gradually. [...] In contrast, the Mundurucú are low-intensity tropical gardeners living in a relatively rich ecological niche [...] The relatively greater availability of food frees males to engage in male-male competitive interactions centered around politics, planning raids and warfare, gossiping, fighting, and elaborate ritual ceremonies. [...] Personal characteristics of the successful Mundurucú male in this competitive society consist of good verbal skills for political oratory, fearlessness, skill at fighting and carrying out raids, bluff and bravado to avoid the risk of battle, and the ability to manipulate and deceive prospective mates on what resources he can offer to maximize offspring.”

“44 percent of all Yanomamo men over the age of twenty-five have killed someone, thus achieving the status of being a unokai. Some kill more than once, and one unokai had killed sixteen times. [...] They also conduct raids on other villages for revenge killings that can take up to four days to execute, involving from ten to twenty men in the raiding party. [...] the men who kill [...] have an average of 1.63 wives compared with 0.63 wives of men who do not kill. The unokais have an average of 4.91 children compared with an average of 1.59 children for non-killers. In terms of reproductive fitness, serious violence pays handsomely in two critical resources.”

“**98 percent of all homicides are killings of people who do not share their killer's genes**. [...] if you are living with someone not genetically related to you, you are eleven times more likely to be killed by that unrelated person than by someone genetically related to you. [...] Data from the United States show a similar pattern—a child is a hundred times more likely to be killed as a result of abuse by a stepparent than by a genetically related parent.”

“In some bird species where both parents forage for their offspring, the death of one parent can result in the other parent abandoning the offspring. The load is just too hard to bear”

“**some women when raped actually achieve orgasm, even though they may strongly resist and are traumatized by the attack**. [...] Clinical reports place the rate of the victim experiencing orgasm at about 5 to 6 percent, but clinicians also report that they suspect the true rate to be higher. [...] research reports document that physiological arousal and lubrication occurs in 21 percent of all cases. Why would that happen? Because in half the cases, the date-raped woman was actually attracted to the perpetrator before the act. Orgasm and the associated contractions are thought to facilitate conception by contracting the cervix and rhythmically dipping it into the sperm pool.”

David Buss, of the University of Texas at Austin, who conducted research into this question, found that men were twice as likely to find the second scenario the most upsetting—it's the sexual relationship that bothers them, not the emotional relationship. While men find the sexual infidelity most distressing, women in contrast find the emotional infidelity most distressing. [...] men are more distressed about infidelity because they could end up wasting resources and energy in raising a child genetically unrelated to them. Women, on the other hand, are concerned about infidelity because it means they may lose the protection, emotional support, and tangible resources provided by their partner.”

“When it comes to same-sex homicides, data from twenty studies show that 97 percent of the perpetrators are male. Men are murderers.”

“**violence increases throughout the teenage years to peak at age nineteen**. This is consistent with the notion that aggression and violence are tied to sexual selection and competition for mates, processes that peak at approximately this age. [...] Fearfulness of bodily and health injury is arguably the psychological mechanism that evolution has built into women to protect them from death, helping to ensure the survival of their young. [...] **females are more likely than males to engage in this "indirect" or "relational aggression," which takes the form of excluding others from social relationships and group activities and damaging their reputation in their peer groups gossiping, spreading rumors, humiliating the individual**. [...] women are much more likely to call their competitors ugly, make fun of their

appearance, and comment on their fat thighs. " Women attempt to ruin their rivals' reputation by saying they have a lot of boyfriends, sleep around a lot, and are sexually promiscuous."

Chapter 2 - Seeds Of Sin: The Genetic Basis To Crime

"identical twins who were separated at birth are surprisingly similar with respect to antisocial personality, despite being reared in very different environments."

"we even have 60 percent of our genes in common with banana trees. So when we talk about fraternal twins having 50 percent of their genes in common, we are referring to 50 percent of just those small genetic differences that separate all human beings."

"40 to 50 percent of the variability among us in antisocial behavior is explained by genetics. [...] *96 percent* of the variance in this combined view of antisocial behavior is heritable. [...] Reactive aggression is a case of someone hitting you, and you hitting them back—a sort of "defensive" or retaliatory aggression where you stand your ground. That form of aggression had a heritability of 38 percent."

"Proactive aggression, on the other hand, is meaner and crueler—you use force to get things from others. That had a somewhat higher heritability of 50 percent. [...] Nonaggressive antisocial behavior was 48 percent heritable, while aggressive behavior was 65 percent heritable. [...] Twin studies tell us that about 50 percent of the variance in antisocial behavior is explained by environmental influences. The genes-versus-environment battle comes out as a tie."

"the familial home influences accounted for on average 22 percent of the total variance in antisocial behavior. In contrast, environmental influences outside the family accounted for 33 percent of the variance. Even at nine years of age, children are being influenced even pushed and shoved—in directions dictated by their peers rather than their parents."

"the more convictions the biological parents had, the more offendin there was in their adopted-away offspring."

"recent studies with larger sample sizes show that young boys with XYY are indeed rated as more aggressive and more delinquent than controls. [...] When Brunner genotyped [...] families he found an astonishing abnormality. These males had a defective gene—the MAOA gene, which normally produces the enzyme monoamine oxidase A. [...] **MAOA is an enzyme that metabolizes several neurotransmitters involved in impulse control, attention, and other cognitive functions, including dopamine, norepinephrine, and serotonin**? Mutations in the normal MAOA gene lead to deficient production of the MAOA

enzyme. It wasn't just that it was low in the affected family members, it was virtually nonexistent. A total lack of MAOA has profound effects. It disrupts the normal function of other neurotransmitters, resulting in a wide range of disorders including attention deficit/hyperactivity dis-order, alcoholism, drug abuse, impulsivity, and other risky behaviors.

"You can knock out or deactivate a gene in mice by replacing it with an artificial DNA sequence. Once in a while [a research] team would come into their lab in the morning and notice a dead mouse. It did not take them long to work out that mice with deletion of the MAOA gene had become ferociously aggressive and were attacking other mice."

"Researchers reported that the **Maori had twice the level of the genotype conferring low levels of MAOA compared with Caucasians in New Zealand**."

"While the base rate of the low-MAOA gene is about 34 percent in Caucasian males and 56 percent in the Maori, it is 77 percent in Chinese males. Yet the homicide rate in China, at about 2.1 per 100,000, is less than that of the United States—the Chinese are not exactly known for their fearless, warrior-like tendencies. [...] **Those with the warrior gene are more hypersensitive to criticism, which in turn results in increased impulsive aggression**."

"The 5HTT gene, the DRD2 gene, the DAT1 gene, and the DRD4 have all appeared on the gene landscape as linked to antisocial and aggressive behavior. What do these particular genes do? They **regulate two important neurotransmitters in the brain—serotonin and dopamine**. [...] Neurotransmitters are brain chemicals essential to brain functioning. There are more than a hundred of them and they help to transmit signals from one brain cell to another to communicate information. [...] Dopamine helps produce drive and motivation. It is critically involved in reward-seeking behavior. **Aggressive behavior can be rewarding, and in animals dopamine receptors help code for this rewarding property of aggression**. [...] The serotonin-transporter gene is one of the most intensively researched genes in my fields of psychology, psychiatry, and neuroscience. [...] About 16 percent of us have the short-allele version. This version makes our **brains overrespond to emotional stimuli and can result in us letting off steam when we get overheated**."

"**Serotonin is a mood stabilizer, which has an inhibitory function in the brain**. It is thought to be one of the biological brakes on impulsive, thoughtless behavior. **It innervates—or lubricates—a part of the brain called the frontal cortex**, which [...] is critically important in regulating aggression. **The less serotonin you have, the more rash you may be**. Brain-imaging research has shown that people given a drink that reduces serotonin by depleting tryptophan an amino acid critical for serotonin production are more likely to retaliate when they are made an unfair offer in a game?"

"the long allele [...] is associated with more **cold-blooded and planned**

psychopathic behavior in those with low responsivity to stress."

"It turns out that we have far fewer genes than was originally thought—about 21,000—roughly the same number that mice have. Although human genes are mapped and are available to all of us on the Internet, a lot remains unknown."

"For example, about 98 percent of our DNA is "junk" DNA, meaning that it does not encode protein sequences—we don't yet know what it's there for or what it does."

Chapter 3 - Murderous Minds: How Violent Brains Malfunction

"[In a brain scan] The murderer [...] shows strong activation in the occipital cortex, just like the normal control. There's nothing wrong with his visual system. In stark contrast to the normal control, however, **the murderer shows a striking lack of activation in the prefrontal cortex**. Overall, the forty-one murderers showed a significant reduction in prefrontal glucose metabolism compared with the controls?"

1. At an emotional level, **reduced prefrontal functioning results in a loss of control over the evolutionarily more primitive parts of the brain**, such as the limbic system, that generate raw emotions like anger and rage. The more sophisticated prefrontal cortex keeps a lid on these limbic emotions. Take that lid off, and the emotions will boil over.

2. At a behavioral level, we know from research on neurological patients that **damage to the prefrontal cortex results in risk-taking, irresponsibility, and rule-breaking**. It's not far to go from these behavioral changes to violent behavior.

3. At a personality level, frontal damage has been shown to result in a whole host of personality changes. These include **impulsivity, loss of self-control, and inability to modify and inhibit behavior appropriately**.

4. At a social level, prefrontal damage results in **immaturity, lack of tact, and poor social judgment**. From here we can imagine how a lack of social skills can result in socially inappropriate behavior and poorer ability to formulate nonaggressive solutions to fractious social encounters.

5. At a cognitive level, poor frontal functioning results in a **loss of intellectual flexibility and poorer problem-solving skills**. These intellectual impairments can later result in school failure, unemployment, and economic deprivation, all factors that predispose someone to a criminal and violent way of life.

"**damage to the orbitofrontal cortex** impairs decision-making and releases the brakes on emotion regulation [...] frequently results in disinhibited,

impulsive behavior, poor decision-making, and a lack of emotional control.

“The under part of the prefrontal cortex specializes in learning from experience and fine-tuning decision-making based on past experience.”

“[Regarding] the ventral—or underneath—prefrontal cortex [the] **reactive, hot-blooded murderer has low prefrontal functioning** in the ventral subregion. In contrast, the **predatory, cold-blooded killer has just as much prefrontal activation as the normal controls**. [...] The **hippocampus** modulates and regulates aggression and when stimulated sets in motion predatory attack. The **thalamus** is a relay station between the emotional limbic areas and the regulatory cortical areas. [...] cold-blooded killers have sufficient prefrontal regulatory resources to act out their aggression in a relatively careful and premeditated fashion.”

“The **angular gyrus** lies in the inferior, or lower, half of the parietal lobe, above the superior temporal cortex, and in front of the visual cortex. It is consequently in a prime position in the brain, lying at the junction of three of the four major lobes—the parietal, the temporal, and the occipital cortices. It connects and integrates information from many modalities—visual, auditory, somatosensory, vestibular—in order to perform complex functions. [...] We imaged the angular gyrus in our murderers and found significantly lower glucose metabolism in this structure than in those of the controls. [...] The angular gyrus is one of the latest areas of the brain to develop [...] if the angular gyrus is not functioning well, then a child's reading, writing, and arithmetic are going to suffer”

“The hippocampus is also part of the neural network that forms the basis for the processing of socially relevant information, and it is involved in recognizing and appraising objects. Disruption to such a system could in part relate to the socially inappropriate behavior shown by some violent individuals [...] Yet **there's more to the hippocampus than memory and ability. It is a key component in the limbic circuit that regulates emotional behavior, and it has been implicated in aggressive, antisocial behavior in both animals and humans**. In animals, it regulates aggression through its connections to deep structures in the middle of the brain, including the lateral hypothalamus and what's called the periaqueductal gray, structures important in controlling both defensive rage attack and predatory attack. So a poorly functioning hippocampus will be of little help to either an offender who is beginning to fly off the handle in the first stage of an argument, or one who is seeking revenge. [...] the posterior cingulate is involved in self-referential thinking the ability to reflect back on oneself and understand how one's behavior can affect others. So **if a psychopath fails to understand how his actions can harm others, this could help explain his thoughtless, antisocial acts and his failure to accept responsibility for his actions**.”

“spouse-abusers showed much greater activation of the emotional amygdala to negative-emotion words, together with less activation in the regulatory

prefrontal cortex. [...] batterers experience greater visual arousal when exposed to threatening stimuli. [...] **Spouse-abusers have a reactive aggressive personality that makes them more likely to lash out when provoked**. Emotional words inordinately grab their attention. They are less able to inhibit the distracting emotional characteristics of stimuli, resulting in impaired cognitive performance. [...] I do think we need to recognize that **there's more to domestic violence than the traditional feminist perspective cares to admit**. Feminists argue that the cause of spousal abuse lies in a patriarchal society that sanctions men's using physical power to control women. We argue instead that **neurobiology nudges some men to overreact at home and that we need to consider a contribution by the brain to spousal abuse**.

"**traditional treatment programs to treat spouse-abusers based on the feminist perspective simply do not work. We need to incorporate neurobiological perspectives into domestic-abuse treatment programs if we genuinely want to eradicate this completely unacceptable behavior of men toward women**."

[For more on the above claim, see: Babcock, J. C., Green, C. E. & Robieb, C. (2004). Does batterers' treatment work? A meta-analytic review of domestic violence treatment. Clinical Psychology Review 23, 1023-53.]

[The following is interesting. It reminds me of what Jefferson Fisher says in his book* The Next Conversation *in that when people lie (especially in a legal context) they give you lots and lots of detail. Whereas when people are telling the truth, they don't tend to do this as much. Plus, liars are much more uncomfortable with silence whereas truth-tellers know they're telling the truth so they're more comfortable with you 'sitting with it' and not saying anything.]

"**lying was consistently associated with increased activation in the prefrontal cortex as well as areas of the parietal cortex**. [...] telling the truth was not associated with any increase in cortical activation."

"Compared to more "impersonal" moral dilemmas that do not bring you face-to-face with someone else, your brain shows increased activation in a circuit that comprises the medial prefrontal cortex, the angular gyrus, the posterior cingulate, and the amygdala. This makes sense, as these brain areas contribute to complex thinking, and the ability to step outside of yourself and evaluate the bigger social picture. [...] About 85 percent of you felt you could not bring yourself to push that man off the bridge [when presented with a moral dilemma to murder somebody in order to save more]. About 15 percent, however, would have sacrificed him. These numbers are obtained in large-scale surveys of moral dilemmas. In contrast, if you put the same question to patients who have lesions to the ventral prefrontal cortex people who as we'll later see are more psychopathic than the rest of us—that "push-him-off" rate triples to about 45 percent."

“studies of antisocial individuals reveal abnormalities in the posterior cingulate, the amygdala, and the hippocampus, while others document abnormal functioning in the superior temporal gyrus in violent offenders, psychopaths, and antisocial individuals.”

“individuals with high psychopathy scores showed reduced activity in the amygdala during emotional, personal moral decision-making. While the amygdala, the neural seat of emotion, shows a bright glow in normal people when faced with emotion-provoking moral dilemmas, this emotional candle is barely flickering in highly psychopathic individuals.”

“psychopaths are less capable of recognizing negative emotions-including fear and sadness-in others' faces. […] Andrea Glenn found that the medial prefrontal cortex, the posterior cingulate, and the angular gyrus were also dysfunctional in psychopaths during moral decision-making and were particularly associated with interpersonal features of the psychopath superficial charm, lying and deception, egocentricity, and manipulation. These brain areas are also part of the neural circuit of moral decision-making and are involved in self-reflection, emotion perspective-taking, and integrating emotion into social thinking.”

Chapter 4 - Cold-Blooded Killers: The Autonomic Nervous System

“**Rabbits that are aggressive and dominant […] have lower resting heart rates than subordinate, nonaggressive rabbits**. Furthermore, when dominance in these rabbits is experimentally manipulated, heart rate goes down as dominance goes up. The same relationships have been found throughout the animal kingdom in macaques, baboons, tree shrews, and mice.”

“**antisocial kids** […] **have lower resting heart rates**. […] Males in general have lower heart rates than females […] The sex difference in heart rate is in place as early as age three, with boys having a heart rate that is 61 beats a minute lower than girls. […] longitudinal studies from England, New Zealand, and Mauritius have indeed confirmed that low heart rate in childhood—as early as age three—is a predictor of later delinquent, criminal, and violent behavior. […] these studies do not demonstrate causality […] low heart rate was even more strongly related to measures of violence than having a criminal parent”

“the clinical symptoms of **conduct disorder** are things like lying, stealing, fighting, and cruelty to animals. These are all behavioral in nature and rely on subjective verbal reports from caregivers of the children themselves.”

“psychopathy can be a successful reproductive strategy, with power and control over others bringing resources that translate into greater reproductive fitness. […] **Psychopaths are always more than willing to blame others to**

justify their actions."

Seventy-six percent of "normal" men have had at least one homicidal fantasy. For normal women the rate is a bit lower, at 62 percent.

"In the laboratory, skin conductances is measured with small electrodes. [...] When you pay attention to a sound, the prefrontal cortex, amygdala, hippocampus, and hypothalamus are activated. Some of these "lower" brain areas the hypothalamus and brain stem stimulate sweating. So people sweat a bit more when thinking or listening to something. Although the sweat response is a peripheral autonomic measure, it is nevertheless a powerful measure of central nervous system processing. **The bigger the skin-conductance response, the greater the degree of attentional processing**."

"A systematic review of all studies conducted on adult criminals, psychopaths, and antisocial adolescents concluded that **there is overwhelming evidence for poor fear conditioning in offenders**."

"How could there be so many more psychopaths in temporary-employment agencies? The answer is that **temp agencies are wonderfully safe havens for psychopaths—almost a breeding ground**. Psychopaths gain in life by ferociously exploiting others. To begin with, their superficial charm allows them to succeed with their parasitic lifestyle, but ultimately they get caught out by those around them. Once detected, they can pack up and move on to the next social group of victims that they will suck dry."

"Superior executive functioning in successful psychopaths"

"A good mind makes good decisions, and to do so it has to rely on"

"**somatic markers** are unpleasant autonomic bodily states produced when one is contemplating a risky action or a difficult decision—the pounding heart and the perspiration. These somatic markers have flagged negative outcomes in the individual's past, and are stored in the somatosensory cortex. [...] This input is then transmitted to the prefrontal cortex, where further evaluation and decision-making takes place. **If the current situation has been previously linked to a negative outcome, the somatic marker for that past event will sound an alarm bell to the decision-making areas of the brain**"

"Parental absence and a lack of bonding may have helped shape the lack of close social connectedness and the superficiality that typifies psychopathic relationships."

""**kindling**," **or stimulation of the emotional limbic system can in some cases occur during the killing. This causes hyperactivation of the autonomic nervous system—resulting in nausea, vomiting, profuse sweating, incontinence, or even vertigo**. This limbic kindling perspective is

very speculative and must be treated with caution. […] visceral cardiovascular feedback and heightened emotional awareness constitute the somatic, bodily markers that provide the ventral, or underneath part of, the prefrontal cortex with sound awareness of the social context the person is in."

Chapter 5 - Broken Brains: The Neuroanatomy Of Violence

"a structural brain deficit in the left prefrontal cortex results in a functional brain abnormality that in turn results in violence. […] impairment to the frontal cortex is particularly associated with reactive aggression. […] spousal abuse can be caused by a lack of prefrontal regulatory control over the limbic regions of the brain, resulting in reactive aggression in the face of emotionally provocative stimuli."

"**lifelong persistent antisocial behavior [led to] reduction in the volume of gray matter in the prefrontal cortex. White matter volume was normal. Antisocial bacon has plenty of fat—just not enough meat, not enough neurons**."

"One group of patients had lesions localized to the ventral prefrontal cortex, the lower region of frontal cortex. It includes the orbitofrontal cortex, which sits right above your eyes, and the ventromedial prefrontal cortex, which is in line with your nose"

"The ventral prefrontal cortex is involved in coding social-emotional events. It connects to the limbic system and other brain areas to generate appropriate emotional responses within a social context, measured here by a sweat response. Without that neural system in place, the individual is emotionally blunted—and we saw earlier that psychopaths and those with antisocial personality disorder are similarly emotionally blunted and lacking in empathy."

"adults suffering head injuries that damage the prefrontal cortex-especially the lower, ventral region-do indeed show disinhibited, impulsive, antisocial behavior that does not conform to the norms of society."

"When the brains of children suffering from fetal alcohol syndrome are scanned, it is found that the right-greater-than-left hippocampal volume that is found in normal controls is exaggerated by 80 percent. … […] hippocampus patrols the dangerous waters of emotion. For one thing, it is critically important in associating a specific place with punishment—something that helps fear conditioning. […] The hippocampus is also a key structure in the limbic circuit that regulates emotional behavior. From animal research we know that **the hippocampus regulates aggression through** projections to the midbrain periaqueductal gray and the perifornical lateral hypothalamus. These are **deep subcortical structures that are highly important in regulating both defensive and reactive aggression as well as predatory attack**. […] the corpus callosum—a colossal body of over 200 million nerve fibers that connect

your two cerebral hemispheres. These fibers—the corona radiata—radiate out from the very center of your brain to the outer areas of your cerebral hemispheres, interconnecting many different brain regions. We measured the volume of the corpus callosum and its corona radiata and found that this volume is much bigger in psychopaths with antisocial personality disorder. It was also longer. And thinner too. A long, thin body of white matter. It's as if **there is too much connectivity in the brains of psychopaths—too much cross talk between the two hemispheres**."

"psychopaths can learn—as long as you use rewards to shape their behavior."

"The right hippocampus is larger than the left in psychopaths. The striatum is larger. The corpus callosum also has a bigger volume."

"**When do we lie most? Community surveys show it's on our first date with a new person**. And this gives us a clue as to why we lie so much—it's **impression management**. [...] The trouble with psychopaths, though, is that they really are extraordinarily good at lying. Just when you think you've nabbed them telling an enormous whopper, they have the uncanny ability to reel off a seemingly convincing explanation for the discrepancy without batting an eye. Believe me, against your own better professional judgment you could walk out of that interview room believing that you must have gotten your facts wrong only to read the file again and check in with the senior probation officer and realize he duped you. You really have to experience it to believe it. **It might surprise you to learn that I don't have a clue who is and who is not a psychopath, even after four years of working full time with them in prison and thirty years of academic research. I'm just not that fast on the uptake in this arena. If I met you for the first time and we chatted for an hour, I would be none the wiser as to whether you were a psychopath or not**."

When I want to know who did what, before I pop the question I tell them that it's important to be honest and they should promise to tell the truth. **Research indicates that getting young children to talk about moral issues first and then asking them to promise to tell the truth significantly encourages a truthful answer—**boosting lie detection accuracy from 40 percent to 60 percent.

"Lying involves theory of mind. When I lie to you about where I was at eleven p.m. on Wednesday, January 7, I need to have an understanding of what you know about the facts of the case and what you do not know. I need to have a sense of what you think is plausible, and what is not. [...] **Liars [...] sit still and suppress motor activity because they are cognitively focusing on their story**. All of their processing resources are going into this activity. Suppression requires prefrontal regulation of the motor and somatosensory areas of the brain that control motor and body movements. [...] throughout childhood there is massive expansion of brain size. Brain weight reaches adult values between the ages of ten and twelve, with a very significant increase in the absolute

volume of white matter by this age. We also know that children become most adept at lying at the same time—by ten years of age. [...] Practicing lying in childhood might particularly enhance prefrontal white matter."

Chapter 6 - Natural Born Killers: Early Health Influences

"Our brains need oxygen to metabolize glucose—a fuel that provides energy for brain cells. Without oxygen, brain cells will start to die in a few minutes. [...] **Hypoxia at birth was also found in one study to be the best predictor of a lack of self-control**"

The life of a young English boy born during the Edwardian era, in 1907, offers a poignant insight. John Bowlby was a Londoner who saw his mother for just one hour a day. She thought that a child could be spoiled by too much attention and affection. When he was seven years old Bowlby was packed off to a boarding school, and by his own account had a terrible time there. In his words, "I wouldn't send a dog away to boarding school at age seven." [...] In those early days of delinquency research he made the innovative argument that the lack of a continuous and loving relationship between mother and infant resulted in the inability of the infant to develop a normal personality, and the inability to form normal interpersonal relationships. [...] there is a critical period early in life when being connected with the mother really counts. In humans this starts at about six months and ends after about two years. For this reason breakage of the mother-infant bonding process for at least four months in the first year of life—as experienced by some of our Copenhagen babies freezes the social—interpersonal development of the infant.

"The higher the testosterone exposure, the longer the size of the ring finger relative to the index finger. Hence men have a relatively longer ring finger than women. [...] Women who have larger waists relative to their hips often have higher testosterone levels, and such women have been found in turn to give birth to children with relatively longer ring fingers. [...] What do we know about people with a more male-like, longer ring finger? For one thing they tend to dominate, show physical advantages, have male-like characteristics, and have personalities linked to aggression. [...] Another correlate of the long ring finger is sensation-seeking and impulsivity [...] Although the evidence is conflicting, men with a longer ring finger tend to have higher attractiveness ratings."

"if a mother smokes during pregnancy it not only has negative consequences on brain development, but it also leads to increased rates of conduct disorder and aggression in her offspring. [...] **Every puff counts. Studies repeatedly show that the more cigarettes the mother smokes, the greater the odds of antisocial behavior in her offspring**. [...] Prenatal nicotine exposure, even at relatively low levels, disrupts the development of the noradrenergic neurotransmitter system. [...] Reduction of noradrenergic functioning caused by smoking would be expected to disrupt sympathetic nervous system activity."

“There are four features of **fetal alcohol syndrome** as first established by the pediatrician Kenneth Jones in 1973: exposure to alcohol during pregnancy, craniofacial abnormalities, growth retardation, and central nervous system (CNS) dysfunction as evidenced by learning disabilities or low IQ. [...] Although fetal alcohol syndrome is relatively rare, Streissguth was able to obtain an incredible 473 cases of either fetal alcohol syndrome or fetal alcohol effects from the Pacific Northwest, and assessed outcomes for antisocial behavior at age fourteen. A full 61 percent of the sample evidenced juvenile delinquency. Sixty percent were expelled or suspended from school. Forty-five percent showed some form of inappropriate sexual behavior, such as incest, sex with animals, or masturbation in public. More than half of the boys and 33 percent of the girls went on to be arrested or convicted for their offending.”

“**Poorer executive functions are also an almost inevitable consequence of fetal alcohol syndrome**. Experiments on animals have demonstrated that during the latter half of pregnancy, when the brain is rapidly developing, alcohol exposure results in a loss of neurons. It also affects glutamatergic neurotransmitter functioning, which in turn reduces hippocampal plasticity and the ability to learn. ... just one alcoholic drink a week during pregnancy was enough to raise the odds of aggression and delinquency in the children.”

Chapter 7 - A Recipe For Violence: Malnutrition, Metals, And Mental Health

“Those exposed to the famine were two and a half times more likely to develop antisocial personality disorder in adulthood than those not exposed to the famine. The effects being especially true if the food shortage occurred during the first or second trimester of pregnancy. [...] lack of iron, zinc, protein, riboflavin, and omega-3 in our diets may dump some of us into the violence trash bin.”

“malnourished kids had higher scores on all dimensions of what we call "externalizing behavior"—aggression, delinquency, and hyperactivity.”

“**iron is involved in DNA synthesis, neurotransmitter production and functioning," and white-matter formation in the brain**. [...] Experimental studies that have supplemented children's diets with iron show improved cognitive functioning. [...] **vitamin B2, enhances the hematological response to iron**. Consequently, riboflavin deficiency would reduce iron and further negatively affect cognition.”

“**The greater the fish consumption, the lower the homicide rate**. [...] women who ate more fish during pregnancy had offspring who showed significantly higher levels of prosocial behavior at age seven. [...] Omega-3 has two important components-DHA (docosahexaenoic acid) and EPA (eicosapentaenoic acid). What does DHA do? It is known to play a key role in

neuronal structure and function. Making up 6 percent of the dry cerebral cortex, it influences the functioning of the blood-brain barrier that regulates what gets into your brain from your bloodstream. It enhances synaptic functioning, facilitating communication between brain cells. It makes up 30 percent of the membrane of your brain cell and regulates the activity of membrane enzymes. It protects the neuron from cell death It increases the size of the cell. DHA also stimulates neurite outgrowth. There is more intricate dendritic branching in the neurons of animals fed a diet rich in omega-3 compared with those fed a normal diet. Dendrites of the cell receive signals from other brain cells, so this dendritic branching translates to more connectedness between cells. The axon that transmits the electrical signal to other cells is longer and has a better sheath to conduct the electrical impulse. DHA regulates serotonin and dopamine neurotransmitters [...] offenders have abnormalities in those neurotransmitters. We also know that DHA is involved in regulating gene expression, so in theory it can help turn on genes that protect against violence—or turn off genes that increase the probability of violence."

"up to one half of all the children in the world have iron or zinc deficiency."

"If as a kid you had acne or if you had white spots on your fingernails, as I did, you can suspect zinc deficiency. [...] Preschoolers with low iron also show a reduction in positive emotions. [...] iron and zinc are critical for the production of neurotransmitters [...] The amygdala and hippocampus, which are impaired in offenders, are packed with zinc-containing neurons. Zinc deficiency in humans during pregnancy can in turn impair DNA, RNA, and protein synthesis during brain development—the building blocks of brain chemistry—and may result in very early brain abnormalities. [...] up to 30 percent of pregnant mothers with low socioeconomic status are believed to be iron-deficient. Smoking during pregnancy also impairs the transportation of zinc from the mother to her fetus, depriving the fetal brain of a key nutrient. [...] Eight of our twenty-two amino acids are essential because our bodies cannot produce them. [...] **high-tryptophan food reduces their aggressive behavior. When tryptophan is experimentally reduced in men and women, they respond more aggressively when provoked**. Reversing that scenario, when tryptophan is enhanced, aggressive behavior is reduced. [...] Low tryptophan likely increases aggression because it impairs the brain's ability to inhibit responses that we should not make. Brain-imaging research has shown that reducing tryptophan reduces functioning in the orbital and inferior regions of the right prefrontal cortex when subjects try to refrain from making a response to a stimulus. We saw earlier that this underneath part of the prefrontal cortex is functionally and structurally impaired in offenders. Because serotonin is synthesized from tryptophan, the amino acid likely predisposes someone to reactive aggression by lowering brain serotonin, the neurotransmitter [...] depleted in impulsive violent offenders. Where does tryptophan come from? Foods like spinach, fish, and turkey."

"one early controversial study—a two-year double-blind controlled study of

twelve- to eighteen-year-old delinquents—obtained a **48 percent reduction in disciplinary offenses after diets were altered in order to reduce refined carbohydrates**. Experimental studies in animals have also demonstrated a causal relationship between low blood sugar and aggression in rats."

"**violent offenders were more prone to hypoglycemia. [...] low blood-sugar levels**. [...] Diets high in refined carbohydrates can cause extreme fluctuations in blood glucose levels [...] Because of the fiber loss, they are rapidly absorbed by the gut, resulting in a large and rapid increase of glucose swishing around in the bloodstream. This in turn triggers an inappropriately large secretion of insulin. **Insulin's job is to soak up the excess glucose and convert it into glycogen so that surplus energy can be stored for future use. But too much insulin release results in too much of the available glucose being taken out of circulation**. This is bad news for the brain, which requires at least 80 milligrams of glucose a minute to function efficiently. Drop below that mark and you progressively observe symptoms of nervousness and irritability. [...] **kids who ate sweets every day were three times more likely to become violent by age thirty-four**."

"An early postnatal source of manganese is soy infant formula, which has eighty times the amount of manganese that natural breast milk has. It's possible that the **higher IQs found in breast-fed babies may be due to formula-fed babies' being exposed to high manganese**, because manganese excretion is controlled by the liver. The livers of babies are underdeveloped, and consequently they are less able to excrete manganese. The excessive manganese could then result in poorer brain functioning and lower IQs. Put the two together and you begin to build a recipe for violence. **Pregnant mothers have a tendency to have low iron. This will result in increased manganese exposure to the fetuses**."

"Large-scale epidemiological studies from many countries around the world now attest to the fact that **schizophrenia patients are much more likely than normal controls to have a history of violent and criminal behavior**. Turning the issue around, delinquent and criminal populations are more likely to show higher rates of psychotic disorders than the general population. This relationship between violence and schizophrenia is not weak. **If you are a schizophrenic male, you are three times more likely to kill than someone of the same social background and marital status who is not schizophrenic**. **If you are a female schizophrenic, you are twenty-two times more likely to kill than a nonschizophrenic female**."

"There are two very important caveats to repeat, however. First, **most schizophrenics neither kill nor are dangerous to others. We should take care not to stigmatize patients with schizophrenia or schizoid personality as both "mad and bad."** At the same time, we need to recognize the raised rates of violence in schizophrenics so that they can receive treatment to reduce the likelihood of violence, and thus reduce the stigma. Second, there are many

other mental disorders—including depression, bipolar disorder, ADHD, and borderline personality disorder—that are also significant mental-health risk factors for violence. It does not stop with schizophrenia, and of course alcohol and drug use are also major mental-health disorders that increase che risk of violence."

Chapter 8 - The Biological Jigsaw Puzzle: Putting The Pieces Together

"I have always been a bit contrarian—my first research papers focused on biosocial interactions in explaining antisocial behavior, something radically different from the prevailing perspective in the 1970s, which was dominated by radical criminology espousing Marxist viewpoints."

"if you were just brought up in an unstable home environment you have a 20 percent chance of committing violence. But when minor physical anomalies are added into the mix, that rate jumps to 70 percent—a threefold increase, just as we witnessed when birth complications interact with maternal rejection."

"prenatal smoking doubled the rate of violence in adulthood in an enormous sample of 5,636 men. Yet if this biological risk factor was combined with teenage pregnancy, unwanted pregnancy, and slow neuromotor development, that baby was a staggering fourteen times as likely to become a persistent adult offender."

"if you have high testosterone levels and a deviant peer group you may become conduct disordered—yet if you have that same high testosterone and circulate in a non-deviant peer group you are instead led to become a leader. Genes also combine with ghastly parenting to shape adolescent aggressive behavior. **However you look at it, studies are showing that when biological and social factors interact, they can be far more malignant than any one factor on its own**."

"Where an antisocial child *lacks* social factors that "push," or predispose him to antisocial behavior, then biological factors may be the more likely explanation. In contrast, social causes of criminal behavior may be more important explanations of antisociality in those exposed to adverse early home conditions."

"How exactly do these genes produce aberrant brain conditions that predispose someone to violence? Recall the low MAOA-antisocial link. Males with this genetic makeup have an 8 percent reduction in the volume of the amygdala, the anterior cingulate, and the orbitofrontal cortex. We know that these brain structures are involved in emotion and are compromised in criminals. From genes to brain to offending. Let's take the BDNF gene as another example. **BDNF—brain-derived neurotrophic factor—is a protein that promotes the survival and structure of neurons and influences**

dendrite growth. Because mutant mice bred to have reduced BDNF have a thinner cortex due to neuronal shrinkage, we know that BDNF maintains neural size and dendritic structure. **BDNF promotes the growth and size of the hippocampus**, which regulates aggression. BDNF also promotes cognitive functions, as well as fear conditioning and anxiety. Given that offenders have poor fear conditioning, blunted emotions, and reduced volume of prefrontal gray matter, there is no surprise that the genotype conferring **low BDNF is associated with increased impulsive aggression in humans**. Mice made deficient in BDNF become highly aggressive and prone to risk-taking, just like their human counterparts."

"If a homicide took place in the child's block four days before testing, it reduced reading scores by almost ten points—or two-thirds of a standard deviation. Similarly, it reduced vocabulary scores by half a standard deviation."

excessive release of cortisol in response to stress is neurotoxic to pyramidal cells in the hippocampus a brain region critical for learning and memory. It kills them off.

"**low verbal IQ is an extremely long-standing and well-replicated correlate of crime**. It has also been documented that African-Americans have lower verbal IQs than Caucasians, as well as higher homicide rates. Sharkey and Sampson have argued that over time, living in a disadvantaged neighborhood reduces the verbal ability of African-American children by about 4 points. Because a year of schooling is thought to result in IQ improvements of between 2 and 4 points, the 4-point drop resulting from a neighborhood homicide is the equivalent of missing a year or more of schooling. **Mess up schooling, and you mess up employment prospects, and we know that after that, adult crime and violence are not far down the road**."

"the underlying structure of the DNA—the nucleotide sequence—remains relatively fixed. But the chromatin proteins that DNA wraps itself around may be altered by the amino acids that make up these proteins. **Proteins can be turned on—or turned off—by the environment**. That alters how the DNA is transcribed and how the genetic material is activated. Methylation—the chemical addition of a methyl group to cytosine, which is one of the four bases of DNA—can also increase or decrease gene expression."

rat pups whose mothers licked and groomed them more in their first ten days of life showed changes in gene expression in the hippocampus. They also dealt better with environmental stressors.

"Protein malnutrition during pregnancy doesn't just alter gene expression in the offspring; the offspring's offspring the grandchildren develop abnormal metabolism even when their own parents were fed quite normally. So the environment not only changes gene expression in the individual it also has permanent effects that transmit to the next generation. The exciting concept

here is that **although 50 percent of the variation in antisocial behavior is genetic in origin, these genes are not fixed. Social influences result in modifications to DNA that have truly profound influences on future neuronal functioning and hence on the future of violence.** We can place these alterations in gene expression into a much broader social context of how abuse and deprivation have foundational, long-lasting effects on the brain—over and above any epigenetic effects. Early social, emotional, and nutritional deprivation in humans has been shown to result in reduced functioning of the orbitofrontal cortex, the infralimbic prefrontal cortex, the hippocampus, the amygdala, and the lateral temporal cortex. It also disrupts white-matter connectivity in the brain—particularly the uncinate fasciculus, a fan-like white-matter tract that connects frontal brain regions to the amygdala and temporal brain areas to the limbic areas. **Prolonged and chronic stress, including disrupted or poor mothering, disrupts the brain's stress-response system. That results in excessive glucocorticoid release, a reduction in glucocorticoid receptors, an imbalance in the brain's stress-defense mechanisms, and ultimately brain degeneration**. Deprivation makes a big dent on the brain. There are also vulnerable periods when stress can take a greater toll on different parts of the brain. **If sexual abuse occurs early, at around ages three to five, for example, hippocampal volumes are reduced. Yet if sex abuse occurs at age fourteen to sixteen, prefrontal cortical volume is reduced instead**. This is broadly consistent with the fact that the hippocampus reaches full maturity early in life and is very much affected by excessive release of cortisol in response to stress."

"Violence is an enormously complex and multilayered construct. A complete understanding of its neural basis is certainly going to involve multiple distributed brain processes that in turn give rise to broad social and psychological processes that predispose someone to violence."

"brain risk factors are not conceptualized as directly causing aggressive behavior, but instead bias thoughts, feelings, and actions in an antisocial direction that then results in violence. Let's start [...] with **cognitive processes**. Here we can see the involvement of the ventromedial prefrontal cortex, the medial-polar prefrontal regions, the angular gyrus, and the anterior and posterior cingulate. Impairment to these regions results in poor planning and organization, impaired attention, the inability to shift response strategies, poor cognitive appraisal of emotion, poor decision-making, impaired self-reflection, and reduced capacity to adequately process rewards and punishments. These cognitive impairments translate into social elements that lead to crime poor occupational and social functioning, noncompliance with societal rules, insensitivity to punishment cues that guide behavior, bad life decisions, poor cognitive control over aggressive thoughts and feelings, overreaction to minor irritations, lack of insight, and school failure."

"Turning to the **affective processing deficits** [...] the neural structures I have highlighted are the amygdala, hippocampal complex, the insula, the anterior

cingulate, and the superior temporal gyrus. Impairments to these regions can result in an inability to understand the mental states of others, learning and memory impairments,
lack of disgust, impaired moral decision-
making, lack of guilt and embarrassment, lack of empathy, poor fear conditioning, poor emotion regulation, and reduction in uncomfortable emotions associated with moral transgressions."

"At the **motor level** on the right-hand side of the figure, brain areas include the dorsolateral prefrontal cortex, orbitofrontal cortex, and the inferior frontal cortex. Brain impairments here result in response per-severation, motor impairments involving a failure to inhibit inappropriate responses, impulsivity, the failure to shift response sets and passively avoid punishment, and motor excess."

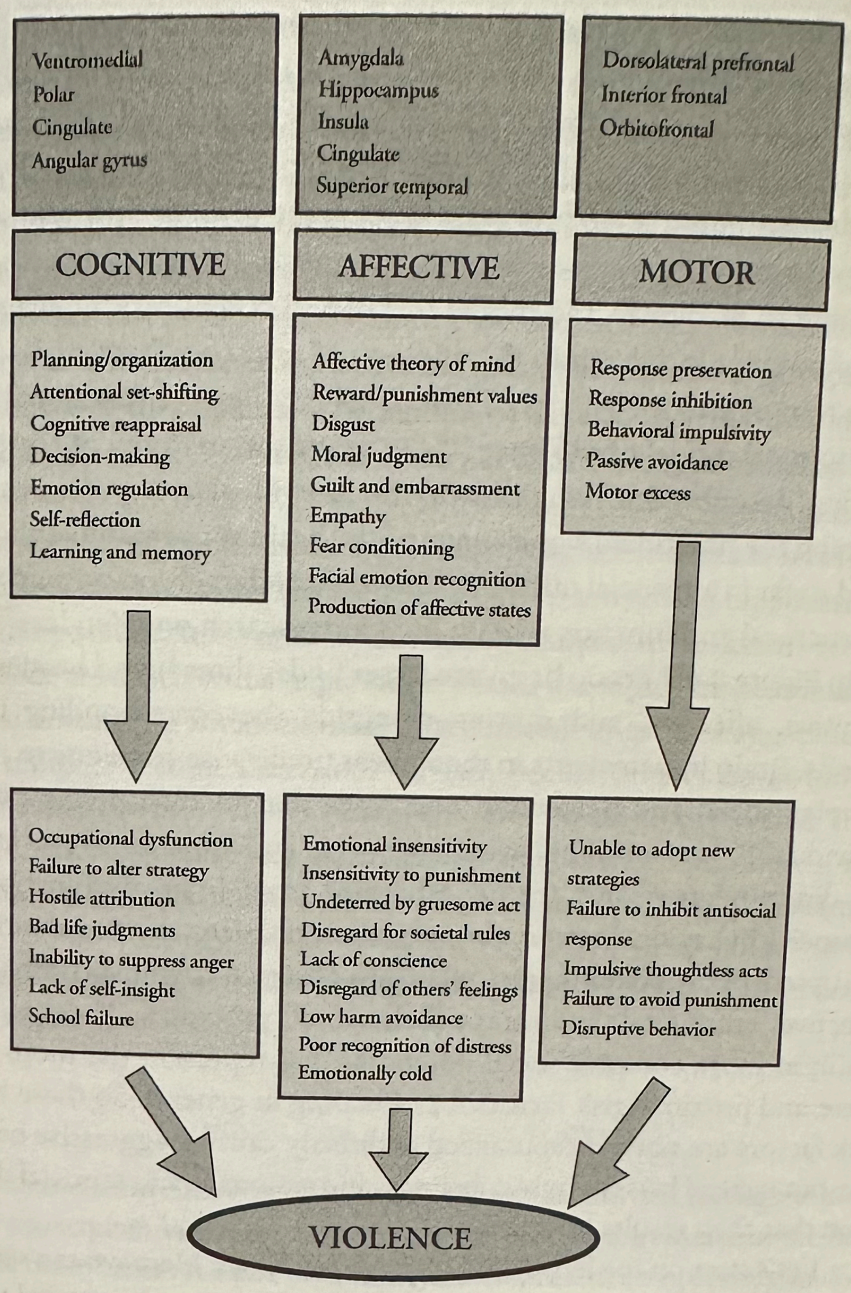


Figure 8.6 Functional neuroanatomical model of violence highlighting cognitive, affective, and motor processes

Chapter 9 - Curing Crime: Biological Interventions

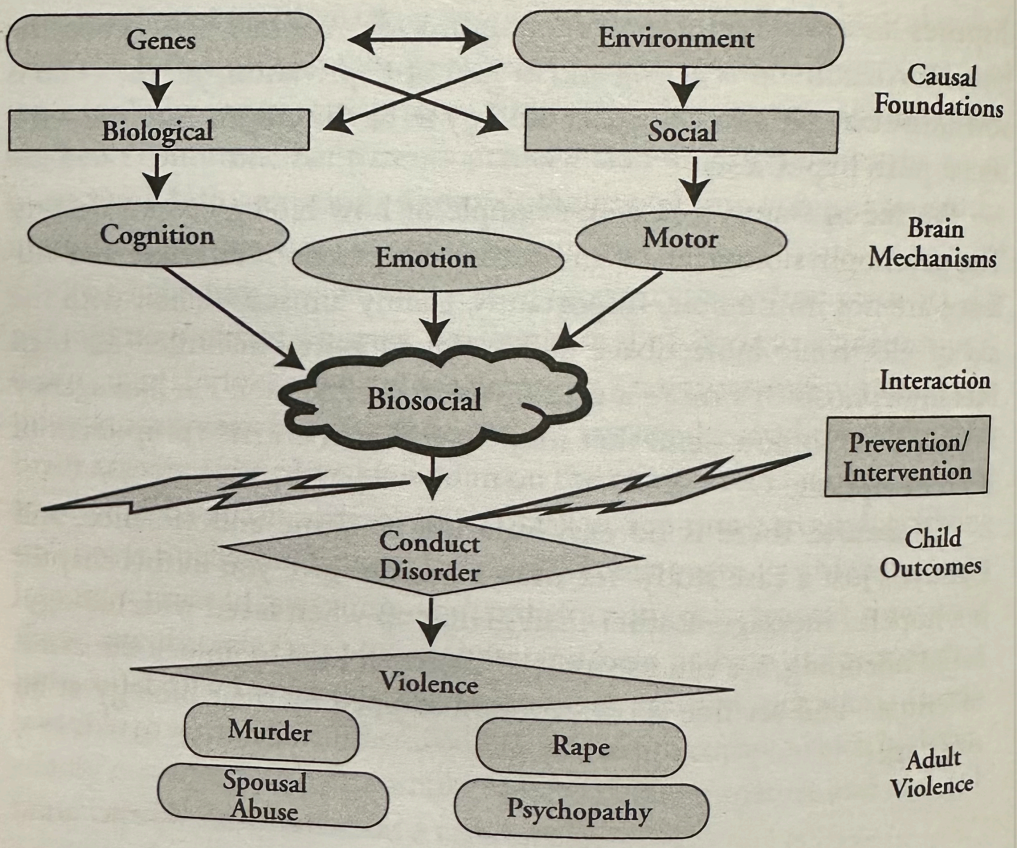


Figure 9.1 Biosocial model of violence

"Brain waves can be grouped into four basic frequency bands. Right now, as you are reading this, fast-wave beta activity predominates because your brain is aroused and activated, scanning this page, absorbing the text, and forming associations. When you are relaxed, alpha predominates. When you are asleep, however, slow-wave delta activity takes over. When you are awake but not very alert, you have more sluggish theta activity. Children in general have relatively more slow-wave theta activity because their brains are immature and still developing. We found that children from the environmentally enriched group showed significantly less theta activity than the controls six years after the intervention had finished. Their brains had matured more and become more aroused. In developmental terms their brains were I. years older than those of the controls.

We then followed the children up for another six years, and behavior problems were assessed at age seventeen. The enriched children had significantly lower scores on ratings of conduct disorder and hyperactivity. They were less cruel to others, not so likely to pick fights, not so hot-tempered, and less likely to bully other children. In addition, they were less likely to be bouncing around the place and seeking out stimulation."

"Early nutrition status *moderates* the relationship between the prevention

program and the antisocial outcome. It works in one group but not in another. Recall that the prevention program had a lot of ingredients. If nutrition was the active ingredient, you'd expect the program to work more in kids who had poor nutrition at the get-go and that's exactly what we found."

"The authoritarian Queen of Hearts in Lewis Carroll's Alice's Adventures in Wonderland was a wayward woman with a radical way of dealing with even the smallest of difficulties. "Off with their heads" was her simple solution to every misdemeanor. Although quite heartless, the Queen of Hearts was on the anatomical road to addressing one of the most difficult to treat classes of violent criminals—pedophiles and sex offenders. Surgical castration is the simple, radical, and highly controversial solution some authorities resorted to in order to reduce recidivism rates of ser offenders. Is this a mindless and unethical policy that should be halted? Or does it get to the heart of the matter and provide a workable solution to an intractable problem?
Surgical castration still continues in Germany, ever since a law was passed in 1970 allowing it. It's a voluntary procedure, and only a few are performed every year. Because it sounds barbaric and is so easy to condemn, the German government has put several safeguards in place to regulate it. The offender has to be over twenty-five, and approval is needed from a panel of experts. Nevertheless, it remains a controversial practice in Europe. The Council of Europe's anti-torture committee in Strasbourg, for instance, views it as a degrading treatment that should be halted."

Chapter 11 - The Future: Where Will Neurocriminology Take Us?

[Final words from the book...]

"My sincere hope is that you will not turn a blind eye to the science [...] Nevertheless, you may be completely convinced that the fundamental message of the anatomy of violence is profoundly misguided. But if you happen to be a Christian, consider the words of Oliver Cromwell when he spoke to the Church of Scotland against its intended alliance with King Charles II:

I beseech you, in the bowels of Christ, think it possible that you might be mistaken.

And if you are not a Christian, I beseech you in your own bowels—or any other part of your anatomy that you choose—to consider that we all have the capacity to be wrong. In dissecting the anatomy of violence, I have that capacity—don't you too? More important than persuasion and conviction is open discussion, laying forth scientific reality, and allowing society to judiciously choose how to reasonably act in the ensuing light. My sincere hope is that our discussion will continue in the forthcoming decades and move us all into a safer and more humane society."

These notes were collected by psychotherapist and author Emil Barna in his efforts to assist with professional development and further education for himself and those who read them. You can find out more about Emil by visiting www.barnacc.com

"A text without a context is a pretext to a proof text."
—Dr. Don Carson