

# Biological Influences on Criminal Behavior

# 5



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## Learning Outcomes

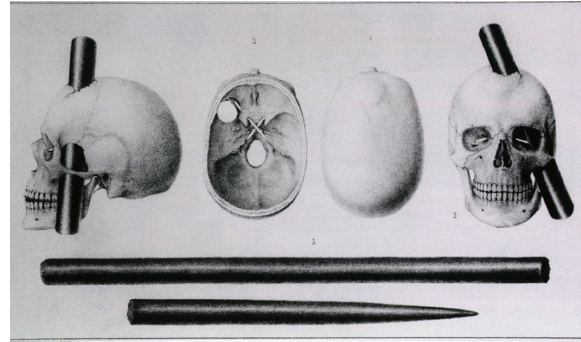
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After reading this chapter, you should be able to

- Examine the biological risk factors that are likely linked to crime.
- Recognize why the study of executive functioning in criminals is important for understanding the neuropsychological causes of criminal behavior.
- Discuss whether there is a genetic susceptibility to engage in criminal behavior.
- Explain how temperament could affect both prosocial and antisocial behavior.
- Describe how personality develops and can be linked to criminal behavior.
- Explore how criminal behavior could be predicted and reinforced by a rise or change in hormones.

## Introductory Case Study: Phineas Gage

*On September 13, 1848, Phineas Gage was injured in a railroad accident when a tamping iron blasted through his face, skull, and brain and exited his head. Despite losing consciousness and suffering heavy bleeding, Gage not only survived the blast but appeared to recover quickly. However, that recovery was largely limited to his physical health. The accident caused a dramatic personality transformation in Gage. He shifted from a hardworking, responsible, intelligent, prudent, and socially well-adjusted person to an irreverent, impulsive, capricious, rowdy, irresponsible person whose life devolved into that of a drifter. This amazing case was immortalized by John Harlow in 1868 in perhaps the most interestingly titled academic paper ever: "Recovery From the Passage of an Iron Bar Through the Head."*



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**Various views of the famous wound in the skull of railroad worker Phineas Gage and the iron rod that pierced his skull.**

*The well-known case study of Phineas Gage is often used to demonstrate that the brain is the anatomical seat of personality as well as social and emotional functioning. In addition, the case demonstrates the intimate bond between environment and person for understanding behavior. Prior to the accident, Gage was—in the parlance of Gottfredson and Hirschi (1990)—a person with high self-control. As a result, he was a dependable, functioning member of society. After the accident damaged his brain, Gage was someone who epitomized the concept of low self-control; he had difficulty maintaining employment and seemed to lose his place as a contributing member of society.*

*In 1994 neuroscientist Hanna Damasio and her colleagues resurrected the case and examined Gage's skull with neuroimaging techniques to ascertain which brain areas affected Gage's decision making and emotional processing. Damasio and her colleagues concluded that Gage's injuries were consistent with those of persons with similar injuries who display similar impairments in rational decision making and emotional processing. The case shows simultaneously that self-control is a brain-based construct and that a random environmental accident can undo that same brain-based construct (Damasio, Grabowski, Frank, Galaburda, & Damasio, 1994).*

*As you read this chapter, consider the following questions regarding this case:*

- 1. Are criminal brains different from noncriminal brains?*
- 2. To what extent is criminal behavior learned, and to what extent is it inherited?*
- 3. What are the implications of the Phineas Gage case? Is it fair to say that we are all capable of engaging in similar behaviors?*

## 5.1 Introduction

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Are criminals “born,” or are criminals “made”? What is the relationship, if any, between brain deficits and criminal behavior? Do people have a genetic predisposition to commit crimes? Or is criminal behavior more likely to be influenced by social factors?

As a field, criminology has historically focused on social and psychological influences that lead to criminal behavior. While research supports these factors as important predictors of crime, an increasing amount of research has demonstrated that biological factors may also contribute to the perpetration of crime. This chapter will explore how the brain, genetics, temperament, personality, and hormones might influence criminal behavior. While the research presented in this chapter is in no way exhaustive, it is intended to provide a sample of the biological influences that appear to be related to criminal behavior.

It should be noted that genetic and other environmental factors are not an “excuse” for criminal behavior. Victims of crime experience no less harm if the perpetrator was predisposed toward the behavior for biological, environmental, social, or other factors. Nonetheless, it is important to continually research and attempt to understand the biological risk factors that have been linked to crime, if for no other reason than to learn how to reduce that risk.

## 5.2 The Brain and Criminal Behavior

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Similar to psychological, social, and environmental factors, there is no single biological factor that can effectively predict future criminal behavior. However, a considerable amount of research has centered on examining the differences in brain functioning between people who commit crimes and those who do not engage in criminal behavior. As a result of this literature, there is abundant evidence related to the impacts of executive functioning and neurological deficits.

### Executive Functioning

The **cognitive** processes (connected with thinking or conscious mental processes) that serve to protect individuals from engaging in inappropriate or criminal behavior are broadly referred to as *executive functions*. **Executive functions** are a set of cognitive processes such as memory, attention, planning, and emotional and behavioral regulation that are essential for the cognitive control of behavior (see Figure 5.1).

### Figure 5.1: Executive functions

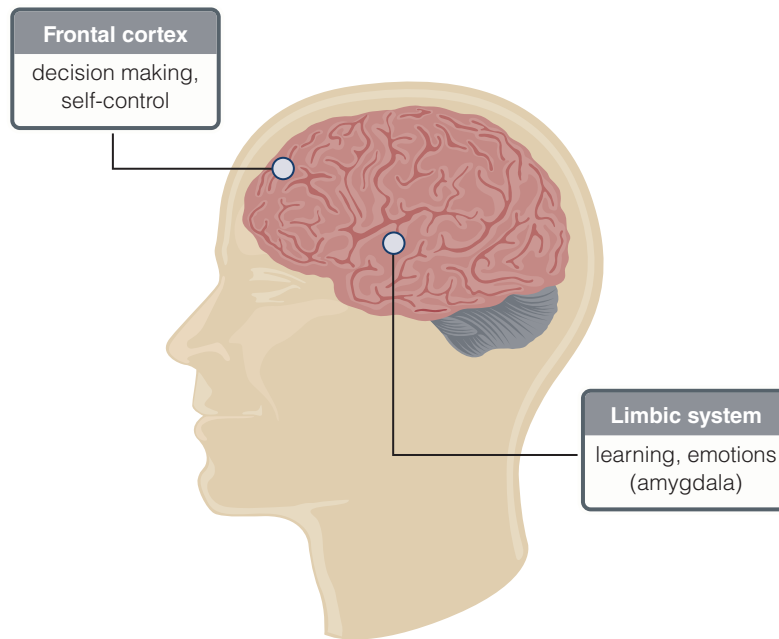
Neuropsychologists have shown that executive functions are profoundly related to the social, cognitive, and behavioral skills required to regulate behavior.



Neurologically, executive functioning occurs in the **prefrontal cortex**, the part of the frontal lobe of the brain that is involved in complex behaviors such as planning and decision making. The **frontal lobe** of the brain houses higher order cognitive functions that regulate the emotional stimuli that come from the **limbic system**, a complex system of networks and nerves in the brain involved in basic emotions and drives (see Figure 5.2).

### Figure 5.2: Frontal lobe, limbic system, and behavior

The limbic system is a complex system of networks and nerves in the brain involved in basic emotions and drives. The frontal cortex is the brain region primarily involved in decision making and personality expression.



In a way, executive functioning is similar to the adult part of the brain that must behave responsibly, prudently, and intelligently, even when more irresponsible emotions are felt. The irresponsible emotions that originate from the limbic system are the child part of the brain—imprudent and often lacking foresight.

Thinking of the brain in adult and child terms is useful for understanding the development of specific brain regions (e.g., the prefrontal cortex) and the social cognitive processes that occur in those regions. Impulsivity generally diminishes with age because of protracted development of the prefrontal cortex. Because impulsivity is central to multiple behavioral disorders, it is important to determine neural commonalities and differences across disorders.



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**The brain can be explained using the analogy of a parent and child, with the executive function taking on the rational and responsible role of a parent and the limbic system giving rise to the impulses of a child.**

Katya Rubia et al. (2008) conducted a study that compared brain activation of 13 boys with conduct disorder, 20 boys with **attention-deficit/hyperactivity disorder (ADHD)** (a disorder defined by a persistent pattern of inattention and/or hyperactivity or impulsivity that interferes with functioning or development), and 20 boys without a disorder. They found that both boys with ADHD and boys with conduct disorder had distinct brain abnormality patterns during inhibitory control (i.e., times when they were asked to control automatic, or impulsive, responses). However, boys with ADHD displayed differences in prefrontal regions, whereas boys with conduct disorder had differences in the posterior temporal parietal lobe. Though we won't go into detail about the parts of the brain here, the importance of this study is that the disorders—which are often **comorbid** (in other words, occurring together)—have distinct underlying neural abnormalities.

Given the importance of executive functioning for behavioral regulation, it is clear that these neurocognitive processes are related to crime. In her seminal literature review, Moffitt (1990) observed:

The normal functions of the frontal lobes of the brain include sustaining attention and concentration, abstract reasoning and concept formation, goal formulation, anticipation and planning, programming and initiation of purposive sequences of motor behavior, effective self-monitoring of behavior and self-awareness, and inhibition of unsuccessful, inappropriate, or impulsive behaviors, with adaptive shifting to alternative behaviors. These functions are commonly referred to as “executive functions,” and they hold consequent implications for social judgment, self-control, responsiveness to punishment, and ethical behavior. (p. 115)

Indeed, recent research suggests that mainstream criminological theories—such as Gottfredson and Hirschi's (1990) general theory based on self-control—are actually proxies of executive functioning. Drawing on data from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–1999, Beaver, Wright, and DeLisi (2007) found that executive functioning as measured by fine motor skills and gross motor skills was significantly related to childhood self-control even while controlling for the effects of parental involvement, parental withdrawal, parental affection, family rules, physical punishment, neighborhood disadvantage, gender, race, and prior self-control. Children with poorer executive functioning had lower self-control (which is, of course, a robust predictor of antisocial conduct), which increased the risk for poor self-regulation and conduct problems.

A suite of biosocial factors contributes to executive functioning. First, the assorted executive functions are strongly heritable, which means that variance in these functions is attributable to genetic factors. For example, Naomi Friedman and her colleagues at the Institute for Behavioral Genetics at the University of Colorado Boulder examined sources of variance in three executive functions: response inhibition, updating working memory representations, and set shifting (which is similar to multitasking). They found that these executive functions are influenced by a common factor that is 99% heritable, making executive functioning among the most heritable psychological constructs (Friedman, Miyake, Young, DeFries, Corley, & Hewitt, 2008). Second, early life environmental risk factors also negatively affect executive functioning. These include poor nutrition, physical abuse, unsafe home environments that may lead to accidents, and overall family dysfunction. Fortunately, these early home problems are specific targets of prevention programs that serve to forestall the development of serious criminality.

## Neuropsychological Deficits

When executive functioning is less than optimal, psychological criminologists focus on the particular problems or deficits that are associated with antisocial conduct. Commonly referred to as **neuropsychological deficits**, these are brain-based deficits in social cognitive processes that are risk factors for conduct problems and related maladaptive behaviors such as problems in school. Neuropsychological deficits are importantly related to antisocial behavior both theoretically and empirically; they are the primary causal force in the severe antisocial development of offenders in Moffitt's (1993) developmental taxonomy (i.e., classification). Syngelaki, Moore, Savage, Fairchild, and Van Goozen (2009) observed, "Violent or antisocial people often display disinhibited, impulsive, and risk-taking behaviors with little concern for the consequences of their actions. Moreover, they seem unable to learn from their mistakes (this particularly applies to individuals with psychopathic characteristics)" (p. 1203).

Research from an array of studies has shown that neuropsychological deficits are associated with criminal behavior and are particularly characteristic of the social cognitive profiles of persons with behavioral disorders (Beaver, Vaughn, DeLisi, Barnes, & Boutwell, 2011; Raine et al., 2005; Séguin, 2004; Syngelaki et al., 2009). For example, Raine and his colleagues (2005) found that neuropsychological deficits were an important causal factor, meaning that early life social cognitive functioning portends a lifetime of severe conduct problems. Morgan and Lilienfeld (2000) conducted a meta-analysis of 39 studies that encompassed 4,589 participants who had antisocial personality disorder (APD), conduct disorder, psychopathy, delinquent status, or offender status. The meta-analysis found that antisocial groups performed significantly worse on executive functioning tests than the control groups did.

Ogilvie, Stewart, Chan, and Shum (2011) conducted a significantly larger meta-analysis of studies that explored the linkages between neuropsychological deficits, executive functioning, and antisocial behavior. Building on work by Morgan and Lilienfeld (2000), Ogilvie and his colleagues examined 126 studies that involved 14,784 participants. The researchers reported results indicating that antisocial individuals have greater neuropsychological deficits than their conventional peers. Overall, the researchers concluded that the relationship between executive dysfunction or neuropsychological deficits and various forms of antisocial behavior is robust.

### *Research on Inattention*

An important neuropsychological deficit is inattention. Attention to one's environment is essential across contexts but is particularly important for academic success and school functioning. This means that severely inattentive individuals are at risk for school problems that in turn often correlate with antisocial conduct. Examples of the importance of attention include being able to give close consideration to detail, sustaining focus long enough to complete a task or lesson, listening when spoken to, sustaining mental effort, and ignoring



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**Individuals with attention problems have difficulty ignoring external stimuli and are much more likely to exhibit antisocial behavior than those who can remain focused.**

extraneous stimuli. Inattention distinguishes children in terms of their school performance and antisocial personality traits.

For example, a study of a community sample of more than 430 middle school students was used to explore inattention in children (DeLisi et al., 2011). About 72% of children had no attention problems and could focus appropriately. These children were prosocial and displayed little risk for delinquency. Two smaller groups displayed inattention that was consistent with ADHD predominantly inattentive type and ADHD predominantly hyperactive-impulsive type. About 10% of the sample had the greatest neuropsychological deficits, especially relating to inattention, and had traits consistent with ADHD combined type (i.e., both inattention and hyperactive-impulsive behavior was present). Moreover, the latter group had the worst school performance as evidenced by three standardized tests, was more callous and unemotional, and was the most psychopathic. Consequently, it can be assumed that this latter group would be at the greatest risk for future antisocial behavior.

### *Research on Etiology of Neuropsychological Deficits*

Due to the important links between neuropsychological deficits and crime, a pressing research area focuses on the etiological processes that result in these deficits. Research findings from nationally representative, large-scale studies are illuminating. Using data from the National Survey of Children, Ratchford and Beaver (2009) found that birth complications and low birth weight were significantly associated with neuropsychological deficits (which in turn predicted low self-control). Three socialization and situational risk factors—parental punishment, family rules, and neighborhood disadvantage—were not predictive of neuropsychological deficits. In a study based on data from the National Longitudinal Study of Adolescent Health, Beaver, Vaughn, DeLisi, and Higgins (2010) examined a host of biosocial causes of neuropsychological deficits and found that exposure to cigarette smoke, brief duration of breastfeeding, low maternal involvement, non-White racial status, and low household income were predictive of neuropsychological deficits.

### *Research on Brain Lesions*

A final source of evidence about the importance of neuropsychological deficits to antisocial behavior stems from brain lesion studies. Persons who develop or incur brain lesions in the orbitofrontal cortex (OFC; the part of the prefrontal cortex that is located behind the eye sockets) are behaviorally similar to antisocial individuals in that they are impulsive, socially inappropriate, irresponsible, unable to read others' moods and motivations, and uninhibited. Indeed, according to Séguin (2004):

The parallels between the effects of OFC lesions on social behavior and the symptoms of antisocial disorders are striking. It is not surprising then that questions about the underpinnings of antisocial disorders have been sought through a frontal lobe account. (p. 185)

The connection between brain lesions and antisocial behavior means that individuals with brain lesions are more likely to commit a crime.



## 5.3 Genetics

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Many people display very different behaviors and even achieve different life outcomes than their siblings, despite being raised by the same parents in the same home in the same neighborhood during the same period. Although there are certainly commonalities between siblings, it is also the case that their unique characteristics—whether intelligence, athletic ability, artistic ability, mental disability, or antisocial traits—launch siblings upward or downward on the social ladder. This is the essence of the interplay between individual and environmental factors and the interplay between psychological and sociological constructs.

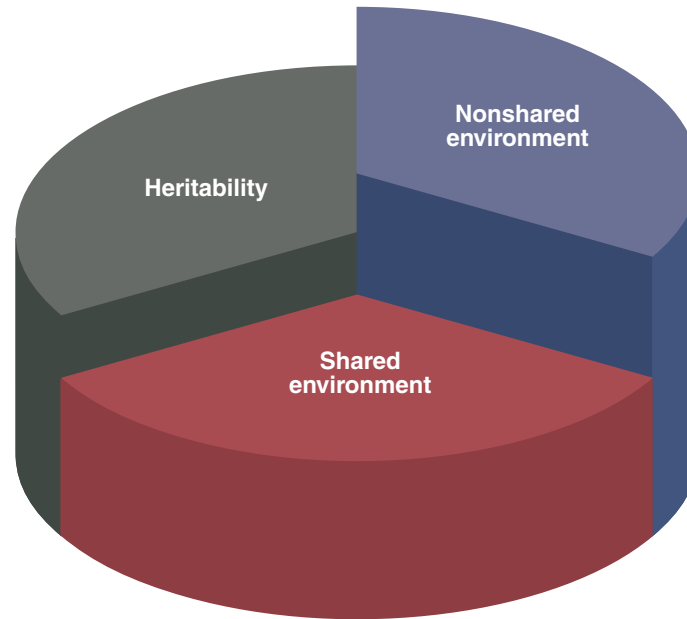
### Twin Studies

Due to extraordinary advances in accessibility to genetic data, psychologists, neuroscientists, and a cadre of criminologists have delved into the genetic mechanisms that contribute to the crime–family relationship. In a landmark study using participants from more than 1,000 families of 11-year-old twins and their parents, several important findings were produced. Researchers discovered that parent–child resemblance in terms of criminal behavior was accounted for by a general susceptibility to externalizing disorders (e.g., aggression), and this general susceptibility was mostly genetic in origin. For example, 73% of the variance (measurement of the spread between the data points) in oppositional defiant disorder (ODD) was **heritable**, or attributable to genetic factors, with 24% attributable to **nonshared environmental factors** unique to the child and just 3% attributable to **shared environmental factors** within the family (see Figure 5.3). Similar effects were found for ADHD. A total of 73% of the variance was attributable to genetic factors; 27% was attributable to nonshared environmental factors, and, interestingly enough, zero variance was attributable to shared environmental factors. For conduct disorder, the most severe of these three conditions, 51% was genetic, 19% was attributable to nonshared environmental factors, and 30% was shared environmental (Bornoalova, Hicks, Iacono, & McGue, 2010).

Using a nationally representative sample of twins, Beaver, DeLisi, Vaughn, Wright, and Boutwell (2008) explored the developmental overlap between language development and self-control. They found that four measures of language development deficits—language skills deficits, letter recognition deficits, beginning sounds deficits, and ending sounds deficits—were significantly associated with low self-control. Due to the nature of their data (i.e., twins), Beaver and his colleagues were also able to access the relative contribution of genetic and environmental factors on the development of both language skills and self-control. They found that 61% of the variance in language skills and self-control was attributable to genetic effects and 39% to environmental effects for the cross-sectional model (i.e., one point in time with different samples). In a longitudinal model (i.e., several points in time with the same sample), the heritability was 76%, with environmental factors accounting for the remaining 24% of the variance. The study provided strong evidence that the etiological pathway between language and self-regulation is convergent (i.e., coming close together), and that much of the association between these constructs has a genetic basis.

### Figure 5.3: Sources of trait and behavioral variance

By analyzing twin data, psychological criminologists are able to quantify how many antisocial traits and conditions originate from genetic and environmental sources.



In yet another twin study, Kenneth Kendler and his colleagues (2007) analyzed longitudinal data from the Virginia Twin Registry to examine the effect that the environment and genes had on delinquent peer-group associations from childhood through adulthood. The results of their models revealed that genetic factors accounted for roughly 30% of the variance in peer-group deviance in childhood. Over time, however, genetic effects on delinquent peers became even stronger and accounted for approximately 50% of the variance in peer-group deviance. The study also pointed out that environmental conditions were important contributors to delinquent peer affiliations. At every time period, environmental effects accounted for approximately 50% of the variance in peer-group deviance. More recent research utilizing data from the National Longitudinal Study of Adolescent Health found that 58% to 74% of the variance in association with delinquent peers was attributable to genetic factors (Beaver, Gibson, et al., 2011). Peer effects are a critically important and multifaceted correlate of crime.

### Genetics and Criminal Behavior

For many years there was virtually no genetic research in criminology because of lack of data and ideological concerns about the implications of genetics research. Over the past few decades, however, this has changed dramatically. With the advent of data sets that include genetic measures, psychological criminologists today frequently publish research on the genetic underpinnings of crime. In this field the availability of data ushered in a new paradigm of research in criminology.

For example, Moffitt (1993) theorized that cognitive problems and antisocial behavior share variance, and recent research has demonstrated that 70% of the variance in life-course-persistent offending (showing antisocial behavior from childhood into adulthood) is attributable to genetic factors (Barnes, Beaver, & Boutwell, 2011). (Moffitt's theory, which includes life-course-persistent offending, will be discussed in more detail in Chapter 7.) In fact, ADHD is a strongly heritable condition that has a mostly genetic etiology. Researchers have found that a childhood diagnosis of ADHD—a disorder that is defined by neurocognitive deficits—is among the strongest predictors of life-course-persistent offending 20 years later (Odgers et al., 2007), especially when it co-occurs with other serious psychopathologies such as conduct disorder.

## Diathesis-Stress Model

It is almost universally recognized that *both* individual and environmental factors are important for understanding behavior or—the focus of this text—criminal behavior. Moreover, it is largely recognized that individual and environmental factors often interact with and mutually reinforce each other. In the field of psychology, this type of interaction is manifested in the **diathesis-stress model**, in which individuals who are at biological or genetic risk for some disorder or condition are most sensitive to the stressors created by environmental risk. Moreover, biological risk factors render individuals more vulnerable to environmental risks. Environmental risk factors in turn render individuals susceptible to maladaptive outcomes or antisocial behavior. It is important to note that biological risks, environmental risks, and their interactions continually affect the individual. The culmination of these interactions in the diathesis-stress model is negative behavior (see Figure 5.4).

See *Spotlight: Family Effects via Gene–Environment Interplay* to read about how genetics and the environment can influence problem behaviors.

### Figure 5.4: Diathesis-stress model

The diathesis-stress model is a popular example of a conceptual framework that recognizes the interactive and mutually enforcing influences between individual-level and environmental-level constructs.



## Spotlight: Family Effects via Gene–Environment Interplay

Given the compatibility between individual-level and environmental-level risk factors for crime, it is often difficult to accurately determine which factors are most responsible for explaining crime. Fortunately, the field of behavioral genetics has shed light on the interesting and often fascinating ways that genes and environments interact (Jang, 2005). Some of these mechanisms are spotlighted here.

*Gene–environment interaction* occurs when a measured genetic factor interacts with a measured environmental factor to produce a behavioral outcome.

*Passive gene–environment correlation* occurs because children share heredity and home environments with family members and thus passively inherit environments that are correlated with their genetic propensities.

*Evocative or reactive gene–environment correlation* reflects the social and environmental interactions that occur due to the genetically influenced characteristics of the child. For example, a child with severe conduct disorder would have adverse interactions with parents, peers, and teachers, and it is those genetically produced traits that engender the reaction.

*Active gene–environment correlation* occurs when individuals pick friends and social settings that are compatible with their underlying genetic propensities. This type of gene–environment correlation is also known as “niche building” or “niche picking.”

The crux of criminological research using genetically informed designs is consistent with the diathesis-stress model. Genetic risk factors are most likely to contribute to criminal behavior when they are coupled with environmental risk factors. The landmark study that established this connection explored the association between variants of the MAOA gene and childhood maltreatment among a birth cohort in New Zealand. The MAOA gene encodes the MAOA enzyme that degrades neurotransmitters in the brain, including dopamine, serotonin, and norepinephrine. Those with a genetic defect in the MAOA gene who were abused as children were significantly likely to be diagnosed with conduct disorder, be convicted of a violent crime, display symptoms of APD, and have a violent disposition (Caspi et al., 2002).

Similarly, another study was the first to utilize a criminal justice status as an environmental pathogen that interacts with genetic factors to produce crime. Using data from a nationally representative sample of American youth, DeLisi, Beaver, Vaughn, and Wright (2009) found that African American females with a variant of the dopamine receptor gene DRD2 who had a father who had been arrested were significantly likely to engage in serious delinquency and violent delinquency across two waves of data collection, and they were significantly likely to be arrested.

These and thousands of other studies are quickly demonstrating—at the molecular genetic level—the intricate ways in which individual and environmental forces come together to produce problem behaviors.



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**If a child has parents who exhibit criminal behavior, there is a chance that genetics and environmental factors can combine to lead the child to his or her own criminal behavior later in life.**

## 5.4 Temperament

Temperament has been defined in various ways. Famed personality researcher Gordon Allport (1961) conceptualized it as

the characteristic phenomena of an individual's nature, including his susceptibility to emotional stimulation, his customary strength and speed of response, the quality of his prevailing mood, and all the peculiarities of fluctuation and intensity of mood, these being phenomena regarded as dependent on constitutional make-up, and therefore largely hereditary in origin. (p. 34)

Another well-known researcher, John Bates (1989), defines temperament as the following: "Biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (p. 4).

Although it has many varied definitions, **temperament** is broadly defined as the stable, biologically based, usual ways in which a person regulates his or her behavior and interacts with the environment. There is general consensus that temperament refers to those aspects of personality that are innate rather than learned. For example, sensitivity level—or the degree to which a child is disturbed by changes in the environment—can be thought of as an aspect of temperament. A person's mood—whether he or she has a generally happy or unhappy demeanor—is another inborn trait.



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**An individual's behavior and interactions with his or her environment are aspects of temperament.**

Before we delve into the features of temperament and theories surrounding temperament and behavior, we first need to understand traits. A **trait** can be defined as a quality or characteristic that describes a person's typical mood, behaviors, or way of being. Temperament and personality (discussed in the next section) are both trait perspectives that explain behavior by the set of characteristics an individual presents. Temperament researchers and personality researchers both utilize traits in their conceptualizations of people. Temperament has a more physiological connotation to it that describes the usual ways that a person behaves and interacts with the environment. For example, people who are relaxed and emotionally stable differ in many ways from people who are anxious and emotionally unpredictable. Temperament researchers focus on heart rate and other indicators of central nervous system functioning that are involved with a person's overall arousal and alertness to the environment. Personality, on the other hand, has a more psychological connotation to it that describes the usual ways in which a person appears and interacts with others.

## Features of Temperament

Over the past half century or so, several key researchers have developed their own models of temperament that, although distinct, tend to agree on the importance of a few essential constructs (Goldsmith et al., 1987; Kagan, 1998, 2010; Rothbart, 2007, 2011; Thomas & Chess, 1977; Zentner & Bates, 2008). What follows are some additional integrative pieces of information about temperament that are useful for thinking about the ways it can contribute to both prosocial and antisocial types of behavior.

- *Temperamental features embody the individual differences that can be seen across the population and span the distribution of various traits from low to high.* When certain negative temperamental features are found at pathologically high levels, and when those features are comorbid—or present along with other pathologically high negative temperamental features—criminal behavior is more likely. For example, persons with high levels of negative emotionality, such as anger and poor effortful control or self-regulation, are prone to greater opportunities to commit problem behaviors. On the other hand, high levels of comorbid positive temperamental features (e.g., sociability and effortful control) facilitate conventional or prosocial behavior.
- *Temperamental features help explain the person–environment development that is essential for understanding crime.* Many negative temperamental features (e.g., high negative emotionality) are so aversive and annoying that they contribute to commensurately negative interaction patterns, which in turn can exacerbate the underlying deficits. For instance, childhood behavioral disorders (e.g., ODD, conduct disorder, and ADHD) often develop into delinquent or criminal careers in part because of the litany of negative interactions that criminals experience with their peers, teachers, parents, and other community members.
- *Temperament is present at birth, significantly heritable (genetic in origin), and relatively stable.* This means that although temperament is not absolutely stable, it is somewhat resistant to change, particularly because it includes fundamental physiological processes. (Absolute stability—the persistence of a trait at a fixed level across time—is rarely seen in psychology. Most psychological constructs are relatively stable, which means that one’s location on a distribution will be consistent across time. For example, IQ can fluctuate across the life span, but persons with very high, medium, and very low IQs will maintain that position in an IQ distribution across time.) The implication of this for understanding criminal behavior is clear. A primary reason why adult criminals with extensive histories of antisocial conduct find it so difficult to “change their ways” and desist from crime is that it is difficult for people to change who they are. Recidivism and criminal justice system noncompliance, then, are not only predictable from a temperament-based perspective but also expected for persons with pathologically difficult temperaments.

## Cloninger’s Theoretical Model

One of the influential models of temperament and personality is the biosocial approach of Robert Cloninger and his colleagues. According to Cloninger, temperament forms the emotional core of personality and involves heritable, neurobiological dispositions to emotions and their corresponding behavioral reactions (Cloninger, 1987; Cloninger, Svrakic, & Przybeck, 1993). Temperamental traits are thus heritable biases in the ways that individuals respond to danger, novelty, and reward. The brilliance of Cloninger’s theoretical model is that temperamental constructs are explicitly linked to neurotransmitter systems.

- Novelty or sensation seeking is characterized as a heritable tendency of frequent exploratory activity and intense feelings of joy or satisfaction in response to novel or appetitive stimuli (those with a novelty- or sensation-seeking trait are typically impulsive, exploratory, fickle, excitable, and quick-tempered, as opposed to reflective, rigid, loyal, stoic, slow tempered, and frugal). Bungee jumping, roller-coaster riding, and related “thrill” activities are examples of novelty- or sensation-seeking behaviors.
- Harm avoidance is characterized by a heritable tendency of intense avoidant or inhibitory responses to stimuli. Avoiding crowds, preferring to watch a sports event at home despite an opportunity to attend the game, and frequently staying in at night are examples of harm-avoidant behaviors. Individuals who score high on harm avoidance are pessimistic, fearful, shy, and fatigable. Low scorers are optimistic, daring, outgoing, and energetic.
- Reward dependence involves behavioral maintenance and conditioned responses to reward and the avoidance of punishment. Engaging in social activities and investing in the views, opinions, and lives of other people are examples of reward-dependent behaviors. Highly reward-dependent people are sentimental, open, warm, and appreciative, whereas low scorers are detached, reserved, cold, and independent.
- A fourth temperamental construct, persistence, has not been assigned an underlying neurotransmitter system. In conventional language, persistence is the level of tenacity or “stick-to-itiveness.” Individuals with high persistence scores are industrious, determined, enthusiastic, and perfectionistic. Low scorers are inert, spoiled, under-achieving, and pragmatic.

Cloninger’s temperamental model has been extensively studied and supported empirically. His model theorizes a direct link between specific neurotransmitter systems and temperamental traits that give rise to criminal behavior (DeLisi & Vaughn, 2011). Indeed, a major thrust of research in criminology today centers on the articulation of the specific genetic effects that contribute to delinquent, violent, and other antisocial behaviors.

## Temperament and Criminal Behavior

Overall, a host of “difficult” temperamental characteristics—such as fearlessness, novelty or sensation seeking, low effortful control, and behavioral disinhibition—render some youths more likely to commit delinquent and criminal behaviors as they age, and these effects are observed during childhood, adolescence, and even into adulthood (Kagan, 1998; Petitclerc, Boivin, Dionne, Zoccolillo, & Tremblay, 2009).

In fact, the short-term and long-term consequences of a generally difficult temperament are grave. In a 2-year prospective study, youth who were rated by their parents as highly irritable in early adolescence were more than 2 times more likely than



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**Research has shown that children with difficult and irritable temperaments are significantly more likely to become depressed, have lower educational success, and develop health problems as adults.**

adolescents without a difficult temperament to develop major depressive disorder during adulthood. In terms of behavioral disorders, highly irritable teens were nearly 2 times more likely to be diagnosed with conduct disorder and nearly 4 times more likely to be diagnosed with ODD (Stringaris, Cohen, Pine, & Leibenluft, 2009). Adolescents with difficult temperaments also had lower educational attainment and lower income than their peers with less difficult temperaments, which, as we learned in Chapter 4, are situational risk factors for crime.

## 5.5 Personality

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Temperament and personality are sister concepts in the sense that both suggest there is a coherent, consistent, unifying set of characteristics that typifies people. Some believe that personality and temperament are essentially the same. Researchers Robert McCrae, Paul Costa, and their colleagues (2000), for example, suggest that “personality traits, like temperaments, are endogenous dispositions that follow intrinsic paths of development essentially independent of environmental influences” (p. 173).

Other researchers, however, posit a distinction between temperament and personality, with temperament “as the substrate upon which the environment acts to produce personality over time” (Kagan, 2010). In this formulation, personality is generally considered the unfolding of temperament into adulthood; in this text, we’ll adhere to this relationship. **Personality** can be defined as pattern of relatively permanent characteristics and unique traits that give both individuality and consistency to a person’s behavior. Let’s explore how personality contributes to behavior.

### Freud’s Tripartite Model of Personality

Sigmund Freud posited that the human psyche is divided into three parts: the id, the ego, and the superego. This is considered the tripartite model of personality (see Figure 5.5).

The **id**, which is present at birth, consists of blind, unreasoning, instinctual desires and motives and represents basic biological and psychological drives—it does not differentiate between fantasy and reality. The id is antisocial and knows no rules, boundaries, or limitations. If the id is left unchecked, it will destroy the person, because it contributes to a pursuit of primal wants.

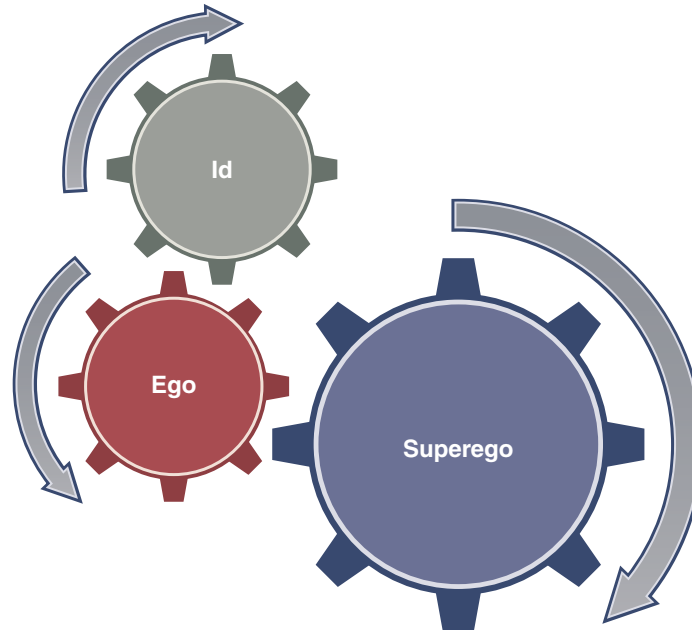
The **ego** mediates between the primal desires of the id and reality; it acts according to the reality principle, which enables an individual to defer pleasure or gratification. A child who grabs a cookie out of another child’s hand, for example, is acting according to the id’s need to satisfy its desires instantaneously; if the child decides instead to stop herself from grabbing the cookie because she knows grabbing it will get her into trouble, she is being influenced by the ego.

The **superego** develops from the ego and can be thought of as the moral code, norms, and values the child has acquired. The superego is responsible for feelings of guilt and shame and is closely aligned with the conscience. In mentally healthy children, the three parts of the personality work together. When the parts are in conflict, individuals may become maladjusted and susceptible to antisocial behavior.



### Figure 5.5: Freudian model of personality

The competing desires and goals of the individual and society are captured by Freud's model of the personality or self.



In the case of an underdeveloped superego, the socialization process has been inadequate or incomplete because the superego is too weak to curb the impulses and drives of the id. Antisocial behavior may also be indirect. Socialization inhibits the open expression of unacceptable urges, but that does not mean the urges disappear; they may merely become unconscious. In this way, delinquent behavior may be a symbolic expression of unconscious impulses. That is why, for example, an offender's unresolved Oedipus complex, which means he has an unconscious desire for the exclusive love of his mother and a rivalry with his father, can lead him to wish unconsciously for his father's death (Regoli, Hewitt, & DeLisi, 2009).

Sometimes delinquent behavior is the result of too much socialization, which produces an overdeveloped superego. Impulses and urges of the id may elicit strong disapproval from the superego. This ongoing conflict causes the ego to experience guilt and anxiety. But because the ego knows that punishment must follow crime, the ego will lead the child to crime to minimize guilt. To ensure punishment, the ego will unconsciously leave clues. From a Freudian perspective, when serious offenders involve themselves in the investigation of their crimes, they are attempting to reduce their feelings of guilt; in effect, they "want" to be caught.

### Erikson's Identity Formation Theory

For Erik Erikson (1950, 1982), the ego goes through crises as it develops over the life course. The development of the ego toward the maturation of the personality is known as **identity formation**. From a psychodynamic perspective, it is useful to see the ways in which life events can greatly affect an individual's sense of self and how stress from these events can lead to

crime. For instance, mass murderers often “snap” and commit their murderous rampages after a triggering event that usually involves a loss of status, such as a divorce or job loss. However, it is important to note that although triggering events seem to make an offender snap, there is always a long, slowly brewing period of real or perceived failures that build within the offender. The offender’s sense of self—and very identity—is so shattered that destructive violence is presumed to be the only solution.

Take, for example, Charles Whitman, who in 1966 shot and killed 16 victims and wounded dozens from the iconic tower at the University of Texas at Austin. The night before this incident, Whitman murdered his mother and wife—due in part to his mother having recently left his father and to family problems within his own marriage. Those initial killings acted as a trigger to then perpetrate the shooting at the university the next day.

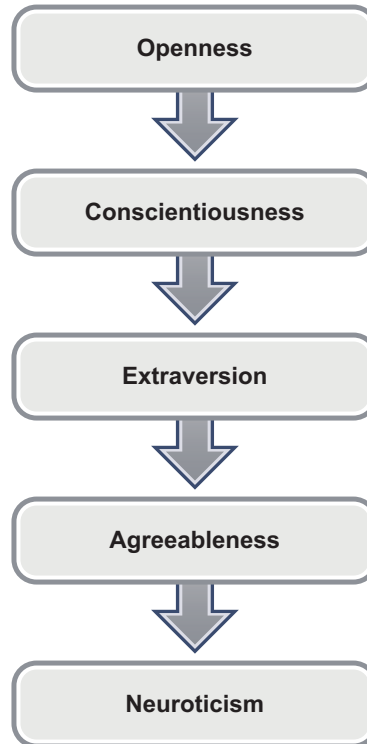
## Five-Factor Model of Personality

Psychologists have developed conceptual models to capture the broad dimensions of personality. These are known as **structural models of personality**. Although every individual possesses a diverse constellation of personality traits, researchers have been able to provide evidence that certain traits tend to correlate, or cluster together. Personality is therefore “reducible” to just a few traits, or factors. For example, most structural models of personality include neuroticism, or a general tendency toward negative emotionality, as one of the major traits of personality. Extraversion, described in its most general sense as an orientation toward the external world, is also common across models. And, depending on the theorist, novelty or sensation seeking may be included as a major dimension of personality as well. McCrae and Costa (1987) developed one of the most influential models of personality, known as the **five-factor model of personality** (see Figure 5.6).

The five factors considered to be the basis of personality can be remembered using the acronym OCEAN. *O* stands for “openness to experience” and refers to an open-mindedness to experiences, people, and intellectual pursuit. *C* stands for “conscientiousness,” or the achievement-oriented, self-disciplined work ethic of an individual. *E* refers to the “extraversion–introversion range” that characterizes people who seek social interaction and those who prefer to be by themselves. *A* stands for “agreeableness,” or the general sociability and ease with which one gets along with others. *N* stands for “neuroticism,” which describes the degree to which one experiences negative emotions. Every individual can be said to possess a different measure of each of these traits. For example, someone may be high on openness and low on conscientiousness, possessing a moderate degree of neuroticism.

### Figure 5.6: Five-factor model of personality

The five-factor model of personality is a set of five broad trait domains or dimensions, often referred to as the “big five”: openness, conscientiousness, extraversion, agreeableness, and neuroticism.



In general, those who study personality and temperament are interested in the forces that motivate a person’s ability to produce and control his or her behavior. Individuals who are prosocial and high on agreeableness are generally able to regulate their conduct, whereas antisocial persons (i.e., persons who regularly engage in hostile or harmful behavior toward others) are less able to do so. These ideas are essential for understanding criminal behavior. For instance, Sarah De Pauw and Ivan Mervielde (2010) merged childhood temperament models with the five-factor model of personality in an attempt to explain internalizing disorders (e.g., anxiety and depression) and externalizing disorders (e.g., aggression). Persons with anxiety disorders have high scores on neuroticism, which is characterized by high levels of fear and anxiety. They have low scores on extraversion, as evidenced by high levels of social inhibition and low scores on conscientiousness based on low levels of attentional control. For externalizing disorders, similar translations can be made. For example, ADHD is characterized by high extraversion based on hyperactivity levels and by low conscientiousness based on reduced attentional control and reduced inhibitory control.

See *Spotlight: Personality Neuroscience* to read about a gene that may be directly related to some disorders and problem behaviors.

### Spotlight: Personality Neuroscience

In large part, personality traits are so stable and enduring because they are heritable. Yoon-Mi Hur and Thomas Bouchard (1997) found that 40% to 55% of assorted facets of sensation or novelty seeking were heritable. Moreover, 55% of the variation between sensation seeking and impulsivity had a shared genetic etiology.

A gene that has received attention for its relation to novelty or sensation seeking is the dopamine D4 receptor gene, or DRD4. There are several variants in the DRD4 gene, and these variants are differentially related to personality traits. Indeed, novelty or sensation seeking was the first to be linked to a specific gene—the 7-repeat (7R) allele of DRD4 has been shown to be associated with novelty- or sensation-seeking personality traits (Benjamin, Patterson, Greenberg, Murphy, & Hamer, 1996; Cloninger, Adolfsson, & Svrakic, 1996; Ebstein et al., 1996). In a review of the first decade of research on DRD4, Hubert Van Tol—whose research was instrumental in discovering the gene—and his colleagues advised that

numerous reports of linkage or a weak association between the 7R alleles of DRD4 and novelty seeking, drug and alcohol abuse, ADHD, and Tourette syndrome may indicate that the dopamine D4 receptor polymorphism is one of several genetic contributions to these traits or disorders. (Oak, Oldenhof, & Van Tol, 2000, p. 316)

In review a few years later, Ebstein (2006) said, “We deduce with some measure of certainty that DRD4 indeed contributes to personality and behavioral traits related to the Novelty Seeking phenotype” (p. 435).

Molecular genetics researchers have found that the 7R allele of the DRD4 is indeed associated with high levels of the personality trait of novelty or sensation seeking. For instance, Laucht, Becker, Blomeyer, and Schmidt (2007) used data from 303 children selected from the Mannheim (Germany) Study of Risk Children, which is a prospective longitudinal study of the effects of early risk factors on subsequent adolescent development. They found that males with the 7R allele drank more alcohol per occasion of drinking and had greater lifetime rates of heavy drinking than those without the 7R allele. Moreover, those with personalities characterized by high levels of novelty or sensation seeking further explained the relationship between the DRD4 7R allele and problem drinking.

The DRD4 7R allele has even been linked to novelty/sensation-seeking-oriented forms of alcohol use, such as binge drinking. Vaughn, Beaver, DeLisi, Howard, and Perron (2009) found that the 7R allele was predictive of binge drinking among respondents from the National Longitudinal Study of Adolescent Health. The relationship held despite controls for demographic characteristics and low self-control.

These findings are so promising that a relatively new subfield in psychology known as personality neuroscience has been established. Its main goal is to locate the genetic and neural bases of personality traits and thus create a fuller understanding of human behavior.

## 5.6 Hormones

Another biological explanation for crime involves the body's **hormones**, chemical substances produced in the body that control and regulate the activity of certain organs or cells. For example, the hormone testosterone has been known to cause aggression when found in the body in high levels. Similarly, poor nutrition has been associated with higher levels of aggression, while the omega-3 vitamin has been linked to lower aggression (Rivendell, 2016).



*Milicad/iStock/Getty Images Plus*

**Studies indicate that higher levels of testosterone combined with lower levels of cortisol are correlated with higher levels of anger.**

Interestingly, however, results related to the relationship of hormones and criminal behavior have been largely mixed. Glenn, Raine, Schug, Gao, and Granger (2011) suggest that the inconsistent results have been partially due to researchers attempting to examine single hormones in isolation. Researchers have begun exploring hormone systems in the context of criminal behavior as interconnected, complex systems. For example, Brown et al. (2008) studied the research findings of 15 scientific investigations that explored the role of hormones in relation to crime. These researchers found that higher testosterone levels in combination with lower cortisol (primary stress hormone) levels are correlated with greater levels of anger.

## Summary and Conclusion

This chapter provided a selective review of four specific biological factors—brain mechanisms, genetics, temperament, personality, and hormones. Executive functioning is crucial for behavioral regulation; individuals with poor executive functioning may be at risk for decreased self-regulation and increased conduct problems. Neuropsychological deficits, which are related to antisocial behavior, also play a role in social cognitive processes that are risk factors for conduct problems and other maladaptive behaviors.

Genetics also play a role in behavior, as we learned through twin studies—which showed that, with specific behavior traits, most traits were more attributable to genetic effects than they were to environmental effects (shared or nonshared).

Temperament and personality are innate characteristics that typify people. Temperament refers to the biologically determined personality tendencies shown at birth, and as we mature, environmental factors interact with temperament to shape personality and behavior.

Finally, researchers have been begun exploring hormone systems in the context of criminal behavior as interconnected, complex systems. However, results related to this relationship have been mixed.

There is a growing literature on biological explanations of crime, and hopefully, we will continue to learn more about how these factors interact and influence criminal behavior.

### Critical Thinking Questions

1. There are some experts in fields such as psychology, law, and criminal justice who deny that biology could have an impact on criminal behavior. What are some reasons that this denial might exist?
2. There is a theory regarding genetics and crime that suggests the genetic makeup of men causes them to engage in more criminal behavior than women. Do you think this is true? Why or why not?
3. Some researchers view temperament as a unifying basis for personality and mental or behavioral disorders. Do you agree?

### Key Terms

**attention-deficit/hyperactivity disorder (ADHD)** A disorder defined by a persistent pattern of inattention and/or hyperactivity or impulsivity that interferes with functioning or development.

**cognitive** Connected with thinking or conscious mental processes.

**comorbid** The co-occurrence of psychological conditions.

**diathesis-stress model** A behavioral model that states that those who are at biological or genetic risk for some disorder or condition are most sensitive to the stressors created by environmental risk.

**ego** The part of the Freudian personality that grows from the id. It mediates between the primal desires of the id and reality; it acts according to the reality principle, which enables an individual to defer pleasure or gratification.

**executive functions** A set of cognitive processes relating to memory, attention, planning, and emotional and behavioral regulation that are essential for the cognitive control of behavior.

**five-factor model of personality** A structural model of personality that contains five dimensions: openness to experience, conscientiousness, extraversion, agreeableness, and neuroticism.

**frontal lobe** The part of the brain that houses higher order cognitive functions that regulate the emotional stimuli that come from the limbic system.

**heritable** Describes variance in a trait or behavior that is attributable to genetic factors.

**hormones** Chemical substances produced in the body that control and regulate the activity of certain organs or cells.

**id** The part of the Freudian personality that is present at birth and consists of blind, unreasoning, instinctual desires and motives. It represents basic biological and psychological drives—it does not differentiate between fantasy and reality.

**identity formation** In Erikson's personality model, the development of the ego toward the maturation of the personality.

**limbic system** The complex system of networks and nerves in the brain involved in basic emotions and drives.

**neuropsychological deficits** Brain-based deficits in social cognitive processes that are risk factors for conduct problems and related maladaptive behaviors, such as school problems.

**nonshared environmental factors** Variance in a trait or behavior that is attributable to factors unique to the person.

**personality** A pattern of relatively permanent characteristics and unique traits that give both individuality and consistency to a person's behavior.

**prefrontal cortex** The part of the frontal lobe of the brain involved in complex behaviors such as planning and decision making.

**shared environmental factors** Variance in a trait or behavior that is attributable to common family factors.

**structural models of personality** Conceptual models that capture the main traits embodied in personality.

**superego** The part of the Freudian personality that develops from the ego and contains the moral code, norms, and values the child has acquired.

**temperament** The stable, biologically based ways in which a person regulates his or her behavior and interacts with the environment.

**trait** A quality or characteristic that describes a person's typical mood, behaviors, or way of being.

