In this chapter, we present an overview of a causal model of the origins of conduct problems during childhood and adolescence. We use the term *conduct problems* to refer to behaviors that violate important behavioral norms or laws. In this sense, both juvenile crimes and DSM-IV symptoms of conduct disorder (CD) are conduct problems. The diagnosis of CD is viewed as the extreme end of the continuum of conduct problems, with the point of demarcation between CD and “normal behavior” reflecting a convention rather than a dichotomy in nature (Lahey et al., 1994). Thus, the present model is applicable to both CD and juvenile delinquency. The milder behavior problems that define DSM-IV oppositional defiant disorder (ODD) are not considered to be conduct problems in this chapter, but we discuss their association with conduct problems.

The dependent variable for the model is the youth’s developmental trajectory of conduct problems. In the general terminology of longitudinal data analysis, trajectories are defined by the youth’s *intercept* (i.e., essentially the level of conduct problems at the youngest age at which conduct problems are measured) and *slope* (i.e., increasing or decreasing trends over time). In this chapter, we focus on school-age children, from the age of school entry through age 17 years. We believe that it will be possible to extend the present model back in time, however, to encompass the earliest phases of the development of conduct problems.

In this chapter, we state hypotheses that are based on data, but we of-
ten go beyond current data. In all cases these hypotheses are advanced in the context of suggested studies that would expose them to risk of refutation. The present model should be considered to be preliminary, partly because key analyses of data from our recent studies from which the hypotheses were induced have not been through peer review.

**ONTOGENY OF CONDUCT PROBLEMS**

A necessary first step in determining the causes of conduct problems is to describe their ontogeny. Several seminal papers (Farrington, 1991; Loeber, 1988; Moffitt, 1993; Patterson, Reid, & Dishion, 1992) suggest that there are multiple developmental pathways for conduct problems. Moffitt (1993) proposed a “developmental taxonomy” in which two groups of antisocial youth were distinguished based on their ages of onset and trajectories of conduct problems. She posited that these groups of antisocial youth differ enough to require different causal explanations. We believe that Moffitt is fundamentally correct in postulating that youth with the earliest and the latest ages of onset of conduct problems tend to be antisocial for different reasons, but our model differs from her model in two ways. First, we believe that differences in conduct problems based on their age of onset fall along a continuum of ages of onset, rather than reflecting a true developmental taxonomy. Second, we posit that the same set of causal factors influence conduct problems that emerge at all ages, but the strength and pattern of these causal influences vary along the continuum of the age of onset of conduct problems.

**Individual Differences in the Ontogeny of Conduct Problems**

In the general population, minor aggression (mostly bullying and fighting), lying, and hurting animals are common at school entry, but their prevalence declines with increasing age through adolescence. We refer to these as developmentally early conduct problems. In contrast, the prevalence of many nonaggressive conduct problems (e.g., stealing, running away from home, truancy, breaking and entering) and serious forms of aggression (e.g., mugging, use of a weapon, and forced sex) increases from middle childhood through adolescence. We term these developmentally late conduct problems.

At school entry, there is a broad range of involvement in developmentally early conduct problems (intercepts), with a small group of children already exhibiting high levels that impair the child’s social and academic functioning. Another small group of children exhibits no conduct problems at school entry, whereas most children fall between these extremes of this continuum. Over the course of development, youth change from their ini-
tial level of conduct problems (intercepts) in every possible direction (slopes).

In general, however, trajectories of conduct problems from school entry through late adolescence are predicted reasonably well by individual differences in the level of developmentally early conduct problems at school entry (Lahey & Loeber, 1994). Children with the highest initial levels of developmentally early conduct problems at school entry are more likely to show persistent or worsening problems over time and are less likely to desist (Brame, Nagin, & Tremblay, 2001; Nagin & Tremblay, 1999). Similarly, children with higher levels of developmentally early conduct problems at school entry both begin to engage in developmentally late conduct problems at younger ages and show steeper slopes, reaching higher levels of developmentally late conduct problems during adolescence than children with lower levels of conduct problems at school entry (Brame et al., 2001; Sampson & Laub, 1992). Children who are high in developmentally early conduct problems at school entry generally do not advance to serious forms of violence during adolescence and adulthood unless they exhibit precocious development of developmentally late conduct problems during childhood or early adolescence (Haemaelaeinen & Pulkkinen, 1996). As a result, adolescents who engage in high levels of serious adolescent delinquency rarely “come out of nowhere.” Few very well-behaved young children engage in substantial levels of delinquency during adolescence, and when they do, they mostly (but not exclusively) engage in nonaggressive behaviors (e.g., theft and truancy) and usually do not engage in violent behaviors (Brame et al., 2001).

Meaning of Age of Onset

Tremblay (Tremblay et al., 1996, 1999; Tremblay, 2000) convincingly argued for a reconceptualization of the term age of onset. He used population-based data to demonstrate that many toddlers hit, kick, intentionally break things, take other children’s toys, state untruths, and resist the authority of adults from the time they can walk and talk (Tremblay et al., 1999). Although not all toddlers engage in such behaviors—for example, only about 40% of Canadian 24-month-olds “sometimes” or “often” hit, kick, or bite (Tremblay et al., 1996)—they are certainly common enough to be viewed as normative. Over the course of development, the prevalence of these behaviors declines greatly, suggesting to Tremblay that most children “unlearn” them as a result of socialization.

Although we believe that Tremblay’s (2000) view is essentially correct, it can be reconciled with traditional approaches of the age of onset of conduct problems. Typically, age of onset is measured by asking respondents (usually parents) to report the age at which a specific conduct problem first occurred. We believe that respondents answer such questions for develop-
mentally early behaviors by reporting the age at which they first viewed the behavior as atypical. A prevalent behavior (e.g., taking toys from others during play) might come to be viewed as atypical either because the immature behavior changed through maturation and social learning into a more serious behavior (e.g., taking a toy when the owner was not looking) or because a behavior (e.g., hitting) persisted unchanged to an age when it was no longer viewed as normative. Moreover, not all conduct problems fit the ontogenic pattern described by Tremblay. For developmentally late behaviors, the report of age of onset actually reflects the first occurrence of the behavior (e.g., breaking and entering). Thus, we believe the concept of age of onset has meaning if it is viewed from the perspective of how the informant answers such questions.

**Improvement in Childhood Conduct Problems**

Nearly half of all children who engage in high levels of conduct problems show considerable improvement by early adolescence (Fergusson, Lynskey, & Horwood, 1996; Moffitt, Caspi, Dickson, Silva, & Stanton, 1996; Nagin & Tremblay, 1999). The dominance of developmental models since Moffitt’s (1993) influential paper, which focuses on the onset of conduct problems, may have unintentionally contributed to a neglect of children whose behavior improves over time. A number of studies suggest that children with early conduct problems who improve over time have less extreme levels of conduct problems in childhood, have higher intelligence scores, have fewer delinquent friends, come from families with higher socioeconomic status (SES), have mothers who did not give birth as teenagers, and have parents who are less antisocial and have fewer mental health problems (Fergusson et al., 1996; Lahey, Loeber, Burke, & Rathouz, 2002; Nagin & Tremblay, 2001). As we will see, the inverse of these factors is also associated with the onset of conduct problems, suggesting that risks for initiating and persisting in conduct problems often overlap.

**CHILD CHARACTERISTICS THAT INCREASE THE LIKELIHOOD OF CONDUCT PROBLEMS**

Gottfredson and Hirschi (1990) proposed that variations in antisocial behavior can be explained by individual differences in antisocial propensity. Although situational influences on conduct problems can be strong, a large body of evidence suggests that the origins of conduct problems cannot be understood without taking individual differences in persons into account. Antisocial propensity is inferred from individual differences in conduct problems, but to avoid circularity it must be defined and measured in independent terms. Thus, Gottfredson and Hirschi (1990) and Farrington (1991, 1995) have provided similar lists of hypothesized components of in-
individually differences in antisocial propensity, including lower intelligence and higher levels of daring, impulsivity, activity level, and physical strength. The present model builds on this conceptual foundation.

In our model, central roles are ascribed both to characteristics of children associated with their propensity to exhibit conduct problems and to transactions with the environment that increase or decrease the likelihood that such antisocial propensity will be manifested in the youth's behavior. Thus, we distinguish two questions about the causes of conduct problems: (1) what are the causes of the child characteristics that constitute antisocial propensity, and (2) what are the causal factors that determine which children will make the developmental transition from antisocial propensity to antisocial behavior?

We posit that multiple child factors contribute to antisocial propensity. These factors influence conduct problems that emerge at all ages, from early childhood through late adolescence, but their influence varies with the age of onset of conduct problems. This is primarily because the strength of the various causal influences on conduct problems influences the age of onset of conduct problems. For youth with earlier ages of onsets of conduct problems, we posit that atypical temperament and low cognitive ability play significant roles, working through transactions with the social environment to increase the level of conduct problems over time. The age of onset of conduct problems increases as the components of antisocial propensity (cognitive abilities and temperament) play progressively less important roles, with peer influence and other social factors playing more important roles. Thus, following the lead of Moffitt (1993), we posit differences in causal influences on earlier and later onset conduct problems, but we view these as reflecting a continuum of differences in age of onset. In the remainder of this section, we present specific hypotheses about the nature of these predisposing child characteristics.

Three Hypothesized Dimensions of Temperament Relevant to Conduct Problems

Like others, we use the term temperament to refer to substantially heritable and relatively persistent individual differences in global aspects of socio-emotional responding that emerge early in childhood and constitute the foundation for many personality traits later in life (Buss & Plomin, 1975, 1984; Caspi, 1998). Because we seek to explain the origins of psychopathology partly in terms of individual differences in temperament, it is essential to distinguish between temperament and psychopathology. We recognize, however, that the conceptual boundary between temperament and psychopathology is fuzzy. In both cases, they are latent constructs inferred from the child's behavior. We use the term temperament to refer to global aspects of socioemotional behavior and the term psychopathology to refer
to more specific behaviors with serious consequences for the youth’s adaptive functioning, but this distinction is not always clear-cut. Unlike most temperament and personality researchers, however, we have taken care to avoid overlap in the items that define our hypothesized dimensions of temperament and psychopathology. For example, although it may make sense for models of personality to include terms like “anxious,” “aggressive,” and “depressed” in the scales of the trait of negative emotionality, such items cannot be included in studies relating temperament to psychopathology as it would raise the possibility that any correlation between negative emotionality and psychopathology is based only on these overlapping items.

The three dimensions of temperament described next are based on two steps in our effort to define the aspects of temperament that are most relevant to the development of conduct problems. First, we conducted a review of the existing literature on early temperament-like child characteristics associated with increased risk for conduct problems. That is, rather than attempting to construct a new general model of temperament, our purpose is to identify aspects of temperament that may function as developmental antecedents to conduct problems. Our first description of the aspects of temperament that are relevant to conduct problems (Lahey, Waldman, & McBurnett, 1999) included the construct of oppositional temperament, which was defined by the symptoms of oppositional defiant disorder. In this version, we have replaced the construct of oppositional temperament with the broader construct of “negative emotionality.”

After compiling a broad list of temperamental attributes that had been found to be correlated with child conduct problems, our second step was to create an investigational scale composed of these items. A parent rating scale was created that is suitable for children ages 4–17 years, consisting of items thought to tap the three hypothesized dimensions of socioemotional responding. A parallel form of the same scale was created for youth self-reports by 9- to 17-year-olds. We conducted a study of a population-based sample enriched with clinic attendees of 1,382 children and adolescents ranging in age from 4 to 17. Exploratory factor analyses and construct validity analyses of part of that sample have been reported (Lahey, Applegate, & Waldman, 2001), but have not yet been published in peer-review journals. This exploratory factor analysis yielded three factors that were consistent with the three aspects of temperament described below. Analyses of these data supported the change from our earlier model (Lahey, Waldman, et al., 1999), as oppositional defiant behavior was found to be correlated with all three temperament dimension in the present model and not just with negative emotionality (Lahey et al., 2001). We are in the process of conducting additional studies to test the hypothesis that the three dimensions of temperament described next are independent from one another and are concurrently and predictively related to conduct problems.
Negative Emotionality

Most trait models of personality include a dimension defined by experiencing negative emotions frequently, intensely, and with little provocation (see reviews by Bouchard & Loehlin, 2001; Zuckerman, Kuhlman, Joreman, Teta, & Kraft, 1993). This dimension is often referred to as *neuroticism* (Digman & Inouye, 1986; Eysenck, 1947; Goldberg, 1993; McCrae & Costa, 1987), but we will use the term *negative emotionality* (Watson, Clark, & Tellegen, 1988). Among adults, negative emotionality is positively correlated with a wide range of mental health problems, including antisocial behavior (Addad & Leslau, 1990; Berman & Paisey, 1984; Eysenck & Eysenck, 1970, 1977; Eysenck & McGurk, 1980; Gershuny & Sher, 1998; Goma-I.-Freixnet, 1995; Krueger, 1999; Moffitt, Caspi, Rutter, & Silva, 2001; Rahman, 1992; Roberts, & Kendler, 1999).

The existing literature on the relation between negative emotionality and child conduct problems is less consistent, however. A number of studies have found significant concurrent or prospective associations of negative emotionality with child conduct problems (Eisenberg et al., 1996; Gabrys, 1983; Gjone & Stevenson, 1997; Rowe & Flannery, 1994). On the other hand, a number of studies have not found negative emotionality to be significantly correlated with delinquent behavior/conduct problems (Fonseca & Yule, 1995; Furnham & Thompson, 1991; Heaven, 1996; John, Caspi, Robins, Moffitt, & Stouthamer-Loeber, 1994; Powell & Stewart, 1983; Rushton & Chrisjohn, 1981; Shapland & Rushton, 1975; Tranah, Harnett, & Yule, 1998). This lack of consistency may reflect differences in the operationalization of negative emotionality across studies or may indicate that the relation between negative emotionality and child conduct problems is complex.

Daring

Farrington and West (1993) found that children rated by parents as “daring” in childhood were considerably more likely to be chronic criminal offenders during adolescence and adulthood. Farrington and West’s (1993) construct of *daring* may be related to some aspects of sensation seeking (Zuckerman, 1996) and novelty seeking (Cloninger, 1987), both of which have been found to be positively correlated with conduct problems in diverse samples (Arnett, 1996; Daderman, 1999; Daderman, Wirsen, & Hallman, 2001; Goma-I.-Freixnet, 1995; Greene, Krcmar, Walters, Rubin, & Hale, 2000; Luengo, Otero, Carrillo-de-la-Pena, & Miron, 1994; Newcomb & McGee, 1991; Schmeck & Pousta, 2001; Simo & Perez, 1991; Wasson, 1980). Thus, some items used to characterize our dimension of daring were based on our earlier studies of sensation seeking in children (Russo et al., 1993).
Farrington and West’s (1993) construct of daring also may be inversely related to Kagan’s construct of behavioral inhibition. Kagan and colleagues (Garcia-Coll, Kagan, & Reznick, 1987; Kagan, Reznick, & Snidman, 1988; Kagan, Reznick, Snidman, Gibbons, & Johnson, 1988) used laboratory observations to classify toddlers as “behaviorally inhibited” or “disinhibited.” Young children in Kagan et al.’s studies were exposed to a variety of novel situations, including an unfamiliar adult and a lighted robot that emerged from behind a curtain and spoke to the children. Observers monitored the children’s fretfulness, latency to approach persons and objects, and latency to vocalize. At the extremes of the distribution of inhibition scores, there was significant stability over time. A number of studies show that toddlers classified as disinhibited readily approached unfamiliar stimuli and were quick to vocalize. As preschoolers, disinhibited children spontaneously vocalized and readily followed the examiner’s requests to “misbehave”: to scribble in a book, spill juice on the floor, and throw a ball at the examiner’s face. Highly inhibited children behaved in much the opposite manner. Most importantly, from our perspective, disinhibition was later found to predict conduct problems during later childhood and early adolescence in several samples (Biederman et al., 2001; Hirshfeld et al., 1992; Hirshfeld-Becker et al., 2002; Kerr, Tremblay, Pagani-Kurtz, & Vitaro, 1997; Raine, Reynolds, Venables, Mednick, & Farrington, 1998; Schwartz, Snidman, & Kagan, 1996).

Cloninger (1987) also identified a dimension of temperament, termed harm avoidance, which may also describe some aspects of the inverse pole of daring. Persons high in harm avoidance are cautious, apprehensive, and inhibited in the face of novel or dangerous situations. Two longitudinal population-based studies have found that children with higher harm avoidance scores were less likely to engage in significant antisocial behavior in adolescence and young adulthood (Sigvardsson, Bohman, & Cloninger, 1987; Tremblay, Pihl, Vitaro, & Dobkin, 1994).

Prosociality

From preschool through adolescence, youth who engage in more conduct problems show less sympathy and concern for others (Cohen & Strayer, 1996; Eisenberg, Fabes, & Murphy, 1996; Frick, O’Brien, Wootton, & McBurnett, 1994; Hastings, Zahn-Waxler, Robinson, Usher, & Bridges, 2000; Hughes, White, Sharpen, & Dunn, 2000; Luengo et al., 1994; Miller & Eisenberg, 1988). Goodman (2001) developed a prosocial behavior scale that is composed of items that are seemingly related to sympathy, including sharing, helping, kindness, consideration for others, and volunteering. In a representative British sample of 10,438 children and adolescents ranging in age from 5 to 15 (Meltzer, Gatward, Goodman, & Ford, 2000), the correlation between this prosocial behavior scale and conduct problems (lying,
fighting, stealing, disobedience, temper tantrums) was \(-.42\) for parent reports, \(-.57\) for teacher reports, and \(-.31\) for youth self-reports (R. Goodman, personal communication, 2001). Even more impressively, Haemaelaeinen and Pulkkinen (1996) obtained peer ratings on a similar prosocial behavior scale at age 8 years and found that it predicted criminal offenses by age 27 years after controlling for early conduct problems and school failure.

Based on these findings, and the theoretical foundations provided by Eisenberg and Mussen (1991), Hoffman (1982), and Zahn-Waxler, Robinson, and Emde (1992), we propose the construct of **prosociality** to refer to a dimension of temperament characterized by dispositional sympathy for others. Because our exploratory factor analysis suggested that guilt over misdeeds and respect for rules were also part of this factor, we suggest that these are linked to the prosociality dimension. This is important, as many studies have found that children who engage in high levels of conduct problems exhibit little guilt over their misdeeds (e.g., Frick et al., 1994; Loeber, Farrington, Stouthamer-Loeber, & Van Kammen, 1998).

**Comment on Extraversion**

Many structural theories of personality specify a broad dimension of **extraversion** that is characterized by positive emotionality, high energy, and sociability (Digman & Inouye, 1986; Eysenck, 1947; Goldberg, 1993; McCrae & Costa, 1987). In their meta-analysis, Miller and Lynam (2001) found that the correlation of antisocial behavior with extraversion is usually positive, but is sometimes negative. We did not specify a dimension of temperament that corresponds to extraversion in the present model, but will explore it in future studies.

**Relation to Existing Structural Models of Personality and Temperament**

It is important to consider the possible relations of our three hypothesized dimensions of temperament to the major models of personality and temperament. The three-factor and five-models models of personality (Costa & McCrae, 1995; Eysenck, 1947; Goldberg & Rosolack, 1994) and widely used child temperament scales (Buss & Plomin, 1975, 1984; Presley & Martin, 1994; Rothbart, Ahadi, Hershey, & Fisher, 2001) all identify a dimension of negative emotionality with content similar to our construct. Thus, it seems likely that our dimension of negative emotionality is similar to the corresponding dimension in other personality and temperament models.

We believe that our dimensions of daring and prosociality will ultimately be found to be related to Eysenck’s (1947) broad construct of
psychoticism and to the five-factor dimensions of conscientiousness and agreeableness (Costa & McCrae, 1995; Digman & Inouye, 1986; John et al., 1994). Of the three dimensions in Eysenck’s model, psychoticism is most strongly and consistently associated with antisocial behavior, particularly with physical aggression (Berman & Paisey, 1984; Goma-I.-Freixnet, 1995; Miller & Lynam, 2001). Similarly, a number of studies of adult ratings of children and adolescents have found that the five-factor dimensions of agreeableness and conscientiousness are inversely correlated with self-reports of delinquent behavior and adult ratings of behavior problems and school adjustment (e.g., Digman & Inouye, 1986; Graziano, 1994; John et al., 1994). This suggests that psychoticism, agreeableness, and conscientiousness are pertinent to our goal of identifying the dimensions of temperament that are most related to conduct problems. How are these constructs related to our hypothesized dimensions of temperament?

The items in Eysenck’s dimension of psychoticism refer to the lack of emotional closeness, empathy, and conventional behavior that is characteristic of individuals who exhibit psychosis. Costa and McCrae (1995) have argued that agreeableness and conscientiousness reflect distinct dimensions that are conflated in Eysenck’s dimension of psychoticism. Indeed, many studies have shown that psychoticism is inversely correlated at substantial levels with both agreeableness and conscientiousness in the five-factor model of personality (e.g., Costa & McCrae, 1995; Goldberg & Rosolack, 1994). In discussing the inverse correlation of psychoticism with antisocial behavior, Costa and McCrae (1995) have hypothesized that agreeableness and conscientiousness are each inversely related to antisocial behavior for different reasons: “Agreeable people tend to be courteous and law abiding because they are mindful of the rights and feelings of others, and because they trust that laws and customs are designed for the common good. Conscientious people also tend to be polite and law abiding, not necessarily because they are prosocial in disposition, but because their conduct is guided by rules” (p. 316).

Thus, it is important to consider the possible relations between the current model and the five-factor dimensions of agreeableness and conscientiousness. Graziano and Eisenberg (1997) suggested that the five-factor model construct of agreeableness incorporates the key elements of Eisenberg and Mussen’s (1991) construct of dispositional sympathy, which includes many of the elements of our dimension of prosociality. Furthermore, the items used to operationalize the five-factor dimension of agreeableness (e.g., sympathetic, generous, kind, cooperative, and trusting) suggest that agreeableness is similar to our prosociality dimension in content. Thus, it is possible that our dimension of prosociality incorporates many central elements of the five-factor dimension of agreeableness.

In contrast, the item content of the conscientiousness dimension in the
NEO (Costa & McCrae, 1987), which is the personality scale that was developed to measure five-factor model traits in adults, does not overlap with our hypothesized dimension of daring. It is interesting, however, that when the authors of the NEO conducted an exploratory factor analysis of a scale developed to measure Eysenck’s three-factor model, they extracted five factors that they interpreted as corresponding to their five-factor model (Costa & McCrae, 1995). Because the Eysenck scale used a different set of items, the five factors that Costa and McCrae extracted had different item content than the NEO scales. The scale that Costa and McCrae identified as conscientiousness in this study was composed of the items of risk taking, impulsive, sensation seeking, and irresponsible. The first three of these items appear to be similar to our dimension of daring. Thus, it is possible that our dimension of daring bears some empirical relation to the five-factor dimension of conscientiousness, even if the item content of this dimension in the NEO scale is different.

Temperament Profiles and Antisocial Propensity

Each of the three hypothesized dimensions of temperament in our model is believed to index a separate aspect of propensity to antisocial behavior. It is not yet clear if they contribute to the likelihood of conduct problems interactively, but the risk for antisocial behavior can only be assessed comprehensively by taking all three dimensions into account. Specifically, we hypothesize that children who are high in negative emotionality, low in prosociality, and high in daring will have the greatest propensity to conduct problems. In contrast, youth with the “antitype” of this high-risk profile (i.e., youth who are low in negative emotionality, high in prosociality, and low in daring) will be very unlikely to engage in conduct problems at any time during childhood or adolescence. We hypothesize that this low-risk antisocial propensity profile protects such youth from social pressures to engage in antisocial behavior throughout childhood and adolescence.

Our hypothesis that conduct problems are related to a profile of temperaments is not original; only the details are new. Thirty years ago, Eysenck (1964, 1996) hypothesized that individuals who are high in the dimensions of neuroticism, psychoticism, and extraversion are more likely to commit crimes. Similarly, using Cloninger’s (1987) model of personality, Tremblay et al. (1994) demonstrated the importance of temperament profiles by showing that children rated as being high in novelty seeking, low in harm avoidance, and low in reward dependence exhibited greater conduct problems during early adolescence than youth with any other temperament profile. In addition, Caspi et al. (1994), Krueger et al. (1994), and Moffitt and colleagues (Moffit et al., 1996; Moffit, Caspi, Harrington, & Milne, 2002) administered Tellegen’s (1982) personality questionnaire to a long-
tudinal sample during adolescence and found the profile of higher negative emotionality and lower “constraint” to be associated with greater antisocial behavior in adolescence and adulthood. Tellegen’s construct of constraint appears to reflect both higher prosociality and lower daring in the present model (both of which we view as “constraining” the expression of negative emotionality in conduct problems). Thus, because our model is quite similar to earlier trait theories, any value of the present model must derive from the details of its hypotheses. In particular, the present model posits somewhat different dimensions of temperament that are operationalized using measures that do not overlap with psychopathology, includes cognitive-verbal deficits ignored in most temperament/personality models, places antisocial propensity in developmental context, integrates the temperament model with a social learning model, and uses the concepts of contemporary behavior genetics to frame our hypotheses regarding both environmental and genetic influences.

A number of papers have addressed the relation between child temperament/personality and conduct problems by defining dichotomous types of personality instead of dimensions. In several samples of children and adolescents across countries, Block’s (1961) personality Q-sort was used to empirically induce three personality types in a sample of adolescent males (Asendorpf, Borkenau, Ostendorf, & Van Aken, 2001; Asendorpf & van Aken, 1999; Hart, Hofmann, Edelstein, & Keller, 1997; Robins, Johns, Caspi, Moffitt, & Stouthamer-Loeber, 1996). Youth were classified as “resilient,” “overcontrolled,” or “undercontrolled,” with the latter having characteristics similar to our high-risk temperament profile and exhibiting substantially more conduct problems than other personality types in all studies. These studies are potentially important in describing a group of youth who are at very high risk for conduct problems. Unfortunately, Block’s Q-sort includes many items that refer to symptoms of externalizing and internalizing psychopathology, raising concerns that the correlation with conduct problems is based partly or wholly on overlapping items in the measure of personality and conduct problems.

Although we loosely speak of our high-risk temperament profile as referring to a group of youth in this chapter, we are not hypothesizing that they constitute a taxonomic type like the “undercontrolled type.” Rather, we believe that variation along all three continuous dimensions of temperament is important in the prediction of conduct problems. This means two things: First, we hypothesize that youth with deviant scores on only one or two of the dimensions of temperament will be at increased risk for later conduct problems (i.e., increased risk is not limited to youth who exhibit all elements of the “profile”). Second, among youth who exhibit the high-risk profile, we hypothesize that youth whose scores on the three temperament dimensions deviate more from the norm will be at greater risk for conduct problems.
Development of Temperament

We believe that the three dimensions of temperament described in the present chapter can be measured reliably beginning in preschool, and perhaps earlier. For example, observational measures of prosociality and negative emotionality used with 4-year-olds (e.g., Hughes et al., 2000) and observational measures of behavioral disinhibition (which we refer to as “daring”) used with toddlers (Kagan et al., 1988) have been found to be related to conduct problems. Additional work is needed to determine the earliest ages at which each dimension of temperament can be measured and how these dimensions change over the course of development. For example, are there individual differences in the behavior of 1-year-olds that reliably predict prosociality later in life?

A chapter that addresses the role of temperament in the origins of conduct problems cannot fail to address the construct of “difficult temperament.” There is evidence that children who are rated as having difficult temperament during infancy and toddlerhood are at increased risk for stable, aggressive conduct problems (Kingston & Prior, 1995; Olson, Bates, Sandy, & Lanthier, 2000; Sanson & Prior, 1999). The empirical relationship between difficult temperament in the first year of life and the present model, if any, remains to be described. We hypothesize, however, that ratings of infant difficultness will predict the high-risk profile of temperament. That is, we predict that infants rated as difficult will tend to be high in negative emotionality, low in prosociality, and high in daring during later childhood. If this hypothesis is supported, it would link two literatures regarding the developmental antecedents of conduct problems.

Cognitive Abilities and Antisocial Propensity

In addition to the three dimensions of temperament, we hypothesize that lower cognitive ability and slow language development increase risk for conduct problems. Many studies suggest that cognitive ability scores, particularly verbal abilities, are inversely related to individual differences in conduct problems (Elkins, Iacono, Doyle, & McGue, 1997; Ge, Donnellan, & Wenk, 2000; Kratzer & Hodgins, 1999; Lynam, Moffitt, & Stouthamer-Loeber, 1993; Moffitt & Silva, 1988; Statin & Klackenberg-Larsson, 1993). This correlation does not appear to be explainable in terms of differences in SES, greater ability of more intelligent youth to avoid detection of their antisocial behaviors, or differences in test motivation (Lynam et al., 1993; Moffitt & Silva, 1988). The specific cognitive deficits associated with conduct problems have been referred to variously using the partially overlapping terms of “intelligence,” “neuropsychological dysfunction,” and “executive functioning.” At this time it is not yet clear if one construct is
more defensible than others. Emerging evidence suggests that a cluster of executive function and language abilities is associated with early-onset conduct problems, even controlling for general intelligence (Giancola, Martin, Tarter, Pelham, & Moss, 1996; Seguin, Boulerice, Harden, Tremblay, & Pihl, 1999), but further research is needed on this important topic.

It is important to note that lower verbal intelligence is correlated with slower language development in early childhood (Sparks, Ganschow, & Thomas, 1996). An association between early deficits in language development and conduct problems is well documented by both cross-sectional and prospective studies of children from the general population (Stattin & Klackenberg-Larsson, 1993) and children with language disorders and other verbal deficits (Baker & Cantwell, 1987; Beitchman et al., 2001; Cohen et al., 1998; Dery, Toupin, Pauze, Mercier, & Fortin, 1999; Pennington & Ozonoff, 1996).

It should be noted that although we have preliminary evidence that the three dimensions of temperament are essentially orthogonal (only weakly intercorrelated), it is not yet clear that cognitive-linguistic deficits are fully independent of the three dimensions of temperament. Indeed, there are two reasons for thinking that intelligence and temperament may not be orthogonal. First, in three studies, youth classified as “undercontrolled,” which shares many characteristics with our high-risk temperament profile, had lower intelligence scores, on average (Asendorpf et al., 2001; Hart et al., 1997; Robins et al., 1996), suggesting that our temperament dimensions may also be linked to lower intelligence. Second, Nigg and Huang-Pollock (Chapter 8, in this volume) and Blair (2002) in his developmental neurobiological model both suggest that cognitive-linguistic abilities and negative emotionality are causally intertwined. As further evidence is gathered, therefore, it may well be necessary to modify our model to include causal links between cognitive-linguistic ability and one or more of the dimensions of temperament.

GENETIC AND ENVIRONMENTAL INFLUENCES

We first review current findings on genetic and environmental influences on conduct problems and the temperamental and cognitive elements of antisocial predisposition. Then we propose specific hypotheses regarding the mechanisms of these influences. As we detail later in this chapter, we examine genetic influences in the context of a social learning model of the origins of conduct problems. We believe that the critically important role of social learning in the origins of conduct problems can only be fully understood when taking the complex interplay of genetic and environmental influences into account.
Genetic and Environmental Influences on the Dimensions of Antisocial Propensity

There is strong and consistent evidence that Eysenck’s dimensions of neuroticism, extraversion, and psychoticism have substantial genetic influences and significant environmental influences (Eysenck, 1990; Lake, Eaves, Maes, Heath, & Martin, 2000; Macaskill, Hopper, White, & Hill, 1994; Pedersen, Plomin, McClearn, & Friberg, 1988). Similarly, studies using the construct of negative emotionality have found evidence of substantial heritability during adulthood (McGue, Bacon, & Lykken, 1993; Tellegen et al., 1988). Studies of adults’ empathic concern about the welfare of others have similarly found substantial heritability (Matthews, Batson, Horn, & Rosenman, 1981; Rushton, Fulker, Neale, Nias, & Eysenck, 1986).

Furthermore, negative emotionality is substantially heritable in toddlers, school-age children, and adolescents (Cyphers, Phillips, Fulker, & Mrazek, 1990; Emde et al., 1992; Gjone & Stevenson, 1997; Goldsmith, Buss, & Lemery, 1997; Phillips & Matheny, 1997; Saudino, Plomin, & DeFries, 1996). Similarly, twin studies of infants, children, and adults consistently suggest that empathy/prosocial behavior is moderately heritable (Davis, Luce, & Kraus, 1994; Emde et al., 1992; Rushton et al., 1986; Zahn-Waxler et al., 1992). Behavioral disinhibition and extraversion are also substantially heritable in toddlers and children (Cyphers et al., 1990; DiLalla, Kagan, & Reznick, 1994; Emde et al., 1992; Goldsmith et al., 1997; Phillips & Matheny, 1997; Robinson, Kagan, Reznick, & Corley, 1992).

There are, of course, also significant environmental influences on each of the three dimensions of temperament. The nature of these environmental influences is largely unknown, but several theorists have hypothesized that empathy, for example, can be influenced through socializing interactions with parents (Eisenberg, Fabes, & Murphy, 1996; Eisenberg & Mussen, 1991; Grusec, 1991). If the present model is correct in positing that temperament plays an important role in the origins of conduct problems, then understanding environmental influences on temperament in enough detail to develop preventive interventions must be a high priority. Keenan and Shaw (Chapter 6, this volume) provide an important perspective on this key issue. Genetic influences on cognitive ability and the development of language skills are also well documented (Plomin & Petrill, 1997), even during the toddler years (Eley, Dale, & Bishop, 2001; Emde et al., 1992; Petrill et al., 1997).

Genetic and Environmental Influences on Conduct Problems

There is abundant evidence from twin and adoption studies that child and adolescent conduct problems are influenced by both genetic and environ-
mental factors (Deater-Deckard & Plomin, 1999; Edelbrock, Rende, Plomin, & Thompson, 1995; Eley, Lichtenstein, & Stevenson, 1999; Ge et al., 1996; Gjone & Stevenson, 1997; Mason & Frick, 1994; Meyer et al., 2000; Miles & Carey, 1997; O'Connor, Neiderhiser, Reiss, Hetherington, & Plomin, 1998; Rhee & Waldman, 2002; Rodgers, Muster, & Rowe, 2001; Rowe, 1983; Rowe, Almeida, & Jacobson, 1999; Rutter, 1997; Rutter et al., 1997; Schmitz, Fulker, & Mrazek, 1995; van den Oord, Boomsma, & Verhulst, 1994). These include both genetic influences on the onset of conduct problems and on their persistence over time (Robinson et al., 1992; Saudino et al., 1996). Later in this chapter, we present specific hypotheses regarding the mechanisms of genetic influences on conduct problems.

**CONDUCT PROBLEMS AND THEIR CO-OCCURRENCE WITH OTHER PROBLEMS**

Youth with childhood conduct problems are more likely to meet diagnostic criteria for attention-deficit/hyperactivity disorder (ADHD) and ODD during childhood than youth with later ages of onset of conduct problems (Hinshaw, Lahey, & Hart, 1993; Lahey et al., 1998; Loeber, Green, Keenan, & Lahey, 1995; Moffitt, 1990; Moffitt et al., 1996). There is also increasing evidence that children with early-onset conduct problems and co-occurring ADHD and ODD are more likely to exhibit aggression, to show persistent or worsening conduct problems over time, and to exhibit psychopathic characteristics later in life (Henry, Caspi, Moffitt, & Silva, 1996; Lynam, 1998).

We hypothesize that early-onset conduct problems, ADHD, and ODD often co-occur because they reflect essentially the same underlying temperamental and cognitive propensities. That is, the high-risk profile of temperament and cognitive deficits is not specifically associated with conduct problems, but is a risk profile for all disruptive behavior disorders. Why, then, do many children exhibit only one or two of these three disorders? We hypothesize two reasons:

1. Differences in the child’s transactions with the social environment will determine which children will exhibit which combination of ADHD, ODD, and CD behaviors. We expand on this key hypothesis later in the chapter.

2. We also expect variations in the degree of variation in each dimension of propensity to be a factor in determining the pattern of disruptive behaviors that each child exhibits. Most children who exhibit only ADHD or only ODD are hypothesized to have only moderately atypical propensity profiles, whereas we expect most children with co-occurring early-onset conduct problems, ADHD, and ODD to have extremely atypi-
cal propensity profiles. There is evidence that supports the hypothesis that children with co-occurring conduct problems, ADHD, and ODD have the highest levels of antisocial propensity. In the Australian Temperament Project, children with comorbid conduct problems and ADHD at age 8 years were more likely to receive high ratings on negative emotionality/irritability from infancy onward than children with only conduct problems, only ADHD, or neither disorder (Sanson & Prior, 1999). In addition, Waschbusch (2002) conducted a meta-analysis of 12 studies of over 6,000 girls and boys and found that verbal intelligence scores were related to conduct problems, but, confirming earlier qualitative reviews (Henry & Moffitt, 1997; Hinshaw, 1992; Hogan, 1999), children with both conduct problems and ADHD tended to have lower verbal intelligence scores than children with only conduct problems, only ADHD, or neither disorder. Indeed, children who exhibited only conduct problems and not ADHD did not differ from controls in verbal intelligence.

Paradoxical Relation between Anxiety and Conduct Problems

Four well-established findings about conduct problems and anxiety have long seemed contradictory, but can perhaps be explained by the present model. First, anxiety disorders co-occur with conduct problems at greater than chance rates in childhood, adolescence, and adulthood (Loeber & Keenan, 1994; Zoccolillo, 1992). Second, children with conduct problems who are socially withdrawn are at increased risk for persistent and serious conduct problems (Blumstein, Farrington, & Moitra, 1985; Kerr et al., 1997; Serbin, Moskowitz, Schwartzman, & Ledingham, 1991). Third, shyness or anxiety in childhood in the absence of early conduct problems is associated with a decreased risk of later conduct problems (Graham & Rutter, 1973; Kohlberg, Ricks, & Snarey, 1984; Mitchell & Rosa, 1981; Sanson, Pedlow, Cann, Prior, & Oberklaid, 1996). Fourth, delinquents with higher levels of anxiety show lower rates of recidivism (Quay & Love, 1977).

Thus, anxiety and shyness sometimes appear to foster conduct problems and sometimes seem to protect against conduct problems. In terms of the present model, we hypothesize that shyness or anxiety that reflects low daring (i.e., timidity and shyness) will protect against the development of conduct problems. To the extent that anxiety reflects negative emotionality, however, anxiety will be positively correlated with conduct problems (because negative emotionality is positively correlated with conduct problems). In addition, when children are considered to be socially withdrawn or shy because they are low in prosociality (i.e., they do not care about other children), their social withdrawal will be positively correlated with conduct problems because prosociality is inversely related to conduct problems.

This hypothesis is consistent with the recent findings of a follow-up at
age 26 years of the Dunedin Longitudinal Study (Moffitt et al., 2002). Per-
sonality measures administered in adolescence showed that males who ab-
stained from antisocial behavior from childhood into adulthood could be
said to be anxious in the sense of be low in daring, but were prosocial and
low in negative emotionality. Boys showing life-course-persistent conduct
problems exhibited the opposite pattern. What is needed, of course, is a
prospective test of this hypothesis using measures of temperament adminis-
tered in childhood rather than in adolescence.

Genotype–Environment Interactions and Correlations

Like others, we believe that the environment plays a profoundly important
role in the development of conduct problems. In order to fully understand
environmental influences and harness their power in prevention and treat-
ment, however, the role of the environment must be studied in the context
of its interplay with genetic influences. In particular, we believe that genetic
and environmental influences on conduct problems work partly through
both genotype–environment interactions and genotype–environment corre-
lations (Rutter, 1997; Rutter et al., 1997).

Genotype–Environment Interactions

Specifically, we hypothesize two types of genotype–environment interac-
tions:

1. There is evidence that genetic influences on conduct problems
can be muted by favorable social learning environments. In particular, a
number of adoption studies indicate that conduct problems in the adopted-
away offspring of antisocial parents are less common when they are raised
by well-adjusted adoptive parents than by adoptive parents with problems
like their biological parents (Bohman, 1996; Cadoret, Yates, Troughton,
Woodward, & Stewart, 1995).

2. Different individuals respond in different ways to the social fac-
tors that encourage conduct problems. For example, some youth who are
poorly supervised and live in neighborhoods in which there are many delin-
quent role models will engage in serious delinquent acts with these peers,
but most will not. We posit that genetic influences increase or decrease the
likelihood that youth will respond to the social press to engage in delin-
quent behavior. Recently, Caspi et al. (2002) have provided striking evi-
dence that maltreated children who have a particular allele of the gene that
encodes monoamine oxidase A, which is an enzyme that inactivates a num-
ber of neurotransmitters, are more likely to engage in antisocial behavior
than maltreated children without this allele. We expect that many such
gene–environment interactions will need to be examined to understand the
role of both genes and the environment.
Although previous studies of genotype–environment interaction have examined differences in the magnitude of genetic and environmental influences as a function of naturally occurring variation in environments, it would be possible to increase the power for examining such interactions by creating experimenter-manipulated environments. That is, future twin studies of genotype–environment interaction for conduct problems could employ designs that incorporate random assignment to environmental manipulations (e.g., early parent training) to explore genotype–environment interactions. It is possible that such studies would find greater evidence of genotype–environment interactions on conduct problems than naturalistic studies by increasing the range of variation in trait-relevant social environments.

Genotype–Environment Correlations

Passive, evocative, and active genotype–environment correlations are also thought to be involved in the development of conduct problems (Plomin, DeFries, & Loehlin, 1977; Rutter, 1997; Rutter et al., 1997). That is, genetic and environmental influences on the origins of conduct problems are not independent, but are correlated.

The hypothesis of passive genotype–environment correlations means that the antisocial propensity that the child brings to the family, and the causally significant aspects of the family environment in which the child is raised, share the same genetic influences. Children with the greatest antisocial propensity tend to have absent antisocial fathers and to be raised by younger antisocial mothers with mental health problems (Klerman, 1993; Lahey et al., 1988; Lahey, Russo, Walker, & Piacentini, 1989; Nagin, Pogarsky, & Farrington, 1997; Wahler & Hann, 1987; Wakschlag et al., 2000). We hypothesize that this is partly because the same genes influence the behavior of both parents and their children. Because antisocial families are poorly prepared to provide the kinds of skilled childrearing that could prevent the development of conduct problem, this genotype–environment correlation helps propel the developmental progression from antisocial propensity to conduct problems.

Evocative genotype–environment correlations reflect the effects of the child’s genetically influenced temperament and cognitive characteristics on the social environment, and the effects, in turn, of the social environment on the development of conduct problems. Consistent with the social learning model (Patterson, 1982; Reid & Patterson, 1989), we hypothesize that parenting plays the key role in the developmental transformation of antisocial predisposition into conduct problems. Cognitively and temperamentally predisposed children are less likely to develop conduct problems if they are raised in adaptive social environments. Unfortunately, the child’s predisposing characteristics are hypothesized to evoke exactly the kinds of
coercive, harsh, nonresponsive, inconsistent, and negative parenting behaviors that transform antisocial propensity into conduct problems (Anderson, Lytton, & Romney, 1986; Ge et al., 1996; Loeber & Tengs, 1986; Patterson, 1982; Sanson & Prior, 1999).

Active genotype–environment correlations mean that, partly because of genetic influences, some children are more likely than others to seek out social environments that foster the development of conduct problems. For example, children who are on a developmental pathway to adolescent conduct problems preferentially associate with delinquent peers who foster their delinquent behavior. There is evidence that association with delinquent peers is partly genetically influenced (Rowe & Osgood, 1984).

INTERPLAY OF CHILD AND ENVIRONMENTAL FACTORS

How do individual differences in antisocial propensity cause conduct problems? The answer lies in the crucially important interplay between child characteristics (propensity) and the social environment (Keenan & Shaw, 1995). Consider, for example, two aspects of the interplay of negative emotionality with the social environment. First, by definition, toddlers who are high in negative emotionality become highly upset when they are frustrated or annoyed (e.g., by other children playing with a toy they want, by teachers instructing them to change activities, or by being bumped by another child). Their largely unlearned, intense, and nonspecific affective responses during toddlerhood provide a fertile behavioral basis for oppositional behavior. Indeed, little is required from the social environmental to shape such global affective reactions into oppositional behaviors (defiance, tantrums, etc.). In addition, such children respond in intensely negative ways to frustrating disciplinary restrictions, raising the likelihood of the increasingly aversive parent–child exchanges that Patterson (1982) refers to as the “coercion cycle.” Second, as Tremblay (2000) demonstrated, it is common (but far from universal) for toddlers to be aggressive: to hit, kick, and bite. We posit that toddlers who are high in negative emotionality are both (1) more likely to be aggressive, and (2) to be aggressive in affect-laden ways that have serious consequences for self and others. For example, we hypothesize that toddlers who are high in negative emotionality tend to be aggressive in emotionally intense ways that are reinforced by their dominating other children (and sometimes adults).

Prosociality and daring are thought to influence the development of conduct problems in similar ways. For example, consider a social exchange in which a preschool child hits another child in an argument over a toy. For a child who is low in prosociality, the victim’s crying and acquiescence might reinforce the aggression, but this same reaction might be punishing to a child who is high in prosociality. Similarly, a peer’s suggestion that they
leave the school building without permission might seem exciting and desirable to a child who is high on daring, but too risky to a child who is low on daring. In many such ways, the three dimensions of temperament that children bring to their social environments both shape the environment and influence his or her reaction to it.

Although the mechanisms of the inverse association between cognitive ability and conduct problems are not yet clear, we suspect that there are multiple ways in which deficient cognitive and verbal skills contribute to the development of conduct problems. For example, in early childhood, individual differences in intelligence are manifested partly as differences in the development of communication skills (Stattin & Klackenberg-Larsson, 1993). Following Keenan and Shaw (1997), we posit that toddlers with better communication skills are easier to socialize. This is because they comprehend parental instructions better, can communicate their wishes better, and hence are less likely to become frustrated during interactions with their parents.

Two recent studies suggest important ways in which cognitive deficits might interact with negative emotionality to adversely affect the social environment. In the words of Hughes, Cutting, and Dunn (2001), preschool children with high levels of behavior problems “act nasty” when frustrated in rigged competitive tasks more often than other children. In everyday life, it is likely that below-average cognitive abilities increase the likelihood of actual failure in school tasks, games, and sports. Thus, if children with less well developed cognitive skills and early conduct problems often fail, and react emotionally when they fail, they may be children that their well-behaved peers would reject (Maszk, Eisenberg, & Guthrie, 1999) and children that teachers find difficult to discipline in constructive ways.

During primary school, children who are low in cognitive abilities and exhibit conduct problems are at increased risk for grade retention. Using longitudinal data, Pagani, Tremblay, Vitaro, Boulerice, and McDuff (2001) found that grade retention did not improve academic performance but increased future conduct problems, particularly in boys. This might happen because grade retention places the aggressive child in an environment with younger and weaker classmates who are more likely to reinforce his or her antisocial behavior by cowering and complying. This study has important implications both for theories of the origins and maintenance of conduct problems and for public policy, as recent moves toward greater grade retention in the United States could foster the development of conduct problems.

**SPECIFYING AND EVALUATING THE MODEL**

In this section, we lay out the major specific hypotheses of the current model and suggest critical empirical tests needed to evaluate the validity of the present model.
Key Hypotheses Regarding the Origins of Conduct Problems

Many hypotheses regarding the origins of conduct problems are embedded in the text above. In this section, we offer a number of hypotheses that deserve particular attention and suggest studies needed to provide the most stringent tests of these hypotheses.

Mediation of Genetic Influences

There is growing evidence that the genetic influences on childhood conduct problems, ODD, and ADHD overlap to a considerable degree (Coolidge, Thede, & Young, 2000; Eaves et al., 2000; Thapar, Harrington, & McGuffin, 2001; Waldman, Rhee, Levy, & Hay, 2001). We hypothesize an explanation for this overlap in genetic influences that is based on our model of predisposing child characteristics. This hypothesis is the cornerstone of our model, as we believe it provides a necessary blueprint for understanding genetic and environmental influences on conduct problems.

In our model, genetic influences do not have a direct impact on conduct problems. Broad dimensions of human behavior have direct genetic influences, but specific complex behaviors, such as stealing and vandalism, do not. Genetic influences on conduct problems are hypothesized to be indirect, through the four broad dimensions of antisocial propensity. Specifically, we hypothesize that the temperamental and cognitive-verbal components of antisocial propensity (1) each have unique genetic influences, and (2) these components of propensity mediate the genetic influences on conduct problems (Lahey, Waldman, et al., 1999). Genetic influences are hypothesized to affect the environments in which conduct problems are learned partly due to the effects of child characteristics (temperament and cognitive ability) on the environment (active and evocative genotype–environment correlations), but also through passive genotype–environment correlations.

Four recent studies provide evidence relevant to our genetic mediation hypothesis. Schmitz et al. (1999) obtained maternal ratings of the negative emotionality of twins at the ages of 14, 20, 24, and 36 months and ratings on the Child Behavior Checklist (CBCL) at 48 months. Negative emotionality measured at all ages predicted CBCL Externalizing scores (composite of oppositional, aggressive, and nonaggressive conduct problems) at age 4 years. Consistent with our mediation hypothesis, 96% of the correlation between early negative emotionality and later conduct problems was explained by genetic influences common to both variables. In a well-conceived study, Lemery, Essex, and Smider (in press) developed “purified” measures of temperament and child behavior and emotional problems by eliminating overlapping items. In 270 pairs of twins, temperament measured at age 5 predicted behavior problems at age 7. More importantly, genetic influences on age 7 conduct problems were substantial and were en-
tirely mediated by age 5 temperament measures. Although their dimensions of temperament differed from our own, two of the dimensions of temperament that Lemery et al. identified through exploratory factor analyses (negative affectivity and surgency) resemble our hypothesized dimensions of negative emotionality and daring enough to lend plausibility to our mediation hypothesis.

Over a much longer age span, Gjone and Stevenson (1997) also conducted multivariate behavior genetic analyses of a sample of 759 twin pairs who were 5–15 years old in the first assessment. Parent ratings of negative emotionality in the first assessment predicted both CBCL Aggression and Delinquency ratings 2 years later. Negative emotionality and Aggression scores shared common genetic influences, but neither common genetic nor shared environmental influences explained the prospective association between temperament and CBCL Delinquency scores. Although our model would have predicted some shared causal influences on negative emotionality and CBCL Delinquency scores, this finding is consistent with our hypothesis that developmentally early conduct problems, which constitute most of the Aggression scale items, and which are found mostly among youth with earlier ages of onset, have stronger genetic influences that the items on the Delinquency scale (which are also common among youth with later ages of onset).

There also is suggestive evidence that executive functioning shares a substantial proportion of its genetic influences with childhood conduct problems, ODD, and ADHD (Coolidge et al., 2000). This is consistent with our hypothesis that genetic influences on childhood conduct problems (and co-occurring ADHD and ODD) are mediated partly by deficits in verbal–executive aspects of cognitive ability.

At the molecular level, the nature of genetic influences on conduct problems is undoubtedly complex, but our model may facilitate their identification. As reviewed above, there is evidence that the genetic influences on conduct problems are shared with ADHD, ODD, and perhaps other mental disorders. Our model suggests that each of the components of antisocial propensity is influenced by a distinct sets of genes, which indirectly influence the development of conduct problems through the four components of antisocial propensity. If this hypothesis is correct, it may be easier to identify the smaller and more independent sets of genes that influence each of the four dimensions of antisocial propensity than to search for the multiple sets of overlapping genes that indirectly influence conduct problems and other types of mental health problems.

Sex Differences in Conduct Problems

From about 4 years of age, boys are more likely than girls to engage in conduct problems (Keenan & Shaw, 1997; Lahey, Schwab-Stone, et al., 2000;
Moffitt et al., 2001; Tremblay et al., 1996). Because the magnitude of these sex differences is considerable, any successful explanation of sex differences will greatly inform general models of the origins of conduct problems. We hypothesize that the causes of conduct problems are the same for girls and boys, with sex differences in conduct problems arising mostly from sex differences in the levels of the components of antisocial propensity (Rhee & Waldman, 2002; Rowe, Vazsonyi, & Flannery, 1995). For example, boys lag behind girls on average in the development of language communication during the crucial toddler years (Sanson, Smart, Prior, & Oberklaid, 1993). Keenan and Shaw (1997) suggested that girls are easier to socialize for this reason and that the resulting differences in socialization help create sex differences in conduct problems. To take a second example, girls show higher levels of empathy and guilt than males from toddlerhood through adolescence (Keenan, Loeber, & Green, 1999; Keenan & Shaw, 1997; Zahn-Waxler et al., 1992). We posit that prosociality plays the same role in the development of conduct problems in girls and boys, but from an early age boys are less prosocial. This difference may reflect inherent sex differences in prosociality, early sex differences in socialization that create differences in prosociality, or both.

There is some evidence, however, that there could be more fundamental sex differences in genetic and environmental influences on conduct problems. Two studies suggest that genetic and environmental influences are similar for girls and boys on developmentally early conduct problems, but are more distinct on developmentally late conduct problems (Eley et al., 1999; Silberg et al., 1996). This could reflect sex differences in the magnitude of genetic influences, but it raises the possibility of unique causal influences on girls’ conduct problems that are not included in the present model, such as genetic influences on pubertal timing. This seems plausible as some evidence suggests that early-maturing girls show an earlier and higher peak in conduct problems (Moffitt et al., 2001) and pubertal timing has strong genetic influences in girls (Pickles et al., 1998). There are many possible explanations for the potential sex difference in environmental influences on developmentally late conduct problems. First, they may reflect differences in the ways in which parents and teachers socialize girls and boys (Keenan & Shaw, 1997). Second, they may result from sex differences in the interaction between pubertal development and peer influences (Caspi, Lynam, Moffitt, & Silva, 1993). Third, girls may be more sensitive to some kinds of social influences than boys, with one potential difference of this type being greater sensitivity to family discord among girls than boys (Keenan et al., 1999).

There are three additional ways in which there could be fundamental sex differences in the causes of conduct problems. There is a substantial difference between girls and boys in the extent of co-occurrence of conduct problems with depression, substance abuse, and other disorders (Keenan et
al., 1999), raising the possibility that conduct problems in girls may share more etiological influences with these other disorders than do boys. In addition, evidence from Gjone and Stevenson (1997) suggests that the association between negative emotionality and conduct problems may be stronger for boys than girls. Finally, although much remains to be learned (Keenan et al., 1999; Moffit et al., 2001), some studies suggest that girls who engage in conduct problems have similar characteristics regardless of their age of onset of conduct problems, whereas the characteristics of boys with earlier versus later ages of onset differ considerably (Kratzer & Hodgins, 1999; Silverthorn & Frick, 1999; Silverthorn, Frick, & Reynolds, 2001). Thus, there are many possible reasons why sex differences in conduct problems could reflect fundamental sex differences in the causal matrix. All of these possibilities deserve study, but a sensible first step would be to test the hypothesis that sex differences in conduct problems can be fully explained by sex differences in mean levels of the components of antisocial propensity. Moffit et al. (2001) provided important evidence of this possibility using a population-based sample of youth. When two dimensions of personality (negative emotionality and constraint) that were measured during adolescence were added to a regression model of sex differences in delinquent behavior, sex differences in personality accounted for nearly all of the sex differences.

Demographics and Conduct Problems

An inverse relation between SES and conduct problems has been found in many population-based studies (Lahey, Miller, Gordon, & Riley, 1999). An important goal of any general model of conduct problems is to explain why this is the case, and also to explain why the great majority of children from low-SES families do not engage in serious conduct problems. We hypothesize that the multiple environmental factors associated with lower SES influence the developmental transition from antisocial propensity to conduct problems. These SES-linked environmental factors include living in high-crime neighborhoods, attending schools with delinquent peers, and the family’s lack of economic resources—which affect access to daycare, afterschool care, mental health services, and the like (Harnish, Dodge, & Valente, 1995; Kilgore, Snyder, & Lentz, 2000). We hypothesize that these environmental circumstances foster the social learning of conduct problems (Caspi, Taylor, Moffitt, & Plomin, 2000). On the other hand, part of the correlation of lower SES with conduct problems reflects selection effects. There is evidence of downward socioeconomic mobility (or staying at the low SES of their family of origin) among parents who are antisocial and/or have mental health and substance abuse problems (Dohrenwend & Dohrenwend, 1974; Miech et al., 1999). In some instances, then, characteristics of persons lead them to live in adverse socioeconomic circumstances (selec-
tion effects) and these circumstances, in turn, influence their children (casual effects).

Why do most children living in low-SES circumstances not engage in serious antisocial behavior? Consistent with our general model, we hypothesize that children who are not temperamentally and cognitively predisposed to develop conduct problems will be less influenced by the environmental factors associated with lower SES than predisposed children. Because there are genetic influences on antisocial propensity, this means that the environmental influences associated with SES influence the child partly through genotype–environment interactions.

There is also evidence that women who give birth at younger ages are more likely to have children who engage in conduct problems (e.g., Levine, Pollack, & Comfort, 2001; Nagin et al., 1997). Following Jaffee, Caspi, Moffitt, and Silva (2001), we hypothesize that this reflects both person factors that select certain women into early childbearing and environmental influences on their offspring associated with early childbearing. These hypotheses regarding sociodemographic influences could be put to the strongest test in genetically informative, multigenerational designs, such as a study of the offspring of twin mothers.

Race–Ethnic Differences in Conduct Problems

After controlling for SES and neighborhood factors, there is little or no difference in the prevalence of most conduct problems among African American, Hispanic, and non-Hispanic white youth (Bird et al., 2001; Loeber et al., 1998). There appear to be race–ethnic differences in some specific crimes, however, such as drug selling and assault with a deadly weapon (Blum et al., 2000). We hypothesize that these differences are mostly attributable to a marked difference in the tendency of youth in different race–ethnic groups to join antisocial gangs. Evidence is sparse for girls, but there is clear evidence that the boys who join gangs had high and escalating levels of aggressive and nonaggressive conduct problems prior to joining their first gang (Esbensen, Huizinga, & Weiher, 1993; Lahey, Gordon, Loeber, Stouthamer-Loeber, & Farrington, 1999). Over the past 100 years, the race–ethnic groups that have been most likely to join antisocial gangs have changed, with Irish immigrants being the mostly likely to join gangs around the turn of the 20th century, for example. At this time in history, misbehaving non-Hispanic white boys are much less likely to join gangs than misbehaving African American and Hispanic boys (Lahey, Gordon, et al., 1999). There is also clear evidence from longitudinal studies that during their period of gang membership, gang members show marked increases in the frequency of drug-related and violent offenses (so that they account for 10 times more assaults and drug sales than nongang members), which declines after their period of gang membership ends (Esbensen et al., 1993;
Thornberry, Krohn, Lizotte, & Chard-Wierschem, 1993). We posit that the powerful social influence of gang membership accounts for much of race–ethnic differences in serious adolescent antisocial behavior. The outlook for gang influence is guardedly optimistic, as there has been a 13% decline in the number of law enforcement jurisdictions in the United States with known gangs from 1996 to 2000 and a 5% decline in the number of gang members from 1999 to 2000. Still, there were an estimated 772,500 gang members in the United States during 2000 (Office of Juvenile Justice and Delinquency Prevention, 2002). In addition, there are findings that suggest other possible race–ethnic differences in the nature of social influences on conduct problems (such as parenting styles) that must be pursued in future studies (e.g., Deater-Deckard, Dodge, Bates, & Pettit, 1996; Donnellan, Ge, & Wenk, 2001). Given the profound importance of culture, it would not be surprising to find differences in causal influences on conduct problems, but such differences have not yet been convincingly demonstrated.

Playing (and Refuting) the Devil’s Advocate

The greatest threat to the validity of the present model of the origins of conduct problems (and other models that ascribe a role to temperament or personality constructs) is that the correlations on which they are based could be circular. Consider a parent who has been asked to complete two rating scales about her daughter, one composed of items referring to conduct problems and the other composed of items that assess her temperament. After rating the child’s antisocial behavior, the parent is asked if her daughter “gets upset easily,” “cares about the feelings of others,” and “likes things that may be dangerous.” The mother may answer these questions by thinking of her daughter’s frequent fighting. Even if there is evidence to the contrary in the girl’s behavior, the salience of her fighting may lead the mother to infer that her daughter is easily upset, unconcerned about others, and likes dangerous situations. A youth completing self-report instruments might complete them in the same circular way.

It is essential to move beyond this potential circularity in testing the present causal model. Several research strategies seem appropriate for this purpose:

1. It is important for some studies to use measures of temperament that are not completed by the same individuals who report on the child’s conduct problems. A number of such studies have already been completed, however, which lend credibility to the model. For example, Kagan’s (1992) laboratory measure of behavioral disinhibition, which is based on observations by independent observers, is associated with the development of conduct problems (Biederman et al., 2000; Schwartz et al., 1996). Similarly, observational measures have shown that preschoolers with conduct problems engage in less prosocial behavior and display more negative emo-
tion during play with a friend (Hughes et al., 2000) and react more emotionally to failure in a competitive task (Hughes et al., 2001). Eisenberg et al. (1996) used gaze aversion while watching a film of a distressed child and Zhou et al. (2002) used ratings of facial expressions while viewing slides depicting the positive or negative emotions of others as measures of empathy. Similarly, Hastings et al. (2000) used feigned accidents to the child’s mother to observe the child’s empathic response, with some aspects of empathy being correlated with conduct problems in both studies. Fortunately, structured tests of cognitive and language skills by examiners are relatively free of confounds if the examiners are unaware of child’s behavior problems (but individual differences in behavior during assessments could bias the test results).

2. Because of the low cost and convenience of rating scales, particularly in large-scale population-based studies, it is essential to validate temperament rating scales against observational and laboratory measures.

3. The similarities of the current model of temperament to structural personality theories suggest another important way to validate measures of temperament and to understand their meaning. Eyseck’s (1947) model, for example, has stimulated many studies of biological differences in individuals with varying scores on his dimensions of personality. For example, using functional magnetic resonance imaging, Canli et al. (2001) found striking correlations in the \( r = .70–.85 \) range between neuroticism scores and activity in frontal and limbic structures in response to negatively valenced stimuli. Similarly strong correlations were found between extraversion scores and brain activity in response to positively valenced stimuli. Such studies using measures of the our hypothesized dimensions of temperament would do much to validate the measures and further understanding of the individual differences in brain functioning associated with temperament. Other well-developed research programs on the neurobiology of personality and emotion (Davidson, Putnam, & Larson, 2000; Depue & Collins, 1999) and on individual differences in conditioning and reward sensitivity also provide highly promising avenues for validating the model (Beyts, Frcka, Martin, & Levey, 1983; Daugherty, Quay, & Ramos, 1993; Newman, Widom, & Stewart, 1985).

4. Prospective studies beginning early in childhood that test predictions about the future development of conduct problems will be essential to testing the model in the most informative manner. If, for example, preschool children with the high-risk propensity profile fail to show marked increases in conduct problems during later childhood and adolescence, the model would be disconfirmed.

5. The validity of the present model can also be evaluated by testing specific model-driven hypotheses, such as the hypothesis that the temperamental and cognitive-linguistic components of propensity mediate genetic influences on conduct problems.
Studies Needed to Expose the Current Model to Risk of Refutation

The many specific hypotheses advanced in this chapter relate the social environment and individual differences in child characteristics (the components of antisocial propensity, sex, and race–ethnicity) to individual differences in the development of conduct problems. These hypotheses can be best tested in representative population-based samples that can map the relation of child characteristics and social environments onto individual differences in the development of conduct problems. Representative samples are needed to avoid sampling biases that create false correlations. These samples would need to contain sufficient numbers of children who engage in significant levels of conduct problems to provide adequate statistical power. This would require either large sample sizes or the oversampling of high-risk subgroups, such as lower SES families. Alternatively, well-reasoned comparisons of selected groups, such as clinic attendees and matched controls could be useful, but any use of nonrepresentative samples raises risks of artifacts due to biased sampling and population stratification. The hypotheses of independent genetic influences on the components of propensity and their mediation of genetic influences on conduct problems could be tested in genetically informative population-based samples, such as samples of twins or other siblings, with longitudinal studies providing the greatest information of both the timing of influences and the nature of influences on the persistence of conduct problems. Such scientifically strong studies are expensive and time-consuming, but, in the long run, they provide the quickest and most cost-effective way to advance knowledge of the causes of this troubling personal and social problem.

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REFERENCES


A Developmental Propensity Model


