Module 68

Schizophrenia


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Module Learning Objectives

68-1 Describe the patterns of thinking, perceiving, and feeling that characterize schizophrenia.

68-2 Contrast chronic and acute schizophrenia.

68-3 Discuss how brain abnormalities and viral infections help explain schizophrenia.

68-4 Discuss the evidence for genetic influences on schizophrenia, and describe some factors that may be early warning signs of schizophrenia in children.

schizophrenia a psychological disorder characterized by delusions, hallucinations, disorganized speech, and/or diminished or inappropriate emotional expression.

psychosis a psychological disorder in which a person loses contact with reality, experiencing irrational ideas and distorted perceptions.

delusions false beliefs, often of persecution or grandeur, that may accompany psychotic disorders.

AP® Exam Tip

It is common for the AP® exam to measure your awareness of various "media myths" about psychology. One of the most common of these myths is that schizophrenia means "split personality" or "multiple personality." Read this section carefully to achieve an accurate understanding of what schizophrenia is—and isn't.

Imagine trying to communicate with Maxine, a young woman with schizophrenia whose thoughts spill out in no logical order. Her biographer, Susan Sheehan (1982, p. 25), observed her saying aloud to no one in particular, "This morning, when I was at Hillside [Hospital], I was making a movie. I was surrounded by movie stars. . . . I'm Mary Poppins. Is this room painted blue to get me upset? My grandmother died four weeks after my eighteenth birthday."

Nearly 1 in 100 people (about 60 percent men) develop schizophrenia, with an estimated 24 million across the world suffering from this dreaded disorder (Abel et al., 2010; WHO, 2011).

Symptoms of Schizophrenia

68-1 What patterns of thinking, perceiving, and feeling characterize schizophrenia?

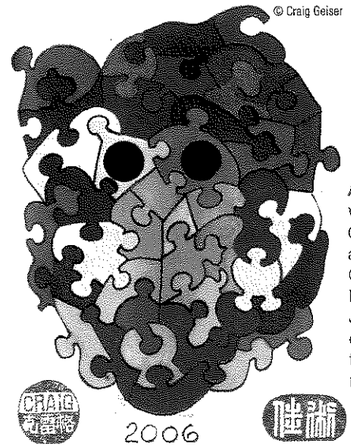
Literally translated, **schizophrenia** means "split mind." It refers *not* to a multiple-personality split but rather to a split from reality that shows itself in disturbed perceptions, disorganized thinking and speech, and diminished, inappropriate emotions. As such, it is the chief example of a **psychosis,** a *psychotic disorder* marked by irrationality and lost contact with reality.

Disorganized Thinking and Disturbed Perceptions

As Maxine's strange monologue illustrates, the thinking of a person with schizophrenia is fragmented, bizarre, and often distorted by false beliefs called **delusions** ("I'm Mary Poppins"). Those with *paranoid* tendencies are particularly prone to delusions of persecution. Even within sentences, jumbled ideas may create what is called *word salad.* One young man begged for "a little more allegro in the treatment," and suggested that "liberationary movement with a view to the widening of the horizon" will "ergo extort some wit in lectures."

A person with schizophrenia may have **hallucinations** (sensory experiences without sensory stimulation). They may see, feel, taste, or smell things that are not there. Most often, however, the hallucinations are auditory, frequently voices making insulting remarks or giving orders. The voices may tell the patient that she is bad or that she must burn herself with a cigarette lighter. Imagine your own reaction if a dream broke into your waking consciousness. When the unreal seems real, the resulting perceptions are at best bizarre, at worst terrifying.

Disorganized thoughts may result from a breakdown in *selective attention.* Recall from Module 16 that we normally have a remarkable capacity for giving our undivided attention to one set of sensory stimuli while filtering out others. Those with schizophrenia cannot do this. Thus, irrelevant, minute stimuli, such as the grooves on a brick or the inflections of a voice, may distract their attention from a bigger event or a speaker's meaning. As one former patient recalled, "What had happened to me . . . was a breakdown in the filter, and a hodge-podge of unrelated stimuli were distracting me from things which should have had my undivided attention" (MacDonald, 1960, p. 218). This selective-attention difficulty is but one of dozens of cognitive differences associated with schizophrenia (Reichenberg & Harvey, 2007).



Art by someone diagnosed with schizophrenia
Commenting on the kind of artwork shown here (from Craig Geiser's 2010 art exhibit in Michigan), poet and art critic John Ashbery wrote: "The lure of the work is strong, but so is the terror of the unanswerable riddles it proposes."

AP® Exam Tip

Are you clear about the difference between delusions and hallucinations? Delusions are false *thoughts.* Hallucinations are false *sensory experiences.*

Diminished and Inappropriate Emotions

The expressed emotions of schizophrenia are often utterly inappropriate, split off from reality (Kring & Caponigro, 2010). Maxine laughed after recalling her grandmother's death. On other occasions, she cried when others laughed, or became angry for no apparent reason. Others with schizophrenia lapse into an emotionless state of *flat affect.* Most also have difficulty perceiving facial emotions and reading others' states of mind (Green & Horan, 2010; Kohler et al., 2010).

Motor behavior may also be inappropriate. Some perform senseless, compulsive acts, such as continually rocking or rubbing an arm. Others, who exhibit *catatonia,* may remain motionless for hours and then become agitated.

As you can imagine, such disorganized thinking, disturbed perceptions, and inappropriate emotions profoundly disrupt social relationships and make it difficult to hold a job. Even those with *dissociative identity disorder,* which we'll discuss later in this unit, may continue to function in everyday life, but less so those with schizophrenia. During their most severe periods, those with schizophrenia live in a private inner world, preoccupied with illogical ideas and unreal images. Given a supportive environment and medication, over 40 percent of schizophrenia patients will have periods of a year or more of normal life experience (Jobe & Harrow, 2010). Many others remain socially withdrawn and isolated or rejected throughout much of their lives (Hooley, 2010).

"When someone asks me to explain schizophrenia I tell them, you know how sometimes in your dreams you are in them yourself and some of them feel like real nightmares? My schizophrenia was like I was walking through a dream. But everything around me was real. At times, today's world seems so boring and I wonder if I would like to step back into the schizophrenic dream, but then I remember all the scary and horrifying experiences." -STUART EMMONS, WITH CRAIG GEISER, KALMAN J. KAPLAN, AND MARTIN HARROW, *LIVING WITH SCHIZOPHRENIA,* 1997

hallucination false sensory experience, such as seeing something in the absence of an external visual stimulus.

Onset and Development of Schizophrenia

68-2 How do chronic and acute schizophrenia differ?

Schizophrenia typically strikes as young people are maturing into adulthood. Although it only afflicts 1 in 100 people, it knows no national boundaries, and it affects both males and females—though men tend to be struck earlier, more severely, and slightly more often (Aleman et al., 2003; Picchioni & Murray, 2007).

For some, schizophrenia will appear suddenly, seemingly as a reaction to stress. For others, as was the case with Maxine, schizophrenia develops gradually, emerging from a long history of social inadequacy and poor school performance (MacCabe et al., 2008). No wonder those predisposed to schizophrenia often end up in the lower socioeconomic levels, or even homeless.

We have thus far described schizophrenia as if it were a single disorder. Actually, it varies. Schizophrenia patients with *positive symptoms* may experience hallucinations, talk in disorganized and deluded ways, and exhibit inappropriate laughter, tears, or rage. Those with *negative symptoms* have toneless voices, expressionless faces, or mute and rigid bodies. Thus, positive symptoms are the *presence* of inappropriate behaviors, and negative symptoms are the *absence* of appropriate behaviors.

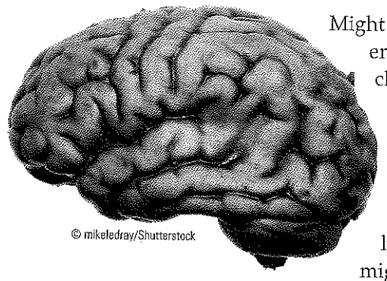
When schizophrenia is a slow-developing process (called *chronic*, or *process, schizophrenia*), recovery is doubtful (WHO, 1979). Those with chronic schizophrenia often exhibit the persistent and incapacitating negative symptom of social withdrawal (Kirkpatrick et al., 2006). Men, whose schizophrenia develops on average four years earlier than women's, more often exhibit negative symptoms and chronic schizophrenia (Räsänen et al., 2000). When previously well-adjusted people develop schizophrenia rapidly (called *acute*, or *reactive, schizophrenia*) following particular life stresses, recovery is much more likely. They more often have the positive symptoms that are responsive to drug therapy (Fenton & McGlashan, 1991, 1994; Fowles, 1992).

Understanding Schizophrenia

Schizophrenia is not only the most dreaded psychological disorder but also one of the most heavily researched. Most of the new research studies link it with brain abnormalities and genetic predispositions. Schizophrenia is a disease of the brain manifest in symptoms of the mind.

Brain Abnormalities

68-3 How do brain abnormalities and viral infections help explain schizophrenia?



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Might imbalances in brain chemistry underlie schizophrenia? Scientists have long known that strange behavior can have strange chemical causes. The saying "mad as a hatter" refers to the psychological deterioration of British hatmakers whose brains, it was later discovered, were slowly poisoned as they moistened the brims of mercury-laden felt hats with their tongue and lips (Smith, 1983). As we saw in Module 25, scientists are clarifying the mechanism by which chemicals such as LSD produce hallucinations. These discoveries hint that schizophrenia symptoms might have a biochemical key.

DOPAMINE OVERACTIVITY

Researchers discovered one such key when they examined schizophrenia patients' brains after death and found an excess of receptors for *dopamine*—a sixfold excess for the so-called D4 dopamine receptor (Seeman et al., 1993; Wong et al., 1986). They now speculate that such a hyper-responsive dopamine system may intensify brain signals in schizophrenia, creating positive symptoms such as hallucinations and paranoia (Grace, 2010). As we might therefore expect, drugs that block dopamine receptors often lessen these symptoms; drugs that increase dopamine levels, such as amphetamines and cocaine, sometimes intensify them (Seeman, 2007; Swerdlow & Koob, 1987).

FYI

Most schizophrenia patients smoke, often heavily. Nicotine apparently stimulates certain brain receptors, which helps focus attention (Diaz et al., 2008; Javitt & Coyle, 2004).

ABNORMAL BRAIN ACTIVITY AND ANATOMY

Modern brain-scanning techniques reveal that many people with chronic schizophrenia have abnormal activity in multiple brain areas. Some have abnormally low brain activity in the frontal lobes, which are critical for reasoning, planning, and problem solving (Morey et al., 2005; Pettegrew et al., 1993; Resnick, 1992). People diagnosed with schizophrenia also display a noticeable decline in the brain waves that reflect synchronized neural firing in the frontal lobes (Spencer et al., 2004; Symond et al., 2005). Out-of-sync neurons may disrupt the integrated functioning of neural networks, possibly contributing to schizophrenia symptoms.

One study took PET scans of brain activity while people were hallucinating (Silbersweig et al., 1995). When participants heard a voice or saw something, their brain became vigorously active in several core regions, including the thalamus, a structure deep in the brain that filters incoming sensory signals and transmits them to the cortex. Another PET scan study of people with paranoia found increased activity in the amygdala, a fear-processing center (Epstein et al., 1998).

Chris Mueller/Redux

Studying the neurophysiology of schizophrenia Psychiatrist E. Fuller Torrey has collected the brains of hundreds of those who died as young adults and suffered disorders such as schizophrenia and bipolar disorder.

Many studies have found enlarged, fluid-filled areas and a corresponding shrinkage and thinning of cerebral tissue in people with schizophrenia (Goldman et al., 2009; Wright et al., 2000). Some studies have even found such abnormalities in the brains of people who would *later* develop this disorder and in their close relatives (Karlsgodt et al., 2010). The greater the brain shrinkage, the more severe the thought disorder (Collinson et al., 2003; Nelson et al., 1998; Shenton, 1992). One smaller-than-normal area is the cortex. Another is the corpus callosum connection between the two hemispheres (Arnone et al., 2008). Another is the thalamus, which may explain why people with schizophrenia have difficulty filtering sensory input and focusing attention (Andreasen et al., 1994; Ellison-Wright et al., 2008). The bottom line of various studies is that schizophrenia involves not one isolated brain abnormality but problems with several brain regions and their interconnections (Andreasen, 1997, 2001).

Naturally, scientists wonder what causes these abnormalities. Some point to mishaps during prenatal development or delivery (Fatemi & Folsom, 2009; Walker et al., 2010). Risk factors for schizophrenia include low birth weight, maternal diabetes, older paternal age, and oxygen deprivation during delivery (King et al., 2010). Famine may also increase risks. People conceived during the peak of the Dutch wartime famine later displayed a doubled rate of schizophrenia, as did those conceived during the famine that occurred from 1959 to 1961 in eastern China (St. Clair et al., 2005; Susser et al., 1996).

MATERNAL VIRUS DURING MIDPREGNANCY

Consider another possible culprit: a midpregnancy viral infection that impairs fetal brain development (Patterson, 2007). Can you imagine some ways to test this fetal-virus idea? Scientists have asked the following:

- *Are people at increased risk of schizophrenia if, during the middle of their fetal development, their country experienced a flu epidemic?* The repeated answer is *Yes* (Mednick et al., 1994; Murray et al., 1992; Wright et al., 1995).
- *Are people born in densely populated areas, where viral diseases spread more readily, at greater risk for schizophrenia?* The answer, confirmed in a study of 1.75 million Danes, is *Yes* (Jablensky, 1999; Mortensen, 1999).
- *Are those born during the winter and spring months—after the fall-winter flu season—also at increased risk?* Although the increase is small, just 5 to 8 percent, the answer is again *Yes* (Fox, 2010; Torrey et al., 1997, 2002).

- *In the Southern Hemisphere, where the seasons are the reverse of the Northern Hemisphere, are the months of above-average schizophrenia births similarly reversed?* Again, the answer is *Yes,* though somewhat less so. In Australia, for example, people born between August and October are at greater risk—*unless* they migrated from the Northern Hemisphere, in which case their risk is greater if they were born between January and March (McGrath et al., 1995, 1999).
- *Are mothers who report being sick with influenza during pregnancy more likely to bear children who develop schizophrenia?* In one study of nearly 8000 women, the answer was *Yes.* The schizophrenia risk increased from the customary 1 percent to about 2 percent—but only when infections occurred during the second trimester (Brown et al., 2000). Maternal influenza infection during pregnancy also affects brain development in monkeys (Short et al., 2010).
- *Does blood drawn from pregnant women whose offspring develop schizophrenia show higher-than-normal levels of antibodies that suggest a viral infection?* In one study of 27 women whose children later developed schizophrenia, the answer was *Yes* (Buka et al., 2001). And the answer was again *Yes* in a huge California study, which collected blood samples from some 20,000 pregnant women during the 1950s and 1960s (Brown et al., 2004). Another study found traces of a specific retrovirus (HERV) in nearly half of people with schizophrenia and virtually none in healthy people (Perron et al., 2008).

These converging lines of evidence suggest that fetal-virus infections play a contributing role in the development of schizophrenia. They also strengthen the recommendation that "women who will be more than three months pregnant during the flu season" have a flu shot (CDC, 2003).

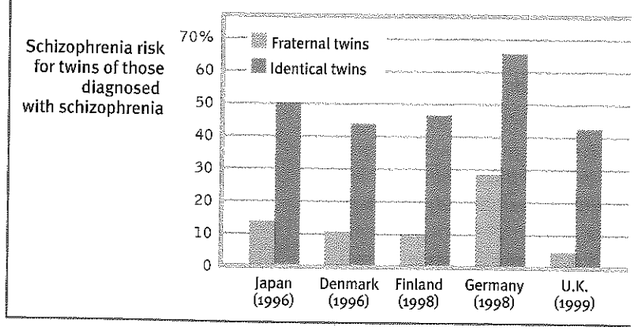
Why might a second-trimester maternal flu bout put fetuses at risk? Is it the virus itself? The mother's immune response to it? Medications taken (Wyatt et al., 2001)? Does the infection weaken the brain's supportive glial cells, leading to reduced synaptic connections (Moises et al., 2002)? In time, answers may become available.

Genetic Factors

68.4 Are there genetic influences on schizophrenia? What factors may be early warning signs of schizophrenia in children?

Fetal-virus infections do appear to increase the odds that a child will develop schizophrenia. But this theory cannot tell us why only 2 percent of women who catch the flu during their second trimester of pregnancy bear children who develop schizophrenia. Might people also inherit a predisposition to this disorder? The evidence strongly suggests that, *Yes,* some do. The nearly 1-in-100 odds of any person's being diagnosed with schizophrenia become about 1 in 10 among those whose sibling or parent has the disorder, and close to 1 in 2 if the affected sibling is an identical twin (**FIGURE 68.1**). Although only a dozen or so such cases are on record, the co-twin of an identical twin with schizophrenia retains that 1-in-2 chance even when the twins are reared apart (Plomin et al., 1997).

Figure 68.1
Risk of developing schizophrenia The lifetime risk of developing schizophrenia varies with one's genetic relatedness to someone having this disorder. Across countries, barely more than 1 in 10 fraternal twins, but some 5 in 10 identical twins, share a schizophrenia diagnosis. (Adapted from Gottesman, 2001.)



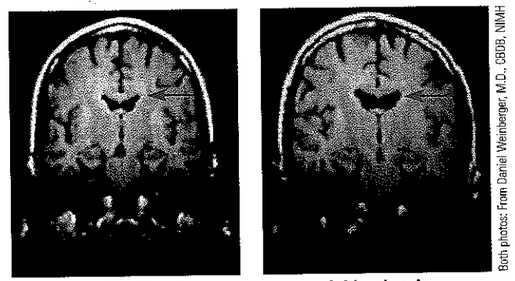
Remember, though, that identical twins also share a prenatal environment. About two-thirds also share a placenta and the blood it supplies; the other one-third have two single placentas. If an identical twin has schizophrenia, the co-twin's chances of being similarly afflicted are 6 in 10 if they shared a placenta. If they had separate placentas, as do fraternal twins, the chances are only 1 in 10 (Davis et al., 1995a,b; Phelps et al., 1997). Twins who share a placenta are more likely to experience the same prenatal viruses. So it is possible that shared germs as well as shared genes produce identical twin similarities.

Adoption studies, however, confirm that the genetic link is real (Gottesman, 1991). Children adopted by someone who develops schizophrenia seldom "catch" the disorder. Rather, adopted children have an elevated risk if a *biological* parent is diagnosed with schizophrenia.

With the genetic factor established, researchers are now sleuthing specific genes that, in some combination, might predispose schizophrenia-inducing brain abnormalities (Levinson et al., 2011; Mitchell & Porteous, 2011; Vacic et al., 2011; Wang et al., 2010). (It is not our genes but our brains that directly control our behavior.) Some of these genes influence the effects of dopamine and other neurotransmitters in the brain. Others affect the production of *myelin,* a fatty substance that coats the axons of nerve cells and lets impulses travel at high speed through neural networks.

Although the genetic contribution to schizophrenia is beyond question, the genetic formula is not as straightforward as the inheritance of eye color. Genome studies of thousands of individuals with and without schizophrenia indicate that schizophrenia is influenced by many genes, each with very small effects (International Schizophrenia Consortium, 2009; Pogue-Geile & Yokley, 2010). Recall from Module 14 that *epigenetic* (literally "in addition to genetic") factors influence gene expression. Like hot water activating the tea bag, environmental factors such as prenatal viral infections, nutritional deprivation, and maternal stress can "turn on" the genes that predispose schizophrenia. Identical twins' differing histories in the womb and beyond explain why only one of them may show differing gene expressions (Walker et al., 2010). As we have so often seen, nature and nurture interact. Neither hand claps alone.

Schizophrenia in identical twins
When twins differ, only the one afflicted with schizophrenia typically has enlarged, fluid-filled cranial cavities (right) (Suddath et al., 1990). The difference between the twins implies some nongenetic factor, such as a virus, is also at work.



Thanks to our expanding understanding of genetic and brain influences on maladies such as schizophrenia, the general public more and more attributes psychiatric disorders to biological factors (Pescosolido et al., 2010). In 2007, one privately funded new research center announced its ambitious aim: "To unambiguously diagnose patients with psychiatric disorders based on their DNA sequence in 10 years' time" (Holden, 2007). In 2010, $120 million in start-up funding launched a bold new effort to study the neuroscience and genetics of schizophrenia and other psychiatric disorders (Kaiser, 2010). So, can scientists develop genetic tests that reveal who is at risk? If so, will people in the future subject their embryos to genetic testing (and gene repair or abortion) if they are at risk for this or some other psychological or physical malady? Might they take their egg and sperm to a genetics lab for screening before combining them to produce an embryo? Or will children be tested for genetic risks and given appropriate preventive treatments? In this brave new twenty-first-century world, such questions await answers.

FYI

The odds of any four people picked at random all being diagnosed with schizophrenia are 1 in 100 million. But genetically identical sisters Nora, Iris, Myra, and Hester Genain all have the disease. Two of the sisters have more severe forms of the disorder than the others, suggesting the influence of environmental as well as biological factors.

Psychological Factors

If prenatal viruses and genetic predispositions do not, by themselves, cause schizophrenia, neither do family or social factors alone. It remains true, as Susan Nicol and Irving Gottesman (1983) noted almost three decades ago, that "no environmental causes have been discovered that will invariably, or even with moderate probability, produce schizophrenia in persons who are not related to" a person with schizophrenia.

Hoping to identify environmental triggers of schizophrenia, several investigators are following the development of "high-risk" children, such as those born to a parent with schizophrenia or exposed to prenatal risks (Freedman et al., 1998; Olin & Mednick, 1996; Susser, 1999). One study followed 163 teens and early-twenties adults who had two relatives with schizophrenia. During the 2.5-year study, the 20 percent who developed schizophrenia displayed some tendency to withdraw socially and behave oddly before the onset of

the disorder (Johnstone et al., 2005). By comparing the experiences of high-risk and low-risk children who do versus do not develop schizophrenia, researchers have so far pinpointed the following possible early warning signs:

- A mother whose schizophrenia was severe and long-lasting
- Birth complications, often involving oxygen deprivation and low birth weight
- Separation from parents
- Short attention span and poor muscle coordination
- Disruptive or withdrawn behavior
- Emotional unpredictability
- Poor peer relations and solo play

* * *

Most of us can relate more easily to the ups and downs of mood disorders than to the strange thoughts, perceptions, and behaviors of schizophrenia. Sometimes our thoughts do jump around, but in the absence of disorder we do not talk nonsensically. Occasionally we feel unjustly suspicious of someone, but we do not fear that the world is plotting against us. Often our perceptions err, but rarely do we see or hear things that are not there. We have felt regret after laughing at someone's misfortune, but we rarely giggle in response to bad news. At times we just want to be alone, but we do not live in social isolation. However, millions of people around the world do talk strangely, suffer delusions, hear nonexistent voices, see things that are not there, laugh or cry at inappropriate times, or withdraw into private imaginary worlds. The quest to solve the cruel puzzle of schizophrenia therefore continues, and more vigorously than ever.

Before You Move On

► ASK YOURSELF

Do you think the media accurately portray the behavior of people suffering from schizophrenia? Why or why not?

► TEST YOURSELF

How do researchers believe that biological and environmental factors interact in the onset of schizophrenia?

Answers to the Test Yourself questions can be found in Appendix E at the end of the book.

Module 68 Review

68-1 What patterns of thinking, perceiving, and feeling characterize schizophrenia?

- *Schizophrenia* is a disorder that typically strikes during late adolescence, affects men slightly more than women, and seems to occur in all cultures.
- Symptoms are disorganized and delusional thinking, disturbed perceptions, and diminished or inappropriate emotions.
- *Delusions* are false beliefs; *hallucinations* are sensory experiences without sensory stimulation.

68-2 How do chronic and acute schizophrenia differ?

- Schizophrenia symptoms may be positive (the presence of inappropriate behaviors) or negative (the absence of appropriate behaviors).
- In chronic (or process) schizophrenia, the disorder develops gradually and recovery is doubtful.
- In acute (or reactive) schizophrenia, the onset is sudden, in reaction to stress, and the prospects for recovery are brighter.

68-3 How do brain abnormalities and viral infections help explain schizophrenia?

- People with schizophrenia have increased dopamine receptors, which may intensify brain signals, creating positive symptoms such as hallucinations and paranoia.
- Brain abnormalities associated with schizophrenia include enlarged, fluid-filled cerebral cavities and corresponding decreases in the cortex.
- Brain scans reveal abnormal activity in the frontal lobes, thalamus, and amygdala.
- Interacting malfunctions in multiple brain regions and their connections may produce schizophrenia's symptoms.
- Possible contributing factors include viral infections or famine conditions during the mother's pregnancy and low weight or oxygen deprivation at birth.

68-4 Are there genetic influences on schizophrenia? What factors may be early warning signs of schizophrenia in children?

- Twin and adoption studies indicate that the predisposition to schizophrenia is inherited, and environmental factors influence gene expression to enable this disorder, which is found worldwide.
- No environmental causes invariably produce schizophrenia.
- Possible early warning signs of later development of schizophrenia include both biological factors (a mother with severe and long-lasting schizophrenia; oxygen deprivation and low weight at birth; short attention span and poor muscle coordination) as well as psychological factors (disruptive or withdrawn behavior; emotional unpredictability; poor peer relations and solo play).