1 DEVELOPMENT OF THE BODY, BRAIN, AND MIND

#1	Adolescence ends at 18 years old	8
#2	Girls are universally experiencing puberty sooner in recent years	16
#3	The teen brain is fully developed by age 18	24
#4	Anorexia treatment usually requires teens to be separated from their parents	33
#5	Technology has made teens better at multitasking	38
Mini myths for development of the body, brain, and mind		**46**
#6	Pubertal "early bloomers" fare better than "late bloomers"	46
#7	Teens can study better while listening to music	48
#8	The "Freshman 15": College students gain 15 pounds their freshman year	50
#9	Horses are helpful in the treatment of eating disorders, autism spectrum, and more	51
#10	The onset of puberty is very upsetting to most teens	52
#11	Male teens are much less likely than females to be preoccupied with their physical appearance	54
#12	Most teens hardly ever engage in leisure reading these days	55
#13	Greek life has a negative effect on college students academically	56
#14	Paying for prep courses is the best way to make large gains on the SAT	57

Great Myths of Adolescence, First Edition. Jeremy D. Jewell, Michael I. Axelrod, Mitchell J. Prinstein, and Stephen Hupp.

Myth #1

Adolescence ends at 18 years old

Disney built an animated film empire by telling coming of age stories about princesses and female heroines. Take Rapunzel from the movie *Tangled* (Conli, Greno, & Howard, 2010), who, on the eve of her 18th birthday, leaves her sheltered tower to enter a world that is both dangerous and enchanting. "Venture outside your comfort zone. The rewards are worth it," she says as she lowers herself out of the tower using her long, blond hair (Conli et al., 2010). What follows is the story of Rapunzel's journey from childhood to adulthood. Jasmine from *Aladdin* (Clements & Musker, 1992) was 15. Ariel from *The Little Mermaid* (Musker, Ashman, & Clements, 1989) was 16. Belle from *Beauty and the Beast* (Hahn, Trousdale, & Wise, 1991) was 17. Aurora from *Sleeping Beauty* (Disney & Geronimi, 1959) was 16. Merida from *Brave* (Sarafian, Andrews, & Chapman, 2012) was 16, and Snow White (Disney & Hand, 1937) was 14 when they had their coming-of-age experiences or events marking the transition from childhood to adulthood. For these Disney characters, the transition involved becoming mature, independent, and self-assured.

Disney's depiction of these characters' coming-of-age happening at or slightly before 18 coincides with the age at which many cultural and religious traditions honor the adolescent becoming an adult. In Spanish-speaking Latin America, families and friends celebrate a girl's 15th birthday by throwing a large party, or Quinceanera, marking the transition from childhood to young womanhood. The Jewish coming-of-age takes place when boys celebrate their Bar Mitzvahs and girls celebrate their Bat Mitzvahs at age 13 and 12 respectively, a demonstration of their religious commitment, recognition of the responsibilities associated with Jewish law, and acknowledgment of adulthood. On North Baffin Island, the Inuit coming-of-age for boys occurs between the ages of 11 and 12 when they're expected to demonstrate their hunting skills and ability to survive the harsh Arctic weather.

Scholars have traditionally viewed high school graduation as marking the end of the coming of age for most contemporary teenagers in industrialized societies (see Delaney, 1995). The culmination of 4 years of supervised education by adults concluding in the graduation ceremony resembles many religious and tribal coming-of-age rituals. What follows for the majority of American high school graduates is higher education (i.e., 2- or 4-year college) or a place in the workforce (Bureau of Labor Statistics, 2016), both traditionally considered a time when an individual is expected to behave in an adult-like manner. The public generally views

18 to be the start of adulthood. For example, *The Escapist*, an online magazine, conducted an online poll and found 18 years to be the most often selected age to the question "when does adolescence end?" (*The Escapist*, 2015).

It shouldn't be surprising that people believe 18 to be the end of adolescence. Many of the freedoms and responsibilities of adulthood are legally permitted by the age of 18. For example, in most countries, boys and girls can marry, enlist in the military, purchase alcohol and tobacco products, drive a tractor trailer, get a tattoo, and skydive on their 18th birthday. In the US, the Fair Standards Labor Act sets 14 years as the minimum age for employment. Fourteen is also the minimum age in most states when juveniles may be tried in criminal (i.e., adult) court (Office of Juvenile Justice and Delinquency Prevention, 2003). So it seems that the myth that adolescence ends at 18 years is promoted by both distorted popular culture references, like the Disney princesses and heroines, as well as state and federal governmental statutes.

Another source for this myth is the desire for easy answers. Human beings want to believe that answers to important questions are straightforward and void of gray areas. For human and nonhuman primates, the purpose of adolescence is clear. It's a time of physical and sexual maturity, acquisition of skills necessary for adulthood, establishing independence from parents, and modifying social relationships with same and opposite gender peers. What is much less clear is when the developmental period of adolescence ends and adulthood begins. Such uncertainty can be problematic, as behavioral research has found human beings avoid ambiguity or individuals' subjective experiences with uncertainty (Frisch & Baron, 1988). Perhaps it's more comforting to believe that adulthood begins at or shortly after 18 years of age rather than consider the complexity of the question or admit that there is no straightforward answer.

So, when does adolescence end? At one time, the boundaries of adolescence were the teenage years, beginning at 13 and ending at 19 (Steinberg, 2011). During the 20th century, the span of adolescence increased substantially following research suggesting physical maturity (e.g., puberty) begins earlier (Settersten, Furstenberg, & Rumbaut, 2005), as science has learned, for example, that the average age of menarche has dropped since data were first collected almost 200 years ago (Steinberg, 2011). However, many contemporary adolescent development scholars now recommend understanding the end of adolescence by examining specific biological and societal markers that represent the transition from adolescence to adulthood rather than simply considering age (e.g., Arnett, 2000).

Biologically, three hormonal events mark the start of puberty (see Blakemore, Burnett, & Dahl, 2010). Gonadarche begins with the activation of the hypothalamus-pituitary-gland gonadal gland system, triggering the production of estrogen and testosterone, and marking the beginning of puberty. Adrenache, which often occurs before gonadarche, begins with the secretion of increased levels of androgens leading to the development of secondary sex characteristics. The third hormonal event involves a growth spurt that results in body size and composition changes. Only gonadarche has a clear end, developing the ability to reproduce, which can vary considerably among individuals making it difficult to assign a specific age to the official end of puberty and adolescence.

A different biological marker might provide a more exact answer to the question of when adolescence ends. Researchers have found that the chronotypes, or the behavioral expression of circadian rhythms (i.e., biological sleeping patterns), of humans increase until 19.5 years for females and 20.9 years for males, and then begin decreasing across the remainder of the lifespan (Roenneberg, Wirz-Justice, & Merrow, 2003). Put slightly differently, humans start becoming night owls at about the age of 10 until about the age of 20, when they gradually shift, over time, to becoming early risers. The amount of time asleep might not change much, but the general tendency for someone to fall sleep later (and wake later) or fall asleep earlier (and wake earlier) seems to vary between different developmental periods. Interestingly, and perhaps not surprisingly, given both are related to biology, changes in chronotype correspond to pubertal changes. There is a general propensity for girls to develop before boys, which is also observed in chronotype. While research hasn't yet ruled out other factors related to chronotype (e.g., behavioral, environmental), convincing data suggest the changes in sleep patterns might signify a biological endpoint to adolescence at about 20 years of age (Roenneberg et al., 2004).

Societal markers that represent the transition from adolescence to adulthood are much more subjective than biological markers but equally important in the developmental literature. A social perspective suggests the conclusion of adolescence coincides with an individual's realization of a stable adult role (Choudhury, 2010). Specifically, societal transitions have involved becoming economically independent, leaving home, completing formal education, working full time, getting married, and having a child (Melgar & Rossi, 2012). Research is finding that these transitions are occurring later for young people today. For example, the median age of marriage 50 years ago was 22 for men and 20 for women (Arnett, 2000). In 2016, the median age of marriage for men and women

was almost 30 and 28, respectively (U.S. Census Bureau, 2017). In addition, the mean age of first-time mothers has increased from just over 21 years of age in 1970 to just over 26 years in 2014 (Mathews & Hamilton, 2002, 2016). To summarize, people are marrying later and having children later, possibly changing the societal marker for when adolescence ends and adulthood begins.

Other research paints, perhaps, a more striking difference between young people today and those of previous generations. Large-scale surveys spanning multiple decades and comparing generations of 23-year-olds on economic independence indicators such as full-time employment, still in school, leaving home, and receiving financial support have uncovered some interesting and, perhaps, not surprising findings. Specifically, all indicators decreased in favor of less financial independence in the younger generation (Steinberg, 2014). For example, more 23-year-olds from the high school graduating classes of 2002 and 2003 were in school compared with the graduating classes of 1976 and 1977 (33% vs. 20%), more were receiving financial support from parents (67% vs. 30%), fewer were living on their own (50% vs. 67%), and fewer were working more than 35 h a week (60% vs. 75%). These differences were just as noticeable when considering 25-year-olds. Fewer from the younger generation (i.e., graduating classes of 2002 and 2003) were financially independent from their parents (67% vs. 75%), living on their own (less than 67% vs. more than 75%), and working full time (70% vs. 80%) when compared with those from the older generation (i.e., graduating classes of 1976–1977).

These data are consistent with other data indicating many young adults remain unsettled after the age of 18. For example, young people between the ages of 20 and 29 are four times more likely than 15- to 19-year-olds and three times more likely than 30- to 34-year-olds to change where they live (Arnett, 2000). A common societal feature of adulthood is establishing a permanent residence, and it appears from the data that fewer young adults are settling down, at least in terms of where they reside. In addition, young people are changing jobs more now than ever before, as loyalty towards employers has decreased with each generation since World War II (Tolbize, 2008). A recent LinkedIn report (Berger, 2016) found that those graduating college between 2006 and 2016 worked, on average, for three companies within 5 years of graduating college. College graduates between 1986 and 1990 worked, on average, for about 2.5 companies within 10 years of graduating college. Scholars contend that the period between 19 and 30 years represents many demographic changes, including where one lives and works (Arnett, 2000).

These data suggest that individuals are transitioning later in life to roles and responsibility generally associated with adulthood. Furthermore, individuals are achieving financial independence from their parents later in life, including completing higher education, holding a full-time job, and living away from mom and dad. Taken together, it doesn't seem appropriate to label 18 as the end of adolescence when considering these generally agreed-upon social markers. However, it is also possible these social markers are either outdated or considered less important by today's standards. To investigate this issue, developmental psychologist Jeffrey Jensen Arnett (2001) asked adolescents (age 13–19), young adults (age 20–29), and midlife adults (age 30–55) about their conceptions of the transition from the adolescent years to adulthood. Arnett found that accepting responsibility and the consequences for one's behavior, identifying personal beliefs and values independent of parental or others' influences, and establishing a relationship with parents based on equality were most important across all three groups. He also found that, while being financially independent from parents was rated high among the groups, other social markers described above (e.g., full-time employment, completed education, purchase of a house, marriage, having at least one child) were rated lower than biological (e.g., able to father or bear children) and legal/chronological (reached age 18 or 21) transitions. In summarizing his findings, Arnett said, "individualistic criteria rank highest in importance, especially character qualities of accepting responsibility for one's own actions and deciding on one's own beliefs and values" (p. 142). And do young people feel as if they've achieved or reached adulthood? Arnett, in the same study, found that 86% of midlife adults (age 30–55) endorsed feeling they had reached adulthood compared to 46% of the young adults and 19% of the adolescents. Most notable, however, was the finding that 50% of the young adults endorsed the item "in some respects yes, in some respects no" when reporting on their beliefs about reaching adulthood.

What you need to know

A single, universal age boundary cannot be drawn between adolescence and adulthood. Rather, it might be best to think about the transition as occurring gradually over time, which is, in theory, what adolescence represents. The word *adolescence* comes from the Latin verb *adolescere*, which means "to grow into adulthood." Adolescence is the period in which a child becomes an adult. Placing an age on that process misses the

point of what this developmental period signifies, a period influenced by many variables. Moreover, individual differences exist in when the process begins and ends. However, there are other frameworks to consider. For example, it might be best, as Arnett (2001) suggests, to consider the period following adolescence (i.e., 19–25 years) as *emerging adulthood*. He argues that this period is distinct from both adolescence and adulthood. Adolescence might no longer be conceptualized as a transition period from childhood to adulthood but, rather, a developmental period characterized by dramatic biological, cognitive, and social changes resulting in a preparedness to enter emerging adulthood. Emerging adulthood, then, describes the period after adolescence and before mid-adulthood. As author Jacqueline Arnone (2014) wrote, it seems that "25 is the new 18."

Research is clear that fewer young adults are taking on adult responsibilities (e.g., financial independence, marriage, parenthood) at the same age that their parents did. But why? To answer this question it might be important to understand the reasons young people are transitioning to adulthood later in life compared with just a few generations ago. Laurence Steinberg (2014), an expert on adolescent development, espoused several commonly held assumptions regarding this question that might not necessarily be supported by solid scientific research. For example, adults see young people today as "lazy, self-absorbed, and spoiled" (p. 60). Moreover, the media has labeled today's youth as entitled, believing they inherently deserve a life of privilege and special treatment (Greenbergerm, Lessard, Chen, & Farruggia, 2008). However, youth today are no more entitled than those of previous generations, as research over the last 30 years has found that changes in selfishness are related more to age than generation. For example, college students today are no less self-centered than college students 10 or 20 years ago; they are, however, more self-centered than their parents and grandparents when examining differences across generations (see Roberts, Edmonds, & Grijalva, 2010).

So, attempts at answering the question why are young people making the transition to adulthood later have been met with unsupported theories. What about theories supported by evidence? Steinberg (2014) offers one that considers recent research on brain development. Studies examining adolescent brain structure confirm that brain regions underlying attention, evaluation of risk and reward, and self-control continue to develop beyond age 18 (see Yurgelun-Todd, 2007). Furthermore, changes in cognitive ability, as a result of changes in the brain, gradually improve problem-solving during this time. Taken

together, the lengthening of adolescence or the appearance of a new development period (i.e., emerging adulthood) might have something to do with brain development and the emergence of skills important for success in adulthood.

For those individuals transitioning from adolescence to adulthood and for the parents of those transitioning from adolescence to adulthood, understanding research and current scientific thinking about this developmental period is important for two reasons. First, it might alleviate worries or concerns about a failed adolescence. That is, those who are late transitioning from adolescence to adulthood aren't necessarily unsuccessful but, rather, more typical of their peers. For example, it's more acceptable now, versus 30 years ago, to settle down with a career and family after age 25. Thinking back to Disney princesses and heroines, Elsa from the movie *Frozen* (Del Vecho, Buck, & Lee, 2013), who was coroneted at 21, might represent a more typical picture of when emerging adulthood begins (at least from the viewpoint of a Disney princess). Second, no one should expect an overnight transformation. Experiences and learning opportunities occurring during adolescence are critical to helping an individual acquire skills important for success in adulthood. This, coupled with dramatic changes in the brain occurring simultaneously, marks a transitional period covering many years and not several days, making Rapunzel's one-day coming-of-age story seem as unrealistic as her using her long hair to escape a castle tower.

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Myth #2 Girls are universally experiencing puberty sooner in recent years

The *New York Times Magazine*, in a headline, asked if puberty before the age of 10 was the new normal (Weil, 2012). Citing historical data, the article suggested that girls were experiencing puberty much earlier today when compared with girls a decade ago. The article complemented the data with stories of young girls, as young as 4 years of age, growing pubic hair, developing breasts, and sprouting to heights well above their classmates.

Puberty refers to "the period during which an individual becomes capable of sexual reproduction" (Steinberg, 2011, p. 24). More generally, puberty represents a time when significant biological and physical changes occur in developing boys and girls. Biologically, hormonal events mark the start of puberty. These hormonal events trigger physical changes that occur during puberty. Physically, puberty is marked by an acceleration in growth prompting noteworthy increases in height and weight. Puberty is also indicated by the development of primary sex characteristics, including sex glands that enable sexual reproduction, and secondary sex characteristics that include changes in the genitals and breasts, and the growth of pubic and body hair.

Stories about young children showing signs of puberty are alarming, especially to parents who might be concerned that their young daughter could become capable of sexual reproduction at such an early age. Perhaps even more alarming, the data are, in fact, indicating girls experience aspects of puberty earlier now than ever before. For example, trends over time show statistically significant declines over the last two decades in the mean age at onset of breast development (also called breast budding; see Euling et al., 2008). Specifically, the mean age at onset of breast development has dropped from approximately 11 years of age for American and European girls in studies published prior to 1980 to below 10 years of age in studies published since 2000 (Aksglaede, Sorensen, Petersen, Skakkebaek, & Juul, 2009; Sorensen et al., 2012). For example, a 2009 study of Danish girls estimated the mean age to be 9.86 years (Aksglaede et al., 2009). Research also indicates a downward trend over time. The Danish study reported data from a 1991 cohort (i.e., girls assessed 15 years earlier) estimating the mean age at onset of breast development to be 10.88 years or a whole year later than the 2006 Danish cohort. Studies of American women born between 1959 and 1965 placed the mean age at onset between 11.2 and 12.8 years (Harlan, Harlan, & Grillo, 1980; Marshall & Tanner, 1969). In a more recent study conducted in the United States, the average age at onset of breast development of women born between 1996 and 1998 estimates the age of onset of breast development to be approximately 8.8 and 9.7 years for African American and non-Hispanic white girls, respectively (Biro et al., 2013). Breast development, or the first appearance of breast tissue, is generally considered one marker used for identifying the onset of puberty in girls.

So, given the data presented above, wouldn't it be true that girls are experiencing puberty earlier in recent years? Well, herein lies one likely source of this myth—confusion over terminology. While it's true the mean age at which girls begin developing breasts has declined, other indications of puberty's onset, such as the mean age of menarche (i.e., first time of menstruation), have stabilized (Harris, Prior, & Koehoorn, 2008; McDowell, Brody, & Hughes, 2007). Furthermore, data on trends associated with the onset of pubic hair growth of girls, another marker of puberty, are inconclusive (Euling et al., 2008). Specifically, studies using Tanner stages (i.e., a common system for describing the five physical stages of pubertal development) show considerable inter-individual and interracial/ethnicity variability in the onset of female pubic hair growth making it difficult to establish secular trends in either direction. Consequently, the claim that girls are universally experiencing puberty earlier is largely dependent on how "experiencing

puberty" is defined and if "universally experiencing puberty earlier" means all aspects of puberty, including menarche and pubic hair growth, then, no, the statement that girls are experiencing puberty earlier in recent years is not true.

The myth that girls are universally experiencing puberty earlier in recent years also provides an example of how a kernel of truth can be confused for a more complicated fact. Historical data since the mid-19th century indicate a downward trend in mean age of menarche. However, remember long-term trends in mean age of menarche in the United States and other developed countries have slowed or leveled off in recent decades (Papadimitriou, 2016a). For example, studies since the 1960s have found a slight increase in the average age of menarche in the United Kingdom, Sweden, and Belgium (+0.14, +0.05, and +0.03 years per decade, respectively) suggesting secular trends have, at least in these countries, stabilized (Parent et al., 2003). Other developed European countries have shown a deceleration in secular trends. For example, the mean age of menarche has declined no more than 44 days per decade since 1960 in the countries of Denmark, Finland, the Netherlands, Russia, and France (Parent et al., 2003). These data are similar to those reported in studies of samples from the United States (McDowell et al., 2007; Papadimitriou, 2016a). Illustrating the complex nature of this myth, data from Israel and certain studies from the United Kingdom indicate recent declines in average age of menarche after a period of stabilization (Flash-Luzzatti, Weil, Shalev, Oron, & Chodick, 2014; Morris, Jones, Schoemaker, Ashworth, & Swerdlow, 2011).

Research has found a four- to five-year range in age at onset of puberty, which observed in most human beings is unique among mammals (Parent et al., 2003). Menarche, another marker of puberty, is an important developmental milestone in a girl's life. Anthropologists frequently describe how menarche as a coming of age rite is celebrated in non-Western cultures (Rosewarne, 2012). Usually occurring between 2 and 2.5 years after the appearance of breast tissue, menarche marks the time when females achieve advanced sexual maturation (Papadimitriou, 2016b). In addition, there are differences in the age of menarche among girls of different ethnicities and races, geographical regions, and socioeconomic backgrounds. For example, a study of over 1,100 girls found the mean age of menarche for African American girls was half a year earlier than for non-Hispanic white girls (12.6 versus 12.0; Biro et al., 2006). Such variability appears to be a function of the interaction between genes and the environment (nature and nurture). That is, individual differences in the onset of menarche are accounted for by

heritable predispositions to begin puberty at a certain time interacting with environmental variables, especially nutrition and health.

Understanding long-term trends in the mean age at onset of menarche requires the review of available data over long periods of time. Unfortunately, formal data collection of age at onset of menarche only started around the mid-1800s (Steinberg, 2011). However, broad long-term changes in age at onset of menarche date to Neolithic times. Obtaining estimates from skeletal remains, researchers have suggested menarche occurred for prehistoric girls between 7 and 13 years of age (Gluckman & Hanson, 2006). Ancient Sanskrit writings by Indian officials dating back 2,500 years reference upper-class girls first menstruating at 12 years (Papadimitriou, 2016b). Surprisingly, the mean age of 12 years didn't appear to change much in the thousand years between 500 BCE and 500 CE. During classical times (i.e., between 400 BCE and 400 CE), Greek and Roman writers, from Aristotle to the famous physician Galen, consistently marked the age of menarche at around 14 years (Papadimitriou, 2016b). A medical encyclopedia published during the Tang dynasty period (618–906 CE) in China placed the age of menarche also at 14 years, although this number might have had more to do with the influence of numbers in Chinese medicine (the number 7 held significance in the life of Chinese females) than accurate observations (Papadimitriou, 2016b). Writings in medieval Europe also suggested the age of menarche was 14 years, with a range between 12 and 15 years (Admundsen & Diers, 1973). Data on age of menarche during the modern era, especially after the industrial revolution, suggest a delay. Likely caused by disease spread by increasing population density, and poor hygiene and health conditions, the onset of menarche in industrialized nations across the second half of the 18th century ranged between about 15.5 and 17 years, slightly later than what was reported during the Middle Ages but much later than what has been reported in modern times (Papadimitriou, 2016a; Steinberg, 2011).

What's clear from the data described here is that stabilized long-term trends in average age of menarche have not followed decreasing long-term trends in average age at onset of breast development. For example, correlations between menarche and the onset of breast development for women born between 1977 and 1979 are low, suggesting a minimal relationship between the two events, whereas a strong relationship existed between menarche and the onset of breast development for women born between the 1930s and 1960s (Biro et al., 2006). Several researchers have theorized maturational changes in tempo (i.e., changes in the length of time of puberty) are responsible for this discrepancy (e.g., Papadimitriou,

2016a), whereas others have suggested the age at onset of breast development may be an early sign of the interaction between genes and the environment (e.g., Parent et al., 2003). Researchers have attributed improvements in health, nutrition, and general living conditions to the steady decline in age of menarche from the late 1800s to the mid-1900s (Euling et al., 2008). Researchers have also noted that recent health trends, such as the alarming rise of obesity among young girls in the United States, have likely contributed to the long-term trends noted above. Taken altogether, these findings only underscore the complexities associated with understanding trends about the age at onset of puberty for females.

It's also worth noting that varying research design characteristics cloud the long-term trend picture. According to an expert panel of researchers that examined data from 1940 to 1994, factors involving sample size, subject characteristics (e.g., race/ethnicity, socioeconomic status), assessment, and reporting methods make comparisons across studies difficult (Euling et al., 2008). For example, different methods of reporting age at menarche are used across studies, and each method has noteworthy design limitations that warrant caution when interpreting results. Retrospective reporting asks women to recall the first time of menstruation. This method is prone to recall bias and is impacted by the length of time between being asked about age at menarche and the actual event (Karapanou & Papadimitriou, 2010). Another common reporting method involves prospective inquiry or questioning a sample of nonmenstruating girls at fixed time intervals until menstruation occurs. Although this method is more accurate than retrospective reporting, attrition (i.e., subjects dropping out of the research study or otherwise being lost to the researchers) and other practical challenges with conducting research over several years are considered methodological limitations (Biro et al., 2006; Karapanou & Papadimitriou, 2010).

To summarize, there appears to be a kernel of truth to the statement that girls are universally experiencing puberty earlier. Yet, the data paint a complicated picture. Trends over time describing the onset of puberty differ depending on the markers used. Research using the initial appearance of breast tissue (i.e., onset of breast development) to mark puberty's onset clearly identifies a declining trend over time. Studies using age at menarche as the indicator of onset of puberty find secular trends are slowing down or leveling off. Menarche is most associated with sexual reproduction, which is when females are generally considered to have achieved advanced sexual development. Consequently, concerns over the early attainment of sexual maturity in girls might be overstated.

What you need to know

Although long-term trends in age at menarche have stabilized, there remains a population of girls whose first menstruation occurs early. This finding, coupled with research indicating the average girl begins to show breast tissue development at 9 years of age, has certain health implications. Premature sexual development and maturation, or precocious puberty, is a common source of pediatric referral (Leger & Carel, 2016). Precocious puberty describes a clinical condition in which the signs of puberty (e.g., appearance of secondary sexual characteristics including breast tissue and pubic hair, noted growth acceleration) appear before the age of 8 years in girls (Partsch & Sippell, 2001). Epidemiological estimates from the 1980s suggested approximately 1:5,000 to 1:10,000 children met clinical thresholds with a female to male ratio of about 10 to 1 (Gonzalez, 1982). Not surprisingly, given the decline in mean age of onset of breast development, more recent data indicate higher prevalence rates. For example, a recent large-scale study of Danish children found about eight per 10,000 girls aged 5 to 9 met criteria for precocious puberty (Teilmann, Pedersen, Jensen, Skakkebaek, & Juul, 2005). Also not surprisingly, the incidence of precocious puberty of children with conditions affecting the central nervous system, such as neurofibromatosis and encephalopathy, is much higher (Partsch & Sippell, 2001). Understanding etiologies and underlying mechanisms of precocious puberty is beyond the scope of this chapter. However, premature activation of the hormones by parts of the brain responsible for the initiation of puberty has been implicated as a likely cause.

Researchers note that normal developmental variations among girls when secondary sex characteristics appear are responsible for the many challenges that exist in accurately identifying precocious puberty. Specifically, "the distinction between early puberty and normal puberty is not clear-cut" (Leger & Carel, 2016, p. 147). Many experts contend that age-related norms for pubertal stages for breast growth have not been updated to account for downward secular trends and a redefinition of precocious puberty is necessary (see Sorensen et al., 2012).

What is clear is that early pubertal timing is related to negative developmental outcomes. For example, health implications of early menarche include obesity, cardiovascular risks, and increased risk of cancer (Karapanou & Papadimitriou, 2010). Early menarche is also associated with negative psychological outcomes including anxiety, depression, eating disorders, and delinquency (Marceau, Ram, Houts, Grimm, & Susman, 2011). Finally, early pubertal timing in girls has been linked to

earlier sexual activity including sexual intercourse (Karapanou & Papadimitriou, 2010; Marceau et al., 2011). However, correlation (or linking two associated variables) should never be confused for causation. In the research described earlier, other variables might help explain the relationship between puberty onset and health and developmental outcomes. For example, exposure to carefully designed sexual education programming can reduce the risk of adolescent sexual activity (Steinberg, 2011).

Parents should make themselves aware of when their daughter might expect to begin developing secondary sex characteristics (e.g., appearance of breast tissue and pubic hair) and experience menarche. It's equally important for parents to recognize that the timing and tempo of puberty and sexual maturation can differ considerably among girls. Experts recommend maintaining an open parent–daughter dialogue about puberty and consulting health care professionals when concerns about the timing or tempo of puberty surface. Finally, for more excellent discussion of this myth, see Mercer (2016).

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Myth #3

The teen brain is fully developed by age 18

Mozart was said to have been a skilled pianist and violinist at the age of 5 and composed his first symphony at 8. Before turning 13, Pablo Picasso was well on his way to becoming a historically significant artist. At the 1990 United States Open, Serena Williams won her first tennis grand slam event two weeks before turning 18, besting Martina Hingis, who, herself, won a grand slam event at age 17. Akrit Jaswal, a boy from a small rural village in India, successfully performed surgery at the ripe old age of 7.

Using these youth as examples, it isn't surprising many believe the brain is fully, or at least mostly, developed by age 18. How else are these youth able to achieve such fantastic feats? And the idea of fully developed adolescent brains is commonplace in popular culture. Consider the brains of Bella of the *Twilight Saga Series* (Meyer, 2010) or Katniss from the *Hunger Games* (Collins, 2009). These teenage heroines were articulate, confident, independent, and thoughtful. They were also great problem-solvers, and acted responsibly and heroically. In Katniss's case, she started a revolution on par with the likes of John Adams and Thomas Jefferson. How could she not have a mature, adult-like brain?

Yes, Hollywood frequently portrays teenagers as sex-crazed, carefree, sensation-seekers who have no regard for anyone but themselves, and the news media mostly reports on teenagers making poor decisions. However, it's hard to ignore images of, or stories about, teenagers who are clearly well beyond their years.

A 2006 *New Yorker* cartoon showed two parents grounding their teenage son until his cerebral cortex fully matured (Smaller, 2006). This cartoon illustrates how many parents think of their adolescent and his or her brain as a work in progress until some magical day close to the 18th birthday. Dr. David Moshman (2011), professor emeritus of educational psychology wrote about the cartoon, suggesting it revealed several false assumptions about adolescents and their brains. For example, he noted

that a common misconception about the adolescent brain is that the outcome of brain development in adolescence is a mature brain in adulthood at around the age of 18 years. However, this belief ignores a great deal of research indicating that the brain continues developing well beyond 18 years of age (see Johnson, Blum, & Giedd, 2009). Specifically, important parts of the brain responsible for decision-making and problem-solving are not fully developed until well into an individual's 20s. Moreover, a mature brain resulting from the completion of brain development at age 18 coincides with societal markers representing the end of adolescence and beginning of adulthood. For example, in most countries, many of the freedoms and responsibilities of being an adult (e.g., age of consent to marry, purchase alcohol and tobacco, enlist in the military) are legally permitted by the age of 18. Such legal standards might assume the brain is fully developed by this time, suggesting individuals are capable of advanced decision-making and problem-solving at this age. However, the notion that adolescence, as a distinct developmental period, ends at 18 years is also a myth, thus refuting this assumption.

People tend to accept some evidence as truth and fail to fully appreciate the complexity of the science behind a claim. For example, research indicates that sensation-seeking peaks at about age 18 (Romer & Hennessy, 2007). This trend is notably consistent with other age-related trends in risk-taking behavior (gun mortality, traffic fatalities, criminal behavior; see Males, 2009; Romer, 2010). Considering that risk-taking behavior is generally associated with areas of the prefrontal cortex, or the area of the brain responsible for planning, organizing, and weighing risks and benefits, it seems reasonable to conclude that the decline in sensation-seeking or delinquency that occurs at 18 years coincides with a fully developed or adult-like brain at that same age. However, research has found other risk-taking behaviors peak later. For instance, alcohol use peaks at about 21 years of age (see Romer, 2010). It's likely this peak has as much to do with when one can legally purchase alcohol in the US than when the brain stops developing. Furthermore, we forget that the brain is a highly complex organ and we make a mistake when assigning total blame to the brain for aberrant behavior, especially when establishing claims from brain scan research. We also falsely conclude a one-to-one correspondence between the brain and impulsivity, anxiety, depression, or any other behavior or mental health condition, appropriate or inappropriate, adaptive or maladaptive. Rather, a more complete conceptualization of the relationship between the brain and behavior suggests complex transactions among the brain, behavior, and the social environment (Dahl, 2004).

Myths are also promoted when research findings are misrepresented in the news media, such as a 2004 research study published in *The Journal of Neuroscience* (see Bjork et al., 2004). The researchers asked 12 healthy adolescents and 12 healthy young adults to engage in a task in which they were required to quickly press a button after a brief period (i.e., 2s) following the display of a symbol on a small mirror mounted in front of the eye. The symbols differentiated whether subjects could earn money or avoid losing money. Subjects' brains were monitored using magnetic resonance imaging (MRI) with the area of the brain thought to be associated with motivation scanned specifically. During high-payment trials, brain activity in the right nucleus accumbens, commonly described as the center of the brain's reward circuit, was slightly higher for adults than for adolescents. The authors of the study noted in the published article that similarities existed between adolescents and adults when performing the task and when most areas of the brain that were scanned. However, a New York newspaper led with the headline "scientists may have discovered a biological excuse for laziness" (Talan, 2004). James Bjork, lead author on the study, was quoted in the story as saying the research "tells us that teenagers love stuff, but aren't willing to get off the couch to get it as adults are." The study's findings support neither claim. Studying laziness and the adolescent brain would require conducting brain scans on a preidentified group of lazy teenagers and a preidentified group of hardworking teenagers. To understand how the teenage brain might differ from the adult brain, researchers would also have to include lazy and hardworking adults, and compare the four groups. Even such a research design wouldn't be able to conclude that certain types of brains *caused* laziness.

Laurence Steinberg (2010), author of a popular college textbook on adolescence, wrote in a commentary on the science of adolescent brain development that the adolescent brain is markedly different from both the child brain and adult brain. Perhaps more importantly, Steinberg noted that the changes in the brain occurring during adolescence are "among the most dramatic and important to occur during the human lifespan" (p. 161). For example, the prefrontal cortex is pruned during adolescence (see Spear, 2010). This synaptic pruning involves the elimination of unnecessary connections between brain cells, thus enhancing the brain's efficiency. Regarding brain function, research suggests that individuals begin using multiple parts of the brain concurrently during the adolescent developmental period. For instance, the prefrontal cortex works together with other areas, including the limbic system, when someone is required to organize thinking and feeling

simultaneously (see Steinberg, 2011). This marks an important point in brain development, as the limbic system, which is partially responsible for the processing of emotions, experiences, social information, and rewards and punishment, is generally overactive during adolescence. Collaboration between the prefrontal cortex and the limbic system results in better emotional self-regulation or management of emotions and behavior. While it is known that adolescent brain development is significant and necessary for individuals to begin acquiring adult characteristics and skills, the question remains—when does the brain stop developing?

The study of the brain is generally divided into two areas: brain structure and brain function. Brain structure refers to the brain's physical form and shape, while brain function describes how the brain works. Considering brain structure first, researchers have discovered that the organization of the brain changes through childhood and adolescence, but also well into adulthood. That is, the brain that you're born with is markedly different from the brain you have as a teenager, and the brain you have as a teenager is markedly different from the brain you have as an adult. More to the point, the brain's physical structure does not stop developing once you turn 18 years of age.

Brain science has provided much in the way of support for the notion that brain structure continues to develop beyond an individual's transition from adolescence to adulthood. Jay Giedd (2008), a noted neuroscientist, concluded, in his review, that the brain's gray matter—the parts of the brain containing cell bodies—peaks at puberty and declines through adolescence. Specifically, the density of gray matter, which appears to correlate negatively with an individual's abilities and skills, is most pronounced during childhood with noticeable drop-offs into adulthood (i.e., up to the age of 30) because of continued synaptic pruning. What this means is that the adolescent brain continues to improve its efficiency well into adulthood. Conversely, white matter in the brain, or structures in the brain that extend from cell bodies and carry electrical signals across neurons, increases throughout adolescence, likely as a result of myelination, or the process by which a fatty substance surrounds part of the neuron, insulating it to ensure proper functioning of the nervous system. According to Giedd, increased myelination is noticeably apparent in the corpus callosum (the part of the brain associated with integration between the right and left hemisphere), rapidly increasing during adolescence and young adulthood, improving functions such as memory, attention, and language. Taken altogether, Giedd's review suggests the adolescent brain is rapidly developing and

that this rapid development continues at least through early adulthood. Other reviews of the research have noted similar developmental trends in gray and white matter. Age-related increases in white matter coincided with gray matter decreases throughout adolescence, with an acceleration in the loss of prefrontal cortex gray matter occurring between the ages of 23 and 30 years, or well after the generally accepted end of adolescence (i.e., 18 years; see Paus, 2005). These findings offer insight into some of the changes that occur during and after adolescence. Remember, the prefrontal cortex is responsible, in part, for planning, organizing, and weighing risks and benefits. With these changes occurring through adolescence and not ending at adolescence, we should be cautious about expecting teenagers or even young adults to be completely autonomous or independent when planning, organizing, and weighing risks and benefits.

Many other studies examining brain structure confirm that the prefrontal cortex matures later than other brain regions. Specifically, research using MRI has found that brain regions underlying attention, evaluation of risks and rewards, and response inhibition continue to develop structurally beyond adolescence (see Yurgelun-Todd, 2007). In addition, MRI techniques show that the most noteworthy changes during adolescence and young adulthood involve regions of the brain responsible for abstract thought, organization, decision-making, and planning (Yurgelun-Todd, 2007). These studies have led researchers to conclude that structural changes in the brain correspond to improvements in cognitive functioning and efficiency, and emotional processing and regulation during adolescence and young adulthood.

Research on brain functioning across childhood, adolescence, and adulthood tells a similar story. That is, the brain's functions continue to mature long after adolescence. Researchers using functional magnetic resonance imaging (fMRI) techniques have found that the adolescent brain differs significantly from the adult brain when individuals are required to consider a speaker's intention (i.e., recognize whether the speaker was being sincere or ironic), comprehend one's own intentions (i.e., recognize the causality of events), and understand thoughts and emotions (see Blakemore, 2012). In one example, researchers scanned the brains of adolescent (aged 10–18) and adult (aged 22–32) participants while the participants read scenarios related to social emotions (e.g., embarrassment, guilt; see Burnett, Bird, Moll, Frith, & Blakemore, 2009). Different from basic emotions (e.g., fear, anger), social emotions necessitate an understanding of another person's emotional state (e.g., guilt requires you to understand how another person feels as a result of

your behavior). The scans revealed several interesting findings. Adolescent brains were more active than adult brains in a region generally believed to be responsible for an individual's consideration of the mental state of others. However, a part of the brain thought to be associated with recognizing social concepts was more active for adults than adolescents. These results confirm findings from many studies over more than 30 years suggesting the relative functions of different parts of the brain change with age. That is, adolescents use different brain regions when engaging in cognitive and emotional processing tasks than adults, indicating noteworthy changes to how the brain functions between adolescence and the onset of adulthood (Yurgelun-Todd, 2007).

Other fMRI studies have found that, with age, activity in the prefrontal region of the brain "becomes more focal and specialized while irrelevant and diffuse activity in this region is reduced" (Yurgelun-Todd, 2007, p. 255). This change translates into improved cognitive performance (e.g., abstract reasoning, attention, memory) and emotional processing (e.g., understanding and managing emotional responses) not just from childhood into adolescence but from adolescence into adulthood. Steinberg (2010) noted that impulse control, effective decision-making, recognizing consequences, planning, and ignoring peer pressure all improve from preadolescence into early adulthood. However, impulsive and risk-taking behavior doesn't cease when adolescents turn 18 years of age. For example, longitudinal studies of alcohol, marijuana, and tobacco use show increased usage between 19 and 21 years of age with a slight decline at about 23 years of age (see Romer, 2010). This shouldn't come as a surprise, as brain functioning occurring in regions of the brain responsible for impulse control and risk-taking behavior appears to be in a state of constant change between adolescence and young adulthood.

What you need to know

Brain researchers use the terms "malleable" and "plastic" to describe the fact that the brain has the enormous potential to change. When considering the brain, and specifically the incredible structural and functional changes that occur, many authors and child development professionals only reference early childhood. However, the brain appears to be a work in progress across the lifespan. Such an understanding about the brain provides a hopeful perspective, one that suggests you might be able to teach an old dog new tricks. Specific to teenagers, the time between 10

and 20 years of age offers an array of psychological, physiological, and neurological changes, which can promote development in multiple domains (e.g., academic, behavioral, emotional, social; White, 2009). However, the teenage brain is not an incomplete brain. Adolescents come into possession of certain cognitive skills that allow for critical and thoughtful reasoning to occur. Taken altogether, adolescence might be best viewed as a time of opportunity.

Sheryl Feinstein (2009), an author on parenting, suggested the adolescent brain represented "a chance to learn something quickly and with more ease than at any other time of life" (p. 7). Just as the toddler brain prepares the child to learn language, the teenage brain primes the adolescent to learn impulse control skills (e.g., manage emotions and resist urges), reason more abstractly (e.g., morality isn't black and white), think more critically (e.g., "my parents can't always be right"), enhance communication skills (e.g., speaking to members of the opposite sex), and develop new social relationships (e.g., romantic relationships). Adolescence is also a time of discovery and changes in cognition associated with changes in the brain allowing teenagers to consider themselves and their lives in the future (Dahl, 2004).

Adults are encouraged to be sources of support for teenagers. They should facilitate opportunities for adolescents to establish autonomy and trust, work hard to maintain open lines of communication, model appropriate social behavior, and allow for a teenager's self-discovery. Feinstein (2009) recommends "understanding and tolerance" (p. 57) during the teen years. However, setting limits on teenage behavior and providing adequate supervision is also important (Friman, 2010). Research has found that parenting styles characterized by high levels of warmth and responsiveness, and high expectations often produce better outcomes for adolescents than parenting styles that are punitive (i.e., use harsh and punitive disciplinary practices), indulgent (i.e., responsive but with low expectations), or indifferent (i.e., low responsiveness with low expectations; Steinberg, 2011).

Changes occurring in the brain during adolescence may help explain many of the challenges of this developmental period. The developing amygdala, a part of the brain related to emotional control, may stimulate intense feelings that appear for no apparent reason. Furthermore, adolescents are prone to impulsivity and risk-taking behavior, show suspicion for adults and authority, and increase the amount of time spent with peers (White, 2009). These common features of adolescence might produce tension between teenagers and parents, and lead to intense

conflicts. However, these challenges of adolescence, or the developmental changes that occur between childhood and adulthood, also represent opportunities. The trials and tribulations of adolescence "serve valuable purposes and allow adolescence to work as a stage of change" (Dahl, 2004, p. 81). Put slightly differently, overcoming challenges of adolescence prepares individuals for adulthood and the challenges that occur during adulthood.

As much as adolescence is a time of opportunity, it is also a time of risk. The phrases "natural tinderbox" and "hazard period" have been used by scholars to describe the liabilities that exist during adolescence (see Dahl, 2004; White, 2009). Specifically, entering adolescence can be a risk factor for the onset of psychological disorders including anxiety and depression. In addition, adolescents are susceptible to problems involving delinquency, substance use, and school failure. While there are obvious environmental contributors to these problems (e.g., increased unsupervised time, more intense social pressures), the developing brain is, at least partially, responsible for why adolescents are at risk for these problems. For example, areas of the brain responsible for risk-taking behavior are more active during adolescence (Steinberg, 2010). In addition, neural circuits applied to problem-solving during adolescence are likely to become established during adulthood (White, 2009). That's fine if the problem-solving leads to positive outcomes. Unfortunately, maladaptive problem-solving skills learned during adolescence can remain with an individual into adulthood. Perhaps equally important, parents and others must remember that the adolescent brain continues to develop beyond the age of 18 years. Consequently, maladaptive problem-solving happening the first few years after high school, for example during college, could influence an individual's functioning as an adult.

Coming back to the brilliant teenagers described at the beginning of this chapter, it's likely these wunderkinds represent outliers, exceptional individuals with exceptional talents. Moreover, it's likely their brains were in a state of change just like the brains of their more typical peers. As for Bella and Katniss, they, too, are unusual. When referencing archetypical adolescent brains from popular culture, perhaps it's best to consider Seth, Evan, and McLovin from the movie *Superbad* or the kids from *The Goldbergs, Modern Family*, or *The Middle*, contemporary sitcoms that feature common teenager experiences. These teens better exemplify the consequences of an overactive limbic system and a prefrontal cortex that is sometimes out for lunch.

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Myth #4 Anorexia treatment usually requires teens to be separated from their parents

A tonsillectomy is the surgical practice of removing tonsils from a youth most commonly due to recurring tonsil infections or inflammation of the tonsils. Similarly, the term "parentectomy" has been applied to the therapeutic practice of removing parents from a youth who has been diagnosed with anorexia nervosa (Harper, 1983). Anorexia nervosa is an eating disorder characterized by a restriction of food intake that leads to significantly low weight. The disorder also commonly includes an intense fear of weight gain and a problematic perception of one's body (American Psychiatric Association, 2013).

Even the earliest documented interventions for anorexia included a recommendation to separate youth from their "anorexogenic" parents (Le Grange, Lock, Loeb, & Nicholls, 2009). For example, in his seminal 1874 work describing the disorder, after coining the term anorexia nervosa, Sir William Withey Gull (1874) also advocated the position that youth with anorexia should be separated from their family as part of the treatment. About a decade later, in the 1880s, Jean-Martin Charcot further advanced Gull's position by advocating the use of "isolation therapy" for anorexia in order to keep youth and their family separated during treatment (Silverman, 1997).

Charcot even describes a case in which a teenage girl was near death, and she only got better once he insisted to her hesitant parents that they must leave the city. The teen even recognized the value of her isolation as she reportedly told Charcot:

> As long as papa and mama had not gone…I was afraid that my illness was not serious, and as I had a horror of eating, I did not eat. But when I saw that you were determined to be master, I was afraid, and in spite of repugnance I tried to eat, and I was able to, little by little. (Silverman, 1997, p. 298)

Ever since these early descriptions of anorexia, the "anorectic family," also called the "psychosomatic family," has continued to receive considerable blame for the development and maintenance of anorexia due to family characteristics such as rigidity, overprotectiveness, and overly feeling each other's emotions (Minuchin et al., 1975; Minuchin, Rosman, & Baker, 1978). This persistent parent-blaming approach has led to the common practice of admitting youth with anorexia into hospital inpatient units, often with the goal of separating youth from their families for an extended period of time (Insel, 2012; Le Grange, n.d.).

More recently, news headlines such as "Pushy Parents 'to Blame for Anorexia in Sporty Teenagers'" reflect the notion that parents are a primary cause of anorexia (Wynne-Jones, 2006), and this level of parent-blaming may lead some to believe it is necessary for youth to be separated from their parents during treatment. The separation of parents from their youth with anorexia is also reflected in the recent movie *To the Bone* (Curtis, Miller, Lynn, & Noxon, 2017). In the movie, the 20-year-old main character, Ellen, is required to agree to at least six months of inpatient care in order to be treated by Dr. Beckham (played by a lightly bearded Keanu Reeves). During the movie, it's revealed that Ellen's parents have let her down in many ways, such as by going through a divorce and by being disengaged from Ellen's life. Toward the beginning of Ellen's inpatient stay, Dr. Beckham attempts one session of therapy with her parents, but it goes so badly he vows, "We're never doing family therapy again," also adding, "That was a sh*t show." The only other contact Ellen has with a parent is when she sneaks away to visit her mother. Taking blame for Ellen's anorexia, her mother admits "I didn't hold you enough; I didn't bond with you." Moreover, Ellen's mother had recently received some advice that prompted her to pull out a baby bottle filled with rice milk. Ellen initially rejected this attempt to make up for the lost bond, but moments later she let her mother cradle her, feed her, and sing "Hush, Little Baby." Overall, this movie sends the messages that parents are a primary cause of anorexia and that the treatment requires significant separation from the family.

Relatedly, two questions need to be considered that are to do with the role of parents in the development and treatment of anorexia. The first question is: Do parents cause anorexia? The answer is somewhat complicated because there is no way to conduct a randomized control study in which different children are randomly assigned to having different types of parents. Thus, we are left with adoption and correlational studies, which cannot be used to definitively determine causes. However, the existing research points toward many variables that have been

associated with the development of anorexia in youth. Twin studies and other types of research point toward a strong genetic contribution (Bulik, Slof-Op't Landt, van Furth, & Sullivan, 2007) that may also interact with environmental variables. Some possible environmental variables include exposure to certain types of media, peer groups, and adverse life events (Mazzeo & Bulik, 2009). Parenting behaviors, such as parental modeling of problematic eating, parental teasing about weight, and parental psychopathology are also associated with anorexia (Mazzeo & Bulik, 2009). That is, for some youth with anorexia, their parents' behavior could have been one of several factors contributing to their eating history. However, for many youth with anorexia, no such problematic parenting behaviors are evident. In sum, after reviewing all of the evidence, the Academy for Eating Disorders concludes in a position paper that "whereas family factors can play a role in the genesis and maintenance of eating disorders, current knowledge refutes the idea that they're either the exclusive or even the primary mechanisms that underlie risk" (Le Grange et al., 2009, p. 1).

The second question to consider is: Do youth need to be separated from their parents for treatment to be successful? The answer to this question is more clear-cut. That is, most adolescents with anorexia do not need to be separated from their parents for a positive treatment outcome. In fact, quite the opposite is often true. Several randomized control studies have demonstrated that effective treatment often incorporates parents as a key part of the treatment process. For example, one such study compared a family-based treatment (in which parents were involved) to an adolescent-focused treatment (in which the parents were *not* involved). One year following treatment, 49% of the adolescents in the family-based treatment group experienced a full remission, which was significantly higher than the 23% of the adolescents in the adolescent-focused treatment group attaining full remission. Several other well-designed studies found similar results (Lock, 2015). Taken together, these studies indicate that the inclusion of parents in therapy was helpful for the long-term maintenance of improvements made during therapy.

One major reason that people may believe youth should routinely be separated from their parents as part of treatment for anorexia is that there is a kernel of truth to this idea. That is, a small minority of parents demonstrate such dysfunctional parenting behaviors that they may need to receive substantial treatment for themselves, and in some cases youth may need to be removed from their homes due to child abuse or neglect. However, this is not the case for the majority of parents with youth diagnosed with an eating disorder. Although some parents also may

engage in some behaviors that contribute to their child's anorexia, it is likely more beneficial to include them in treatment so that they can help the treatment gains last over time. Another kernel of truth is that some adolescents have restricted their calorie consumption so severely that their life is in imminent danger, and they may need to be hospitalized. However, parents can still provide helpful support during and after the hospitalization.

There are a few reasons that this myth can be harmful. First, if parents are worried about being blamed for their child's anorexia, they may be less likely to bring their child to treatment (Bozsik, Bennett, Stefano, Whisenhunt, & Hudson, in press). Second, this myth may make parents feel guilty even though they often had had little to do with the development of the disorder. Third, when parents are not involved in treatment, the treatment gains are more likely to diminish over time (Lock et al., 2010). Finally, hospitalization has the potential to be traumatic for both the youth and their parents (Le Grange, n.d.). Thus, whenever possible, the best treatment path incorporates parents in a way that does not assign them primary blame.

What you need to know

In 2008, a systematic review of the existing research revealed that family therapy was the only well-established psychosocial treatment for youth with anorexia (Keel & Haedt, 2008). Seven years later, an updated review by a different author also came to the same conclusion (Lock, 2015). More specifically, the Maudsley Model is a type of family therapy used in many of the studies demonstrating a good outcome. This approach includes: (a) making the whole family aware of the dangers associated with anorexia, (b) assessing the family interactions related to eating, and (c) helping the family change in ways to better facilitate healthy eating (Lock & Le Grange, 2015). Although family members are not blamed as the primary cause of anorexia, they're incorporated because they help make the greatest changes. Interestingly, the Maudsley Model did receive brief mention in the *To the Bone* movie described earlier, but this was only to point out that it didn't work for a young woman in the waiting room.

There are currently no well-established treatments (or even probably efficacious treatments) for youth with other eating disorders such as bulimia nervosa or binge-eating disorder (Lock, 2015). Family therapy and supportive individual therapy are both currently considered to be

possibly efficacious for bulimia, and internet-delivered cognitive-behavioral therapy is possibly efficacious for binge-eating disorder. However, the bar for a treatment to be considered possibly efficacious is relatively low (Southam-Gerow & Prinstein, 2014). Thus, more treatment research is especially needed for bulimia and binge-eating disorder.

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Myth #5

Technology has made teens better at multitasking

The Sims 4, the popular life simulation video game, takes multitasking to a whole new level. Sims, or players' virtual characters, are able to exercise, talk with other Sims, and watch television, all at the same time. Not impressed? The latest installment of the game allows Sims to simultaneously flirt, give career advice, and use the toilet. Try that at home.

The Sims creates a world enveloped by technology. Where your little pixel person goes, in even the simplest of Sim worlds, there's bound to be technology. Contrast any Sim with Peter Griffin from the crude but popular adult cartoon *Family Guy*. After being told by his friend Quagmire that he's an idiot and "can't even talk and chew gum at the same time," a cutaway reveals Peter lying face down on the sidewalk, apparently chewing gum ("Brian's a Bad Father" from Season 12, Episode 11). His wife calls for him and he replies, "I'm doing something. One thing at a time" (Langford & Sheridan, 2014). Peter is not known for being savvy with technology, unlike his Sim counterparts (watch "Quagmire's Quagmire," from *Family Guy* Season 12, Episode 3, when Peter travels to the Apple Store to help Quagmire purchase a computer

only to become entangled by an earbud cord; Chevapravatdumrong & Michels, 2013). Considering these two popular culture amusements, it's easy to understand how one might presume that technology use is associated with effective multitasking.

Some scientists believe that multitasking is, itself, a myth. What appears to be multitasking is actually switching attention between tasks. It's very difficult for the brain to think about two ideas simultaneously or attend to multiple tasks concurrently (Howard, 2006). As neuroscientist John Medina (2008) said, "we are biologically incapable of processing attention-rich inputs simultaneously" (p. 85). Others have suggested that multitasking, such as driving and talking on the phone simultaneously, is one end of a continuum describing time between switching tasks (Salvucci, Taatgen, & Borst, 2009). Listening to a lecture and taking notes is an example of task-switching where the time between tasks might only be seconds. Regardless, there is a general belief that multitasking exists and that it is an important skill, especially in today's technology-rich society (Rose, 2010).

Today's teenagers have grown up not knowing a time without easy access to technology. First-year college students in Western cultures don't understand what it's like to live in a time without cell phones or the internet. Moreover, teenagers are spending much of their time immersed in technology (e.g., smartphone, computer, tablet, television, gaming device). In fact, many young people are spending more time with technology than sleeping. In a 2015 study, teenagers reported using technology almost 9 h per day, minus time spent using technology for school or homework (Common Sense Media, 2015). However, this figure is considerably more than what's been reported in the recent past. According to a 2010 Kaiser Foundation study, kids 8 to 18 years of age spent an average of more than 7.5 h a day, 7 days a week using technology, up from just over 6 h per day in 1999, but considerably lower than the 9 h per day reported by teenagers in the 2015 study (Rideout, Foehr, & Roberts, 2010). And college students are using smartphones just as often. A 2014 study found college women use their cell phones approximately 10 h per day, whereas men reported spending an average of approximately 7.5 h per day using cell phones (Roberts, Yaya, & Manolis, 2014). Not surprisingly, college students' cell phone usage has also increased in recent years. A 2012 study estimated college students used their cell phones approximately 7 h per day (Junco & Cotton, 2012).

While these numbers are staggering, the implications of increased technology usage among young people are interesting. For example, technology among teens is believed to aid in multitasking, a concept that involves quickly switching attention between multiple tasks. A 2006 *Time*

Magazine article proclaimed millennials as "the multitasking generation" (Wallis, 2006). Youth in the story described completing homework while listening to music, checking email while reading, and looking at Facebook while responding to texts—lots of time spent with technology and lots of time spent multitasking with technology.

The misguided belief that teens are good multitaskers because of their use of technology may have something to do with the numbers. Research suggests that media multitasking is commonplace among young people today. For example, a 2010 study found that almost 30% of youth in seventh through twelfth grade reported using two or more media (i.e., listening to music, using a computer or tablet, watching television, reading, playing video games) simultaneously (Rideout et al., 2010). The same study found that between half and three-quarters of adolescents reported media multitasking at least some or most of the time. For example, 66% of youth reported often using a computer and another media form concurrently. Another study found that 81% of 8- to 18-year-olds endorsed spending at least some of their time media multitasking (Foehr, 2006). The study also found that heavy multitaskers (i.e., those reporting multitasking most of the day), which amounted to approximately 15% of the sample, were engaged with technology almost 13 h per day. Given these numbers, there appears to be a relationship between technology use and media multitasking. However, one cannot infer causation (i.e., technology use causes teens to be effective multitaskers) from the available data. Rather, all that can be said is that frequent technology use and heavy media multitasking appear to occur together, which isn't surprising given that most new technologies encourage multitasking (e.g., smartphones allow users to concurrently hold a conversation via text message, track a snowstorm, and play a game of Candy Crush).

Myths are also promoted by the tendency to make meaningful connections between two variables based solely on their similarities. Technology and multitasking are clearly related. Again, smartphones allow users to easily engage in multiple tasks simultaneously (e.g., listen to music while texting a friend). It stands to reason that frequent technology usage would improve multitasking. Experimental research has found that teaching people to perform two tasks concurrently improves performance on those tasks (Cardoso-Leite, Green, & Bavelier, 2015). This isn't surprising, as training and practice improve performance. Researchers in the field of learning agree that "repeating an activity (i.e., training) leads to performance benefits on the trained and possibly similar activities" (Cardoso-Leite et al., 2015, p. 106). The more one does something, the more one becomes proficient at it. Characters in *The Sims*

universe are effective multitaskers because they're able to practice multitasking with technology over and over. The logic makes sense, which might help explain why the myth that adolescents' use of technology enhances multitasking is so believable.

However, the truth of the statement that technology use enhances multitasking ability relies on the assumption that multitasking using technology (e.g., media multitasking) does, in fact, lead to improved multitasking. Yet, research suggests that heavy media multitaskers might be less effective at task-switching (e.g., shifting attention between one task and another) than those who rarely media multitask (Strayer & Watson, 2012). In one study, researchers compared heavy and light media multitaskers' performance on tasks requiring subjects to classify letters as vowels or consonants and classify digits as odd or even (Ophir, Nass, & Wagner, 2009). The researchers examined participants' response times during switch trials (trial followed by trial of the other type) and nonswitch trials (trial followed by trial of the same type). Surprisingly, heavy media multitaskers performed worse than light media multitaskers when required to switch tasks. Specifically, the heavy media multitaskers responded slower than light media multitaskers during both trial types and slowed down more during switch trials than the light media multitaskers. Put differently, frequent multitasking with technology did not lead to improved multitasking. Rather, light media multitaskers performed better than heavy media multitaskers when required to switch attention when completing two different tasks. Other research has found that college student subjects identifying themselves as expert multitaskers performed poorly on a laboratory task of attention and recall (Sanbonmatsu, Strayer, Mederios-Ward, & Watson, 2013). The researchers hypothesized that multitasking might result from an individual's inability to "block out distractions and focus on a singular task" (p. 7). This might help explain why some people find it so difficult to ignore text messages while driving.

The myth that technology use has made teens better multitaskers also relies on the assumption that multitasking, as a skill, is desirable. However, there appears to be a number of pitfalls related to multitasking. For example, a Forbes.com article from February 2017 titled "Want to be more Productive? Stop Multitasking" reported that multitasking could reduce productivity by as much as 40% (Quast, 2017). Although this figure is only an estimate, much of the research on multitasking suggests it is not something one wants to do very often. Reviews of the literature consistently find that heavy media multitasking negatively affects attention, concentration, academic assignment quality, learning

quality, and academic performance (Levine, Waite, & Bowman, 2012; Wallis, 2010). Specific to middle and high school aged students, research indicates frequent media multitaskers do poorly on performance measures of attention, inhibition, and working memory (Baumgartner, Weeda, van der Heijden, & Huizinga, 2014; Cain, Leonard, Gabrieli, & Finn, 2016; Moisala et al., 2016). Furthermore, teenagers who identify themselves as heavy media multitaskers report higher levels of impulsivity and score significantly lower on standardized assessment of academic achievement than light media multitaskers (Cain et al., 2016; Moisala et al., 2016). For example, one study found that statewide academic assessment scores in Math and English Language Arts were negatively correlated with self-reported media multitasking (Cain et al., 2016). Specifically, light media multitaskers performed better than heavy media multitaskers on both tests.

For college students, multitasking during class, especially when social media is used, is also associated with distractibility and poor academic performance (Junco, 2012; McCoy, 2016). For example, one study using survey data from almost 2,000 students from a large university found that frequent Facebook use or text messaging while completing schoolwork was negatively associated with grade point average (GPA; Junco & Cotton, 2012). This isn't surprising as experimental research has found that multitasking negatively affects classroom performance. In one study, researchers provided students in an upper-level communications course with laptops as a "supplement to the lecture, discussion and lab activities" (Hembrooke & Gay, 2003, p. 7). During one particular class, students were randomly assigned to one of two conditions: laptop open or laptop closed during lecture. Those in the laptop open condition began the class period in the lecture and then moved to a lab activity, while those in the laptop closed condition began the class in the lab activity and moved to the lecture. Each group was tested on the lecture's content immediately after the lecture portion of the class. Not surprisingly, the researchers found that students in the laptop open condition scored significantly worse than the laptop-closed group on short answer recall questions. The results were the same two months later when researchers replicated the study but with subjects assigned to the opposite condition. The researchers also found that students using their laptops for course-related purposes (e.g., looking up information relevant to the course) performed as poorly on comprehension questions as those who used their laptops to look up irrelevant information. In a more recent study, researchers found low student engagement during class and poor lecture comprehension when students were intentionally distracted in class by Facebook (Gupta

& Irwin, 2016). Surprisingly, this was true whether the lecture was of high or low interest to students.

Taken altogether, technology does not appear to improve multitasking for the vast majority of individuals. Moreover, research indicates that adolescent media multitasking negatively impacts various aspects of cognitive functioning including attention, concentration, inhibition, and working memory, as well as academic performance. Although most of us are not productive multitaskers, how is it that *The Sims* characters are able to simultaneously talk on the phone, cook a grilled cheese sandwich, and put out a fire? And how can Homer Simpson, after learning to drive with his knees, simultaneously make snow cones, turn on a fog machine, and DJ using a turntable all while driving ("Brake My Wife, Please," from Season 14, Episode 20)? Perhaps they represent what cognitive psychologists David Strayer and Jason Watson call "Supertaskers," or the very small minority of individuals who are highly effective multitaskers (Strayer & Watson, 2012). Most likely it's because they're fictional characters who defy the laws of reality.

What you need to know

There is still a lot to learn about technology and multitasking beyond what's already been studied. For example, research continues to investigate the long-term effects of chronic technology usage and media multitasking on the brains of children and adolescents. Additional research is also needed to help understand differences between heavy and light media multitaskers. While basic and applied research works to answer these questions, there are some points to consider currently when thinking about teenagers, technology, and multitasking.

Not surprisingly, research has offered many advantages to limiting adolescents' screen time. A recent review published in *Pediatrics*, the primary journal of the American Academy of Pediatrics, noted several significant health and developmental risks associated with heavy technology usage (Chassiakos, Radesky, Christakis, Moreno, & Cross, 2016). For example, teenagers' excessive television viewing is correlated with obesity and sleep problems. There is also an inverse relationship between technology usage and academic performance (Rideout et al., 2010). Specifically, heavy technology use is associated with lower grades.

However, research also indicates that there are potential benefits associated with technology usage. For example, online social interactions among teenagers have been found to be mostly positive and neutral

(Underwood, Ehrenreich, More, Solis, & Brinkley, 2015), which might help explain why online social communication among teenagers has been shown to improve the quality of existing relationships (Davis, 2012). In addition, technology used wisely in educational contexts can enhance learning outcomes. For example, a statistical analysis of 20 studies found that the use of technology in middle school literacy programs improved reading comprehension skills (Moran, Ferdig, Pearson, Wardrop, & Blomeyer, 2008).

When it comes to adolescent technology use, most experts in child development, education, and healthcare recommend sensible family practices. For example, the American Psychological Association suggests that parents closely monitor their teen's use of technology and not allow teens to use technology in their bedrooms or other locations where parental monitoring is difficult (da Salvia, 2015). Parents are also encouraged to maintain open lines of communication with their adolescent to explain and discuss media content that might involve adult themes. The American Academic of Pediatrics recommends parents work with their teenagers to develop a Family Media Plan (www.healthychildren.org/MediaUsePlan). The plan can help families and teenagers negotiate screen-free areas of the home (e.g., bedroom, dinner table), device curfews and other times when technology shouldn't be used, and appropriate media content. Parents can also use this resource to help their teenager balance online and offline time, and understand appropriate media manners (e.g., not using their cell phone during mealtimes) and digital citizenship (e.g., being polite to people while online). Ideally, parents should be working with teenagers to ensure the development of healthy technology usage. Behaviors that promote healthy technology usage established during adolescence are likely to remain with the individual into adulthood.

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Mini myths for development of the body, brain, and mind

Myth #6

Pubertal "early bloomers" fare better than "late bloomers"

Ten-year-old boys are playing Little League and a wayward ball has been thrown far, far off the field, well behind home plate. Suddenly, a much more mature-looking boy rides by the dugout on his moped. He dismounts, picks up the ball, and throws it all the way to the outfield.

"Who is *he*?" the coach asks.

"He's in our grade," the kids tell him. "I heard he spent two years in 'juvi,'" one offers. "I heard he broke some kid's arm who owed him money." And the coach, in awe, responds "Who cares about that crap, can he play?"

This scene is from a remake of the classic film, *The Bad News Bears* (Linklater, 2005), and illustrates both the myth as well as the nugget of truth behind the myth, which is that, while kids who develop more quickly than others may be envied on the field, their off-field behavior can be troublesome.

And while many parents hold a favorable view of their child experiencing puberty earlier, if they have aspirations for their teen to become the next great athlete, unexpected negative consequences often follow these "early bloomers." This notion has psychologists worried. Many suggest it creates what scientists call "biopsychosocial asynchrony," meaning that children's bodies appear to be ready for sexual debut and accordingly, based on their appearance alone, they may be treated by others with expectations, advances, or assumptions that are commensurate with someone much older. But because their brain development, life experience, and access to social support still reflects that of a typical child years younger than they appear, this is a mismatch that could confer serious risk for a wide range of psychological problems (Rudolph, 2014).

Many studies now suggest that early pubertal development is associated with a greater likelihood of externalizing symptoms, such as aggressive behavior, earlier sexual debut, and substance use (Negriff & Susman, 2011). Among girls, early-onset puberty also is significantly associated with depression and body-dissatisfaction (Ge, Conger, & Elder, 1996).

Research also suggests the most powerful factors predicting negative outcomes may be related to the tendency for those who develop early to begin hanging out with peers who are closer to their apparent age, rather than their actual age. Among girls, this may be especially problematic (Negriff & Susman, 2011). Research suggests that early-blooming girls, who often are the most physically mature compared with any others in their grade, often attract the attention of older boys. Within this older peer group, girls are exposed to opportunities for sexual behavior, substance use, and deviancy that are not present when spending time with their same-aged peers, and this accelerates girls' social maturation at a rate that does not match their psychological readiness (Negriff & Susman, 2011). Research confirms that this early affiliation with risky teens explains much of the association between early puberty and negative outcomes (Negriff & Susman, 2011).

Early bloomers trick us. Based on their physical maturity, their peers, parents, and even they themselves may sometimes feel that they're ready

to experience adult-like challenges within the world around them. But we should not let ourselves be fooled, because early-bloomers are children in adolescents' clothing, and they still need the protections and support that we would offer any child their age.

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Myth #7

Teens can study better while listening to music

University professors, who are often required to walk across campus, can become pretty good experts on the behavioral routines of college students. And while it actually *is* relatively common to see college students walking around in pajama pants, there's a more universal fashion trend—headphones. They come in all sizes and colors. Students wear them while walking to class, while laying around waiting for class, and yes—sometimes—while in class. Unfortunately, research has recently found that headphone use is increasingly a cause of death for some, with pedestrian deaths related to headphone use more than doubling from 2004 to 2011 (Lichensetin, Smith, Ambrose, & Moody, 2012).

But most often students wear headphones and listen to music while studying and reading. In fact, research shows that listening to music while studying is actually the norm. For example, research by Johansson and colleagues (Johansson, Holmqvist, Mossberg, & Lindgren, 2012) found that 81% of their college student sample sometimes listened to music while studying. Similarly, 90% of students in a study by Furnham, Trew, and Sneade (1999) reported listening to music while studying. Therefore, it's no surprise that teens (and probably many adults) believe that listening to music helps them study. In fact, data from our own research (Jewell & Hupp, 2018) indicates that an overwhelming majority of college students

(85%) have heard of this myth, and a majority also believe the myth (44–62%). And belief in this myth was even higher, 77%, for the sample of college students in the study by Johansson et al. (2012).

So before looking at the research, let's make sure to clearly understand what the myth is saying—that listening to music helps one study *better* than the alternative to music, which would presumably be silence. To shed some light on this question, a recent study by Dobbs, Furnham, and McClelland (2011) tested the cognitive performance of girls ages 11–18 years old in the following three conditions: silence, pop music, and the background noise typical in an office. Students were assessed on three cognitive performance measures testing abstract reasoning, a popular test of logic and reasoning, and a test of verbal reasoning. Silence was better than noise in all three tasks and better than music in two of the three tasks. In fact, while listening to music students did not perform better than silence on any of the tasks. However, the researchers didn't stop there, going one step further to investigate difference in introverts compared to extraverts. In 1967, Hans Eysenck theorized that extraverts essentially live in a state of understimulation and therefore they seek out external stimuli, while introverts often feel overstimulated in social situations and seek solitude (Eysenck, 1967). Interestingly, a number of researchers have examined how one's level of extraversion may predict whether listening to music harms cognitive performance. So going back to the study by Dobbs et al. (2011), they in fact did find that as students' levels of extraversion increased, the deleterious effects of noise disappeared. So what's the simple answer to the myth? Well, if you are an extreme extravert, listening to music while you study is about the same as studying in silence. But if you are not an extravert, listening to music will hinder your studying, so you can keep the headphones on but just don't turn on the music.

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Myth #8 The "Freshman 15": College students gain 15 pounds their freshman year

While most would agree that adjusting to college life can be stressful, the myth of the "Freshman 15" certainly adds to that stress. The phrase "Freshman 15" was first coined by Watkins (a college student author) in an article in the popular teen magazine, *Seventeen* (1989). In the article, Watkins refers to the "…'freshman fifteen' syndrome, where students gain about fifteen pounds during their first year of college" (p. 162). However, the article appears to have been referring to the research by Hovell, Mewborn, Randle, and Fowler-Johnson (1985) who found that female college freshmen gained almost 9 pounds on average. These researchers surmised that the cause of the weight gain was related to the high fat and calorie food served in typical dormitory housing. By 1990, just one year after the term "Freshman 15" was used in *Seventeen* magazine (1989), the term exploded in the media—occurring in almost 300 newspaper and university newspaper articles (Brown, 2008). The myth has even made its way into pop culture. In a recent episode of *The Walking Dead*, as a group of bad guys takes over "The Kingdom," the leader says, "We're going to give you just enough to keep you working, but you're probably going to lose the freshman fifteen pretty quick" (Johnson, Kang, & Satrazemis, 2017). And this myth appears to have been given a life of its own, as 71–72% of college students in our own research sample believe the myth to be true (Jewell & Hupp, 2018).

While fear of the "Freshman 15" was taking hold across the US and beyond, this fear was definitely unfounded. A review of an average weight gain in college students by Zagorsky and Smith (2011) found that, of the 20 studies available at the time, the average weight gain was only 3.8 pounds. The authors went on to analyze data from the National Longitudinal Survey of Youth, which consisted of almost 9,000 participants. On average, college freshmen gained a relatively small

amount (about 3 pounds for females and 3.5 pounds for males). And what about the fatty dorm food hypothesis? Well, the results are mixed. Males who lived in a dorm gained about a pound more than those who did not, but females actually gained about a pound *less* when they lived in a dorm (Zagorsky & Smith, 2011). Maintaining a healthy diet and exercising regularly are two good habits for all of us. But there appears to be no reason for college freshmen to fear dramatic weight gain. So college freshmen can relax. And if they feel the need to stress out about anything, try studying!

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Myth #9 Horses are helpful in the treatment of eating disorders, autism spectrum, and more

According to Dr. Oz, equine-assisted therapy is one of the "hottest" types of alternative medicine (Rader & Chiaro, 2010). Equine-assisted therapy uses horses in a therapeutic manner to provide intervention for psychological disorders. Dr. Oz further indicated that "These beautiful animals uncover psychological issues. You know why? Because based on what patients project on to them, you can actually help figure out what's going on with people. We use horses to treat depression, anxiety, and autism because they bring out honesty in us" (Rader & Chiaro, 2010). Other issues treated by equine-assisted therapy include eating disorders,

substance use, and exposure to trauma, with one website suggesting that "82% of teens showed more improvement in just five sessions of EAP [equine-assisted psychotherapy] than they had in years of traditional therapy" (Corcoran, n.d.).

A recent review article summarized the results of 14 studies that used horses as part of therapeutic treatment for issues such as those described above, and the authors concluded that the research does not support the use of this intervention (Anestis, Anestis, Zawilinski, & Lilienfeld, 2014). Specifically, the "studies failed to provide consistent evidence that [using horses in therapy] is superior to the mere passage of time in the treatment of any mental disorder" (p. 1115). That is, any positive results in the studies were likely the result of initial short-lasting positive experiences with trying something new (i.e., novelty effects), experimenter expectancies, and design flaws. We couldn't find evidence that Dr. Oz has changed his tune about equine-assisted therapy; however, his positive promotion of other ineffective interventions has resulted in a reprimand from a consumer protection committee (Christensen & Wilson, 2014), which seems to be a trot in the right direction.

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Myth #10

The onset of puberty is very upsetting to most teens

Puberty is one of the most important biological milestones in adolescence. In fact, many cultures use puberty as a social marker for the beginning of adulthood. However, for a variety of reasons puberty has historically been viewed as a life event that is upsetting for those teens that first experience

some parts of puberty, such as menarche or onset of menstruation in females. In fact, in our own research using a college student sample, 46–50% of students agreed that the onset of puberty is very upsetting for most teens (Jewell & Hupp, 2018). Perhaps the most shocking and disturbing media example promoting this myth is a scene from the beginning of the movie *Carrie* (De Palma & Cohen, 1976) where the naïve and uninformed main character (Carrie, played by Sissy Spacek) is taking a shower after PE class in high school and is shocked when she begins menstruating. Interestingly, this same scene was repeated in the 2013 remake (Peirce, Cohen, & Aguirre-Sacasa, 2013) of the 1976 movie.

But in fact, research shows that menarche is not a universally distressing and upsetting event to most teens, as early research on this topic in the United States has contradicted this myth (Ruble & Brooks-Gunn, 1982). For example, Ruble and Brooks-Gunn found that while some teens in their sample (46%) noted that menarche created some annoyance due to having to carry menstrual supplies, there were also a number of positive aspects to menarche such as the fact that it reflects becoming physically mature (noted in 76% of the sample). The authors concluded that "while menarche may be initially disruptive, particularly for early-maturing and unprepared girls, it typically does not seem to be a traumatic experience" (p. 1565). In fact, research has generally found that the experience of menarche is mostly positive when cultures highlight the positive aspects of menarche, avoid stigmatizing the event, and provide information regarding menarche prior to the actual event (for a review see Arnett, 2014). The importance of education and preparation for menarche was also noted in the original Ruble and Brooks-Gunn study. Thus, while some factors may lead to distress when menarche occurs, female teens' experiences can certainly be influenced by a number of factors including preparation as well as how others in society view the event.

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Myth #11 Male teens are much less likely than females to be preoccupied with their physical appearance

Consider headlines such as "Female Preoccupation with Physical Appearance" (University of Michigan, 1998), "Fighting Unhealthy Perceptions of Body Image: Why Women Obsess Over Appearance" (Valton, 2017), and "Why Disney Princesses and 'Princess Culture' are Bad for Girls" (Hains, 2016). Headlines such as these represent the stereotype that preoccupation with minor (or imagined) flaws in physical appearance is attributed to females much more so than males. This stereotype is especially pronounced in the teenage years. For example, teens are often depicted in the media critically examining their own facial features or bodies in a mirror. When this preoccupation causes significant emotional distress or impairment, the teen may meet the diagnostic criteria for body dysmorphic disorder (BDD; American Psychiatric Association, 2013). Thus, rates of BDD are a good indication how accurate the stereotype really is. Are male teens really less likely to have this disorder? A recent large prevalence study with a community-based sample of teens, the first of its kind, showed that 1.7% of teen females were likely to meet the criteria for BDD, which was not significantly different from the 1.8% of males meeting these criteria (Schneider, Turner, Mond, & Hudson, 2017). Further, a systematic review summarized eight other studies which examined prevalence rates of BDD with adolescents (including college students) (Veale, Gledhill, Christodoulou, & Hodsoll, 2016). Four of the studies did show slightly higher rates of BDD in females; however, the other four studies showed slightly higher rates of BDD in males. All in all, the rates of BDD in females and males are quite similar. Notably, there is one type of BDD that is considerably more common in males—muscle dysphoria, which involves a preoccupation with a perception of one's own smaller muscle size (American Psychiatric Association, 2013; Campagna & Bowsher, 2016).

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Myth #12 Most teens hardly ever engage in leisure reading these days

It's true that teens these days are spending more and more time engaging with screens (Common Sense Media, 2013). Televisions, computers, tablets, and phones all compete for a teenager's attention. Has the time yet come when teens have given up on other activities, such as leisure reading, altogether? Probably not. Recent research shows that only 22% of 13-year-olds report engaging in leisure reading only rarely (i.e., "never" or "hardly ever"), with 53% of them engaging in leisure reading at least once a week (National Center for Education Statistics, 2013). Older teenagers reported somewhat less reading. That is, 27% of 17-year-olds rarely read for leisure while 40% of them read for leisure a least once a week. Thus, teens are still reading for leisure at a fairly high rate, even though the same study also reported a gradual decline in the number of teens who read every day from 1984 to 2012. Although, increased screen time might help account for why teens are reading less, another answer might be found with their parents. In a national sample of nearly 8,900 parents of 4-year-olds, 49% indicated that they only read to their children twice a week or less (Kahn, Purtell, Logan, Ansari, & Justice, 2017). Thus, a large percentage of the parents weren't following the recommendation of the American Academy of Pediatrics to engage in daily reading with young children (Council on Early Childhood, 2014). In fact, 23% of the parents reported *never* reading to their 4-year-olds. The good news is that teens these days still do a fair amount of leisure reading on their own; however, the myth that they "hardly ever engage in leisure reading" is one of the myths in this book that could one day become a reality. Thus, one potential way parents can increase the likelihood that their teens engage in leisure reading is to start with them when they're young.

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Myth #13 Greek life has a negative effect on college students academically

"Greek Life" in college, or membership in fraternities and sororities, is often maligned in television and film. Movies like *Animal House* (Reitman, Simmons, & Landis, 1978) and *Van Wilder* (D'Amico, Foster, von Alvensleben, & Becker, 2002) epitomize the "party first, go to class later" motto portrayed in these films. But is it true that students who become involved in fraternities and sororities have poor academic performance in college? Several researchers over the years have attempted to answer the question, with mixed results, though most of these studies suffered from methodological flaws (e.g., relying on self-reported grades) or small sample sizes (DeBard, Lake, & Binder, 2006; Pike, 1996, 2000). However, one of the largest studies on this topic found results that would surprise many (DeBard & Sacks, 2011). This study of over 45,000 students from 17 institutions compared students involved in fraternities, sororities, and their same sex counterparts not involved in Greek Life on actual academic records of grade point average, retention, and hours earned. They also controlled for high school grade point average and ACT (formerly, American College Testing) score in their analyses. The researchers found that "students who joined Greek letter organizations in their first year earned significantly higher grade point averages than independent students did" (DeBard & Sacks, 2011, p. 114). Additionally, students in Greek organizations also had higher retention rates to the next year compared to students who were not affiliated with a Greek organization. So while movies about debauched frat boys and sorority girls may sell movie tickets, the truth is actually much more complex.

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Myth #14 Paying for prep courses is the best way to make large gains on the SAT

Another book in Great Myths of Psychology series, *Great Myths of Education and Learning*, debunks the myth that "coaching produces large gains in college admission test scores" (Holmes, 2016, p. 174). Colleges and universities commonly require students to take college admissions tests, and every year over a million students take the Scholastic Aptitude Test (SAT) alone (College Board, 2016). High school students often pay over $1,000 for prep courses with the hope of making large gains on the college admission tests (Carrins, 2014); however, research shows that large gains are unlikely. Examining only studies with good research designs, a meta-analysis (mathematical synthesis of studies) found that students made only small gains attributable to prep courses (Kulik, Bangert-Drowns, & Kulik, 1984), and other reviews have consistently reported similar results (Becker, 1990). The most recent review found more moderate effects but still concluded that the gains were less than promised by the companies offering up the prep course (Montgomery & Lilly, 2012). Taken together, these studies show that prep courses can help improve SAT scores somewhat, but they do not consistently help students make large gains. Even small gains, however, may be enough to make the difference for some students when it comes to getting into the college of their choosing, and this has led some to

question how fair it is for wealthier students to afford the course. Interestingly, the College Board (a nonprofit organization) recently partnered with the Khan Academy® to release a free online SAT practice resource which includes practice tests, study tips, and practice tips (College Board, 2016). This free program has yet to be compared with paid programs, but it has the potential to create more equity in terms of college admission tests.

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