

CHILD GROWTH AND DEVELOPMENT



Long Beach Community College

Child Growth and Development

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CHAPTER OVERVIEW

1: Introduction to Child Development

Learning Objectives

After this chapter, you should be able to:

- Describe the principles that underlie development.
- Differentiate periods of human development.
- Evaluate issues in development.
- Distinguish the different methods of research.
- Explain what a theory is.
- Compare and contrast different theories of child development.

Welcome to Child Growth and Development. This text is a presentation of how and why children grow, develop, and learn. We will look at how we change physically over time from conception through adolescence. We examine cognitive change, or how our ability to think and remember changes over the first 20 years or so of life. And we will look at how our emotions, psychological state, and social relationships change throughout childhood and adolescence.¹

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1.1: Principles of Development

There are several underlying principles of development to keep in mind:

- Development is lifelong and change is apparent across the lifespan (although this text ends with adolescence). And early experiences affect later development.
- Development is multidirectional. We show gains in some areas of development while showing loss in other areas.
- Development is multidimensional. We change across three general domains/dimensions; physical, cognitive, and social and emotional.
 - The physical domain includes changes in height and weight, changes in gross and fine motor skills, sensory capabilities, the nervous system, as well as the propensity for disease and illness.
 - The cognitive domain encompasses the changes in intelligence, wisdom, perception, problem-solving, memory, and language.
 - The social and emotional domain (also referred to as psychosocial) focuses on changes in emotion, self-perception, and interpersonal relationships with families, peers, and friends.

All three domains influence each other. It is also important to note that a change in one domain may cascade and prompt changes in the other domains.

- Development is characterized by plasticity, which is our ability to change and that many of our characteristics are malleable. *Early experiences are important, but children are remarkably resilient (able to overcome adversity).*
- Development is multicontextual.² We are influenced by both nature (genetics) and nurture (the environment) - when and where we live and our actions, beliefs, and values are a response to circumstances surrounding us. The key here is to understand that behaviors, motivations, emotions, and choices are all part of a bigger picture.³

Now let's look at a framework for examining development.

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1.2: Periods of Development

Think about what periods of development that you think a course on Child Development would address. How many stages are on your list? Perhaps you have three: infancy, childhood, and teenagers. Developmentalists (those that study development) break this part of the life span into these five stages as follows:

- Prenatal Development (conception through birth)
- Infancy and Toddlerhood (birth through two years)
- Early Childhood (3 to 5 years)
- Middle Childhood (6 to 11 years)
- Adolescence (12 years to adulthood)

This list reflects unique aspects of the various stages of childhood and adolescence that will be explored in this book. So while both an 8-month-old and an 8-year-old are considered children, they have very different motor abilities, social relationships, and cognitive skills. Their nutritional needs are different and their primary psychological concerns are also distinctive.

Prenatal Development

Conception occurs and development begins. All of the major structures of the body are forming and the health of the mother is of primary concern. Understanding nutrition, teratogens (or environmental factors that can lead to birth defects), and labor and delivery are primary concerns.



Figure 1.2.1: A tiny embryo depicting some development of arms and legs, as well as facial features that are starting to show. (Image by [lunar caustic](#) is licensed under [CC BY 2.0](#))

Infancy and Toddlerhood

The two years of life are ones of dramatic growth and change. A newborn, with a keen sense of hearing but very poor vision, is transformed into a walking, talking toddler within a relatively short period of time. Caregivers are also transformed from someone who manages feeding and sleep schedules to a constantly moving guide and safety inspector for a mobile, energetic child.



Figure 1.2.2: A swaddled newborn. (Image by [Han Myo Htwe](#) on [Unsplash](#))

Early Childhood

Early childhood is also referred to as the preschool years and consists of the years which follow toddlerhood and precede formal schooling. As a three to five-year-old, the child is busy learning language, is gaining a sense of self and greater independence, and is beginning to learn the workings of the physical world. This knowledge does not come quickly, however, and preschoolers may initially have interesting conceptions of size, time, space and distance such as fearing that they may go down the drain if they sit at the front of the bathtub or by demonstrating how long something will take by holding out their two index fingers several inches apart. A toddler's fierce determination to do something may give way to a four-year-old's sense of guilt for action that brings the disapproval of others.



Figure 1.2.3: Two young children playing in the Singapore Botanic Gardens (Image by [Alaric Sim](#) on [Unsplash](#))

Middle Childhood

The ages of six through eleven comprise middle childhood and much of what children experience at this age is connected to their involvement in the early grades of school. Now the world becomes one of learning and testing new academic skills and by assessing one's abilities and accomplishments by making comparisons between self and others. Schools compare students and make these comparisons public through team sports, test scores, and other forms of recognition. Growth rates slow down and children are able to refine their motor skills at this point in life. And children begin to learn about social relationships beyond the family through interaction with friends and fellow students.



Figure 1.2.4: Two children running down the street in Carenage, Trinidad, and Tobago (Image by [Wayne Lee-Sing](#) on [Unsplash](#))

Adolescence

Adolescence is a period of dramatic physical change marked by an overall physical growth spurt and sexual maturation, known as puberty. It is also a time of cognitive change as the adolescent begins to think of new possibilities and to consider abstract concepts such as love, fear, and freedom. Ironically, adolescents have a sense of invincibility that puts them at greater risk of dying from accidents or contracting sexually transmitted infections that can have lifelong consequences.⁸



Figure 1.2.5: Two smiling teenage women. (Image by [Matheus Ferrero](#) on [Unsplash](#))

There are some aspects of development that have been hotly debated. Let's explore these.

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1.3: Issues in Development

Nature and Nurture

Why are people the way they are? Are features such as height, weight, personality, being diabetic, etc. the result of heredity or environmental factors-or both? For decades, scholars have carried on the "nature/nurture" debate. For any particular feature, those on the side of Nature would argue that heredity plays the most important role in bringing about that feature. Those on the side of Nurture would argue that one's environment is most significant in shaping the way we are. This debate continues in all aspects of human development, and most scholars agree that there is a constant interplay between the two forces. It is difficult to isolate the root of any single behavior as a result solely of nature or nurture.

Continuity versus Discontinuity

Is human development best characterized as a slow, gradual process, or is it best viewed as one of the more abrupt changes? The answer to that question often depends on which developmental theorist you ask and what topic is being studied. The theories of Freud, Erikson, Piaget, and Kohlberg are called stage theories. Stage theories or discontinuous development assume that developmental change often occurs in distinct stages that are qualitatively different from each other, and in a set, universal sequence. At each stage of development, children and adults have different qualities and characteristics. Thus, stage theorists assume development is more discontinuous. Others, such as the behaviorists, Vygotsky, and information processing theorists, assume development is a more slow and gradual process known as continuous development. For instance, they would see the adult as not possessing new skills, but more advanced skills that were already present in some form in the child. Brain development and environmental experiences contribute to the acquisition of more developed skills.

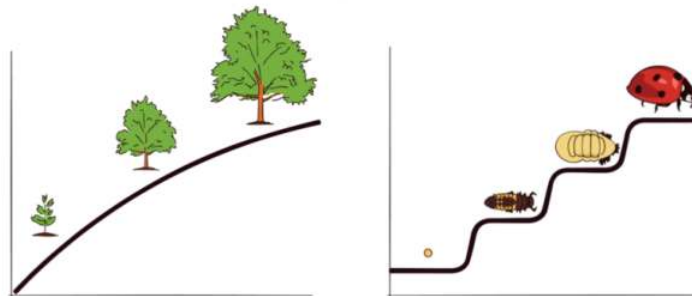


Figure 1.3.1: The graph to the left shows three stages in the continuous growth of a tree. The graph to the right shows four distinct stages of development in the life cycle of a ladybug. (Image by NOBA is licensed under CC BY-NC-SA 4.0)

Active versus Passive

How much do you play a role in your own developmental path? Are you at the whim of your genetic inheritance or the environment that surrounds you? Some theorists see humans as playing a much more active role in their own development. Piaget, for instance, believed that children actively explore their world and construct new ways of thinking to explain the things they experience. In contrast, many behaviorists view humans as being more passive in the developmental process.¹¹

How do we know so much about how we grow, develop, and learn? Let's look at how that data is gathered through research

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1.4: Research Methods

An important part of learning any science is having a basic knowledge of the techniques used in gathering information. The hallmark of scientific investigation is that of following a set of procedures designed to keep questioning or skepticism alive while describing, explaining, or testing any phenomenon. Some people are hesitant to trust academicians or researchers because they always seem to change their story. That, however, is exactly what science is all about; it involves continuously renewing our understanding of the subjects in question and an ongoing investigation of how and why events occur. Science is a vehicle for going on a never-ending journey. In the area of development, we have seen changes in recommendations for nutrition, in explanations of psychological states as people age, and in parenting advice. So think of learning about human development as a lifelong endeavor.

Take a moment to write down two things that you know about childhood. Now, how do you know? Chances are you know these things based on your own history (experiential reality) or based on what others have told you or cultural ideas (agreement reality) (Secombe and Warner, 2004). There are several problems with personal inquiry. Read the following sentence aloud:

Paris in the the spring

Are you sure that is what it said? Read it again:

Paris in the the spring

If you read it differently the second time (adding the second “the”) you just experienced one of the problems with personal inquiry; that is, the tendency to see what we believe. Our assumptions very often guide our perceptions, consequently, when we believe something, we tend to see it even if it is not there. This problem may just be a result of cognitive ‘blindness’ or it may be part of a more conscious attempt to support our own views. Confirmation bias is the tendency to look for evidence that we are right and in so doing, we ignore contradictory evidence. Popper suggests that the distinction between that which is scientific and that which is unscientific is that science is falsifiable; scientific inquiry involves attempts to reject or refute a theory or set of assumptions (Thornton, 2005). Theory that cannot be falsified is not scientific. And much of what we do in personal inquiry involves drawing conclusions based on what we have personally experienced or validating our own experience by discussing what we think is true with others who share the same views.

Science offers a more systematic way to make comparisons guard against bias.

Scientific Methods

One method of scientific investigation involves the following steps: 1. Determining a research question 2. Reviewing previous studies addressing the topic in question (known as a literature review) 3. Determining a method of gathering information 4. Conducting the study

5. Interpreting results 6. Drawing conclusions; stating limitations of the study and suggestions for future research 7. Making your findings available to others (both to share information and to have your work scrutinized by others)

Your findings can then be used by others as they explore the area of interest and through this process a literature or knowledge base is established. This model of scientific investigation presents research as a linear process guided by a specific research question. And it typically involves quantifying or using statistics to understand and report what has been studied. Many academic journals publish reports on studies conducted in this manner.

Another model of research referred to as qualitative research may involve steps such as these: 1. Begin with a broad area of interest 2. Gain entrance into a group to be researched 3. Gather field notes about the setting, the people, the structure, the activities or other areas of interest 4. Ask open ended, broad “grand tour” types of questions when interviewing subjects 5. Modify research questions as study continues 6. Note patterns or consistencies 7. Explore new areas deemed important by the people being observed 8. Report findings

In this type of research, theoretical ideas are “grounded” in the experiences of the participants. The researcher is the student and the people in the setting are the teachers as they inform the researcher of their world (Glazer & Strauss, 1967). Researchers are to be aware of their own biases and assumptions, acknowledge them and bracket them in efforts to keep them from limiting accuracy in reporting. Sometimes qualitative studies are used initially to explore a topic and more quantitative studies are used to test or explain what was first described.

Research Methods

Let's look more closely at some techniques, or research methods, used to describe, explain, or evaluate. Each of these designs has strengths and weaknesses and is sometimes used in combination with other designs within a single study.

Observational Studies

Observational studies involve watching and recording the actions of participants. This may take place in the natural setting, such as observing children at play at a park, or behind a one-way glass while children are at play in a laboratory playroom. The researcher may follow a checklist and record the frequency and duration of events (perhaps how many conflicts occur among 2-year-olds) or may observe and record as much as possible about an event (such as observing children in a classroom and capturing the details about the room design and what the children and teachers are doing and saying). In general, observational studies have the strength of allowing the researcher to see how people behave rather than relying on self-report. What people do and what they say they do are often very different. A major weakness of observational studies is that they do not allow the researcher to explain causal relationships. Yet, observational studies are useful and widely used when studying children. Children tend to change their behavior when they know they are being watched (known as the Hawthorne effect) and may not survey well.

Experiments

Experiments are designed to test hypotheses (or specific statements about the relationship between variables) in a controlled setting in efforts to explain how certain factors or events produce outcomes. A variable is anything that changes in value. Concepts are operationalized or transformed into variables in research, which means that the researcher must specify exactly what is going to be measured in the study.

Three conditions must be met in order to establish cause and effect. Experimental designs are useful in meeting these conditions. 1. The independent and dependent variables must be related. In other words, when one is altered, the other changes in response. (The independent variable is something altered or introduced by the researcher. The dependent variable is the outcome or the factor affected by the introduction of the independent variable. For example, if we are looking at the impact of exercise on stress levels, the independent variable would be exercise; the dependent variable would be stress.) 2. The cause must come before the effect. Experiments involve measuring subjects on the dependent variable before exposing them to the independent variable (establishing a baseline). So we would measure the subjects' level of stress before introducing exercise and then again after the exercise to see if there has been a change in stress levels. (Observational and survey research does not always allow us to look at the timing of these events, which makes understanding causality problematic with these designs.) 3. The cause must be isolated. The researcher must ensure that no outside, perhaps unknown variables are actually causing the effect we see. The experimental design helps make this possible. In an experiment, we would make sure that our subjects' diets were held constant throughout the exercise program. Otherwise, the diet might really be creating a change in stress level rather than exercise.

A basic experimental design involves beginning with a sample (or subset of a population) and randomly assigning subjects to one of two groups: the experimental group or the control group. The experimental group is the group that is going to be exposed to an independent variable or condition the researcher is introducing as a potential cause of an event. The control group is going to be used for comparison and is going to have the same experience as the experimental group but will not be exposed to the independent variable. After exposing the experimental group to the independent variable, the two groups are measured again to see if a change has occurred. If so, we are in a better position to suggest that the independent variable caused the change in the dependent variable.

The major advantage of the experimental design is that of helping to establish cause and effect relationships. A disadvantage of this design is the difficulty of translating much of what happens in a laboratory setting into real life.

Case Studies

Case studies involve exploring a single case or situation in great detail. Information may be gathered with the use of observation, interviews, testing, or other methods to uncover as much as possible about a person or situation. Case studies are helpful when investigating unusual situations such as brain trauma or children reared in isolation. And they are often used by clinicians who conduct case studies as part of their normal practice when gathering information about a client or patient coming in for treatment. Case studies can be used to explore areas about which little is known and can provide rich detail about situations or conditions.

However, the findings from case studies cannot be generalized or applied to larger populations; this is because cases are not randomly selected and no control group is used for comparison.



Figure 1.4.1: Illustrated poster from a classroom describing a case study. (Image by MaryGeorge is licensed under [CC BY-SA 4.0](#))

Surveys

Surveys are familiar to most people because they are so widely used. Surveys enhance accessibility to subjects because they can be conducted in person, over the phone, through the mail, or online. A survey involves asking a standard set of questions to a group of subjects. In a highly structured survey, subjects are forced to choose from a response set such as “strongly disagree, disagree, undecided, agree, strongly agree”; or “0, 1-5, 6-10, etc.” This is known as the **Likert Scale**. Surveys are commonly used by sociologists, marketing researchers, political scientists, therapists, and others to gather information on many independent and dependent variables in a relatively short period of time. Surveys typically yield surface information on a wide variety of factors, but may not allow for in-depth understanding of human behavior.

Of course, surveys can be designed in a number of ways. They may include forced choice questions and semi-structured questions in which the researcher allows the respondent to describe or give details about certain events. One of the most difficult aspects of designing a good survey is wording questions in an unbiased way and asking the right questions so that respondents can give a clear response rather than choosing “undecided” each time. Knowing that 30% of respondents are undecided is of little use! So a lot of time and effort should be placed on the construction of survey items. One of the benefits of having forced choice items is that each response is coded so that the results can be quickly entered and analyzed using statistical software. Analysis takes much longer when respondents give lengthy responses that must be analyzed in a different way. Surveys are useful in examining stated values, attitudes, opinions, and reporting on practices. However, they are based on self-report or what people say they do rather than on observation and this can limit accuracy.

Developmental Designs

Developmental designs are techniques used in developmental research (and other areas as well). These techniques try to examine how age, cohort, gender, and social class impact development.

Longitudinal Research

Longitudinal research involves beginning with a group of people who may be of the same age and background and measuring them repeatedly over a long period of time. One of the benefits of this type of research is that people can be followed through time and be compared with them when they were younger.



Figure 1.4.2: A longitudinal research design. (Image by NOBA is licensed under [CC BY-NC-SA 4.0](#))

A problem with this type of research is that it is very expensive and subjects may drop out over time. The Perry Preschool Project which began in 1962 is an example of a longitudinal study that continues to provide data on children’s development.

Cross-sectional Research

Cross-sectional research involves beginning with a sample that represents a cross-section of the population. Respondents who vary in age, gender, ethnicity, and social class might be asked to complete a survey about television program preferences or attitudes toward the use of the Internet. The attitudes of males and females could then be compared, as could attitudes based on age. In cross-sectional research, respondents are measured only once.

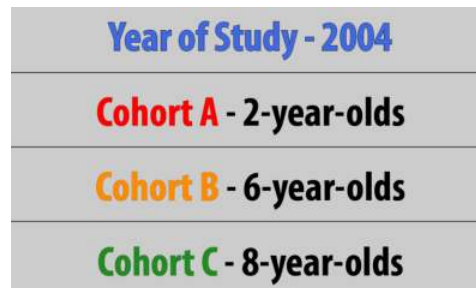


Figure 1.4.3: A cross-sectional research design. (Image by NOBA is licensed under CC BY-NC-SA 4.0)

This method is much less expensive than longitudinal research but does not allow the researcher to distinguish between the impact of age and the cohort effect. Different attitudes about the use of technology, for example, might not be altered by a person's biological age as much as their life experiences as members of a cohort.

Sequential Research

Sequential research involves combining aspects of the previous two techniques; beginning with a cross-sectional sample and measuring them through time.

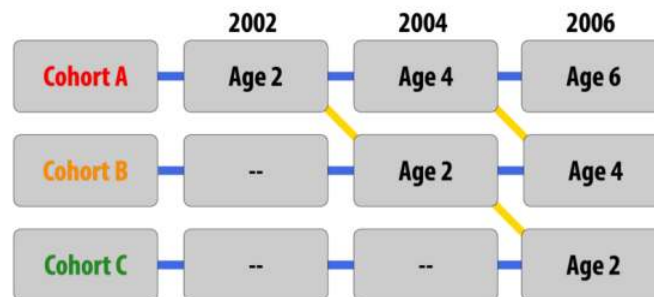


Figure 1.4.4: A sequential research design. (Image by NOBA is licensed under CC BY-NC-SA 4.0)

This is the perfect model for looking at age, gender, social class, and ethnicity. But the drawbacks of high costs and attrition are here as well.¹⁶

Table 1.4.1: Advantages and Disadvantages of Different Research Designs (Research Methods in Developmental Psychology by Angela Lukowski)

Type of Research Design	Advantages	Disadvantages
Longitudinal	- Examines changes within individuals over time - Provides a developmental analysis	- Expensive - Takes a long time - Participant attrition - Possibility of practice effects - Cannot examine cohort effects
Cross-sectional	- Examines changes between participants of different ages at the same point in time - Provides information on age-related change	- Cannot examine change over time - Cannot examine cohort effects
Sequential	- Examines changes within individuals over time - Examines changes between participants of different ages at the same point in time - Can be used to examine cohort effects	- May be expensive - Possibility of practice effects

Consent and Ethics in Research

Research should, as much as possible, be based on participants' freely volunteered informed consent. For minors, this also requires consent from their legal guardians. This implies a responsibility to explain fully and meaningfully to both the child and their guardians what the research is about and how it will be disseminated. Participants and their legal guardians should be aware of the research purpose and procedures, their right to refuse to participate; the extent to which confidentiality will be maintained; the potential uses to which the data might be put; the foreseeable risks and expected benefits; and that participants have the right to discontinue at any time.

But consent alone does not absolve the responsibility of researchers to anticipate and guard against potentially harmful consequences for participants.¹⁸ It is critical that researchers protect all rights of the participants including confidentiality.

Child development is a fascinating field of study – but care must be taken to ensure that researchers use appropriate methods to examine infant and child behavior, use the correct experimental design to answer their questions, and be aware of the special challenges that are part-and-parcel of developmental research. Hopefully, this information helped you develop an understanding of these various issues and to be ready to think more critically about research questions that interest you. There are so many interesting questions that remain to be examined by future generations of developmental scientists – maybe you will make one of the next big discoveries!¹⁹

Another really important framework to use when trying to understand children's development are theories of development. Let's explore what theories are and introduce you to some major theories in child development.

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1.5: Developmental Theories

What is a Theory?

Students sometimes feel intimidated by theory; even the phrase, “Now we are going to look at some theories...” is met with blank stares and other indications that the audience is now lost. But theories are valuable tools for understanding human behavior; in fact, they are proposed explanations for the “how” and “whys” of development. Have you ever wondered, “Why is my three year old so inquisitive?” or “Why are some fifth graders rejected by their classmates?” Theories can help explain these and other occurrences. Developmental theories offer explanations about how we develop, why we change over time and the kinds of influences that impact development.

A **theory** guides and helps us interpret research findings as well. It provides the researcher with a blueprint or model to be used to help piece together various studies. Think of theories as guidelines much like directions that come with an appliance or other object that requires assembly. The instructions can help one piece together smaller parts more easily than if trial and error are used.

Theories can be developed using induction in which a number of single cases are observed and after patterns or similarities are noted, the theorist develops ideas based on these examples. Established theories are then tested through research; however, not all theories are equally suited to scientific investigation. Some theories are difficult to test but are still useful in stimulating debate or providing concepts that have practical application. Keep in mind that theories are not facts; they are guidelines for investigation and practice, and they gain credibility through research that fails to disprove them.²⁰

Let’s take a look at some key theories in Child Development.

Sigmund Freud’s Psychosexual Theory

We begin with the often controversial figure, Sigmund Freud (1856-1939). Freud has been a very influential figure in the area of development; his view of development and psychopathology dominated the field of psychiatry until the growth of behaviorism in the 1950s. His assumptions that personality forms during the first few years of life and that the ways in which parents or other caregivers interact with children have a long-lasting impact on children’s emotional states have guided parents, educators, clinicians, and policy-makers for many years. We have only recently begun to recognize that early childhood experiences do not always result in certain personality traits or emotional states. There is a growing body of literature addressing resilience in children who come from harsh backgrounds and yet develop without damaging emotional scars (O’Grady and Metz, 1987). Freud has stimulated an enormous amount of research and generated many ideas. Agreeing with Freud’s theory in its entirety is hardly necessary for appreciating the contribution he has made to the field of development.

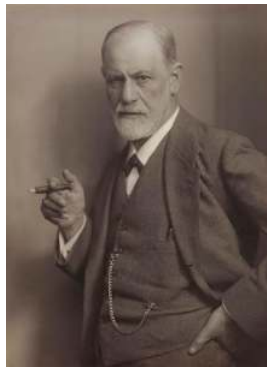


Figure 1.5.1: Sigmund Freud. (Image is in the public domain)

Freud’s theory of self suggests that there are three parts of the self.

- The **id** is the part of the self that is inborn. It responds to biological urges without pause and is guided by the principle of pleasure: if it feels good, it is the thing to do. A newborn is all id. The newborn cries when hungry, defecates when the urge strikes.
- The **ego** develops through interaction with others and is guided by logic or the reality principle. It has the ability to delay gratification. It knows that urges have to be managed. It mediates between the id and superego using logic and reality to calm the other parts of the self.

- The **superego** represents society's demands for its members. It is guided by a sense of guilt. Values, morals, and the conscience are all part of the superego.

The personality is thought to develop in response to the child's ability to learn to manage biological urges. Parenting is important here. If the parent is either overly punitive or lax, the child may not progress to the next stage. Here is a brief introduction to Freud's stages.

Table 1.5.1: Sigmund Freud's Psychosexual Theory

Name of Stage	Descriptions of Stage
Oral Stage	The oral stage lasts from birth until around age 2. The infant is all id. At this stage, all stimulation and comfort is focused on the mouth and is based on the reflex of sucking. Too much indulgence or too little stimulation may lead to fixation.
Anal Stage	The anal stage coincides with potty training or learning to manage biological urges. The ego is beginning to develop in this stage. Anal fixation may result in a person who is compulsively clean and organized or one who is sloppy and lacks self-control.
Phallic Stage	The phallic stage occurs in early childhood and marks the development of the superego and a sense of masculinity or femininity as culture dictates.
Latency	Latency occurs during middle childhood when a child's urges quiet down and friendships become the focus. The ego and superego can be refined as the child learns how to cooperate and negotiate with others.
Genital Stage	The genital stage begins with puberty and continues through adulthood. Now the preoccupation is that of sex and reproduction.

Strengths and Weaknesses of Freud's Theory

Freud's theory has been heavily criticized for several reasons. One is that it is very difficult to test scientifically. How can parenting in infancy be traced to personality in adulthood? Are there other variables that might better explain development? The theory is also considered to be sexist in suggesting that women who do not accept an inferior position in society are somehow psychologically flawed. Freud focuses on the darker side of human nature and suggests that much of what determines our actions is unknown to us. So why do we study Freud? As mentioned above, despite the criticisms, Freud's assumptions about the importance of early childhood experiences in shaping our psychological selves have found their way into child development, education, and parenting practices. Freud's theory has heuristic value in providing a framework from which to elaborate and modify subsequent theories of development. Many later theories, particularly behaviorism and humanism, were challenges to Freud's views.²²

Main Points to Note About Freud's Psychosexual Theory

Freud believed that:

- Development in the early years has a lasting impact.
- There are three parts of the self: the id, the ego, and the superego
- People go through five stages of psychosexual development: the oral stage, the anal stage, the phallic stage, latency, and the genital stage

We study Freud because his assumptions the importance of early childhood experience provide a framework for later theories (the both elaborated and contradicted/challenged his work).

Erik Erikson's Psychosocial Theory

Now, let's turn to a less controversial theorist, Erik Erikson. Erikson (1902-1994) suggested that our relationships and society's expectations motivate much of our behavior in his theory of psychosocial development. Erikson was a student of Freud's but emphasized the importance of the ego, or conscious thought, in determining our actions. In other words, he believed that we are not driven by unconscious urges. We know what motivates us and we consciously think about how to achieve our goals. He is considered the father of developmental psychology because his model gives us a guideline for the entire life span and suggests certain primary psychological and social concerns throughout life.



Figure 1.5.2: Erik Erikson. (Image is in the public domain)

Erikson expanded on Freud's by emphasizing the importance of culture in parenting practices and motivations and adding three stages of adult development (Erikson, 1950; 1968).

He believed that we are aware of what motivates us throughout life and the ego has greater importance in guiding our actions than does the id. We make conscious choices in life and these choices focus on meeting certain social and cultural needs rather than purely biological ones. Humans are motivated, for instance, by the need to feel that the world is a trustworthy place, that we are capable individuals, that we can make a contribution to society, and that we have lived a meaningful life. These are all psychosocial problems.

Erikson divided the lifespan into eight stages. In each stage, we have a major psychosocial task to accomplish or crisis to overcome. Erikson believed that our personality continues to take shape throughout our lifespan as we face these challenges in living. Here is a brief overview of the eight stages:

Table 1.5.2: Erik Erikson's Psychosocial Theory

Name of Stage	Description of Stage
Trust vs. mistrust (0-1)	The infant must have basic needs met in a consistent way in order to feel that the world is a trustworthy place.
Autonomy vs. shame and doubt (1-2)	Mobile toddlers have newfound freedom they like to exercise and by being allowed to do so, they learn some basic independence.
Initiative vs. Guilt (3-5)	Preschoolers like to initiate activities and emphasize doing things "all by myself."
Industry vs. inferiority (6- 11)	School aged children focus on accomplishments and begin making comparisons between themselves and their classmates
Identity vs. role confusion (adolescence)	Teenagers are trying to gain a sense of identity as they experiment with various roles, beliefs, and ideas.
Intimacy vs. Isolation (young adulthood)	In our 20s and 30s we are making some of our first long-term commitments in intimate relationships.
Generativity vs. stagnation (middle adulthood)	The 40s through the early 60s we focus on being productive at work and home and are motivated by wanting to feel that we've made a contribution to society.
Integrity vs. Despair (late adulthood)	We look back on our lives and hope to like what we see-that we have lived well and have a sense of integrity because we lived according to our beliefs.

These eight stages form a foundation for discussions on emotional and social development during the life span. Keep in mind, however, that these stages or crises can occur more than once. For instance, a person may struggle with a lack of trust beyond infancy under certain circumstances. Erikson's theory has been criticized for focusing so heavily on stages and assuming that the completion of one stage is a prerequisite for the next crisis of development. His theory also focuses on the social expectations that are found in certain cultures, but not in all. For instance, the idea that adolescence is a time of searching for identity might translate well in the middle-class culture of the United States, but not as well in cultures where the transition into adulthood coincides with puberty through rites of passage and where adult roles offer fewer choices.²⁴

Main Points to Note About Erikson's Psychosocial Theory

Erikson was a student of Freud but focused on conscious thought.

- His stages of psychosocial development address the entire lifespan and suggest primary psychosocial crisis in some cultures that adults can use to understand how to support children's social and emotional development.
- The stages include: trust vs. mistrust, autonomy vs. shame and doubt, initiative vs. guilt, industry vs. inferiority, identity vs. role confusion, intimacy vs. isolation, generativity vs. stagnation, and integrity vs. despair.

Behaviorism

While Freud and Erikson looked at what was going on in the mind, behaviorism rejected any reference to mind and viewed overt and observable behavior as the proper subject matter of psychology. Through the scientific study of behavior, it was hoped that laws of learning could be derived that would promote the prediction and control of behavior.²⁵

Ivan Pavlov

Ivan Pavlov (1880-1937) was a Russian physiologist interested in studying digestion. As he recorded the amount of salivation his laboratory dogs produced as they ate, he noticed that they actually began to salivate before the food arrived as the researcher walked down the hall and toward the cage. "This," he thought, "is not natural!" One would expect a dog to automatically salivate when food hit their palate, but BEFORE the food comes? Of course, what had happened was . . . you tell me. That's right! The dogs knew that the food was coming because they had learned to associate the footsteps with the food. The key word here is "learned". A learned response is called a "conditioned" response.



Figure 1.5.3: Ivan Pavlov. (Image is in the public domain)

Pavlov began to experiment with this concept of **classical conditioning**. He began to ring a bell, for instance, prior to introducing the food. Sure enough, after making this connection several times, the dogs could be made to salivate to the sound of a bell. Once the bell had become an event to which the dogs had learned to salivate, it was called a **conditioned stimulus**. The act of salivating to a bell was a response that had also been learned, now termed in Pavlov's jargon, a conditioned response. Notice that the response, salivation, is the same whether it is conditioned or unconditioned (unlearned or natural). What changed is the stimulus to which the dog salivates. One is natural (unconditioned) and one is learned (conditioned).

Let's think about how classical conditioning is used on us. One of the most widespread applications of classical conditioning principles was brought to us by the psychologist, John B. Watson.

John B. Watson

John B. Watson (1878-1958) believed that most of our fears and other emotional responses are classically conditioned. He had gained a good deal of popularity in the 1920s with his expert advice on parenting offered to the public.



Figure 1.5.4: John B. Watson. (Image is in the public domain)

He tried to demonstrate the power of classical conditioning with his famous experiment with an 18-month-old boy named “Little Albert”. Watson sat Albert down and introduced a variety of seemingly scary objects to him: a burning piece of newspaper, a white rat, etc. But Albert remained curious and reached for all of these things. Watson knew that one of our only inborn fears is the fear of loud noises so he proceeded to make a loud noise each time he introduced one of Albert’s favorites, a white rat. After hearing the loud noise several times paired with the rat, Albert soon came to fear the rat and began to cry when it was introduced. Watson filmed this experiment for posterity and used it to demonstrate that he could help parents achieve any outcomes they desired, if they would only follow his advice. Watson wrote columns in newspapers and in magazines and gained a lot of popularity among parents eager to apply science to household order.

Operant conditioning, on the other hand, looks at the way the consequences of a behavior increase or decrease the likelihood of a behavior occurring again. So let’s look at this a bit more.

B.F. Skinner and Operant Conditioning

B. F. Skinner (1904-1990), who brought us the principles of operant conditioning, suggested that reinforcement is a more effective means of encouraging a behavior than is criticism or punishment. By focusing on strengthening desirable behavior, we have a greater impact than if we emphasize what is undesirable. Reinforcement is anything that an organism desires and is motivated to obtain.



Figure 1.5.5: B. F. Skinner. (Image is in the public domain)

A **reinforcer** is something that encourages or promotes a behavior. Some things are natural rewards. They are considered intrinsic or primary because their value is easily understood. Think of what kinds of things babies or animals such as puppies find rewarding.

Extrinsic or secondary reinforcers are things that have a value not immediately understood. Their value is indirect. They can be traded in for what is ultimately desired.

The use of **positive reinforcement** involves adding something to a situation in order to encourage a behavior. For example, if I give a child a cookie for cleaning a room, the addition of the cookie makes cleaning more likely in the future. Think of ways in which you positively reinforce others.

Negative reinforcement occurs when taking something unpleasant away from a situation encourages behavior. For example, I have an alarm clock that makes a very unpleasant, loud sound when it goes off in the morning. As a result, I get up and turn it off. By removing the noise, I am reinforced for getting up. How do you negatively reinforce others?

Punishment is an effort to stop a behavior. It means to follow an action with something unpleasant or painful. Punishment is often less effective than reinforcement for several reasons. It doesn’t indicate the desired behavior, it may result in suppressing rather than stopping a behavior, (in other words, the person may not do what is being punished when you’re around, but may do it often when you leave), and a focus on punishment can result in not noticing when the person does well. Not all behaviors are learned

through association or reinforcement. Many of the things we do are learned by watching others. This is addressed in social learning theory.

Social Learning Theory

Albert Bandura (1925-) is a leading contributor to social learning theory. He calls our attention to the ways in which many of our actions are not learned through conditioning; rather, they are learned by watching others (1977). Young children frequently learn behaviors through imitation



Figure 1.5.6: Albert Bandura. (Image by Albert Bandura is licensed under [CC BY-SA 4.0](#))

Sometimes, particularly when we do not know what else to do, we learn by modeling or copying the behavior of others. A kindergartner on his or her first day of school might eagerly look at how others are acting and try to act the same way to fit in more quickly. Adolescents struggling with their identity rely heavily on their peers to act as role-models. Sometimes we do things because we've seen it pay off for someone else. They were operantly conditioned, but we engage in the behavior because we hope it will pay off for us as well. This is referred to as vicarious reinforcement (Bandura, Ross and Ross, 1963).

Bandura (1986) suggests that there is interplay between the environment and the individual. We are not just the product of our surroundings, rather we influence our surroundings. Parents not only influence their child's environment, perhaps intentionally through the use of reinforcement, etc., but children influence parents as well. Parents may respond differently with their first child than with their fourth. Perhaps they try to be the perfect parents with their firstborn, but by the time their last child comes along they have very different expectations both of themselves and their child. Our environment creates us and we create our environment.³⁰

Bandura and the Bobo Doll Experiment & Today's Children and the Media

Other social influences: TV or not TV? Bandura (et als. 1963) began a series of studies to look at the impact of television, particularly commercials, on the behavior of children. Are children more likely to act out aggressively when they see this behavior modeled? What if they see it being reinforced? Bandura began by conducting an experiment in which he showed children a film of a woman hitting an inflatable clown or "bobo" doll. Then the children were allowed in the room where they found the doll and immediately began to hit it. This was without any reinforcement whatsoever. Not only that, but they found new ways to behave aggressively. It's as if they learned an aggressive role.

Children view far more television today than in the 1960s; so much, in fact, that they have been referred to as Generation M (media). The amount of screen time varies by age. As of 2017, children 0-8 spend an average of 2 hours and 19 minutes. Children 8-12 years of age spend almost 6 hours a day on screen media. And 13- to 18-year-olds spend an average of just under 9 hours a day in entertainment media use.

The prevalence of violence, sexual content, and messages promoting foods high in fat and sugar in the media are certainly cause for concern and the subjects of ongoing research and policy review. Many children spend even more time on the computer viewing content from the internet. The amount of time spent connected to the internet continues to increase with the use of smartphones that essentially serve as mini-computers. And the ways children and adolescents interact with the media continues to change. The popularity of YouTube and the various social media platforms are examples of this. What might be the implications of this?³¹

Main Points to Note About Behaviorism

Behaviorists look at observable behavior and how it can be predicted and controlled.

- Pavlov experimented with classical conditioning, the process of conditioning a response to stimulus (the dog's salivating to the bell).
- Watson offered advice to parents to show them how classical conditioning can be used. His most famous experiment was conditioning Little Albert to fear a white rat.
- Skinner believed that reinforcing behavior is the most effective way of increasing desirable behavior. This is done through operant conditioning.
- Bandura noted that many behaviors are not learned through any type of conditioning, but rather through imitation. And he believed that people are not only influenced by their surroundings, but that they also have an impact on their surroundings.

Theories also explore cognitive development and how mental processes change over time.

Jean Piaget's Theory of Cognitive Development

Jean Piaget (1896-1980) is one of the most influential cognitive theorists. Piaget was inspired to explore children's ability to think and reason by watching his own children's development. He was one of the first to recognize and map out the ways in which children's thought differs from that of adults. His interest in this area began when he was asked to test the IQ of children and began to notice that there was a pattern in their wrong answers. He believed that children's intellectual skills change over time through maturation. Children of differing ages interpret the world differently.



Figure 1.5.7: Jean Piaget. (Image is in the public domain)

Piaget believed our desire to understand the world comes from a need for cognitive **equilibrium**. This is an agreement or balance between what we sense in the outside world and what we know in our minds. If we experience something that we cannot understand, we try to restore the balance by either changing our thoughts or by altering the experience to fit into what we do understand. Perhaps you meet someone who is very different from anyone you know. How do you make sense of this person? You might use them to establish a new category of people in your mind or you might think about how they are similar to someone else.

A **schema** or schemes are categories of knowledge. They are like mental boxes of concepts. A child has to learn many concepts. They may have a scheme for "under" and "soft" or "running" and "sour". All of these are schema. Our efforts to understand the world around us lead us to develop new schema and to modify old ones.

One way to make sense of new experiences is to focus on how they are similar to what we already know. This is **assimilation**. So the person we meet who is very different may be understood as being "sort of like my brother" or "his voice sounds a lot like yours." Or a new food may be assimilated when we determine that it tastes like chicken!

Another way to make sense of the world is to change our mind. We can make a cognitive accommodation to this new experience by adding new schema. This food is unlike anything I've tasted before. I now have a new category of foods that are bitter-sweet in flavor, for instance. This is **accommodation**. Do you accommodate or assimilate more frequently? Children accommodate more frequently as they build new schema. Adults tend to look for similarity in their experience and assimilate. They may be less inclined to think "outside the box." Piaget suggested different ways of understanding that are associated with maturation. He divided this into four stages:

Table 1.5.3: Jean Piaget's Theory of Cognitive Development

Name of Stage	Description of Stage
Sensorimotor Stage	During the sensorimotor stage children rely on use of the senses and motor skills. From birth until about age 2, the infant knows by tasting, smelling, touching, hearing, and moving objects around. This is a real hands on type of knowledge.
Preoperational Stage	In the preoperational stage , children from ages 2 to 7, become able to think about the world using symbols. A symbol is something that stands for something else. The use of language, whether it is in the form of words or gestures, facilitates knowing and communicating about the world. This is the hallmark of preoperational intelligence and occurs in early childhood. However, these children are preoperational or pre-logical. They still do not understand how the physical world operates. They may, for instance, fear that they will go down the drain if they sit at the front of the bathtub, even though they are too big.
Concrete Operational	Children in the concrete operational stage, ages 7 to 11, develop the ability to think logically about the physical world. Middle childhood is a time of understanding concepts such as size, distance, and constancy of matter, and cause and effect relationships. A child knows that a scrambled egg is still an egg and that 8 ounces of water is still 8 ounces no matter what shape of glass contains it.
Formal Operational	During the formal operational stage children, at about age 12, acquire the ability to think logically about concrete and abstract events. The teenager who has reached this stage is able to consider possibilities and to contemplate ideas about situations that have never been directly encountered. More abstract understanding of religious ideas or morals or ethics and abstract principles such as freedom and dignity can be considered.

Criticisms of Piaget's Theory

Piaget has been criticized for overemphasizing the role that physical maturation plays in cognitive development and in underestimating the role that culture and interaction (or experience) plays in cognitive development. Looking across cultures reveals considerable variation in what children are able to do at various ages. Piaget may have underestimated what children are capable of given the right circumstances.³³

Main Points To Note About Piaget's Theory of Cognitive Development

Piaget, one of the most influential cognitive theorists, believed that

- Understanding is motivated by trying to balance what we sense in the world and what we know in our minds.
- Understanding is organized through creating categories of knowledge. When presented with new knowledge we may add new schema or modify existing ones.

Children's understanding of the world of the world changes as their cognitive skills mature through four stages: sensorimotor stage, preoperational stage, concrete operational stage, and formal operational stage.

Lev Vygotsky's Sociocultural Theory

Lev Vygotsky (1896-1934) was a Russian psychologist who wrote in the early 1900s but whose work was discovered in the United States in the 1960s but became more widely known in the 1980s. Vygotsky differed with Piaget in that he believed that a person not

only has a set of abilities, but also a set of potential abilities that can be realized if given the proper guidance from others. His sociocultural theory emphasizes the importance of culture and interaction in the development of cognitive abilities. He believed that through guided participation known as scaffolding, with a teacher or capable peer, a child can learn cognitive skills within a certain range known as the **zone of proximal development**.³⁴ His belief was that development occurred first through children's immediate social interactions, and then moved to the individual level as they began to internalize their learning.³⁵



Figure 1.5.8: Lev Vygotsky. (Image by The Vygotsky Project is licensed under [CC BY-SA 3.0](#))

Have you ever taught a child to perform a task? Maybe it was brushing their teeth or preparing food. Chances are you spoke to them and described what you were doing while you demonstrated the skill and let them work along with you all through the process. You gave them assistance when they seemed to need it, but once they knew what to do-you stood back and let them go. This is **scaffolding** and can be seen demonstrated throughout the world. This approach to teaching has also been adopted by educators. Rather than assessing students on what they are doing, they should be understood in terms of what they are capable of doing with the proper guidance. You can see how Vygotsky would be very popular with modern day educators.³⁷

Main Points to Note About Vygotsky's Sociocultural Theory

Vygotsky concentrated on the child's interactions with peers and adults. He believed that the child was an apprentice, learning through sensitive social interactions with more skilled peers and adults.

Comparing Piaget and Vygotsky

Vygotsky concentrated more on the child's immediate social and cultural environment and his or her interactions with adults and peers. While Piaget saw the child as actively discovering the world through individual interactions with it, Vygotsky saw the child as more of an apprentice, learning through a social environment of others who had more experience and were sensitive to the child's needs and abilities.³⁸

Like Vygotsky's, Bronfenbrenner looked at the social influences on learning and development.

Urie Bronfenbrenner's Ecological Systems Model

Urie Bronfenbrenner (1917-2005) offers us one of the most comprehensive theories of human development. Bronfenbrenner studied Freud, Erikson, Piaget, and learning theorists and believed that all of those theories could be enhanced by adding the dimension of context. What is being taught and how society interprets situations depends on who is involved in the life of a child and on when and where a child lives.



Figure 1.5.9: Urie Bronfenbrenner. (Image by Marco Vicente González is licensed under [CC BY-SA 4.0](#))

Bronfenbrenner's ecological systems model explains the direct and indirect influences on an individual's development.

Table 1.5.4: Urie Bronfenbrenner's Ecological Systems Model

Name of System	Description of System
Microsystems	Microsystems impact a child directly. These are the people with whom the child interacts such as parents, peers, and teachers. The relationship between individuals and those around them need to be considered. For example, to appreciate what is going on with a student in math, the relationship between the student and teacher should be known.
Mesosystems	Mesosystems are interactions between those surrounding the individual. The relationship between parents and schools, for example will indirectly affect the child.
Exosystem	Larger institutions such as the mass media or the healthcare system are referred to as the exosystem . These have an impact on families and peers and schools who operate under policies and regulations found in these institutions.
Macrosystems	We find cultural values and beliefs at the level of macrosystems . These larger ideals and expectations inform institutions that will ultimately impact the individual.
Chronosystem	All of this happens in an historical context referred to as the chronosystem . Cultural values change over time, as do policies of educational institutions or governments in certain political climates. Development occurs at a point in time.

For example, in order to understand a student in math, we can't simply look at that individual and what challenges they face directly with the subject. We have to look at the interactions that occur between teacher and child. Perhaps the teacher needs to make modifications as well. The teacher may be responding to regulations made by the school, such as new expectations for students in math or constraints on time that interfere with the teacher's ability to instruct. These new demands may be a response to national efforts to promote math and science deemed important by political leaders in response to relations with other countries at a particular time in history.

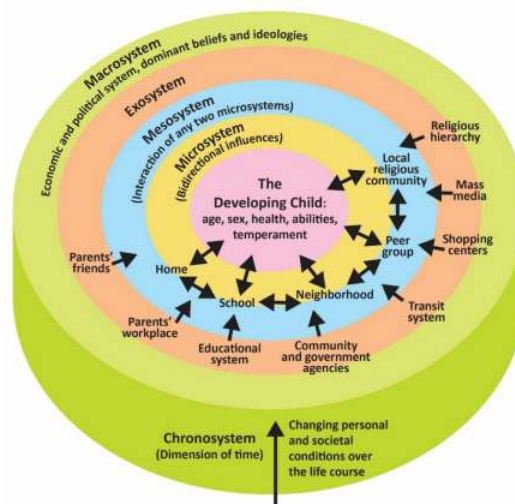


Figure 1.5.10: Bronfenbrenner's ecological systems theory. (Image by Ian Joslin is licensed under CC BY 4.0)

Bronfenbrenner's ecological systems model challenges us to go beyond the individual if we want to understand human development and promote improvements.⁴¹

Main Points to Note About Bronfenbrenner's Ecological Model

After studying all of the prior theories, Bronfenbrenner added an important element of context to the discussion of influences on human development.

- He believed that the people involved in children's lives and when and where they live are important considerations.
- He created a model of nested systems that influence the child (and are influenced by the child) that include: microsystems, mesosystems, the exosystem, macrosystems, and chronosystems.

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Rasmussen, Eric (2017, Oct 19). *Screen Time and Kids: Insights from a New Report*. Retrieved from <https://www.pbs.org/parents/thrive/screen-time-and-kids-insights-from-a-new-report>

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1.S: Summary

In this chapter we looked at:

- underlying principles of development
- the five periods of development
- three issues in development
- Various methods of research
- important theories that help us understand development

Next, we are going to be examining where we all started with conception, heredity, and prenatal development.

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CHAPTER OVERVIEW

2: Conception, Heredity, and Prenatal Development

Learning Objectives

After this chapter, you should be able to:

1. Evaluate roles of nature and nurture in development.
2. Define genes and chromosomes.
3. Differentiate mitosis and meiosis.
4. Explain dominant and recessive patterns on inheritance.
5. List common genetic disorders and chromosomal abnormalities.
6. Describe changes that occur within each of the three periods of prenatal development.
7. Recognize the risks to prenatal development posed by exposure to teratogens.
8. Evaluate different types of prenatal assessment.

In this chapter, we will begin by examining some of the ways in which heredity helps to shape the way we are. We will look at what happens genetically during conception, and describe some known genetic and chromosomal disorders. Next we will consider what happens during prenatal development, including the impact of teratogens. We will also discuss the impact that both the mother and father have on the developing fetus.

[2.1: Heredity](#)

[2.2: Prenatal Development](#)

[2.S: Summary](#)

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2.1: Heredity

Nature and Nurture

Most scholars agree that there is a constant interplay between nature (heredity) and nurture (the environment). It is difficult to isolate the root of any single characteristic as a result solely of nature or nurture, and most scholars believe that even determining the extent to which nature or nurture impacts a human feature is difficult to answer. In fact, almost all human features are polygenic (a result of many genes) and multifactorial (a result of many factors, both genetic and environmental). It's as if one's genetic make-up sets up a range of possibilities, which may or may not be realized depending upon one's environmental experiences. For instance, a person might be genetically predisposed to develop diabetes, but the person's lifestyle may determine whether or not they actually develop the disease.

This bidirectional interplay between nature and nurture is the **epigenetic framework**, which suggests that the environment can affect the expression of genes just as genetic predispositions can impact a person's potentials. And environmental circumstances can trigger symptoms of a genetic disorder.²

Environment Correlations

Environment Correlations refer to the processes by which genetic factors contribute to variations in the environment (Plomin, DeFries, Knopik, & Neiderhiser, 2013). There are three types of genotype-environment correlations:

Passive genotype-environment correlation occurs when children passively inherit the genes and the environments their family provides. Certain behavioral characteristics, such as being athletically inclined, may run in families. The children have inherited both the genes that would enable success at these activities, and given the environmental encouragement to engage in these actions.



Figure 2.1.1: Two skiers. (Image by Alexey Ruban on Unsplash)

Evocative genotype-environment correlation refers to how the social environment reacts to individuals based on their inherited characteristics. For example, whether one has a more outgoing or shy temperament will affect how he or she is treated by others.

Active genotype-environment correlation occurs when individuals seek out environments that support their genetic tendencies. This is also referred to as niche picking. For example, children who are musically inclined seek out music instruction and opportunities that facilitate their natural musical ability.

Conversely, **Genotype-Environment Interactions** involve genetic susceptibility to the environment. Adoption studies provide evidence for genotype-environment interactions. For example, the Early Growth and Development Study (Leve, Neiderhiser, Scaramella, & Reiss, 2010) followed 360 adopted children and their adopted and biological parents in a longitudinal study. Results have shown that children whose biological parents exhibited psychopathology, exhibited significantly fewer behavior problems when their adoptive parents used more structured parenting than unstructured. Additionally, elevated psychopathology in adoptive parents increased the risk for the children's development of behavior problems, but only when the biological parents' psychopathology was high. Consequently, the results show how environmental effects on behavior differ based on the genotype, especially stressful environments on genetically at-risk children. ⁴

Genes and Chromosomes

Now, let's look more closely at just nature. Nature refers to the contribution of genetics to one's development. The basic building block of the nature perspective is the gene. **Genes** are recipes for making proteins, while proteins influence the structure and

functions of cells. Genes are located on the chromosomes and there are an estimated 20,500 genes for humans, according to the Human Genome Project (NIH, 2015).

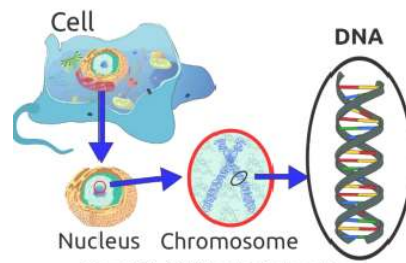


Figure 2.2 – DNA's location in the cell.⁵

Figure 2.1.2: DNA's location in the cell. (Image by Radio89 is licensed under CC BY-SA 3.0)

Normal human cells contain 46 chromosomes (or 23 pairs; one from each parent) in the nucleus of the cells. After conception, most cells of the body are created by a process called mitosis. **Mitosis** is defined as the cell's nucleus making an exact copy of all the chromosomes and splitting into two new cells.

However, the cells used in sexual reproduction, called the gametes (sperm or ova), are formed in a process called meiosis. In meiosis, the gamete's chromosomes duplicate, and then divide twice resulting in four cells containing only half the genetic material of the original gamete. Thus, each sperm and egg possesses only 23 chromosomes and combine to produce the normal 46.

Table 2.1 - Mitosis & Meiosis 6

Type of Cell Division	Explanation	Steps
Mitosis	All cells, except those used in sexual reproduction, are created by mitosis	Step 1. Chromosomes make a duplicate copy Step 2. Two identical cells are created
Meiosis	Cells used in sexual reproduction are created by meiosis	Step 1. Exchange of gene between the chromosomes (crossing over) Step 2. Chromosomes make a duplicate Step 3. First cell division Step 4. Second cell division

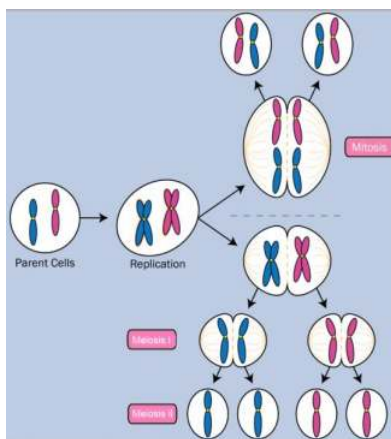


Figure 2.1.3: Mitosis and Meiosis. (Image by Community College Consortium for Bioscience Credentials is licensed under CC BY 3.0)

Given the amount of genes present and the unpredictability of the meiosis process, the likelihood of having offspring that are genetically identical (and not twins) is one in trillions (Gould & Keeton, 1997).

Of the 23 pairs of chromosomes created at conception, 22 pairs are similar in length. These are called **autosomes**. The remaining pair, or **sex chromosomes**, may differ in length. If a child receives the combination of XY, the child will be genetically male. If the child receives the combination XX, the child will be genetically female.⁸

Here is an image (called a karyogram) of what the 23 pairs of chromosomes look like. Notice the differences between the sex chromosomes in female (XX) and male (XY).

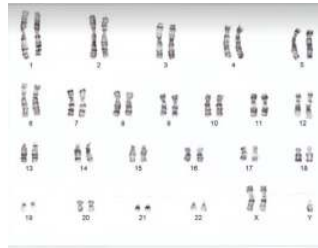


Figure 2.1.4: The 23 pairs of chromosomes. (Image by Nami-ja is in the public domain)

Genotypes and Phenotypes & Patterns on Inheritance

The word **genotype** refers to the sum total of all the genes a person inherits. The word **phenotype** refers to the features that are actually expressed. Look in the mirror. What do you see, your genotype or your phenotype? What determines whether or not genes are expressed? Because genes are inherited in pairs on the chromosomes, we may receive either the same version of a gene from our mother and father, that is, be **homozygous** for that characteristic the gene influences. If we receive a different version of the gene from each parent, that is referred to as **heterozygous**.

In the homozygous situation we will display that characteristic. It is in the heterozygous condition that it becomes clear that not all genes are created equal. Some genes are **dominant**, meaning they express themselves in the phenotype even when paired with a different version of the gene, while their silent partner is called recessive. **Recessive** genes express themselves only when paired with a similar version gene. Geneticists refer to different versions of a gene as alleles. Some dominant traits include having facial dimples, curly hair, normal vision, and dark hair. Some recessive traits include red hair, being nearsighted, and straight hair.

Most characteristics are not the result of a single gene; they are **polygenic**, meaning they are the result of several genes. In addition, the dominant and recessive patterns described above are usually not that simple either. Sometimes the dominant gene does not completely suppress the recessive gene; this is called incomplete dominance. 10

Genetic Disorders

Most of the known **genetic disorders** are dominant gene-linked; however, the vast majority of dominant gene linked disorders are not serious or debilitating. For example, the majority of those with Tourette's Syndrome suffer only minor tics from time to time and can easily control their symptoms. When dominant-gene linked diseases are serious, they do not tend to become symptomatic until later in life. Huntington's Disease is a dominant gene linked disorder that affects the nervous system and is fatal, but does not appear until midlife.

Recessive gene disorders, such as cystic fibrosis and sickle-cell anemia, are less common but may actually claim more lives because they are less likely to be detected as people are unaware that they are carriers of the disease.

Some genetic disorders are sex-linked; the defective gene is found on the X-chromosome. Males have only one X chromosome so are at greater risk for sex-linked disorders due to a recessive gene such as hemophilia, color-blindness, and baldness. For females to be affected by recessive genetic defects, they need to inherit the recessive gene on both X-chromosomes. But if the defective gene is dominant, females are equally at risk.

Here are tables of some genetic disorders:

Recessive Disorders (Homozygous): The individual inherits a gene change from both parents. If the gene is inherited from just one parent, the person is a carrier and does not have the condition.

Table 2.2 - Recessive Disorders (Homozygous)11

Disorder	Description	Cases per Birth
Sickle Cell Disease (SCD)	A condition in which the red blood cells in the body are shaped like a sickle (like the letter C) and affect the ability of the blood to transport oxygen.	1 in 500 Black births 1 in 36,000 Hispanic births
Cystic Fibrosis (CF)	A condition that affects breathing and digestion due to thick mucus building up in the body, especially the lungs and digestive system. In CF, the mucus is thicker than normal and sticky.	1 in 3500
Phenylketonuria (PKU)	A metabolic disorder in which the individual cannot metabolize phenylalanine, an amino acid. Left untreated, intellectual deficits occur. PKU is easily detected and is treated with a special diet.	1 in 10,000
Tay Sachs Disease	Caused by an enzyme deficiency resulting in the accumulation of lipids in the nerves cells of the brain. This accumulation results in progressive damage to the cells and a decrease in cognitive and physical development. Death typically occurs by age five.	1 in 4000 1 in 30 American Jews is a carrier 1 in 20 French Canadians is a carrier
Albinism	When the individual lacks melanin and processes little to no pigment in the skin, hair, and eyes. Vision problems can also occur.	Fewer than 20,000 US cases per year

Autosomal Dominant Disorders (Heterozygous): In order to have the disorder, the individual only needs to inherit the gene change from one parent.

Table 2.3 - Autosomal Dominant Disorders (Heterozygous)¹²

Disorder	Description	Cases per Birth
Huntington's Disease	A condition that affects the individual's nervous system. Nerve cells become damaged, causing various parts of the brain to deteriorate. The disease affects movement, behavior and cognition. It is fatal, and occurs at midlife.	1 in 10,000
Tourette Syndrome	A tic disorder which results in uncontrollable motor and vocal tics as well as body jerking	1 in 250
Achondroplasia	The most common form of disproportionate short stature. The individual has abnormal bone growth resulting in short stature, disproportionately short arms and legs, short fingers, a large head, and specific facial features.	1 in 15,000-40,000

Sex-Linked Disorders: When the X chromosome carries the mutated gene, the disorder is referred to as an X-linked disorder. Males are more affected than females because they possess only one X chromosome without an additional X chromosome to counter the harmful gene.

Table 2.4 - Sex-Linked Disorders¹³

Disorder	Description	Cases per Birth
Fragile X Syndrome	Occurs when the body cannot make enough of a protein it needs for the brain to grow and problems with learning and behavior can occur. Fragile X syndrome is caused from an abnormality in the X chromosome, which then breaks. If a female has a fragile X, her second X chromosome usually is healthy, but males with fragile X don't have a second healthy X chromosome. This is why symptoms of Fragile X usually are more serious in males.	1 in 4000 males 1 in 8000 females
Hemophilia	Occurs when there are problems in blood clotting causing both internal and external bleeding.	1 in 10,000 males
Duchenne Muscular Dystrophy	A weakening of the muscles resulting in an inability to move, wasting away, and possible death.	1 in 3500 males

Chromosomal Abnormalities: A **chromosomal abnormality** occurs when a child inherits too many or too few chromosomes. The most common cause of chromosomal abnormalities is the age of the mother. As the mother ages, the ovum is more likely to suffer abnormalities due to longer term exposure to environmental factors. Consequently, some gametes do not divide evenly when they are forming. Therefore, some cells have more than 46 chromosomes. In fact, it is believed that close to half of all zygotes have an odd number of chromosomes. Most of these zygotes fail to develop and are spontaneously aborted by the mother's body. ¹⁴

Here is a table of some autosomal chromosomal disorders:

Autosomal Chromosome Disorders: The individual inherits too many or too few chromosomes.

Table 2.5 - Autosomal Chromosomal Disorders¹⁵

Disorder	Description
Down Syndrome/Trisomy 21	Caused by an extra chromosome 21 and includes a combination of birth defects. Affected individuals have some degree of intellectual disability, characteristic facial features, often heart defects, and other health problems. The severity varies greatly among affected individuals.
Trisomy 9 Mosaicism	Caused by having an extra chromosome 9 in some cells. The severity of effects relates to the proportion of cells with extra chromosomes. The effects include fetal growth restriction resulting in low birth weight and multiple anomalies, including facial, cardiac, musculoskeletal, genital, kidney, and respiratory abnormalities.
Trisomy 13	Caused by an extra chromosome 13. Affected individuals have multiple birth defects and generally die in the first weeks or months of life.
Trisomy 18	Caused by an extra chromosome 18 and the affected individual also has multiple birth defects and early death.



Figure 2.1.5: Infant boy with Trisomy 9 Mosaicism. (Image by Ashley Onken used with permission)



Figure 2.1.6: Girl with XXX Syndrome. (Image is in the public domain)

When the abnormality is on 23rd pair, the result is a sex-linked chromosomal abnormality. This happens when a person has less than or more than two sex chromosomes. 18

Here is a table of some sex-linked chromosomal disorders:

Table 2.6 - Sex-Linked Chromosomal Disorders¹⁹

Disorder	Description
Turner Syndrome (XO)	Caused when all or part of one of the X chromosomes is lost before or soon after conception due to a random event. The resulting zygote has an XO composition. Turner Syndrome affects cognitive functioning and sexual maturation in girls. Infertility and a short stature may be noted.
Klinefelter Syndrome (XXY)	Caused when an extra X chromosome is present in the cells of a male due to a random event. The Y chromosome stimulates the growth of male genitalia, but the additional X chromosome inhibits this development. The male can have some breast development, infertility, and low levels of testosterone.
XYY Syndrome	Caused when an extra Y chromosome is present in the cells of a male. There are few symptoms. They may include being taller than average, acne, and an increased risk of learning problems. The person is generally otherwise normal, including normal fertility.
Triple X Syndrome (XXX)	Caused when an extra X chromosome is present in the cells of a female. It may result in being taller than average, learning difficulties, decreased muscle tone, seizures, and kidney problems.

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2.2: Prenatal Development

Now we turn our attention to prenatal development which is divided into three periods: The germinal period, the embryonic period, and the fetal period. The following is an overview of some of the changes that take place during each period.

The Germinal Period

The **germinal period** (about 14 days in length) lasts from **conception** to implantation of the fertilized egg in the lining of the uterus. At ejaculation, millions of sperm are released into the vagina, but only a few reach the egg and typically only one fertilizes the egg. Once a single sperm has entered the wall of the egg, the wall becomes hard and prevents other sperm from entering. After the sperm has entered the egg, the tail of the sperm breaks off and the head of the sperm, containing the genetic information from the father, unites with the nucleus of the egg. It is typically fertilized in the top section of the fallopian tube and continues its journey to the uterus. As a result, a new cell is formed. This cell, containing the combined genetic information from both parents, is referred to as a **zygote**.



Figure 2.2.1: Sperm and ovum at conception. (Image is in the public domain)

During this time, the organism begins cell division through mitosis. After five days of mitosis, there are 100 cells, which is now called a blastocyst. The blastocyst consists of both an inner and an outer group of cells. The inner group of cells, or embryonic disk will become the embryo, while the outer group of cells, or trophoblast, becomes the support system that nourishes the developing organism. This stage ends when the blastocyst fully implants into the uterine wall (U.S. National Library of Medicine, 2015).

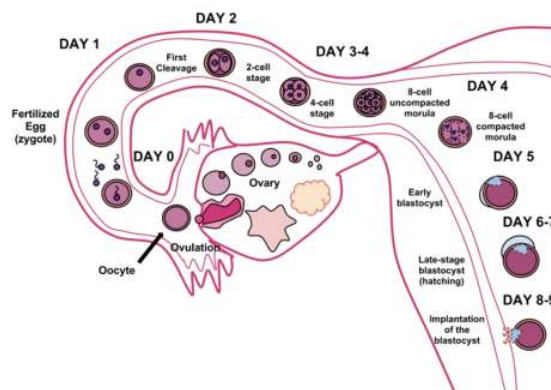


Figure 2.2.2: The cycle of fertilization. (Image by Ttrue12 is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/))

Mitosis is a fragile process and fewer than one half of all zygotes survive beyond the first two weeks (Hall, 2004). Some of the reasons for this include: the egg and sperm do not join properly, thus their genetic material does not combine, there is too little or damaged genetic material, the zygote does not replicate, or the blastocyst does not implant into the uterine wall. The failure rate is higher for in vitro conceptions. The figure below illustrates the journey of the ova from its release to its fertilization, cell duplication, and implantation into the uterine lining. 22

The Embryonic Period

Starting the third week, the blastocyst has implanted in the uterine wall. Upon implantation this multi-cellular organism is called an **embryo**. Now blood vessels grow forming the placenta. The **placenta** is a structure connected to the uterus that provides nourishment and oxygen from the mother to the developing embryo via the umbilical cord.

During this period, cells continue to **differentiate**. Growth during prenatal development occurs in two major directions: from head to tail called **cephalocaudal development** and from the midline outward referred to as **proximodistal development**. This means

that those structures nearest the head develop before those nearest the feet and those structures nearest the torso develop before those away from the center of the body (such as hands and fingers). You will see that this pattern continues after birth.

The head develops in the fourth week and the precursor to the heart begins to pulse. In the early stages of the embryonic period, gills and a tail are apparent. However, by the end of this stage they disappear and the organism takes on a more human appearance.



Figure 2.2.3: A human embryo. (Image by Anatomist90 is licensed under [CC BY-SA 3.0](#))

About 20 percent of organisms fail during the embryonic period, usually due to gross chromosomal abnormalities, often before the mother even knows that she is pregnant. It is during this stage that the major structures of the body are taking form, making the embryonic period the time when the organism is most vulnerable to the greatest amount of damage if exposed to harmful substances. Prospective mothers are not often aware of the risks they introduce to the developing embryo during this time. The embryo is approximately 1 inch in length and weighs about 4 grams at the end of eight weeks. The embryo can move and respond to touch at this time. 24

The Fetal Period

From the ninth week until birth (which is forty weeks for a full-term pregnancy), the organism is referred to as a **fetus**. During this stage, the major structures are continuing to develop. By the third month, the fetus has all its body parts including external genitalia. The fetus is about 3 inches long and weighs about 28 grams. In the following weeks, the fetus will develop hair, nails, teeth and the excretory and digestive systems will continue to develop.



Figure 2.2.4: A human fetus. (Image by [lunar caustic](#) is licensed under [CC BY-SA 2.0](#))

During the 4th - 6th months, the eyes become more sensitive to light and hearing develops. The respiratory system continues to develop, and reflexes such as sucking, swallowing and hiccups, develop during the 5th month. Cycles of sleep and wakefulness are present at this time as well. The first chance of survival outside the womb, known as the age of viability is reached at about 24 weeks (Morgan, Goldenberg, & Schulkin, 2008). Many practitioners hesitate to resuscitate before 24 weeks. The majority of the neurons in the brain have developed by 24 weeks, although they are still rudimentary, and the glial or nurse cells that support neurons continue to grow. At 24 weeks the fetus can feel pain (Royal College of Obstetricians and Gynecologists, 1997).

Between the 7th - 9th months, the fetus is primarily preparing for birth. It is exercising its muscles and its lungs begin to expand and contract. The fetus gains about 5 pounds and 7 inches during this last trimester of pregnancy, and during the 8th month, a layer of fat develops under the skin. This layer of fat serves as insulation and helps the baby regulate body temperature after birth.

At around 36 weeks the fetus is almost ready for birth. It weighs about 6 pounds and is about 18.5 inches long. By week 37 all of the fetus's organ systems are developed enough that it could survive outside the mother's uterus without many of the risks associated with premature birth. The fetus continues to gain weight and grow in length until approximately 40 weeks. By then the fetus has very little room to move around and birth becomes imminent. The progression through the stages is shown in the following figure. 26



Figure 2.2.5: The development of a fetus. (Image by CNX Psychology is licensed under CC BY 4.0)

📌 Monozygotic and Dizygotic Twins

Monozygotic or identical twins occur when a fertilized egg splits apart in the first two weeks of development. The result is the creation of two separate, but genetically identical offspring. That is, they possess the same genotype and often the same phenotype. About one-third of twins are monozygotic twins.

Sometimes, however, two eggs or ova are released and fertilized by two separate sperm. The result is **dizygotic** or fraternal twins. These two individuals share the same amount of genetic material as would any two children from the same mother and father. In other words, they possess a different genotype and phenotype.

Older mothers are more likely to have dizygotic twins than are younger mothers, and couples who use fertility drugs are also more likely to give birth to dizygotic twins. 28



Figure 2.2.6: Monozygotic Twins (Image is in the public domain)



Figure 2.2.7: Dizygotic Twins (Image by Jennifer Paris used with permission)

Teratogens

Good prenatal care is essential to protect against maternal and fetal/infant mortality and birth complications. The embryo and fetus is most at risk for some of the most severe problems during the first three months of development. Unfortunately, this is a time at which many mothers are unaware that they are pregnant. Today, we know many of the factors that can jeopardize the health of the developing child. The study of factors that contribute to birth defects is called teratology. **Teratogens** are environmental factors that can contribute to birth defects, and include some maternal diseases, pollutants, drugs and alcohol.

Factors influencing prenatal risks: There are several considerations in determining the type and amount of damage that might result from exposure to a particular teratogen (Berger, 2005). These include:

- **The timing of the exposure:** Structures in the body are vulnerable to the most severe damage when they are forming. If a substance is introduced during a particular structure's critical period (time of development), the damage to that structure may be greater. For example, the ears and arms reach their critical periods at about 6 weeks after conception. If a mother exposes the embryo to certain substances during this period, the arms and ears may be malformed. (see figure below)
- **The amount of exposure:** Some substances are not harmful unless the amounts reach a certain level. The critical level depends in part on the size and metabolism of the mother.
- **The number of teratogens:** Fetuses exposed to multiple teratogens typically have more problems than those exposed to only one.
- **Genetics:** Genetic makeup also plays a role on the impact a particular teratogen might have on the child. This is suggested by fraternal twins exposed to the same prenatal environment, but they do not experience the same teratogenic effects. The genetic makeup of the mother can also have an effect; some mothers may be more resistant to teratogenic effects than others.
- **Being male or female:** Males are more likely to experience damage due to teratogens than are females. It is believed that the Y chromosome, which contains fewer genes than the X, may have an impact. 31

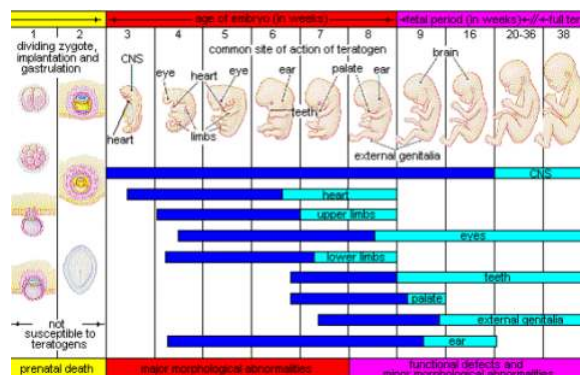


Figure 2.2.8: The development of an embryo into a fetus. (Image by Laura Overstreet is licensed under CC BY-NC-SA 3.0)

There are four categories of teratogens:

1. **Physical teratogens:** These could be saunas, hot tubs, or infections that raise a pregnant woman's body temperature to 102 degrees Fahrenheit or higher. This is associated with neural tube defects, spontaneous abortions, and various cardiovascular abnormalities.
2. **Metabolic conditions affecting pregnant females:** Metabolic conditions are abnormalities in the chemical process of producing energy from food, and thereby affect the development and function of the body. If a pregnant woman is

malnourished, then her fetus likely lacks the nutrients essential for its development. These include: malnutrition, diabetes, and thyroid disorders.

3. **Infections:** Different maternal infections, including rubella virus, herpes simplex virus, and syphilis can cause congenital abnormalities in fetuses.
4. **Drugs and chemicals:** When pregnant females ingest or absorb these, they may cause a variety of different effects based on specific agent, amount of exposure, and timing. This category includes: radiation, heavy metals (including lead), insecticides and herbicides, prescription and over the counter drugs, illicit and recreational drugs, alcohol, cigarettes, nicotine, caffeine, and even some vitamins. 33

While there are many, many potential teratogens, the following tables look at the effects of some different types of teratogens. The risks of exposure vary based on lifestyle and health. The effects may vary greatly depending on the factors mentioned previously. Protection and prevention will vary based on the method of exposure.

Table 2.2.1: Drugs as Teratogens

Teratogen	Potential Effects
Caffeine	Moderate amounts of caffeine (200 mg or around 12 ounces of coffee) appear to be safe during pregnancy. Some studies have shown a link between higher amounts of caffeine and miscarriage and preterm birth. ³⁴
Tobacco	Tobacco use has been associated with low birth weight, placenta previa, preterm delivery, fetal growth restriction, sudden infant death syndrome, cleft lip or palate, and later health problems (such as high blood pressure and diabetes). ³⁵
Alcohol	There is no safe amount of alcohol a woman can drink while pregnant. Alcohol can slow down the baby's growth, affect the baby's brain, and cause birth defects, and may results in fetal alcohol spectrum disorder (FASD). The effects can be mild to severe. Children born with a severe form of FASD can have abnormal facial features, severe learning disabilities, behavioral problems, and other problems. ³⁶
Cocaine	Cocaine use has connected with low birth weight, stillbirths, spontaneous abortion, placental abruption, premature birth, miscarriage, and neonatal abstinence syndrome (fetal addiction leads the newborn to experiences withdrawal). ³⁷
Marijuana	No amount of marijuana has been proven safe to use during pregnancy. Heavy use has been associated with brain damage, premature birth, and stillbirth. ³⁸
Heroin	Using heroin during pregnancy can cause birth defects, placental abruption, premature birth, low birthweight, neonatal abstinence syndrome, still birth, and sudden infant death syndrome. ³⁹
Over-the-Counter (OTC) medication	Some OTC medications are safe to use during pregnancy and others may cause health problems during pregnancy. Pregnant women should consult their health care provider before using OTC medications. ⁴⁰
Prescription drugs	Some prescription drugs can cause birth defects that change the shape or function of one or more parts of the body that can affect overall health. Pregnant women should consult their health care provider before discontinuing or starting new medications. ⁴¹
Herbal or dietary supplements	Except for some vitamins, little is known about using herbal or dietary supplements while pregnant. Most often there are no good studies to show if the herb can cause harm to you or your baby. Also, some herbs that are safe when used in small amounts as food might be harmful when used in large amounts as medicines. ⁴²

Table 2.2.2: Environmental Teratogens

Teratogen	Potential Effects
Lead	Exposure to high levels of lead before and during pregnancy can lead to high blood pressure, problems with fetal brain and nervous system development, premature birth, low birthweight, and miscarriage. ⁴³
Mercury	Exposure to mercury in the womb can cause brain damage and hearing and vision problems. ⁴⁴
Radiation	Exposure to radiation during pregnancy (especially between 2 and 18 weeks of pregnancy) can slow growth, cause birth defects, affect brain development, cause cancer, and cause miscarriage. ⁴⁵
Solvents	These chemicals include degreasers, paint thinners, stain and varnish removers, paints, and more. Maternal inhalation of solvents can cause fetal exposure that may cause miscarriage, slow fetal growth, premature birth, and birth defects. ⁴⁶

Table 2.2.3: Maternal Infections as Teratogens

Teratogen	Potential Effects
Rubella	Congenital infection (becoming infected while in the womb) can damage the development of the eyes, ears, heart, and brain and result in deafness. ⁴⁷
Zika	Congenital infection can cause microcephaly and other severe brain abnormalities. ⁴⁸
Varicella (chicken pox)	Congenital infection can cause a severe form of the infection affecting the eyes, limbs, skin, and central nervous system. ⁴⁹
Sexually transmitted infections	Infections such as HIV, gonorrhea, syphilis, and chlamydia can be passed from the mother during pregnancy and/or delivery. ⁵⁰
Listeria	Pregnant women are more susceptible to this food-borne illness. Congenital infection can cause miscarriage, stillbirth, premature labor, and neonatal sepsis. ⁵¹

Table 2.2.4: Teratogens from Animals/Pets

Teratogen	Potential Effects
Toxoplasmosis	This parasite can be passed through cat feces and undercooked meat (especially pork, lamb, or deer meat). If the fetus is infected it can cause miscarriage, stillbirth, hydrocephalus, macro or microcephalus, vision issues, and damage to the nervous system. ⁵²
Lymphocytic choriomeningitis	This virus carried by rodents including mice, hamsters, and guinea pigs. If an infected mother passes it to her fetus it can cause issues with brain development, long-term neurological and/or visual impairment, and higher mortality rates after birth. ⁵³

Maternal Factors

There are additional factors that affect the outcome of pregnancy for both mother and child. Let's look at these next.



Figure 2.2.9: A pregnant woman relaxing in a tub. (Image by Thomas Pompernigg is licensed under CC BY-SA 2.0)

Mothers over 35

Most women over 35 who become pregnant are in good health and have healthy pregnancies. However, according to the March of Dimes (2016d), women over age 35 are more likely to have an increased risk of:

- Fertility problems
- High blood pressure
- Diabetes
- Miscarriages
- Placenta Previa
- Cesarean section
- Premature birth
- Stillbirth
- A baby with a genetic disorder or other birth defects

Because a woman is born with all her eggs, environmental teratogens can affect the quality of the eggs as women get older. Also, a woman's reproductive system ages which can adversely affect the pregnancy. Some women over 35 choose special prenatal screening tests, such as a maternal blood screening, to determine if there are any health risks for the baby.

Although there are medical concerns associated with having a child later in life, there are also many positive consequences to being a more mature parent. Older parents are more confident, less stressed, and typically married, providing family stability. Their children perform better on math and reading tests, and they are less prone to injuries or emotional troubles (Albert, 2013). Women who choose to wait are often well educated and lead healthy lives. According to Gregory (2007), older women are more stable, demonstrate a stronger family focus, possess greater self-confidence, and have more money. Having a child later in one's career equals overall higher wages. In fact, for every year a woman delays motherhood, she makes 9% more in lifetime earnings. Lastly, women who delay having children actually live longer.

Teenage Pregnancy

A teenage mother is at a greater risk for having pregnancy complications including anemia, and high blood pressure. These risks are even greater for those under age 15. Infants born to teenage mothers have a higher risk for being premature and having low birthweight or other serious health problems. Premature and low birthweight babies may have organs that are not fully developed which can result in breathing problems, bleeding in the brain, vision loss, serious intestinal problems, and higher likelihood of dying. Reasons for these health issues include that teenagers are the least likely of all age groups to get early and regular prenatal care and they may engage in negative behaviors including eating unhealthy food, smoking, drinking alcohol, and taking drugs.

Gestational Diabetes

Seven percent of pregnant women develop **gestational diabetes** (March of Dimes, 2015b). Diabetes is a condition where the body has too much glucose in the bloodstream.



Figure 2.2.10: A gestational diabetes kit. (Image by [Jessica Merz](#) is licensed under [CC BY 2.0](#))

Most pregnant women have their glucose level tested between 24 to 28 weeks of pregnancy. Gestational diabetes usually goes away after the mother gives birth, but it might indicate a risk for developing diabetes later in life. If untreated, gestational diabetes can cause premature birth, stillbirth, the baby having breathing problems at birth, jaundice, or low blood sugar. Babies born to mothers with gestational diabetes can also be considerably heavier (more than 9 pounds) making the labor and birth process more difficult. For expectant mothers, untreated gestational diabetes can cause preeclampsia (high blood pressure and signs that the liver and kidneys may not be working properly) discussed later in the chapter.

Risk factors for gestational diabetes include age (being over age 25), being overweight or gaining too much weight during pregnancy, family history of diabetes, having had gestational diabetes with a prior pregnancy, and race and ethnicity (African-American, Native American, Hispanic, Asian, or Pacific Islander have a higher risk). Eating healthy and maintaining a healthy weight during pregnancy can reduce the chance of gestational diabetes. Women who already have diabetes and become pregnant need to attend all their prenatal care visits, and follow the same advice as those for women with gestational diabetes as the risk of preeclampsia, premature birth, birth defects, and stillbirth are the same.

High Blood Pressure (Hypertension)

Hypertension is a condition in which the pressure against the wall of the arteries becomes too high. There are two types of high blood pressure during pregnancy, gestational and chronic. Gestational hypertension only occurs during pregnancy and goes away after birth. Chronic high blood pressure refers to women who already had hypertension before the pregnancy or to those who developed it during pregnancy and it did not go away after birth.



Figure 2.2.11: A woman having her blood pressure taken. (Image by [rawpixel](#) on [Unsplash](#))

According to the March of Dimes (2015c), about 8 in every 100 pregnant women have high blood pressure. High blood pressure during pregnancy can cause premature birth and low birth weight (under five and a half pounds), placental abruption, and mothers can develop preeclampsia.

Rh Disease

Rh is a protein found in the blood. Most people are Rh positive, meaning they have this protein. Some people are Rh negative, meaning this protein is absent. Mothers who are Rh negative are at risk of having a baby with a form of anemia called Rh disease (March of Dimes, 2009). A father who is Rh-positive and mother who is Rh-negative can conceive a baby who is Rh-positive. Some of the fetus's blood cells may get into the mother's bloodstream and her immune system is unable to recognize the Rh factor.

The immune system starts to produce antibodies to fight off what it thinks is a foreign invader. Once her body produces immunity, the antibodies can cross the placenta and start to destroy the red blood cells of the developing fetus. As this process takes time, often the first Rh positive baby is not harmed, but as the mother's body will continue to produce antibodies to the Rh factor across her lifetime, subsequent pregnancies can pose greater risk for an Rh positive baby. In the newborn, Rh disease can lead to jaundice, anemia, heart failure, brain damage and death.

Weight Gain during Pregnancy

According to March of Dimes (2016f), during pregnancy most women need only an additional 300 calories per day to aid in the growth of the fetus. Gaining too little or too much weight during pregnancy can be harmful. Women who gain too little may have a baby who is low-birth weight, while those who gain too much are likely to have a premature or large baby. There is also a greater risk for the mother developing preeclampsia and diabetes, which can cause further problems during the pregnancy.

The table below shows the healthy weight gain during pregnancy. Putting on the weight slowly is best. Mothers who are concerned about their weight gain should talk to their health care provider.

Table 2.2.5: Weight Gain during Pregnancy

If you were a healthy weight before pregnancy:	If you were underweight before pregnancy:	If you were overweight before pregnancy:	If you were obese before pregnancy:
- Gain 25-35 pounds 1-4 1/2 pounds in the 1st trimester 1 pound per week in the 2nd and 3rd trimesters	- Gain 28-30 pounds 1-4 1/2 pounds in the 1st trimester - A little more than 1 pound per week thereafter	- Gain 12-25 pounds 1-4 1/2 pounds in the 1st trimester - A little more than 1/2 pound per week in 2nd and 3rd trimesters	11-20 pounds 1-4 1/2 pounds in the 1st trimester - A little more than 1/2 pound per week in 2nd and 3rd trimesters

Mothers of twins or higher order multiples need to gain more in each category.

Stress

Feeling stressed is common during pregnancy, but high levels of stress can cause complications including having a premature baby or a low-birthweight baby. Babies born early or too small are at an increased risk for health problems. Stress-related hormones may cause these complications by affecting a woman's immune systems resulting in an infection and premature birth. Additionally, some women deal with stress by smoking, drinking alcohol, or taking drugs, which can lead to problems in the pregnancy. High levels of stress in pregnancy have also been correlated with problems in the baby's brain development and immune system functioning, as well as childhood problems such as trouble paying attention and being afraid (March of Dimes, 2012b).

Depression

Depression is a significant medical condition in which feelings of sadness, worthlessness, guilt, and fatigue interfere with one's daily functioning. Depression can occur before, during, or after pregnancy, and 1 in 7 women are treated for depression sometime between the year before pregnancy and year after pregnancy (March of Dimes, 2015a). Women who have experienced depression previously are more likely to have depression during pregnancy. Consequences of depression include the baby being born premature, having a low birthweight, being more irritable, less active, less attentive, and having fewer facial expressions.

About 13% of pregnant women take an antidepressant during pregnancy. It is important that women taking antidepressants during pregnancy discuss the medication with a health care provider as some medications can cause harm to the developing organism.

Paternal Impact

The age of fathers at the time of conception is also an important factor in health risks for children. According to Nippoldt (2015), offspring of men over 40 faces an increased risk of miscarriages, autism, birth defects, achondroplasia (bone growth disorder) and schizophrenia. These increased health risks are thought to be due to accumulated chromosomal aberrations and mutations during the maturation of sperm cells in older men (Bray, Gunnell, & Smith, 2006). However, like older women, the overall risks are small.

In addition, men are more likely than women to work in occupations where hazardous chemicals, many of which have teratogenic effects or may cause genetic mutations, are used (Cordier, 2008). These may include petrochemicals, lead, and pesticides that can cause normal sperm and lead to miscarriages or diseases. Men are also more likely to be a source of second hand smoke for their developing offspring. As noted earlier, smoking by either the mother or around the mother can hinder prenatal development. 57



Figure 2.2.12: A USDA employee pouring hazardous chemicals into a storage container. (Image by USDA is in the public domain)

Prenatal Assessment

A number of assessments are suggested to women as part of their routine prenatal care to find conditions that may increase the risk of complications for the mother and fetus (Eisenberg, Murkoff, & Hathaway, 1996). These can include blood and urine analyses and screening and diagnostic tests for birth defects.



Figure 2.2.13: A woman receiving an ultrasound. (Image by MedicalPrudens is licensed under CC0 1.0)

Ultrasound is one of the main screening tests done in combination with blood tests. The ultrasound is a test in which sound waves are used to examine the fetus. There are two general types. Transvaginal ultrasounds are used in early pregnancy, while transabdominal ultrasounds are more common and used after 10 weeks of pregnancy (typically, 16 to 20 weeks).

Ultrasounds are used to check the fetus for defects or problems. It can also find out the age of the fetus, location of the placenta, fetal position, movement, breathing and heart rate, amount of amniotic fluid in the uterus, and number of fetuses. Most women have at least one ultrasound during pregnancy, but if problems are noted, additional ultrasounds may be recommended.

When diagnosis of a birth defect is necessary, ultrasounds help guide the more invasive diagnostic tests of amniocentesis and chorionic villus sampling. **Amniocentesis** is a procedure in which a needle is used to withdraw a small amount of amniotic fluid and cells from the sac surrounding the fetus and later tested.

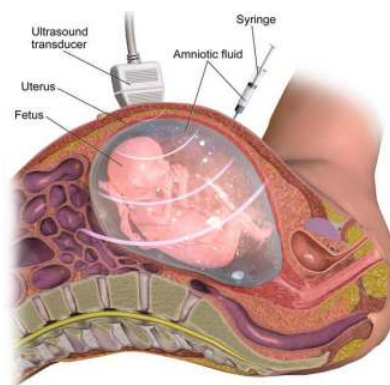


Figure 2.2.14: Amniocentesis. (Image by BruceBlaus is licensed under CC BY-SA 4.0)

Chorionic Villus Sampling is a procedure in which a small sample of cells is taken from the placenta and tested. Both amniocentesis and chorionic villus sampling have a risk of miscarriage, and consequently, they are not done routinely. 61

Complications of Pregnancy

There are a number of common side effects of pregnancy. Not everyone experiences all of these, nor to the same degree. And although they are considered "minor", this is not to say that these problems are not potentially very uncomfortable. These side

effects include nausea (particularly during the first 3-4 months of pregnancy as a result of higher levels of estrogen in the system), heartburn, gas, hemorrhoids, backache, leg cramps, insomnia, constipation, shortness of breath or varicose veins (as a result of carrying a heavy load on the abdomen). These are minor issues.

But there are also serious complications of pregnancy which can pose health risks to mother and child and that often require hospitalization.

Hyperemesis gravidarum is characterized by severe nausea, vomiting, weight loss, and possibly dehydration. Signs and symptoms may also include vomiting many times a day and feeling faint. The exact causes of hyperemesis gravidarum are unknown. Risk factors include the first pregnancy, multiple pregnancy, obesity, prior or family history of HG, trophoblastic disorder, and a history of eating disorders. Treatment includes drinking fluids and a bland diet. Medication, intravenous fluids, and hospitalization may be required. Hyperemesis gravidarum is estimated to affect 0.3–2.0% of pregnant women. Those affected have a low risk of miscarriage but a higher risk of premature birth.

Ectopic Pregnancy occurs when the zygote becomes attached to the fallopian tube before reaching the uterus. About 1 in 50 pregnancies in the United States are tubal pregnancies and this number has been increasing because of the higher rates of pelvic inflammatory disease and Chlamydia (Carroll, 2007). Abdominal pain, vaginal bleeding, nausea and fainting are symptoms of ectopic pregnancy.

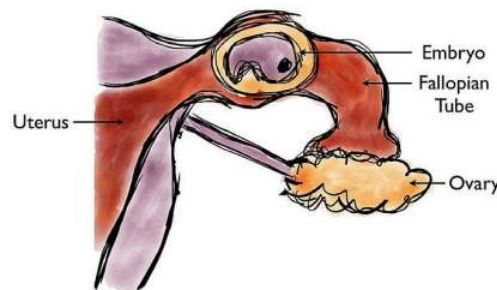


Figure 2.2.15: An ectopic pregnancy. (Image by Takatakakumi is licensed under [CC BY-SA 3.0](https://creativecommons.org/licenses/by-sa/3.0/))

Spontaneous abortion is experienced in an estimated 20-40 percent of undiagnosed pregnancies and in another 10 percent of diagnosed pregnancies. Usually the body aborts due to chromosomal abnormalities, and this typically happens before the 12th week of pregnancy. Cramping and bleeding result and normal periods return after several months. Some women are more likely to have repeated miscarriages due to chromosomal, amniotic, or hormonal problems, but miscarriage can also be a result of defective sperm (Carrell et. al., 2003).

Preeclampsia, also known as **Toxemia**, is characterized by a sharp rise in blood pressure, a leakage of protein into the urine as a result of kidney problems, and swelling of the hands, feet, and face during the third trimester of pregnancy. Preeclampsia is the most common complication of pregnancy. When preeclampsia causes seizures, the condition is known as eclampsia, which is the second leading cause of maternal death in the United States. Preeclampsia is also a leading cause of fetal complications, which include low birth weight, premature birth, and stillbirth. Treatment is typically bed rest and sometimes medication. If this treatment is ineffective, labor may be induced.

Maternal Mortality: Approximately 1000 women die in childbirth around the world each day (World Health Organization, 2010). Rates are highest in Sub-Saharan Africa and South Asia, although there has been a substantial decrease in these rates. The campaign to make childbirth safe for everyone has led to the development of clinics accessible to those living in more isolated areas and training more midwives to assist in childbirth.⁶³

Infertility and Building Families

Infertility

When a couple has failed to conceive a child in a year, they receive the diagnosis of infertility. Infertility affects about 10 to 15 percent of couples in the United States (Mayo Clinic, 2015). Male factors create infertility in about a third of the cases. For men, the most common cause is a lack of sperm production or low sperm production.

Female factors cause infertility in another third of cases. For women, one of the most common causes of infertility is the failure to ovulate. Another cause of infertility in women is Pelvic Inflammatory Disease (PID), which is an infection of a woman's reproductive organs (Carroll, 2007).

Both male and female factors contribute to the remainder of cases of infertility. 64

Options for Building Families

There are numerous options to pursue parenthood and building families. Let's briefly explore some of these.

Assisted Reproductive Technology Assisted reproductive technology (ART) is the technology used to achieve pregnancy in procedures such as fertility medication (to stimulate ovulation), surgical procedures, artificial insemination (IUI), in vitro fertilization (IVF) and surrogacy. These options are available for people who are experiencing infertility or cannot conceive children naturally (which also includes single parents, and gay/lesbian couples). 65

Intrauterine insemination: (IUI) as a type of artificial insemination involves the placement of sperm directly into the uterus at the time of ovulation, either in a natural menstrual cycle or following ovarian stimulation. 66

In vitro fertilization (IVF): IVF generally starts with stimulating the ovaries to increase egg production. Most fertility medications are agents that stimulate the development of follicles in the ovary. Examples are gonadotropins and gonadotropin releasing hormone. After stimulation, the physician surgically extracts one or more eggs from the ovary, and unites them with sperm in a laboratory setting, with the intent of producing one or more embryos. Fertilization takes place outside the body, and the fertilized egg is reinserted into the woman's reproductive tract, in a procedure called embryo transfer. 67



Figure 2.2.16: The IVF process. (Image by Manu5 is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/))

Donor Gametes & Embryos: People can also use sperm, ova (eggs), and embryos from donors in conjunction with ART. These donations take place through agencies and donor banks or between private individuals. In the U.S., donors can be compensated for their donations.

Surrogacy: In surrogacy, one woman (surrogate mother) carries a child for another person/s (commissioning person/couple), based on a legal agreement before conception requiring the child to be relinquished to the commissioning person/couple following birth. There are different types of surrogacy which relate to whether or not the ova used to conceive the child are her own (**traditional surrogacy**) or not (**gestational surrogacy**). 69

Adoption: People can also choose to pursue **adoption** to build their families (with or without experiencing infertility). Adoption can take place through the foster care system, privately, or through agencies. Adoptions can be domestic (within the U.S.) or international. And they can be open (with differing amounts of contact between biological/birth families and adoptive families) or closed.

Family Built with Surrogacy



Figure 2.2.17: This same-sex couple used a surrogate. (Photo by Daryn Crawford used with permission)

Family Built through Adoption



Figure 2.2.18: This single mother adopted her daughter. (Photo by Michaela Szidloski used with permission)

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38. [Chapter 3: Prenatal Development – Environmental Risks](#) references [Psyc 200 Lifespan Psychology](#) by Laura Overstreet, which is licensed under [CC BY 4.0](#);

Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>

39. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>

40. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>

41. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>

42. [Chapter 3: Prenatal Development – Environmental Risks](#) references [Psyc 200 Lifespan Psychology](#) by Laura Overstreet, which is licensed under [CC BY 4.0](#)

43. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>

44. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>
45. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>
46. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>
47. Chapter 3: Prenatal Development – Environmental Risks references *Psyc 200 Lifespan Psychology* by Laura Overstreet, which is licensed under [CC BY 4.0](#)
48. Protocols on prenatal care for pregnant women with Zika infection and children with microcephaly: nutritional approach by Rachel de Sá Barreto Luna Callou Cruz, Malaquias Batista Filho, Maria de Fátima Costa Caminha, and Edvaldo da Silva Souza is licensed under [CC BY 4.0](#)
49. *Congenital Varicella syndrome* by WikiDoc is licensed under [CC BY-SA 3.0](#)
50. Chapter 3: Prenatal Development – Environmental Risks references *Psyc 200 Lifespan Psychology* by Laura Overstreet, which is licensed under [CC BY 4.0](#)
51. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2860824/>
52. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>
53. Prescription drugs, over-the-counter drugs, supplements and herbal products (n.d.). Retrieved from: <https://www.marchofdimes.org/pregnancy/prescription-drugs-over-the-counter-drugs-supplements-and-herbal-products.aspx>
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2.S: Summary

In this chapter we looked at:

- Heredity, including genetic disorders and chromosomal abnormalities
- Conception
- The germinal, embryonic, and fetal stages of prenatal development
- Influences on prenatal development including teratogens and maternal and paternal factors
- Complications of pregnancy
- Infertility and options for building families

Now let's explore birth and the newborn baby.

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CHAPTER OVERVIEW

3: Birth and the Newborn

Learning Objectives

After this chapter, you should be able to:

- Compare and contrast different methods of childbirth preparation.
- Describe the stages of vaginal delivery.
- Explain why induction or Caesarean section may be necessary.
- Differentiate the common procedures for assessing the condition of the newborn.
- Examine problems newborns experience before, during, and after birth.

After around 266 days of developing inside the womb (for a full-term pregnancy), comes the arduous process of childbirth. After birth, newborns have to regulate their own body temperature, breathe for themselves, and take in all of their nutrition through feeding. Let's look at both the process of birth and some attributes of the newborn.

[3.1: Preparing for Childbirth](#)

[3.2: Childbirth](#)

[3.3: The Newborn](#)

[3.S: Summary](#)

Thumbnail: <https://pixabay.com/photos/baby-slee...y-girl-784608/>

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3.1: Preparing for Childbirth

Prepared childbirth refers to being not only in good physical condition to help provide a healthy environment for the baby to develop, but also helping individuals to prepare to accept their new roles as parents. Additionally, parents can receive information and training that will assist them for delivery and life with the baby. The more future parents can learn about childbirth and the newborn, the better prepared they will be for the adjustment they must make to a new life.

Approaches to Childbirth

There are many different approaches to childbirth that influence how expectant parents prepare. The following table describes a few of these:

Table 3.1.1: Approaches to Childbirth ([Lifespan Development: A Psychological Perspective](#) (page 59) by Martha Lally and Suzanne Valentine-French is licensed under [CC BY-NC-SA 3.0](#); [Lifespan Development - Module 3: Prenatal Development](#) by [Lumen Learning](#) references [Psyc 200 Lifespan Psychology](#) by Laura Overstreet, licensed under [CC BY 4.0](#))

Method	Description
The Lamaze Method	The emphasis of this method is on teaching the woman to be in control in the process of delivery. It includes learning muscle relaxation, breathing through contractions, having a focal point (usually a picture to look at) during contractions and having a support person who goes through the training process with the mother and serves as a coach during delivery.
The Leboyer Method	This method involves giving birth in a quiet, dimly lit room and allowing the newborn to lie on the mother's stomach with the umbilical cord intact for several minutes while being given a warm bath.
Dick-Read Method / Mongan Method / Hypnobirthing	This method comes from the suggestion that the fear of childbirth increases tension and makes the process of childbearing more painful. It emphasizes the use of relaxation and proper breathing with contractions as well as family support and education.
Bradley Method	"The Bradley Method focuses on preparing the mother for a natural childbirth coached by her partner. They learn techniques to reduce the perception of pain and stay relaxed. The emphasis is on being prepared for an unassisted vaginal birth without medication." 2
Alexander Technique	This is a technique that can be used during childbirth that involves training to stop habitual reactions to pain, such as tensing muscles and increase conscious awareness and control over posture and movement. This involves being able to move freely and stay upright during labor and using body positioning that is beneficial to the labor process.3
Waterbirth	Involves immersion in warm water. Proponents believe this method is safe and provides many benefits for both mother and infant, including pain relief and a less traumatic birth experience for the baby. However, critics argue that the procedure introduces unnecessary risks to the infant such as infection and water inhalation.4
Lotus Birth	Or umbilical cord nonseverance – UCNS, is the practice of leaving the umbilical cord uncut after childbirth so that the baby is left attached to the placenta until the cord naturally separates at the umbilicus. This usually occurs within 3–10 days after birth. The practice is performed mainly for spiritual purposes of the parents, including for the perceived spiritual connection between placenta and newborn.5
Silent Birth	Sometimes known as quiet birth, is a birthing procedure advised by L. Ron Hubbard and advocated by Scientologists in which "everyone attending the birth should refrain from spoken words as much as possible." 6
Medicated Childbirth	Health care providers can provide pain relief during labor with different types of medication, including epidurals, spinal blocks, combined spinal-epidurals, and systemic and local analgesia. There are benefits and side effects of each.7



Figure 3.1.1: Expectant parents in a childbirth preparation class. (Image by [liz.schrenk](#) is licensed under [CC BY-NC-ND 2.0](#))

Choosing Location of Childbirth & Who Will Deliver

The vast majority of births occur in a hospital setting. However, one percent of women choose to deliver at home (Martin, Hamilton, Osterman, Curtin, & Mathews, 2015). Women who are at low risk for birth complications can successfully deliver at home. More than half (67%) of home deliveries are by certified nurse midwives. Midwives are trained and licensed to assist in delivery and are far less expensive than the cost of a hospital delivery. However, because of the potential for a complication during the birth process, most medical professionals recommend that delivery take place in a hospital. In addition to home births, one-third of out-of-hospital births occur in freestanding clinics, birthing centers, in physician's offices, or other locations.

Contributors and Attributions

2. Oberg, Erica (n.d.). *Childbirth Delivery Methods and Types*. Retrieved from https://www.medicinenet.com/7_childbirth_and_delivery_methods/article.htm#childbirth_and_delivery_methods_and_types_facts.
3. Machover, Ilana. (n.d.). *The Alexander Technique in Natural Childbirth*. Retrieved from <https://www.alexandertechnique.com/articles/childbirth/>.
4. [Water Birth](#) by Wikidoc is licensed under [CC BY-SA 3.0](#)
5. [Lotus Birth](#) by Wikipedia is licensed under [CC BY-SA 3.0](#)
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3.2: Childbirth

Onset of Labor

Childbirth typically occurs within a week of a woman's due date, unless the woman is pregnant with more than one fetus, which usually causes her to go into labor early. As a pregnancy progresses into its final weeks, several physiological changes occur in response to hormones that trigger labor.

A common sign that labor is beginning is the so-called "bloody show." During pregnancy, a plug of mucus accumulates in the cervical canal, blocking the entrance to the uterus. Approximately 1–2 days prior to the onset of true labor, this plug loosens and is expelled, along with a small amount of blood.

As labor nears, the mother's pituitary gland produces oxytocin. This begins to stimulate stronger, more painful uterine contractions, which—in a positive feedback loop—stimulate the secretion of prostaglandins from fetal membranes. Like oxytocin, prostaglandins also enhance uterine contractile strength. The fetal pituitary gland also secretes oxytocin, which increases prostaglandins even further.

And the stretching of the cervix by a full-term fetus in the head-down position is regarded as a stimulant to uterine contractions. Combined, these stimulate true labor. 10

Stages of Birth for Vaginal Delivery

The First Stage

Uterine contractions signify that the first stage of labor has begun. These contractions may initially last about 30 seconds and be spaced 15 to 20 minutes apart. These increase in duration and frequency to more than a minute in length and about 3 to 4 minutes apart. Typically, doctors advise that they be called when contractions are coming about every 5 minutes. Some women experience false labor or Braxton-Hicks Contractions, especially with the first child. These may come and go. They tend to diminish when the mother begins walking around. Real labor pains tend to increase with walking. In one out of 8 pregnancies, the amniotic sac or water in which the fetus is suspended may break before labor begins. In such cases, the physician may induce labor with the use of medication if it does not begin on its own in order to reduce the risk of infection. Normally this sac does not rupture until the later stages of labor.

The first stage of labor is typically the longest. During this stage the cervix or opening to the uterus dilates to 10 centimeters or just under 4 inches. This may take around 12–16 hours for first children or about 6–9 hours for women who have previously given birth. Labor may also begin with a discharge of blood or amniotic fluid.

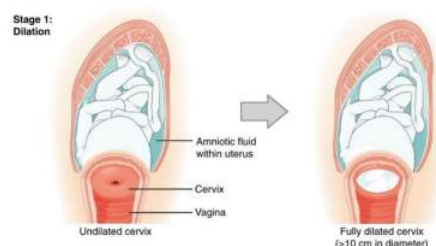


Figure 3.2.1: Early cervical dilation. (Image by OpenStax is licensed under CC BY 3.0)

The Second Stage

The passage of the baby through the birth canal is the second stage of labor. This stage takes about 10–40 minutes. Contractions usually come about every 2–3 minutes. The mother pushes and relaxes as directed by the medical staff. Normally the head is delivered first. The baby is then rotated so that one shoulder can come through and then the other shoulder. The rest of the baby quickly passes through. At this stage, an episiotomy, or incision made in the tissue between the vaginal opening and anus, may be performed to avoid tearing the tissue of the back of the vaginal opening (Mayo Clinic, 2016). The baby's mouth and nose are suctioned out. The umbilical cord is clamped and cut. 12

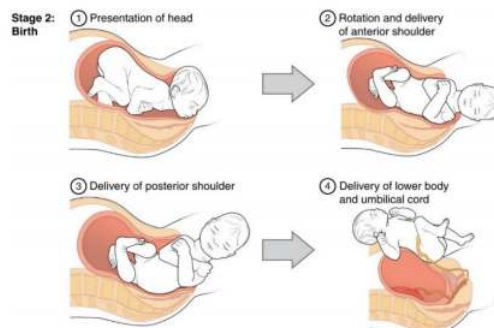


Figure 3.2.2: Full dilation and expulsion of the newborn. (Image by OpenStax is licensed under CC BY 3.0)

The Third Stage

The third and final stage of labor is relatively painless. During this stage, the placenta or afterbirth is delivered. This is typically within 20 minutes after delivery. If an episiotomy was performed it is stitched up during this stage. 14

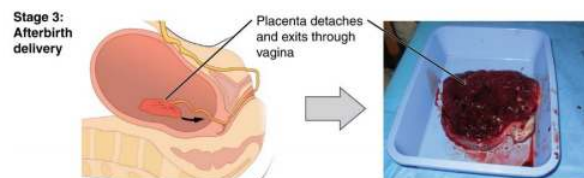


Figure 3.2.3: delivery of the placenta and associated fetal membranes. (Image by OpenStax is licensed under CC BY 3.0)

Additional Considerations

More than 50% of women giving birth at hospitals use an epidural anesthesia during delivery (American Pregnancy Association, 2015). An epidural block is a regional analgesic that can be used during labor and alleviates most pain in the lower body without slowing labor. The epidural block can be used throughout labor and has little to no effect on the baby. Medication is injected into a small space outside the spinal cord in the lower back. It takes 10 to 20 minutes for the medication to take effect. An epidural block with stronger medications, such as anesthetics, can be used shortly before a Cesarean Section or if a vaginal birth requires the use of forceps or vacuum extraction. 16

Women giving birth can also receive other pain medications (although medications given through injection can have negative side effects on the baby). In emergency situations (such as the need for a C-section), women may be given general anesthesia. They can also choose not to utilize any pain medications. That is often referred to as **natural childbirth**.



Figure 3.2.4: Natural childbirth. (Image by U.S. Army Alaska is licensed under CC BY 2.0)

Women can also use alternate positions (including standing, squatting, being on hands and knees, and using a birthing stool) and laboring, and even delivering in tubs of warm water to help relieve the pain of childbirth.

Medical Interventions in Childbirth

Sometimes women cannot go into labor on their own and/or deliver vaginally. Let's look at induction of labor and Cesarean Sections.

Sometimes a baby's arrival may need to be induced before labor begins naturally. **Induction of labor** may be recommended for a variety of reasons when there is concern for the health of the mother or baby. For example:

- The mother is approaching two weeks beyond her due date and labor has not started naturally
- The mother's water has broken, but contractions have not begun
- There is an infection in the mother's uterus
- The baby has stopped growing at the expected pace
- There is not enough amniotic fluid surrounding the baby
- The placenta peels away, either partially or completely, from the inner wall of the uterus before delivery
- The mother has a medical condition that might put her or her baby at risk, such as high blood pressure or diabetes (Mayo Clinic, 2014).

A Cesarean Section (C-section) is surgery to deliver the baby by being removed through the mother's abdomen. In the United States, about one in three women have their babies delivered this way (Martin et al., 2015). Most C-sections are done when problems occur during delivery unexpectedly. These can include:

- Health problems in the mother
- Signs of distress in the baby
- Not enough room for the baby to go through the vagina
- The position of the baby, such as a breech presentation where the head is not in the downward position.



Figure 3.2.5: A woman receiving a C-section. (Image by [Tammra M](#) is licensed under [CC BY 2.0](#))



Figure 3.2.6: A baby being delivered by C-section. (Image by [Patricia Prudente](#) on [Unsplash](#))

C-sections are also more common among women carrying more than one baby. Although the surgery is relatively safe for mother and baby, it is considered major surgery and carries health risks. Additionally, it also takes longer to recover from a C-section than from vaginal birth. After healing, the incision may leave a weak spot in the wall of the uterus. This could cause problems with an attempted vaginal birth later. In the past, doctors were hesitant to allow a vaginal birth after a C-section. However, now more than half of women who have a C-section go on to have a vaginal birth later. 20 This is referred to as a **Vaginal Birth After Cesarean (VBAC)**.

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3.3: The Newborn



Figure 3.3.1: A new mother holding her newborn. (Image by the U.S. Air Force is in the public domain)

Assessing the Newborn

The **Apgar assessment** is conducted one minute and five minutes after birth. This is a very quick way to assess the newborn's overall condition. Five measures are assessed: Heart rate, respiration, muscle tone (assessed by touching the baby's palm), reflex response (the Babinski reflex is tested), and color. A score of 0 to 2 is given on each feature examined. An Apgar of 5 or less is cause for concern. The second Apgar should indicate improvement with a higher score. 22

EVENT MEDICINE
EDUCATION PLANNING OPERATIONS

APGAR SCORE

SCORE	APPEARANCE	PULSE	GRIMACE	ACTIVITY	RESPIRATION
0	 Blue all over	 No pulse	 No response to stimulation	 No movement	 No respiration
1	 Blue extremities	 <100 beats/min	 Grimace on stimulation	 Some flexion	 Weak, irregular, slow
2	 No blue colouration	 >100 beats/min	 Cry on stimulation	 Flexed limbs that resist extension	 Strong cry

≥7 **NORMAL** 4-6 **LOW** ≤3 **CRITICAL**

More FREE resources at eventmedicinegroup.org

Figure 3.3.2: The Apgar assessment. (Image by Event Medicine Group)

Another way to assess the condition of the newborn is the Neonatal Behavioral Assessment Scale (NBAS). The baby's motor development, muscle tone, and stress response are assessed. This tool has been used around the world to further assess the newborn, especially those with low Apgar scores, and to make comparisons of infants in different cultures (Brazelton & Nugent, 1995).

Newborns are also routinely screened for different conditions. Within the first 24 to 48 hours after birth, babies born in hospitals undergo a simple heel stick and a few drops of blood are collected on a special paper card. Providers test those dried blood spots for a variety of different congenital disorders, or conditions that are present when the baby is born. In California, newborns are now screened for 80 different genetic and congenital disorders.



Figure 3.3.3: A medical professional performing the heel stick test. (Image by the U.S. Air Force is in the public domain)

Newborns are also screened for hearing disorders and certain serious heart problems using methods other than dried blood spots. 25

Problems of the Newborn

Anoxia

Anoxia is a temporary lack of oxygen to the brain. Difficulty during delivery may lead to anoxia which can result in brain damage or in severe cases, death. Babies who suffer both low birth weight and anoxia are more likely to suffer learning disabilities later in life as well.

Low Birth Weight

A child is considered low birth weight if he or she weighs less than 5 pounds 8 ounces (2500 grams). About 8.2 percent of babies born in the United States are of low birth weight (Center for Disease Control, 2015a). Sixty-seven percent of these babies are also preterm.

A low birth weight baby has difficulty maintaining adequate body temperature because it lacks the fat that would otherwise provide insulation. Such a baby is also at more risk for infection. Very low birth weight babies (2 pounds or less) have an increased risk of developing cerebral palsy. Many causes of low birth weight are preventable with proper prenatal care.

Preterm

A newborn might also have a **low birth weight** if it is born at less than 37 weeks gestation, which qualifies it as a **preterm baby** (CDC, 2015c). Early birth can be triggered by anything that disrupts the mother's system. For instance, vaginal infections can lead to premature birth because such infection causes the mother to release anti-inflammatory chemicals which, in turn, can trigger contractions. Smoking and the use of other teratogens can lead to preterm birth. A significant consequence of preterm birth includes respiratory distress syndrome, which is characterized by weak and irregular breathing (see the image below). Premature babies often cannot yet regulate their own temperature or feed by nursing or bottle. They may struggle to regulate their heart rate effectively and may experience jaundice. They often require care in the Neonatal Intensive Care Unit (NICU) until they are as healthy as a full-term baby.



Figure 3.3.4: a premature baby on CPAP in the NICU. (Photo by Jennifer Paris used with permission)

Small-for-Date Infants

Infants that have birth weights that are below expectation based on their gestational age are referred to as **small-for-date**. These infants may be full term or preterm (see image below), but still weigh less than 90% of all babies of the same gestational age. This is a very serious situation for newborns as their growth was adversely affected. Regev et al. (2003) found that small-for-date infants died at rates more than four times higher than other infants.



Figure 3.3.5: This baby was born at 32 weeks and only weighed 2 pounds and 15 ounces. (Photo by Jennifer Paris used with permission)

Postmature

When babies are not born by 42 weeks gestation, or two weeks after their due date, they are considered overdue or **postmature**. There are some concerns about how long the placenta can function and most doctors will consider induction for overdue babies.

Stillborn

When a fetus (unborn baby) dies while still inside the mother (after 20-24 weeks gestation) or dies during delivery (childbirth). It is said that the delivered baby is stillborn. The causes of many stillbirths are unknown, even when special tests are done to learn the cause. Possible causes include: nicotine, alcohol, or drugs taken by the mother during pregnancy, physical trauma, radiation poisoning, Rh disease, and umbilical cord problems. The number of stillbirths in the United States is about 1 in 115 births, which is about 26,000 a year, or one every 20 minutes. 28

Characteristics of Newborns

Size

The average newborn in the United States weighs about 7.5 pounds and is about 20 inches in length. For the first few days of life, infants typically lose about 5 percent of their body weight as they eliminate waste and get used to feeding. This often goes unnoticed by most parents, but can be cause for concern for those who have a smaller infant. This weight loss is temporary, however, and is followed by a rapid period of growth.



Figure 3.3.6: A newborn being weighed. (Image by Trei Brundrett is licensed under CC BY-SA 2.0)

Body Proportions

The head initially makes up about 50 percent of our entire length when we are developing in the womb. At birth, the head makes up about 25 percent of our length (think about how much of your length would be head if the proportions were still the same!).

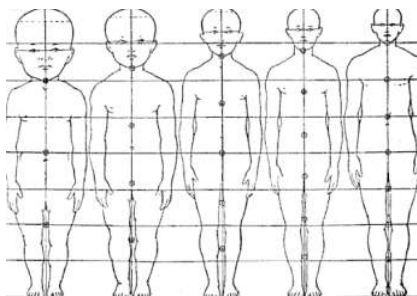


Figure 3.3.7: Body proportions from infancy to adulthood. (Image is in the public domain)

Brain Development

Some of the most dramatic physical change that occurs during this period is in the brain. At birth, the brain is about 25 percent its adult weight and this is not true for any other part of the body. While most of the brain's 100 to 200 billion neurons are present at birth, they are not fully mature. During the next several years dendrites or connections between neurons will undergo a period of transient exuberance or temporary dramatic growth. 31

Appearance at Birth

During labor and birth, the infant's skull changes shape to fit through the birth canal, sometimes causing the child to be born with a misshapen or elongated head. It will usually return to normal on its own within a few days or weeks.

Some newborns have a fine, downy body hair called lanugo. It may be particularly noticeable on the back, shoulders, forehead, ears and face of premature infants. Lanugo disappears within a few weeks. Likewise, not all infants are born with lush heads of hair. Some may be nearly bald while others may have very fine, almost invisible hair. Some babies are even born with a full head of hair. Amongst fair-skinned parents, this fine hair may be blond, even if the parents are not. The picture on the left shows lanugo on the shoulders of newborn twins.



Figure 3.3.8: Lanugo on the shoulder and back of twin girls. (Image is in the public domain)



Figure 3.3.9: A newborn baby covered in vernix. (Image by Upsilon Andromedae is licensed under CC BY 2.0)

Immediately after birth, a newborn's skin is often grayish to dusky blue in color. As soon as the newborn begins to breathe, usually within a minute or two, the skin's color returns to its normal tone. Newborns are wet, covered in streaks of blood, and coated with a white substance known as **vernix**, which is thought to act as an antibacterial barrier, seen in the picture on the right.

The scalp may also be temporarily bruised or swollen, especially in hairless newborns, and the area around the eyes may be puffy.

The newborn may also have Mongolian spots (blue or blue black birthmark on the lower back), various other birthmarks, or peeling skin, particularly on the wrists, hands, ankles, and feet. 34

A newborn's genitals are enlarged and reddened, with male infants having an unusually large scrotum. The breasts may also be enlarged, even in male infants. This is caused by naturally-occurring maternal hormones and is a temporary condition.

The umbilical cord of a newborn is bluish-white in color. After birth, the umbilical cord is normally cut, leaving a 1–2 inch stub. The umbilical stub will dry out, shrivel, darken, and spontaneously fall off within about 3 weeks. Occasionally, hospitals may apply triple dye to the umbilical stub to prevent infection, which may temporarily color the stub and surrounding skin purple.



Figure 3.3.10: The clamping and cutting of a newborn's umbilical cord. (Image by NNethala is licensed under CC BY-SA 3.0)

Newborns lose many of the above physical characteristics quickly. Thus older babies look very different. While older babies are considered "cute," newborns can be "unattractive" by the same criteria and first time parents may need to be educated in this

regard. 36

Sleep

A newborn typically sleeps approximately 16.5 hours per 24-hour period. The infant sleeps in several periods throughout the day and night, which means they wake often throughout the day and night. (Salkind, 2005). 37



Figure 3.3.11: An older newborn baby. (Image by brytny.com on Unsplash)

Reflexes

Newborns are equipped with a number of **reflexes**, which are involuntary movements in response to stimulation. Some of the more common reflexes, such as the sucking reflex and rooting reflex, are important to feeding. The grasping and stepping reflexes are eventually replaced by more voluntary behaviors. Within the first few months of life these reflexes disappear, while other reflexes, such as the eye-blink, swallowing, sneezing, gagging, and withdrawal reflex stay with us as they continue to serve important functions. 39

Sensory Capacities

Throughout much of history, the newborn was considered a passive, disorganized being who possessed minimal abilities. However, current research techniques have demonstrated just how developed the newborn is with especially organized sensory and perceptual abilities.

Vision

The womb is a dark environment void of visual stimulation. Consequently, vision is the most poorly developed sense at birth and time is needed to build those neural pathways between the eye and the brain. Newborns typically cannot see further than 8 to 16 inches away from their faces, and their visual acuity is about 20/400, which means that an infant can see something at 20 feet that an adult with normal vision could see at 400 feet. Thus, the world probably looks blurry to young infants.



Figure 3.3.12: A newborn gazing up at a parent. (Image is in the public domain)

Hearing

The infant's sense of hearing is very keen at birth, and the ability to hear is evidenced as soon as the 7th month of prenatal development. In fact, an infant can distinguish between very similar sounds as early as one month after birth and can distinguish between a familiar and unfamiliar voice even earlier. Infants are especially sensitive to the frequencies of sounds in human speech and prefer the exaggeration of infant-directed speech, which will be discussed later. Newborns also prefer their mother's voices over another female when speaking the same material (DeCasper & Fifer, 1980). Additionally, they will register in utero specific information heard from their mother's voice. 41

Early Hearing

DeCasper and Spence (1986) tested 16 infants whose mothers had previously read to them prenatally. The mothers read several passages to their fetuses, including the first 28 paragraphs of *The Cat in the Hat*, beginning when they were 7 months pregnant. The fetuses had been exposed to the stories on average of 67 times or 3.5 hours.

During the testing, the infants were able to choose between recordings of two stories, one of which was a story their mothers read to them while in the womb, based on how fast they sucked on their pacifiers. They showed a preference for the stories that their mothers read to them while in the womb. 42



Figure 3.3.13: A collection of children's books. (Image by kamiel79 on pixabay)

Touch and Pain

Immediately after birth, a newborn is sensitive to touch and temperature, and is also highly sensitive to pain, responding with crying and cardiovascular responses (Balaban & Reisenauer, 2013). Newborns who are circumcised, which is the surgical removal of the foreskin of the penis, without anesthesia experience pain as demonstrated by increased blood pressure, increased heart rate, decreased oxygen in the blood, and a surge of stress hormones (United States National Library of Medicine, 2016). Research has demonstrated that infants who were circumcised without anesthesia experienced more pain and fear during routine childhood vaccines. Fortunately, many circumcisions are now done with the use of local anesthetics.

Taste and Smell

Studies of taste and smell demonstrate that babies respond with different facial expressions, suggesting that certain preferences are innate. Newborns can distinguish between sour, bitter, sweet, and salty flavors and show a preference for sweet flavors. Newborns also prefer the smell of their mothers. An infant only 6 days old is significantly more likely to turn toward its own mother's breast pad than to the breast pad of another baby's mother (Porter, Makin, Davis, & Christensen, 1992), and within hours of birth an infant also shows a preference for the face of its own mother (Bushnell, 2001; Bushnell, Sai, & Mullin, 1989).

Infants seem to be born with the ability to perceive the world in an intermodal way; that is, through stimulation from more than one sensory modality. For example, infants who sucked on a pacifier with a smooth surface preferred looking at visual models of a pacifier with a smooth surface. But those that were given a pacifier with a textured surface preferred to look at a visual model of a pacifier with a textured surface. 44



Figure 3.3.14: A baby sucking on a pacifier. (Image by Beeki is licensed under [CC0 1.0](#))

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3.S: Summary

In this chapter we looked at:

- methods of childbirth preparation
- the process of childbirth (for both vaginal and Cesarean deliveries)
- assessing newborn health
- problems for the newborn
- characteristics of newborns (including appearance, reflexes, and perceptual abilities)

In the next three chapters we will explore the first three years of life more. Many rapid changes occur during these foundational years.

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CHAPTER OVERVIEW

4: Physical Development in Infancy and Toddlerhood

Learning Objectives

After this chapter, you should be able to:

1. Describe the physical changes that occur during the first two years of life.
2. Identify common infant reflexes.
3. Discuss the sleep needs during the first two years of life.
4. Summarize the sequence of both fine and gross motor skills.
5. Recognize the developing sensory capacities of infants and toddlers.
6. Explain how to meet the evolving nutritional needs of infants and toddlers.

Welcome to the story of development from infancy through toddlerhood; from birth until about two years of age. Researchers have given this part of the life span more attention than any other period, perhaps because changes during this time are so dramatic and so noticeable and perhaps because we have assumed that what happens during these years provides a foundation for one's life to come. However, it has been argued that the significance of development during these years has been overstated (Bruer, 1999). Nevertheless, this is the period of life that contemporary educators, healthcare providers, and parents have focused on most heavily. We will examine growth and nutrition during infancy, as well as other prominent physical changes that take place during this time.¹



Figure 4.1 – A sleeping newborn.²

- 4.1: Rapid Physical Changes
- 4.2: Proportions of the Body
- 4.3: Reflexes
- 4.4: Gross Motor Skills
- 4.5: Fine Motor Skills
- 4.6: Sensory Capacities
- 4.7: Nutrition
- 4.8: Health
- 4.9: Sleep
- 4.S: Summary

Thumbnail: <https://www.pexels.com/photo/child-in-road-786220/>

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4.1: Rapid Physical Changes

As mentioned in the previous chapter, the average newborn in the United States weighs about 7.5 pounds and is about 20 inches in length. After about a 5% weight loss in the first few days, there is a period of rapid growth. By the time an infant is 4 months old, it usually doubles in weight and by one year has tripled its birth weight. By age 2, the weight has quadrupled. The average length at one year is about 26-32 inches.³



Figure 4.1.1: An infant sleeping. (Image by Andres and Antoinette Ricardo used with permission)

Two hormones are very important to this growth process. The first is [Human Growth Hormone](#) (HGH) which influences all growth except that in the Central Nervous System (CNS). The hormone influencing growth in the CNS is called **Thyroid Stimulating Hormone**. Together these hormones influence the growth in early childhood.

Sleep is very important to the growth process as these hormones are released as children sleep each night. As a result, children need 11 to 14 hours of sleep from 2 to 6 years old. Parents may establish rituals, such as reading a story, taking a bath, brushing teeth, etc. to help children wind down and get the sleep they so desperately need.⁴

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4.2: Proportions of the Body

Another dramatic physical change that takes place in the first several years of life is the change in body proportions. The head initially makes up about 50 percent of our entire length when we are developing in the womb. At birth, the head makes up about 25 percent of our length (think about how much of your length would be head if the proportions were still the same!). By age 25 it comprises about 20 percent our length. Imagine now how difficult it must be to raise one's head during the first year of life! And indeed, if you have ever seen a 2 to 4 month old infant lying on the stomach trying to raise the head, you know how much of a challenge this is. The comparison in this graphic was originally introduced in the last chapter.

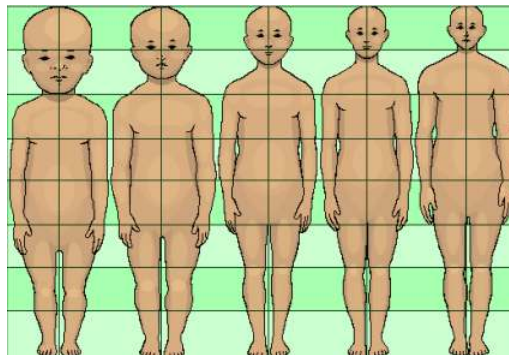


Figure 4.2.1: Shown from left to right: Human body proportions at birth, at 2 years, at 6 years, at 12 years, and at 19 years. (Image by Ephert is licensed under [CC BY-SA 4.0](#))

Some of the most dramatic physical change that occurs during this period is in the brain. At birth, the brain is about 25 percent its adult weight and this is not true for any other part of the body. By age 2, it is at 75 percent its adult weight, at 95 percent by age 6 and at 100 percent by age 7 years.

While most of the brain's 100 to 200 billion neurons are present at birth, they are not fully mature and during the next several years **dendrites** or connections between neurons will undergo a period of transient exuberance or temporary dramatic growth.

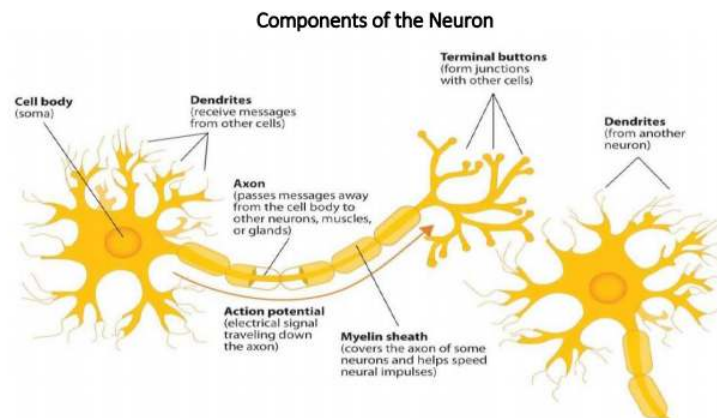


Figure 4.2.2: Components of the neuron. (Image by Martha Lally and Suzanne Valentine-French is licensed under [CC BY-NC-SA 3.0](#))

There is a proliferation of these dendrites during the first two years so that by age 2, a single neuron might have thousands of dendrites. After this dramatic increase, the neural pathways that are not used will be eliminated thereby making those that are used much stronger.⁸ Because of this proliferation of dendrites, by age two a single neuron might have thousands of dendrites.

Synaptogenesis, or the formation of connections between neurons, continues from the prenatal period forming thousands of new connections during infancy and toddlerhood. This period of rapid neural growth is referred to as **Synaptic Blooming**.⁹ This activity is occurring primarily in the cortex or the thin outer covering of the brain involved in voluntary activity and thinking.

 MRI scans of human brain development at 1 week, 3 months, 1 year, 2 years, and 10 years.

Figure 4.2.3: MRI scans of the human brain. (Image is in the public domain)

The prefrontal cortex that is located behind our forehead continues to grow and mature throughout childhood and experiences an additional growth spurt during adolescence. It is the last part of the brain to mature and will eventually comprise 85 percent of the brain's weight. Experience will shape which of these connections are maintained and which of these are lost. Ultimately, about 40 percent of these connections will be lost (Webb, Monk, and Nelson, 2001). As the prefrontal cortex matures, the child is increasingly able to regulate or control emotions, to plan activity, strategize, and have better judgment. Of course, this is not fully accomplished in infancy and toddlerhood but continues throughout childhood and adolescence.

Another major change occurring in the central nervous system is the development of myelin, a coating of fatty tissues around the axon of the neuron. Myelin helps insulate the nerve cell and speed the rate of transmission of impulses from one cell to another. This enhances the building of neural pathways and improves coordination and control of movement and thought processes. The development of myelin continues into adolescence but is most dramatic during the first several years of life.¹⁰

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4.3: Reflexes

Infants are equipped with a number of reflexes which are involuntary movements in response to stimulation. These include the sucking reflex (infants suck on objects that touch their lips automatically), the rooting reflex (which involves turning toward any object that touches the cheek), the palmar grasp (the infant will tightly grasp any object placed in its palm), and the dancing reflex (evident when the infant is held in a standing position and moves its feet up and down alternately as if dancing). These movements occur automatically and are signals that the infant is functioning well neurologically. Within the first several weeks of life these reflexes are replaced with voluntary movements or motor skills. 12

Infants and children grow and develop at a rapid pace during the first few years of life. The development of both gross and fine motor skills helps a child go from a completely dependent newborn to an independently functioning toddler in about a 3-year span. 13

Table 4.3.1: Some Common Infant Reflexes ([Lifespan Development: A Psychological Perspective](#) (page 74) by Martha Lally and Suzanne Valentine-French is licensed under [CC BY-NC-SA 3.0](#) (modified by Antoinette Ricardo))

Reflex	Description	Image	Reflex	Description	Image
Sucking	Suck on anything that touches the lips	 Figure 4.3.1 (Image is in the public domain)	Moro	A sudden noise or loss of support to the head and neck will cause infants to spread out their arms and legs then quickly contract the limbs inward	 Figure 4.3.2 (Image is in the public domain)
Rooting	Turning the head when the cheek is touched	 Figure 4.3.3 (Image is in the public domain)	Tonic Neck	When lying on the back with the head to one side infants will extend the arm and leg on that side while flexing the limbs on the opposite side (looks like a fencer pose).	 Figure 4.3.4 (Image by Samuel Finlayson is licensed under CC BY-SA 4.0)
Grasp	Fingers automatically grip anything that touches the palm of the hand	 Figure 4.3.5 (Image by Raul Luna is licensed under CC BY 2.0)	Stepping	Legs move in stepping like motion when feet touch a smooth surface	 Figure 4.3.6 (Image is in the public domain)
Babinski	The toes will fan out and curl when the sole of the foot is stroked from heel to toe	 Figure 4.3.7 (Image by Medicus of Borg is licensed under CC BY-SA 3.0)			

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4.4: Gross Motor Skills

Voluntary movements involve the use of large muscle groups and are typically large movements of the arms, legs, head, and torso. They are referred to as **gross motor skills** (or large motor skills). These skills begin to develop first. Examples include moving to bring the chin up when lying on the stomach, moving the chest up, rocking back and forth on hands and knees, and then crawling. But it also includes exploring an object with one's feet as many babies do as early as 8 weeks of age if seated in a carrier or other device that frees the hips. This may be easier than reaching for an object with the hands, which requires much more practice (Berk, 2007). And sometimes an infant will try to move toward an object while crawling and surprisingly move backward because of the greater amount of strength in the arms than in the legs! This also tends to lead infants to pull up on furniture, usually with the goal of reaching a desired object. Usually, this will also lead to taking steps and eventually walking. 22

Physical Gross Motor Milestones

As stated above, children grow very quickly and meet physical milestones rapidly in the first few years of life. The following is a table of the major **milestones** (behaviors or physical skills seen in infants and children as they grow and develop that typically occur within normal range) that occur in children during those first formative years. 23

Table 4.4.1: Gross Motor Milestones ([Developmental Milestones](#) by the [CDC](#) is in the public domain)

Typical Age	What Most Children Do by This Age
2 months	• Can hold head up and begins to push up when lying on tummy • Makes smoother movements with arms and legs
4 months	• Holds head steady, unsupported • Pushes down on legs when feet are on a hard surface • May be able to roll over from tummy to back • Brings hands to mouth • When lying on stomach, pushes up to elbows
6 months	• Rolls over in both directions (front to back, back to front) • Begins to sit without support • When standing, supports weight on legs and might bounce • Rocks back and forth, sometimes crawling backward before moving forward
9 months	• Stands, holding on • Can get into sitting position • Sits without support • Pulls to stand • Crawls
1 year	• Gets to a sitting position without help • Pulls up to stand, walks holding on to furniture (“cruising”) • May take a few steps without holding on • May stand alone
18 months	• Walks alone • May walk up steps and run • Pulls toys while walking • Can help undress self
2 years	• Stands on tiptoe • Kicks a ball • Begins to run • Climbs onto and down from furniture without help • Walks up and down stairs holding on • Throws ball overhand



Figure 4.4.1: An infant playing in the sand. (Image by Andres and Antoinette Ricardo used with permission)

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4.5: Fine Motor Skills

More exact movements of the feet, toes, hands, and fingers are referred to as **fine motor skills** (or small motor skills). These include the ability to reach and grasp an object in coordination with vision. Newborns cannot grasp objects voluntarily but do wave their arms toward objects of interest. At about 4 months of age, the infant is able to reach for an object, first with both arms and within a few weeks, with only one arm. Grasping an object involves the use of the fingers and palm, but no thumbs.



Figure 4.5.1: An infant feeding themselves. (Image by Matt Preston is licensed under CC BY-SA 2.0)

Use of the thumb comes at about 9 months of age when the infant is able to grasp an object using the forefinger and thumb. This is known as the **pincer grip**. This ability greatly enhances the ability to control and manipulate an object and infants take great delight in this newfound ability. They may spend hours picking up small objects from the floor and placing them in containers. And as those objects will often next go into the mouth, caregivers must be vigilant about keeping items small enough to be choking hazards out of reach of little fingers. By 9 months, an infant can also watch a moving object, reach for it as it approaches and grabs it. This is quite a complicated set of actions if we remember how difficult this would have been just a few months earlier. 26

Physical Fine Motor Milestones

While fine motor skills are slower to develop (in accordance with proximodistal development), pretty remarkable progress is made in fine motor development during the first two years. As stated above, in the first few years of life children go from having no intentional fine motor control to being able to manipulate objects to play and learn, as well as beginning to care of themselves. The following is a table of the major milestones in fine motor development.

Table 4.5.1: Fine Motor Milestones (Developmental Milestones by the CDC is in the public domain)

Typical Age	What Most Children Do by This Age
2 months	- Grasps reflexively - Does not reach for objects - Holds hands in fist
4 months	- Brings hands to mouth - Uses hands and eyes together, such as seeing a toy and reaching for it - Follows moving things with eyes from side to side - Can hold a toy with whole hand (palmar grasp) and shake it and swing at dangling toys
6 months	- Reaches with both arms - Brings things to mouth - Begins to pass things from one hand to the other
9 months	- Puts things in mouth - Moves things smoothly from one hand to the other - Picks up things between thumb and index finger (pincer grip)
1 year	- Reaches with one hand - Bangs two things together - Puts things in a container, takes things out of a container - Lets things go without help - Pokes with index (pointer) finger
18 months	- Scribbles on own - Can help undress herself - Drinks from a cup - Eats with a spoon with some accuracy - Stacks 2-4 objects
2 years	- Builds towers of 4 or more blocks - Might use one hand more than the other - Makes copies of straight lines and circles - Enjoys pouring and filling - Unbuttons large buttons - Unzips large zippers - Drinks and feeds self with more accuracy

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4.6: Sensory Capacities

Throughout much of history, the newborn was considered a passive, disorganized being who possessed minimal abilities. William James, an early psychologist, had described the newborn's world as "a blooming, buzzing confusion," (Shaffer, 1985). However, current research techniques have demonstrated just how developed the newborn is with especially organized sensory and perceptual abilities.

Vision

The womb is a dark environment void of visual stimulation. Consequently, vision is the most poorly developed sense at birth and time is needed to build those neural pathways between the eye and the brain. Newborns typically cannot see further than 8 to 16 inches away from their faces (which is about the distance from the newborn's face to the mother/caregiver when an infant is breastfeeding/bottle-feeding). Their visual acuity is about 20/400, which means that an infant can see something at 20 feet that an adult with normal vision could see at 400 feet. Thus, the world probably looks blurry to young infants. Because of their poor visual acuity, they look longer at checkerboards with fewer large squares than with many small squares. Infants' thresholds for seeing a visual pattern are higher than adults'. Thus, toys for infants are sometimes manufactured with black and white patterns rather than pastel colors because the higher contrast between black and white makes the pattern more visible to the immature visual system. By about 6 months, infants' visual acuity improves and approximates adult 20/25 acuity.



Figure 4.6.1: An infant looking up at the person feeding them. (Image by Ben_Kerckx on Pixabay)

When viewing a person's face, newborns do not look at the eyes the way adults do; rather, they tend to look at the chin - a less detailed part of the face. However, by 2 or 3 months, they will seek more detail when exploring an object visually and begin showing preferences for unusual images over familiar ones, for patterns over solids, for faces over patterns, and for three-dimensional objects over flat images. Newborns have difficulty distinguishing between colors, but within a few months, they are able to discriminate between colors as well as adults do. Sensitivity to binocular depth cues, which require inputs from both eyes, is evident by about 3 months and continues to develop during the first 6 months. By 6 months, the infant can perceive depth perception in pictures as well (Sen, Yonas, & Knill, 2001). Infants who have experience crawling and exploring will pay greater attention to visual cues of depth and modify their actions accordingly (Berk, 2007).

Hearing

The infant's sense of hearing is very keen at birth, and the ability to hear is evident as soon as the 7th month of prenatal development. In fact, an infant can distinguish between very similar sounds as early as one month after birth and can distinguish between a familiar and unfamiliar voice even earlier. Infants are especially sensitive to the frequencies of sounds in human speech and prefer the exaggeration of infant-directed speech, which will be discussed later. Additionally, infants are innately ready to respond to the sounds of any language, but some of this ability will be lost by 7 or 8 months as the infant becomes familiar with the sounds of a particular language and less sensitive to sounds that are part of an unfamiliar language.

Newborns also prefer their mother's voices over another female when speaking the same material (DeCasper & Fifer, 1980). Additionally, they will register in utero specific information heard from their mother's voice. You may remember the Cat in the Hat study featured in the last chapter that illustrates this.

Touch and Pain

Immediately after birth, a newborn is sensitive to touch and temperature, and is also highly sensitive to pain, responding with crying and cardiovascular responses (Balaban & Reisenauer, 2013). Newborns who are **circumcised**, which is the surgical removal

of the foreskin of the penis, without anesthesia experience pain as demonstrated by increased blood pressure, increased heart rate, decreased oxygen in the blood, and a surge of stress hormones (United States National Library of Medicine, 2016). Research has demonstrated that infants who were circumcised without anesthesia experienced more pain and fear during routine childhood vaccines. Fortunately, local painkillers are now used during many circumcision.

Taste and Smell

Studies of taste and smell demonstrate that babies respond with different facial expressions, suggesting that certain preferences are innate. Newborns can distinguish between sour, bitter, sweet, and salty flavors and show a preference for sweet flavors. Newborns also prefer the smell of their mothers. An infant only 6 days old is significantly more likely to turn toward its own mother's breast pad than to the breast pad of another baby's mother (Porter, Makin, Davis, & Christensen, 1992), and within hours of birth, an infant also shows a preference for the face of its own mother (Bushnell, 2001; Bushnell, Sai, & Mullin, 1989).

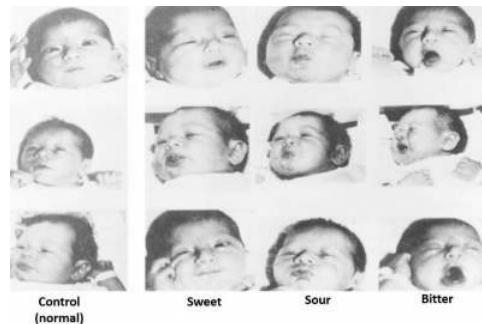


Figure 4.6.2: The responses of infants to different tastes. (Image by Alice Vilela and CC BY 4.0)

Infants seem to be born with the ability to perceive the world in an intermodal way; that is, through stimulation from more than one sensory modality. For example, infants who sucked on a pacifier with either a smooth or textured surface preferred to look at a corresponding (smooth or textured) visual model of the pacifier. By 4 months, infants can match lip movements with speech sounds and can match other audiovisual events. Although sensory development emphasizes the afferent processes used to take in information from the environment, these sensory processes can be affected by the infant's developing motor abilities. Reaching, crawling, and other actions allow the infant to see, touch, and organize his or her experiences in new ways. 30

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4.7: Nutrition

Nutritional needs change with age. Let's examine how caregivers should nourish children during the first years of life and some risks to nutrition that they should be aware of.

Breastfeeding

Breast milk is considered the ideal diet for newborns. **Colostrum**, the first breast milk produced during pregnancy and just after birth has been described as “liquid gold” (United States Department of Health and Human Services (USDHHS), 2011). It is very rich in nutrients and antibodies. Breast milk changes by the third to fifth day after birth, becoming much thinner, but containing just the right amount of fat, sugar, water, and proteins to support overall physical and neurological development. For most babies, breast milk is also easier to digest than formula. Formula fed infants experience more diarrhea and upset stomachs. The absence of antibodies in formula often results in a higher rate of ear infections and respiratory infections. Children who are breastfed have lower rates of childhood leukemia, asthma, obesity, type 1 and 2 diabetes, and a lower risk of SIDS. The USDHHS recommends that mothers breastfeed their infants until at least 6 months of age and that breast milk be used in the diet throughout the first year or two.



Figure 4.7.1: A nurse helping a new mother to breastfeed. (Image by the [Military Health System](#) is in the public domain)

Maternal Benefits of Breastfeeding

Several recent studies have reported that it is not just babies that benefit from breastfeeding. Breastfeeding stimulates contractions in the mother's uterus to help it regain its normal size, and women who breastfeed are more likely to space their pregnancies further apart. Mothers who breastfeed are at lower risk of developing breast cancer (Islami et al., 2015), especially among higher risk racial and ethnic groups (Islami et al., 2015; Redondo et al., 2012). Women who breastfeed have lower rates of ovarian cancer (Titus-Ernstoff, Rees, Terry, & Cramer, 2010), reduced risk for developing Type 2 diabetes (Schwarz et al., 2010; Gunderson, et al., 2015), and rheumatoid arthritis (Karlson, Mandl, Hankinson, & Grodstein, 2004). In most studies these benefits have been seen in women who breastfeed longer than 6 months.

Challenges to Breastfeeding

However, most mothers who breastfeed in the United States stop breastfeeding at about 6-8 weeks, often in order to return to work outside the home (USDHHS, 2011). Mothers can certainly continue to provide breast milk to their babies by expressing and freezing the milk to be bottle-fed at a later time or by being available to their infants at feeding time. However, some mothers find that after the initial encouragement they receive in the hospital to breastfeed, the outside world is less supportive of such efforts. Some workplaces support breastfeeding mothers by providing flexible schedules and welcoming infants, but many do not. In addition, not all women may be able to breastfeed. Women with HIV are routinely discouraged from breastfeeding as the infection may pass to the infant. Similarly, women who are taking certain medications or undergoing radiation treatment may be told not to breastfeed (USDHHS, 2011).

Cost of Breastfeeding

In addition to the nutritional benefits of breastfeeding, breast milk does not have to be purchased. Anyone who has priced formula recently can appreciate this added incentive to breastfeeding. Prices for a year's worth of formula and feeding supplies can cost well over \$1,500 (USDHHS, 2011).

But there are also those who challenge the belief that breast milk is free. For breastmilk to be completely beneficial for infants the mother's life choices will ultimately affect the quality of the nutrition an infant will receive. Let's consider the nutritional intake of the mother. Breastfeeding will both limit some food and drink choices as well as necessitate an increased intake of healthier options. A simple trip down the supermarket aisles will show you that nutritious and healthier options can be more expensive than some of the cheaper more processed options. A large variety of vegetable and fruits must be consumed, accompanied by the right proportions and amounts of the whole grains, dairy products, and fat food groups. Additionally, it is also encouraged for breastfeeding mothers to take vitamins regularly. That raises the question of how free breastfeeding truly is.

A Historic Look at Breastfeeding

The use of wet nurses, or lactating women hired to nurse others' infants, during the middle ages eventually declined and mothers increasingly breastfed their own infants in the late 1800s. In the early part of the 20th century, breastfeeding began to go through another decline. By the 1950s, it was practiced less frequently as formula began to be viewed as superior to breast milk.

In the late 1960s and 1970s, greater emphasis began to be placed on natural childbirth and breastfeeding and the benefits of breastfeeding were more widely publicized. Gradually rates of breastfeeding began to climb, particularly among middle-class educated mothers who received the strongest messages to breastfeed.

Today, women receive consultation from lactation specialists before being discharged from the hospital to ensure that they are informed of the benefits of breastfeeding and given support and encouragement to get their infants to get used to taking the breast. This does not always happen immediately and first time mothers, especially, can become upset or discouraged. In this case, lactation specialists and nursing staff can encourage the mother to keep trying until baby and mother are comfortable with the feeding. 33

Alternatives to Breastfeeding

There are many reasons that mothers struggle to breastfeed or should not breastfeed, including: low milk supply, previous breast surgeries, illicit drug use, medications, infectious disease, and inverted nipples. Other mothers choose not to breastfeed. Some reasons for this include: lack of personal comfort with nursing, the time commitment of nursing, inadequate or unhealthy diet, and wanting more convenience and flexibility with who and when an infant can be fed. For these mothers and infants, formula is available. Besides breast milk, infant formula is the only other milk product that the medical community considers nutritionally acceptable for infants under the age of one year (as opposed to cow's milk, goat's milk, or follow-on formula). It can be used in addition to breastfeeding (supplementing) or as an alternative to breastmilk.

The most commonly used infant formulas contain purified cow's milk whey and casein as a protein source, a blend of vegetable oils as a fat source, lactose as a carbohydrate source, a vitamin-mineral mix, and other ingredients depending on the manufacturer. In addition, there are infant formulas which use soybeans as a protein source in place of cow's milk (mostly in the United States and Great Britain) and formulas which use protein hydrolysed into its component amino acids for infants who are allergic to other proteins³⁴.



Figure 4.7.2: A father bottle-feeding his infant. (Image by Ilya Haykinson is licensed under CC BY-SA 2.0)

One early argument given to promote the practice of breastfeeding was that it promoted bonding and healthy emotional development for infants. However, this does not seem to be the case. Breastfed and bottle-fed infants adjust equally well emotionally (Ferguson & Woodward, 1999). This is good news for mothers who may be unable to breastfeed for a variety of reasons and for fathers who might feel left out.

When, What, and How to Introduce Solid Foods

The American Academy of Pediatrics recommends children be introduced to foods other than breast milk or infant formula when they are about 6 months old. Every child is different. Here are some signs that show that an infant is ready for foods other than breast milk or infant formula:

- Child can sit with little or no support.
- Child has good head control.
- Child opens his or her mouth and leans forward when food is offered.

How Should Foods Be Introduced?

The American Academy of Pediatrics says that for most children, foods do not need to be given in a certain order. Children can begin eating solid foods at about 6 months old. By the time they are 7 or 8 months old, children can eat a variety of foods from different food groups. These foods include infant cereals, meat or other proteins, fruits, vegetables, grains, yogurts and cheeses, and more.

If feeding infant cereals, it is important to offer a variety of fortified infant cereals such as oat, barley, and multi-grain instead of only rice cereal. The Food and Drug Administration does not recommend only providing infant rice cereal because there is a risk for children to be exposed to arsenic.

Children should be allowed to try one food at a time at first and there should be 3 to 5 days before another food is introduced. This helps caregivers see if the child has any problems with that food, such as food allergies.



Figure 4.7.3: A baby being fed solid food. (Image by Ben_Kerckx on Pixabay)

The eight most common allergenic foods are milk, eggs, fish, shellfish, tree nuts, peanuts, wheat, and soybeans. It is no longer recommended that caregivers delay introducing these foods to all children, but if there is a family history of food allergies, the child's doctor or nurse should be consulted. 37

It may take numerous attempts before a child gains a taste for it. So caregivers should not give up if a food is refused on the first offering.

USDA Infant Meal Patterns

The United States Department of Agriculture Food and Nutrition Service provides the following guidance for the day time feeding of infants and toddlers.

Table 4.7.1: Infant Meal Patterns ([Infant Meals](#) by the [USDA](#) is in the public domain)

Meal	0-5 months	6-11 months
Breakfast	4-6 fluid ounces breastmilk or formula	6-8 fluid ounces breastmilk or formula 0-4 tablespoons infant cereal, meat, fish, poultry, whole eggs, cooked dry beans or peas; or 0-2 ounces cheese; or 0-4 ounces (volume) cottage cheese; or 0-4 ounces yogurt; or a combination* 0-2 tablespoons vegetable, fruit, or both*
Lunch or Supper	4-6 fluid ounces breastmilk or formula	6-8 fluid ounces breastmilk or formula 0-4 tablespoons infant cereal, meat, fish, poultry, whole eggs, cooked dry beans or peas; or 0-2 ounces cheese; or 0-4 ounces (volume) cottage cheese; or 0-4 ounces yogurt; or a combination* 0-2 tablespoons vegetable, fruit, or both*
Snack	4-6 fluid ounces breastmilk or formula	2-4 fluid ounces breastmilk or formula 0-1/2 bread slice; or 0-2 crackers; or 0-4 tablespoons infant cereal or ready-to-eat cereal* 0-2 tablespoons vegetable, fruit, or both*

*Required when infant is developmentally ready. All serving sizes are minimum quantities of the food components that are required to be served.

Table 4.7.2: Meal Patterns for Children (1-2 years) ([Child and Adult Meals](#) by the [USDA](#) is in the public domain)

Meal	Ages 1-2
Breakfast	1/2 cup milk 1/4 cup vegetables, fruit, or both 1/2 ounce equivalent grains
Lunch or Supper	1/2 cup milk 1-ounce meat or meat alternative 1/8 cup vegetables 1/8 cup fruits 1/2 ounce equivalent of grains
Snack	Select two of the following: 1/2 cup of milk 1/2 ounce meat or meat alternative 1/2 cup vegetables 1/2 cup fruit 1/2 ounce equivalent of grains

Note: All serving sizes are minimum quantities of the food components that are required to be served.

Child Malnutrition

There can be serious effects for children when there are deficiencies in their nutrition. Let's explore a few types of nutritional concerns.

Wasting

Children in developing countries and countries experiencing the harsh conditions of war are at risk for two major types of malnutrition, also referred to as wasting. Infantile **marasmus** refers to starvation due to a lack of calories and protein. Children who do not receive adequate nutrition lose fat and muscle until their bodies can no longer function. Babies who are breastfed are much less at risk of malnutrition than those who are bottle-fed.

After weaning, children who have diets deficient in protein may experience **kwashiorkor** or the "disease of the displaced child," often occurring after another child has been born and taken over breastfeeding. This results in a loss of appetite and swelling of the abdomen as the body begins to break down the vital organs as a source of protein.

Around the world the rates of wasting have been dropping. However, according to the World Health Organization and UNICEF, in 2014 there were 50 million children under the age of five that experienced these forms of wasting, and 16 million were severely wasted (UNICEF, 2015). Worldwide, these figures indicate that nearly 1 child in every 13 suffers from some form of wasting. The majority of these children live in Asia (34.3 million) and Africa (13.9 million). Wasting can occur as a result of severe food shortages, regional diets that lack certain proteins and vitamins, or infectious diseases that inhibit appetite (Latham, 1997).



Figure 4.7.4: A child suffering from wasting. (Image by the CDC is in the public domain)

The consequences of wasting depend on how late in the progression of the disease parents and guardians seek medical treatment for their children. Unfortunately, in some cultures families do not seek treatment early, and as a result by the time a child is hospitalized the child often dies within the first three days after admission (Latham, 1997). Several studies have reported long-term cognitive effects of early malnutrition (Galler & Ramsey, 1989; Galler, Ramsey, Salt & Archer, 1987; Richardson, 1980), even when home environments were controlled (Galler, Ramsey, Morley, Archer & Salt, 1990). Lower IQ scores (Galler et al., 1987), poor attention (Galler & Ramsey, 1989), and behavioral issues in the classroom (Galler et al., 1990) have been reported in children with a history of serious malnutrition in the first few years of life. 41

Milk Anemia

Milk Anemia in the United States: About 9 million children in the United States are malnourished (Children's Welfare, 1998). More still suffer from milk anemia, a condition in which milk consumption leads to a lack of iron in the diet. This can be due to the practice of giving toddlers milk as a pacifier-when resting, when riding, when waking, and so on. Appetite declines somewhat during toddlerhood and a small amount of milk (especially with added chocolate syrup) can easily satisfy a child's appetite for many hours. The calcium in milk interferes with the absorption of iron in the diet as well. Many preschools and daycare centers give toddlers a drink after they have finished their meal in order to prevent spoiling their appetites. 42

Failure to Thrive

Failure to thrive (FTT) occurs in children whose nutritional intake is insufficient for supporting normal growth and weight gain. FTT typically presents before two years of age, when growth rates are highest. Parents may express concern about picky eating habits, poor weight gain, or smaller size compared relative to peers of similar age. Physicians often identify FTT during routine office visits, when a child's growth parameters are not tracking appropriately on growth curves.

FTT can be caused by physical or mental issues within the child (such as errors of metabolism, acid reflux, anemia, diarrhea, Cystic fibrosis, Crohn's disease, celiac disease, cleft palate, tongue tie, milk allergies, hyperthyroidism, congenital heart disease, etc.) It can also be caused by caregiver's actions (environmental), including inability to produce enough breastmilk, inadequate food supply, providing an insufficient number of feedings, and neglect. These causes may also co-exist. For instance, a child who is not getting sufficient nutrition may act content so that caregivers do not offer feedings of sufficient frequency or volume, and a child with severe acid reflux who appears to be in pain while eating may make a caregiver hesitant to offer sufficient feedings.43

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4.8: Health

Infants depend on the adults that care for them to promote and protect their health. The following section addresses common physical conditions that can affect infants, the danger of shaking babies, and the importance of immunizations.

Common Physical Conditions and Issues during Infancy

Some physical conditions and issues are very common during infancy. Many are normal, and the infant's caregivers can deal with them if they occur. Mostly, it is a matter of the caregivers learning about what is normal for their infant and getting comfortable with the new routine in the household. New parents and caregivers often have questions about the following:

- Bowel Movements
- Colic
- Diaper Rash
- Spitting Up/Vomiting
- Teething
- Urination
- Jaundice

Bowel Movements

Infants' bowel movements go through many changes in color and consistency, even within the first few days after birth. While the color, consistency, and frequency of stool will vary, hard or dry stools may indicate dehydration and increased frequency of watery stools may indicate diarrhea.



Figure 4.8.1: An infant getting their diaper changed. (Image by Kevin Phillips is licensed under CC BY 2.0)

Colic

Many infants are fussy in the evenings, but if the crying does not stop and gets worse throughout the day or night, it may be caused by colic. According to the American Academy of Pediatrics, about one-fifth of all infants develop colic, usually starting between 2 and 4 weeks of age. They may cry inconsolably or scream, extend or pull up their legs, and pass gas. Their stomachs may be enlarged. The crying spells can occur anytime, although they often get worse in the early evening.

The colic will likely improve or disappear by the age of 3 or 4 months. There is no definite explanation for why some infants get colic. Health care providers can help ensure there is no medical reason behind the crying.

Some infants seem to be soothed by being held, rocked, or wrapped snugly in a blanket. Some like a pacifier.



Figure 4.8.2: A father holding a crying infant. (Image by David D is licensed under CC BY 2.0)

Shaken Baby Syndrome

Here is a PSA from the Center for Disease Control (CDC) *The crying. The late-night feedings. The diaper changes. The exhaustion. If you've ever been around a baby who won't stop crying, you know there's potential to get frustrated. Focus on calming yourself and understand that you may not be able to calm your baby. It's not your fault or your baby's.*⁴⁶

It's normal for healthy babies to cry and some babies cry much more than others. And they cannot always be consoled and caregivers can feel pushed to the limit. When caregivers lose control and shake a baby it can have devastating effects.

Shaken Baby Syndrome (SBS) is a severe form of physical child abuse. SBS may be caused from vigorously shaking an infant by the shoulders, arms, or legs. The “whiplash” effect can cause intracranial (within the brain) or intraocular (within the eyes) bleeding. Often there is no obvious external head trauma. Still, children with SBS may display some outward signs:

- Change in sleeping pattern or inability to be awakened
- Confused, restless, or agitated state
- Convulsions or seizures
- Loss of energy or motivation
- Slurred speech
- Uncontrollable crying
- Inability to be consoled
- Inability to nurse or eat

SBS can result in death, mental retardation or developmental delays, paralysis, severe motor dysfunction, spasticity, blindness, and seizures.

Who's at Risk? Small children are especially vulnerable to this type of abuse. Their heads are large in comparison to their bodies, and their neck muscles are weak. Children under one year of age are at highest risk, but SBS has been reported in children up to five years of age. Shaking often occurs in response to a baby crying or having a toilet-training accident. The perpetrator tends to be male and is primarily the biological father or the mother's boyfriend or partner. Caregivers are responsible for about 9%-21% of cases. The explanation typically provided by the caregiver—“I was playing with the baby”—does not begin to account for the severity of trauma. Many times there is also a history of child abuse.

Can It Be Prevented? SBS is completely preventable. However, it is not known whether educational efforts will effectively prevent this type of abuse. Home visitation programs are shown to prevent child abuse in general. Because the child's father or the mother's partner often causes SBS, they should be included in home visitation programs. Home visits bring community resources to families in their homes. Health professionals provide information, healthcare, psychological support, and other services that can help people to be more effective parents and care-givers.

The Bottom Line

- Shaking a baby can cause death or permanent brain damage. It can result in life-long disability.
- Healthy strategies for dealing with a crying baby include:
 - finding the reason for the crying
 - checking for signs of illness or discomfort, such as diaper rash, teething, tight clothing;
 - feeding or burping;
 - soothing the baby by rubbing its back; gently rocking; offering a pacifier;
 - singing or talking;
 - taking a walk using a stroller or a drive in a properly-secured car seat;
 - or calling the doctor if sickness is suspected
- All babies cry. Caregivers often feel overwhelmed by a crying baby. Calling a friend, relative, or neighbor for support or assistance lets the caregiver take a break from the situation. If immediate support is not available, the caregiver could place the baby in a crib (making sure the baby is safe), close the door, and check on the baby every five minutes.⁴⁷



Figure 4.8.3: Medical professionals caring for an infant. (Image by the U.S. Air Force is in the public domain)

Abusive Head Trauma Shaken baby syndrome is part abusive head trauma (AHT), severe form of physical child abuse that results in an injury to the brain of a child. This is important to note because:

- Abusive head trauma is a leading cause of physical child abuse deaths in children under 5 in the United States.
- Abusive head trauma accounts for approximately one third of all child maltreatment deaths.
- The most common trigger for abusive head trauma is inconsolable crying.
- Babies less than one year old are at greatest risk of injury from abusive head trauma.⁴⁹

Teething

Although newborns usually have no visible teeth, baby teeth begin to appear generally about 6 months after birth. During the first few years, all 20 baby teeth will push through the gums, and most children will have their full set of these teeth in place by age 3.

An infant's front four teeth usually appear first, at about 6 months of age, although some children don't get their first tooth until 12-14 months. As their teeth break through the gums, some infants become fussy, and irritable; lose their appetite; or drool more than usual.

The FDA does not recommend gum-numbing medications with an ingredient called benzocaine because they can cause a potentially fatal condition in young children. Safe forms of relief include a chilled teething ring or gently rubbing the child's gums with a clean finger.

Spitting Up/Vomiting

Spitting up is a common occurrence for young infants and is usually not a sign of a more serious problem. But if an infant is not gaining weight or shows other signs of illness, a health care provider should be consulted.



Figure 4.8.4: A father holding his baby with a cloth protecting his shoulder from spit-up. (Image by Colin is licensed under CC BY 2.0)

Urination

Infants urinate as often as every 1 to 3 hours or as infrequently as every 4 to 6 hours. In case of sickness or if the weather is very hot, urine output might drop by half and still be normal. If an infant shows any signs of distress while urinating or if any blood is found in a wet diaper medical care should be sought.

Diaper Rash

A rash on the skin covered by a diaper is quite common. It is usually caused by irritation of the skin from being in contact with stool and urine. It can get worse during bouts of diarrhea. Diaper rash usually can be prevented by frequent diaper changes.

Jaundice

Jaundice can cause an infant's skin, eyes, and mouth to turn a yellowish color. The yellow color is caused by a buildup of bilirubin, a substance that is produced in the body during the normal process of breaking down old red blood cells and forming new ones.

Normally the liver removes bilirubin from the body. But, for many infants, in the first few days after birth, the liver is not yet working at its full power. As a result, the level of bilirubin in the blood gets too high, causing the infant's color to become slightly yellow—this is jaundice. Although jaundice is common and usually not serious, in some cases, high levels of bilirubin could cause brain injury. All infants with jaundice need to be seen by a health care provider. Many infants need no treatment. Their livers start to catch up quickly and begin to remove bilirubin normally, usually within a few days after birth. For some infants, health care providers prescribe phototherapy—a treatment using a special lamp—to help break down the bilirubin in their bodies.



Figure 4.8.5: An infant receiving treatment for jaundice. (Image by Andres and Antoinette Ricardo used with permission)

Protecting Health through Immunization

One way we can protect a child's health (and those around them) is through immunization. The vaccines (given through injection) may hurt a little...but the diseases they can prevent can hurt a lot more! Immunization shots, or vaccinations, are essential. They protect against things like measles, mumps, rubella, hepatitis B, polio, diphtheria, tetanus and pertussis (whooping cough). Immunizations are important for adults as well as for children. Here's why.

The immune system helps the human body fight germs by producing substances to combat them. Once it does, the immune system “remembers” the germ and can fight it again. Vaccines contain germs that have been killed or weakened. When given to a healthy person, the vaccine triggers the immune system to respond and thus build immunity.

Before vaccines, people became immune only by actually getting a disease and surviving it. Immunizations are an easier and less risky way to become immune.

Vaccines are the best defense we have against serious, preventable, and sometimes deadly contagious diseases. Vaccines are some of the safest medical products available, but like any other medical product, there may be risks. Accurate information about the value of vaccines as well as their possible side effects helps people to make informed decisions about vaccination.



Figure 4.8.6: A nurse giving an infant vaccinations. (Image by Maria Immaculata Hospital is licensed under [CC BY-SA 4.0](https://creativecommons.org/licenses/by-sa/4.0/))

Potential Side Effects

Vaccines, like all medical products, may cause side effects in some people. Most of these side effects are minor, such as redness or swelling at the injection site. Read further to learn about possible side effects from vaccines.

Any vaccine can cause side effects. For the most part these are minor (for example, a sore arm or low-grade fever) and go away within a few days.⁵³ Serious side effects after vaccination, such as severe allergic reaction, are very rare.⁵⁴

Remember, vaccines are continually monitored for safety, and like any medication, vaccines can cause side effects. However, a decision not to immunize a child also involves risk and could put the child and others who come into contact with him or her at risk

of contracting a potentially deadly disease.

How Well Do Vaccines Work?

Vaccines work really well. No medicine is perfect, of course, but most childhood vaccines produce immunity about 90–100% of the time.

What about the argument made by some people that vaccines don't work that well . . . that diseases would be going away on their own because of better hygiene or sanitation, even if there were no vaccines?

That simply isn't true. Certainly better hygiene and sanitation can help prevent the spread of disease, but the germs that cause disease will still be around, and as long as they are they will continue to make people sick.

All vaccines must be licensed (approved) by the Food and Drug Administration (FDA) before being used in the United States, and a vaccine must go through extensive testing to show that it works and that it is safe before the FDA will approve it. Among these tests are clinical trials, which compare groups of people who get a vaccine with groups of people who get a control. A vaccine is approved only if FDA makes the determination that it is safe and effective for its intended use.

If you look at the history of any vaccine-preventable disease, you will virtually always see that the number of cases of disease starts to drop when a vaccine is licensed. Vaccines are the most effective tool we have to prevent infectious diseases.

Opposition to Vaccines

In 2010, a pertussis (whooping cough) outbreak in California sickened 9,143 people and resulted in 10 infant deaths: the worst outbreak in 63 years (Centers for Disease Control 2011b). Researchers, suspecting that the primary cause of the outbreak was the waning strength of pertussis vaccines in older children, recommended a booster vaccination for 11–12-year-olds and also for pregnant women (Zacharyczuk 2011). Pertussis most serious for babies; one in five needs to be hospitalized, and since they are too young for the vaccine themselves, it is crucial that people around them be immunized (Centers for Disease Control 2011b). Several states, including California, have been requiring the pertussis booster for older children in recent years with the hope of staving off another outbreak.

But what about people who do not want their children to have this vaccine, or any other? That question is at the heart of a debate that has been simmering for years. Vaccines are biological preparations that improve immunity against a certain disease. Vaccines have contributed to the eradication and weakening of numerous infectious diseases, including smallpox, polio, mumps, chicken pox, and meningitis.



Figure 4.8.7: These two young children contracted polio. (Image by the CDC is in the public domain)

However, many people express concern about potential negative side effects from vaccines. These concerns range from fears about overloading the child's immune system to controversial reports about devastating side effects of the vaccines.⁵⁶

Although children continue to get several vaccines up to their second birthday, these vaccines do not overload the immune system. Every day, an infant's healthy immune system successfully fights off thousands of antigens – the parts of germs that cause their immune system to respond. Even if your child receives several vaccines in one day, vaccines contain only a tiny amount of antigens compared to the antigens your baby encounters every day.

This is the case even if your child receives combination vaccines. Combination vaccines take two or more vaccines that could be given individually and put them into one shot. Children get the same protection as they do from individual vaccines given separately—but with fewer shots.⁵⁷

One misapprehension is that the vaccine itself might cause the disease it is supposed to be immunizing against.⁵⁸ Vaccines help develop immunity by imitating an infection, but this “imitation” infection does not cause illness. Instead it causes the immune system to develop the same response as it does to a real infection so the body can recognize and fight the vaccine-preventable disease in the future. Sometimes, after getting a vaccine, the imitation infection can cause minor symptoms, such as fever. Such minor symptoms are normal and should be expected as the body builds immunity.⁵⁹

Another commonly circulated concern is that vaccinations, specifically the MMR vaccine (MMR stands for measles, mumps, and rubella), are linked to autism. The autism connection has been particularly controversial. In 1998, a British physician named Andrew Wakefield published a study in Great Britain’s *Lancet* magazine that linked the MMR vaccine to autism. The report received a lot of media attention, resulting in British immunization rates decreasing from 91 percent in 1997 to almost 80 percent by 2003, accompanied by a subsequent rise in measles cases (Devlin 2008). A prolonged investigation by the *British Medical Journal* proved that not only was the link in the study nonexistent, but that Dr. Wakefield had falsified data in order to support his claims (CNN 2011). Dr. Wakefield was discredited and stripped of his license, but the doubt still lingers in many parents’ minds.

In the United States, many parents still believe in the now discredited MMR-autism link and refuse to vaccinate their children. Other parents choose not to vaccinate for various reasons like religious or health beliefs. In one instance, a boy whose parents opted not to vaccinate returned home to the U.S. after a trip abroad; no one yet knew he was infected with measles.

The boy exposed 839 people to the disease and caused 11 additional cases of measles, all in other unvaccinated children, including one infant who had to be hospitalized.



Figure 4.8.8: A baby with measles (Image by CDC Global is licensed under CC BY 2.0)

According to a study published in *Pediatrics* (2010), the outbreak cost the public sector \$10,376 per diagnosed case. The study further showed that the intentional non-vaccination of those infected occurred in students from private schools, public charter schools, and public schools in upper-socioeconomic areas (Sugerman et al. 2010).⁶¹

The Immunization Schedule

On-time vaccination throughout childhood is essential because it helps provide immunity before children are exposed to potentially life-threatening diseases. Vaccines are tested to ensure that they are safe and effective for children to receive at the recommended ages.⁶² Fully vaccinated children in the U.S. are protected against sixteen potentially harmful diseases. Vaccine-preventable diseases can be very serious, may require hospitalization, or even be deadly — especially in infants and young children.⁶³

Here is the schedule from the CDC to ensure a child is fully vaccinated:

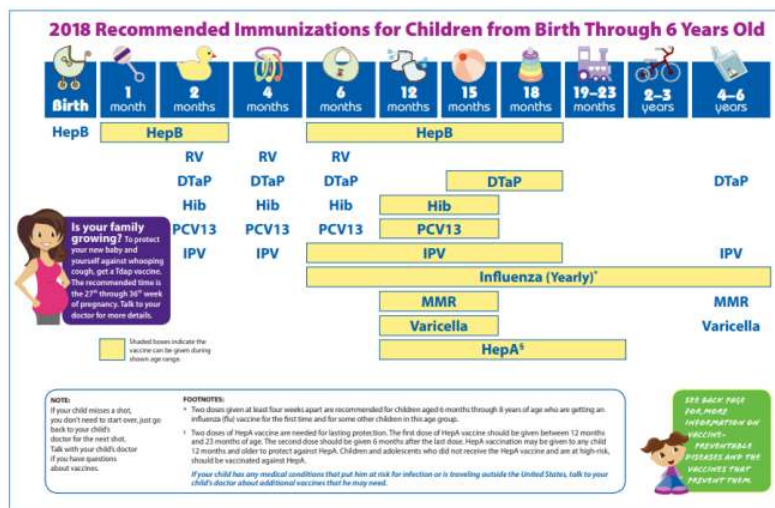


Figure 4.8.9: Immunization schedule. (Image by the CDC is in the public domain)

Vaccine-Preventable Diseases and the Vaccines that Prevent Them

Disease	Vaccine	Disease spread by	Disease symptoms	Disease complications
Chickenpox	Varicella vaccine protects against chickenpox.	Air, direct contact	Rash, tiredness, headache, fever	Infected blisters, bleeding disorders, encephalitis (brain swelling), pneumonia (infection in the lungs)
Diphtheria	DTaP ^a vaccine protects against diphtheria.	Air, direct contact	Sore throat, mild fever, weakness, swollen glands in neck	Swelling of the heart muscle, heart failure, coma, paralysis, death
Hib	Hib vaccine protects against <i>Haemophilus influenzae</i> type b.	Air, direct contact	May be no symptoms unless bacteria enter the blood	Meningitis (infection of the covering around the brain and spinal cord), intellectual disability, encephalitis (life-threatening infection that can block the windpipe and lead to serious breathing problems), pneumonia (infection in the lungs), death
Hepatitis A	HepA vaccine protects against hepatitis A.	Direct contact, contaminated food or water	May be no symptoms; fever, stomach pain, loss of appetite, fatigue, vomiting, jaundice (yellowing of skin and eyes), dark urine	Liver failure, arthralgia (joint pain), kidney, pancreatic, and blood disorders
Hepatitis B	HepB vaccine protects against hepatitis B.	Contact with blood or body fluids	May be no symptoms; fever, headache, weakness, vomiting, jaundice (yellowing of skin and eyes), joint pain	Chronic liver infection, liver failure, liver cancer
Influenza (Flu)	Flu vaccine protects against influenza.	Air, direct contact	Fever, muscle pain, sore throat, cough, extreme fatigue	Pneumonia (infection in the lungs)
Measles	MMR ^{**} vaccine protects against measles.	Air, direct contact	Rash, fever, cough, runny nose, pinkeye	Encephalitis (brain swelling), pneumonia (infection in the lungs), death
Mumps	MMR ^{**} vaccine protects against mumps.	Air, direct contact	Swollen salivary glands (under the jaw), fever, headache, tiredness, muscle pain	Meningitis (infection of the covering around the brain and spinal cord), encephalitis (brain swelling), inflammation of testicles or ovaries, deafness
Pertussis	DTaP ^a vaccine protects against pertussis (whooping cough).	Air, direct contact	Severe cough, runny nose, apnea (a pause in breathing in infants)	Pneumonia (infection in the lungs), death
Polio	IPV vaccine protects against polio.	Air, direct contact, through the mouth	May be no symptoms; sore throat, fever, nausea, headache	Paralysis, death
Pneumococcal	PCV13 vaccine protects against pneumococcus.	Air, direct contact	May be no symptoms; pneumonia (infection in the lungs)	Bacteremia (blood infection), meningitis (infection of the covering around the brain and spinal cord), death
Rotavirus	RV vaccine protects against rotavirus.	Through the mouth	Diarrhea, fever, vomiting	Severe diarrhea, dehydration
Rubella	MMR ^{**} vaccine protects against rubella.	Air, direct contact	Children infected with rubella virus sometimes have a rash, fever, swollen lymph nodes	Very serious in pregnant women—can lead to miscarriage, stillbirth, premature delivery, birth defects
Tetanus	DTaP ^a vaccine protects against tetanus.	Exposure through cuts in skin	Stiffness in neck and abdominal muscles, difficulty swallowing, muscle spasms, fever	Broken bones, breathing difficulty, death

^a DTaP^a combines protection against diphtheria, tetanus, and pertussis.
^{**} MMR^{**} combines protection against measles, mumps, and rubella.

Last updated August 2018 (CDC/11/18)

Figure 4.8.10: Vaccine-Preventable Diseases. (Image by the CDC is in the public domain)

Safety

There are different risks to infant safety. According to the CDC, nonfatal injury rates varied by age group.

- Nonfatal suffocation rates were highest for those less than 1 year of age.
- Rates for fires or burns, and drowning were highest for children 4 years and younger.
- Children 1 to 4 years of age had the highest rates of nonfatal falls and poisoning.

And the leading causes of injury death also differed by age group.

- For children less than 1 year of age, two-thirds of injury deaths were due to suffocation.
- Drowning was the leading cause of injury or death for those 1 to 4 years of age.

car seat safety

Motor vehicle injuries are a leading cause of death among children in the United States. But many of these deaths can be prevented.

- In the United States, 723 children ages 12 years and younger died as occupants in motor vehicle crashes during 2016, and more than 128,000 were injured in 2016.

- One CDC study found that, in one year, more than 618,000 children ages 0-12 rode in vehicles without the use of a child safety seat or booster seat or a seat belt at least some of the time.
- Of the children ages 12 years and younger who died in a crash in 2016 (for which restraint use was known), 35% were not buckled up.⁶⁷

Buckling children in age- and size-appropriate car seats, booster seats, and seat belts reduces the risk of serious and fatal injuries:

- Car seat use reduces the risk of injury in a crash by 71-82% for children when compared to seat belt use alone.
- Booster seat use reduces the risk for serious injury by 45% for children aged 4–8 years when compared with seat belt use alone.
- For older children and adults, seat belt use reduces the risk of death and serious injury by approximately half.⁶⁸

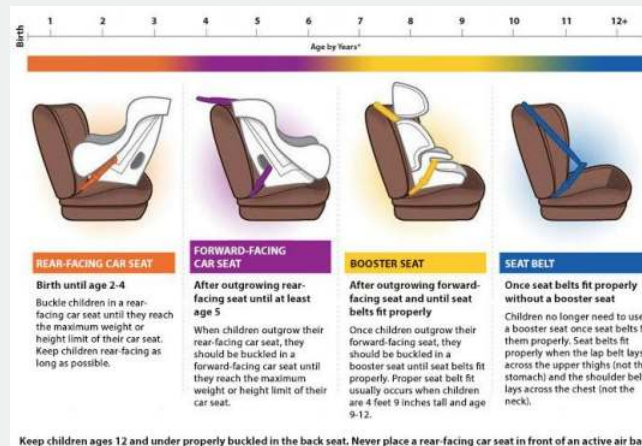


Figure 4.8.11: The different types of car seats based on age. (Image by the CDC is in the public domain)

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4.9: Sleep

A newborn typically sleeps approximately 16.5 hours per 24-hour period. This is usually polyphasic sleep in that the infant is accumulating the 16.5 hours over several sleep periods throughout the day (Salkind, 2005). The infant is averaging 15 hours per 24-hour period by one month, and 14 hours by 6 months. By the time children turn two, they are averaging closer to 10 hours per 24 hours. Additionally, the average newborn will spend close to 50% of the sleep time in the Rapid Eye Movement (REM) phase, which decreases to 25% to 30% in childhood.⁷⁰

Sudden Infant Death Syndrome and Safe Sleep

Sudden Infant Death Syndrome (SIDS) is identified when the death of a healthy infant occurs suddenly and unexpectedly, and medical and forensic investigation findings (including an autopsy) are inconclusive. SIDS is the leading cause of death in infants 1 to 12 months old, and approximately 1,500 infants died of SIDS in 2013 (CDC, 2015). Because SIDS is diagnosed when no other cause of death can be determined, possible causes of SIDS are regularly researched. One leading hypothesis suggests that infants who die from SIDS have abnormalities in the area of the brainstem responsible for regulating breathing (Weekes-Shackelford & Shackelford, 2005).⁷¹



Figure 4.9.1: A baby sleeping safely. (Image by the U.S. Department of Health and Human Services is in the public domain)

Risk Factors Babies are at higher risk for SIDS if they:

- Sleep on their stomachs
- Sleep on soft surfaces, such as an adult mattress, couch, or chair or under soft coverings
- Sleep on or under soft or loose bedding
- Get too hot during sleep.
- Are exposed to cigarette smoke in the womb or in their environment, such as at home, in the car, in the bedroom, or other areas
- Sleep in an adult bed with parents, other children, or pets; this situation is especially dangerous if:
 - The adult smokes, has recently had alcohol, or is tired.
 - The baby is covered by a blanket or quilt.
 - The baby sleeps with more than one bed-sharer.
 - The baby is younger than 11 to 14 weeks of age.

Reducing the Risks There have been dramatic improvements in reducing baby deaths during sleep since the 1990s, when recommendations were introduced to place babies on their back for sleep. However, since the late 1990s, declines have slowed.

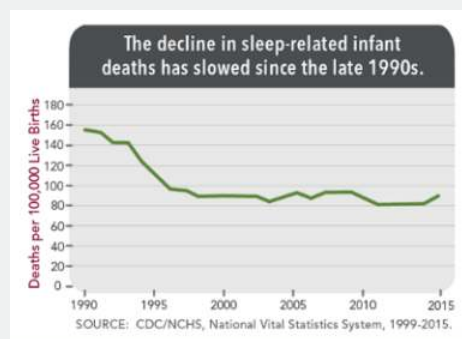


Figure 4.9.2: A graph showing the decline in sleep-related infant deaths. (Image by the CDC is in the public domain)

In 2012, the Back to Sleep campaign became the Safe to Sleep campaign. Safe to Sleep aims to educate all caregivers about SIDS and safe sleep practices. Current recommendations to reduce the risk of SIDS and other sleep-related causes of infant death:

- Always place baby on his or her back to sleep (for naps and at night).
- Use a firm and flat surface.
- Use only a tight fitting sheet on the sleep surface; no other bedding or soft items in the sleep area.
- Breastfeed.
- Share your room with a baby, but on a separate surface designed for infants (not your bed).
- Do not put soft objects, toys, crib bumpers, or loose bedding under, over, or anywhere near baby's sleep area.
- Do no smoke during pregnancy or allow smoking around baby.
- Consider giving baby a pacifier.
- Do not let baby get too hot during sleep.
- Get regular health care (including vaccines).
- Avoid products that go against safe sleep recommendations, especially those that claim to prevent or reduce the risk of SIDS.
- Do not use heart or breathing monitors to reduce the risk of SIDS. 74

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4.S: Summary

In this chapter we looked at:

- Physical changes during the first two years
- Some common infant reflexes
- How fine and gross motor skills develop
- Sensory capacities during the first two years
- Health and safety for infants and toddlers
- The sleep needs during the first two years and ways to reduce the risk of SIDS

In the next chapter we are going to be taking a closer look at theories that help us explain the cognitive and language development during infancy and toddlerhood.

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CHAPTER OVERVIEW

5: Cognitive Development in Infancy and Toddlerhood

Learning Objectives

After this chapter, you should be able to:

1. Describe the substages of the Piaget's sensorimotor stage.
2. Explain how the social environment affects cognitive development according to Vygotsky's theory.
3. Discuss the progression of language development during the first two years.
4. Compare the theories of language development.
5. Define classical and operant conditioning.
6. Summarize the different types of memory

In an effort to better understand the large spectrum of cognition that infants and toddlers go through, it is important to analyze and comprehend various theories that relate to their growth and development. This chapter will take a look at the following theorists: Piaget, Vygotsky, Chomsky, Skinner, Pavlov, Watson, Bandura, and Bronfenbrenner.

[5.1: Piaget](#)

[5.2: Vygotsky](#)

[5.3: Cognitive Milestones](#)

[5.4: Language Development](#)

[5.5: Theories of Cognitive Development, Learning, and Memory](#)

[5.6: Memory and Attention](#)

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5.1: Piaget

Jean Piaget is the most noted theorist when it comes to children's cognitive development. He believed that children's cognition develops in stages. He explained this growth in the following stages:

1. Sensory Motor Stage (Birth through 2 years old)
2. Preoperational Stage (2-7 years old)
3. Concrete Operational Stage (7-11 years old)
4. Formal Operational Stage (12 years old- adulthood)

In this cognitive chapter we will focus on his first stage which occurs in infancy.¹

Piaget and Sensorimotor Intelligence

Piaget describes intelligence in infancy as **sensorimotor** or based on direct, physical contact. Infants taste, feel, pound, push, hear, and move in order to experience the world. Let's explore the transition infants make from responding to the external world reflexively as newborns to solving problems using mental strategies as two years old.

Table 5.1.1: Substages of Piaget's Sensorimotor Stage²

Substage	Age	Description
Substage One: Simple Reflexes	Birth to 1 month	This active learning begins with automatic movements or reflexes. A ball comes into contact with an infant's cheek and is automatically sucked on and licked.
Substage Two: Primary Circular Reactions	1 to 4 months	The infant begins to discriminate between objects and adjust responses accordingly as reflexes are replaced with voluntary movements. An infant may accidentally engage in a behavior and find it interesting such as making a vocalization. This interest motivates trying to do it again and helps the infant learn a new behavior that originally occurred by chance. At first, most actions have to do with the body, but in months to come, will be directed more toward objects.
Substage Three: Secondary Circular Reactions	4 to 8 months	The infant becomes more and more actively engaged in the outside world and takes delight in being able to make things happen. Repeated motion brings particular interest as the infant is able to bang two lids together from the cupboard when seated on the kitchen floor.
Substage Four: Coordination of circular reactions	8 to 12 months	The infant can engage in behaviors that others perform and anticipate upcoming events. Perhaps because of continued maturation of the prefrontal cortex, the infant becomes capable of having a thought and carrying out a planned, goal-directed activity such as seeking a toy that has rolled under the couch. The object continues to exist in the infant's mind even when out of sight and the infant now is capable of making attempts to retrieve it.
Substage Five: Tertiary Circular Reactions	12 to 18 months	The infant more actively engages in experimentation to learn about the physical world. Gravity is learned by pouring water from a cup or pushing bowls from high chairs. The caregiver tries to help the child by picking it up again and placing it on the tray. And what happens? Another experiment! The child pushes it off the tray again causing it to fall and the caregiver to pick it up again!
Substage Six: Internalization of Schemes and Early Representational thought	18 months to 2 years	The child is now able to solve problems using mental strategies, to remember something heard days before and repeat it, to engage in pretend play, and to find objects that have been moved even when

Substage	Age	Description
		out of sight. Take for instance, the child who is upstairs in a room with the door closed, supposedly taking a nap. The doorknob has a safety device on it that makes it impossible for the child to turn the knob. After trying several times in vain to push the door or turn the doorknob, the child carries out a mental strategy learned from prior experience to get the door opened-he knocks on the door! The child is now better equipped with mental strategies for problem- solving.



Figure 5.1.1: An infant sitting in a highchair. (Image by [holycalamity](#) is licensed under [CC BY-SA 2.0](#))

Evaluating Piaget's Sensorimotor Stage

Piaget opened up a new way of looking at infants with his view that their main task is to coordinate their sensory impressions with their motor activity. However, the infant's cognitive world is not as neatly packaged as Piaget portrayed it, and some of Piaget's explanations for the cause of change are debated. In the past several decades, sophisticated experimental techniques have been devised to study infants, and there have been a large number of research studies on infant development. Much of the new research suggests that Piaget's view of sensorimotor development needs to be modified (Baillargeon, 2014; Brooks & Meltzoff, 2014; Johnson & Hannon, 2015).

Object Permanence

One necessary modification would be to when children develop object permanence. Infants seem to be able to recognize that objects have permanence at much younger ages than Piaget proposed (even as young as 3.5 months of age).

The A-not-B Error

The data does not always support Piaget's claim that certain processes are crucial in transitions from one stage to the next. For example, in Piaget's theory, an important feature in the progression into substage 4, coordination of secondary circular reactions, is an infant's inclination to search for a hidden object in a familiar location rather than to look for the object in a new location. Thus, if a toy is hidden twice, initially at location A and subsequently at location B, 8- to 12-month-old infants search correctly at location A initially. But when the toy is subsequently hidden at location B, they make the mistake of continuing to search for it at location A. **A-not-B error** is the term used to describe this common mistake. Older infants are less likely to make the A-not-B error because their concept of object permanence is more complete.

Researchers have found, however, that the A-not-B error does not show up consistently (Sophian, 1985). The evidence indicates that A-not-B errors are sensitive to the delay between hiding the object at B and the infant's attempt to find it (Diamond, 1985). Thus, the A-not-B error might be due to a failure in memory. Another explanation is that infants tend to repeat a previous motor behavior (Clearfield & others, 2006; Smith, 1999).

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5.2: Vygotsky

Development is Determined By Environmental Factors

Piaget set the tone for much of current-day research but his theory has also received a great deal of criticism. Many believe that Piaget ignored the huge influence that society and culture have in shaping a child's development. At a similar time, another researcher named Lev Vygotsky (1896–1934) had come to similar conclusions as Piaget about children's development, in thinking that children learned about the world through physical interaction with it. However, where Piaget felt that children moved naturally through different stages of development, based on biological predispositions and their own individual interactions with the world, Vygotsky claimed that adult or peer intervention was a much more important part of the developmental process.

Vygotsky concentrated more on the child's immediate social and cultural environment and his or her interactions with adults and peers. He argued that development occurred first through children's immediate social interactions, and then moved to the individual level as they began to internalize their learning. While Piaget saw the child as actively discovering the world through individual interactions with it, Vygotsky saw the child as more of an apprentice, learning through a social environment of others who had more experience and were sensitive to the child's needs and abilities. 4



Figure 5.2.1: An adult playing Legos with a child. (Image by Tabeajaichhalt on Pixabay)

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5.3: Cognitive Milestones

Children are actively learning about the world as they perceive it from the time they are in the womb. Here is a table of some of the cognitive milestones infants and toddlers typically develop.

Table 5.3.1: Cognitive Milestones ([Developmental Milestones](#) by the [CDC](#) is in the public domain)

Typical Age	What Most Children Do by This Age
2 months	• Pays attention to faces • Begins to follow things with eyes and recognize people at a distance • Begins to act bored (cries, fussy) if activity doesn't change
4 months	• Lets you know if she is happy or sad • Responds to affection • Reaches for toy with one hand • Uses hands and eyes together, such as seeing a toy and reaching for it • Follows moving things with eyes from side to side • Watches faces closely • Recognizes familiar people and things at a distance
6 months	• Looks around at things nearby • Brings things to mouth • Shows curiosity about things and tries to get things that are out of reach • Begins to pass things from one hand to the other
9 months	• Watches the path of something as it falls • Looks for things he sees you hide • Plays peek-a-boo • Puts things in mouth • Moves things smoothly from one hand to the other • Picks up things like cereal o's between thumb and index finger
1 year	• Explores things in different ways, like shaking, banging, throwing • Finds hidden things easily • Looks at the right picture or thing when it's named • Copies gestures • Starts to use things correctly; for example, drinks from a cup, brushes hair • Bangs two things together • Puts things in a container, takes things out of a container • Lets things go without help • Pokes with index (pointer) finger • Follows simple directions like "pick up the toy"
18 months	• Knows what ordinary things are for; for example, telephone, brush, spoon • Points to get the attention of others • Shows interest in a doll or stuffed animal by pretending to feed • Points to one body part • Scribbles on own • Can follow 1-step verbal commands without any gestures; for example, sits when you say "sit down"
2 years	• Finds things even when hidden under two or three covers • Begins to sort shapes and colors • Completes sentences and rhymes in familiar books • Plays simple make-believe games • Builds towers of 4 or more blocks

Typical Age	What Most Children Do by This Age
	• Might use one hand more than the other • Follows two-step instructions such as “Pick up your shoes and put them in the closet.” • Names items in a picture book such as a cat, bird, or dog

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5.4: Language Development

Do newborns communicate? Absolutely! However, they do not communicate with the use of language. Instead, they communicate their thoughts and needs with body posture (being relaxed or still), gestures, cries, and facial expressions. A person who spends adequate time with an infant can learn which cries indicate pain and which ones indicate hunger, discomfort, or frustration as well as translate their vocalizations, movements, gestures and facial expressions.



Figure 5.4.1: An infant looking up at the camera. (Image by Andres and Antoinette Ricardo used with permission)

Stages of Language Development

1. **Intentional Vocalizations: Cooing and taking turns:** Infants begin to vocalize and repeat vocalizations within the first couple of months of life. That gurgling, musical vocalization called cooing can serve as a source of entertainment to an infant who has been laid down for a nap or seated in a carrier on a car ride. Cooing serves as practice for vocalization as well as the infant hears the sound of his or her own voice and tries to repeat sounds that are entertaining. Infants also begin to learn the pace and pause of conversation as they alternate their vocalization with that of someone else and then take their turn again when the other person's vocalization has stopped. Cooing initially involves making vowel sounds like "oooo". Later, consonants are added to vocalizations such as "nanananana".
2. **Babbling and gesturing:** At about four to six months of age, infants begin making even more elaborate vocalizations that include the sounds required for any language. Guttural sounds, clicks, consonants, and vowel sounds stand ready to equip the child with the ability to repeat whatever sounds are characteristic of the language heard. Eventually, these sounds will no longer be used as the infant grows more accustomed to a particular language. Deaf babies also use gestures to communicate wants, reactions, and feelings. Because gesturing seems to be easier than vocalization for some toddlers, sign language is sometimes taught to enhance one's ability to communicate by making use of the ease of gesturing. The rhythm and pattern of language is used when deaf babies sign just as it is when hearing babies babble.
3. **Understanding:** At around ten months of age, the infant can understand more than he or she can say. You may have experienced this phenomenon as well if you have ever tried to learn a second language. You may have been able to follow a conversation more easily than to contribute to it.
4. **Holophrastic speech:** Children begin using their first words at about 12 or 13 months of age and may use partial words to convey thoughts at even younger ages. These one word expressions are referred to as holophrastic speech. For example, the child may say "ju" for the word "juice" and use this sound when referring to a bottle. The listener must interpret the meaning of the holophrase and when this is someone who has spent time with the child, interpretation is not too difficult. They know that "ju" means "juice" which means the baby wants some milk! But, someone who has not been around the child will have trouble knowing what is meant. Imagine the parent who to a friend exclaims, "Ezra's talking all the time now!" The friend hears only "ju da ga" which, the parent explains, means "I want some milk when I go with Daddy."



Figure 5.4.2: Two children playing with toys. (Image by the U.S. Air Force is in the public domain)

5. Underextension: A child who learns that a word stands for an object may initially think that the word can be used for only that particular object. Only the family's Irish Setter is a "doggie". This is referred to as underextension. More often, however, a child may think that a label applies to all objects that are similar to the original object. In overextension all animals become "doggies", for example.

6. First words and cultural influences: First words if the child is using English tend to be nouns. The child labels objects such as cup or ball. In a verb-friendly language such as Chinese, however, children may learn more verbs. This may also be due to the different emphasis given to objects based on culture. Chinese children may be taught to notice action and relationship between objects while children from the United States may be taught to name an object and its qualities (color, texture, size, etc.). These differences can be seen when comparing interpretations of art by older students from China and the United States.

7. Vocabulary growth spurt: One year olds typically have a vocabulary of about 50 words. But by the time they become toddlers, they have a vocabulary of about 200 words and begin putting those words together in telegraphic speech (I think of it now as 'text message' speech because texting is more common and is similar in that text messages typically only include the minimal amount of words to convey the message).

8. Two word sentences and telegraphic speech: Words are soon combined and 18 month old toddlers can express themselves further by using expressions such as "baby bye- bye" or "doggie pretty". Words needed to convey messages are used, but the articles and other parts of speech necessary for grammatical correctness are not yet used. These expressions sound like a telegraph (or perhaps a better analogy today would be that they read like a text message) where unnecessary words are not used. "Give baby ball" is used rather than "Give the baby the ball." Or a text message of "Send money now!" rather than "Dear Mother. I really need some money to take care of my expenses."9



Figure 5.4.3: A toddler playing with a toy telephone. (Image by Salim Virji is licensed under CC BY-SA 2.0)

Language Milestones

In the first two years of life, children go from communicating by crying to being able to express themselves with words. Here is a table of common language milestones for infants and toddlers.

Table 5.4.1: Language Milestones (Developmental Milestones by the CDC is in the public domain)

Typical Age	What Most Children Do By This Age
2 months	• Coos, makes gurgling sounds • Turns head toward sounds
4 months	• Begins to babble • Babbles with expression and copies sounds he hears • Cries in different ways to show hunger, pain, or being tired
6 months	• Responds to sounds by making sounds • Strings vowels together when babbling (“ah,” “eh,” “oh”) and likes taking turns with parent while making sounds • Responds to own name • Makes sounds to show joy and displeasure • Begins to say consonant sounds (jabbering with “m,” “b”)
9 months	• Understands “no” • Makes a lot of different sounds like “mamamama” and “bababababa” • Copies sounds and gestures of others • Uses fingers to point at things
1 year	• Responds to simple spoken requests • Uses simple gestures, like shaking head “no” or waving “bye-bye” • Makes sounds with changes in tone (sounds more like speech) • Says “mama” and “dada” and exclamations like “uh-oh!” • Tries to say words you say
18 months	• Says several single words • Says and shakes head now • Points to show others what is wanted
2 years	• Points to things or pictures when they are named • Knows names of familiar people and body parts • Says sentences with 2 to 4 words • Follows simple instructions • Repeats words overheard in conversation • Points to things in a book

Child-Directed Speech

Why is a horse a “horsie”? Have you ever wondered why adults tend to use “baby talk” or that sing-song type of intonation and exaggeration used when talking to children? This represents a universal tendency and is known as **child-directed speech** or *parentese* (historically referred to as *motherese*). It involves exaggerating the vowel and consonant sounds, using a high-pitched voice, and delivering the phrase with great facial expression. Why is this done? It may be in order to clearly articulate the sounds of a word so that the child can hear the sounds involved. Or it may be because when this type of speech is used, the infant pays more attention to the speaker and this sets up a pattern of interaction in which the speaker and listener are in tuned with one another.¹²

Theories of Language Development

The following two theories of language development represent two extremes in the level of interaction required for language to occur (Berk, 2007).

Chomsky and the Language Acquisition Device

The view known as **nativism** advocated by Noam Chomsky suggests that infants are equipped with a neurological construct referred to as the **language acquisition device** or LAD that makes infants ready for language. Language develops as long as the

infant is exposed to it. No teaching, training, or reinforcement is required for language to develop.

Social Pragmatics

Another view emphasizes the child's active engagement in learning language out of a need to communicate. The child seeks information, memorizes terms, imitates the speech heard from others and learns to conceptualize using words as language is acquired. Many would argue that all three of these dynamics foster the acquisition of language (Berger, 2004)¹³

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5.5: Theories of Cognitive Development, Learning, and Memory

Pavlov

Ivan Pavlov (1880-1937) was a Russian physiologist interested in studying digestion. As he recorded the amount of salivation his laboratory dogs produced as they ate, he noticed that they actually began to salivate before the food arrived as the researcher walked down the hall and toward the cage. The dogs knew that the food was coming because they had learned to associate the footsteps with the food. The keyword here is “learned”. A learned response is called a “conditioned” response.

Pavlov began to experiment with this “psychic” reflex. He began to ring a bell, for instance, prior to introducing the food. Sure enough, after making this connection several times, the dogs could be made to salivate to the sound of a bell. Once the bell had become an event to which the dogs had learned to salivate, it was called a conditioned stimulus. The act of salivating to a bell was a response that had also been learned, now termed in Pavlov’s jargon, a conditioned response.

Notice that the response, salivation, is the same whether it is conditioned or unconditioned (unlearned or natural). What changed is the stimulus to which the dog salivates. One is natural (unconditioned) and one is learned (conditioned).

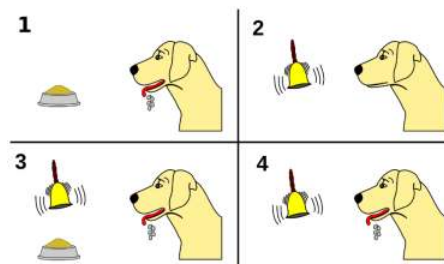


Figure 5.5.1: Pavlov’s experiments with dogs and conditioning. (Image by Maxxl² is licensed under CC BY-SA 4.0)

Let’s think about how classical conditioning is used on us. One of the most widespread applications of classical conditioning principles was brought to us by the psychologist, John B. Watson.¹⁵

Classical Conditioning

Classical conditioning is a form of learning whereby a **conditioned stimulus** (CS) becomes associated with an unrelated **unconditioned stimulus** (US), in order to produce a behavioral response known as a **conditioned response** (CR). The conditioned response is the learned response to the previously neutral stimulus. The unconditioned stimulus is usually a biologically significant stimulus such as food or pain that elicits an **unconditioned response** (UR) from the start. The conditioned stimulus is usually neutral and produces no particular response at first, but after conditioning, it elicits the conditioned response.

If we look at Pavlov’s experiment, we can identify these four factors at work:

- The unconditioned response was the salivation of dogs in response to seeing or smelling their food.
- The unconditioned stimulus was the sight or smell of the food itself.
- The conditioned stimulus was the ringing of the bell. During conditioning, every time the animal was given food, the bell was rung. This was repeated during several trials. After some time, the dog learned to associate the ringing of the bell with food and to respond by salivating. After the conditioning period was finished, the dog would respond by salivating when the bell was rung, even when the unconditioned stimulus (the food) was absent.
- The conditioned response, therefore, was the salivation of the dogs in response to the conditioned stimulus (the ringing of the bell).¹⁶

Neurological Response to Conditioning

Consider how the conditioned response occurs in the brain. When a dog sees food, the visual and olfactory stimuli send information to the brain through their respective neural pathways, ultimately activating the salivary glands to secrete saliva. This reaction is a natural biological process as saliva aids in the digestion of food. When a dog hears a buzzer and at the same time sees food, the auditory stimuli activates the associated neural pathways. However, since these pathways are being activated at the same time as

the other neural pathways, there are weak synapse reactions that occur between the auditory stimuli and the behavioral response. Over time, these synapses are strengthened so that it only takes the sound of a buzzer to activate the pathway leading to salivation.

Operant Conditioning

Operant conditioning is a theory of behaviorism, a learning perspective that focuses on changes in an individual's observable behaviors. In **operant conditioning theory**, new or continued behaviors are impacted by new or continued consequences. Research regarding this principle of learning was first studied by Edward L. Thorndike in the late 1800's, then brought to popularity by B.F. Skinner in the mid-1900's. Much of this research informs current practices in human behavior and interaction.

Skinner's Research

Thorndike's initial research was highly influential on another psychologist, B.F. Skinner. Almost half a century after Thorndike's first publication of the principles of operant conditioning, Skinner attempted to prove an extension to this theory—that all behaviors were in some way a result of operant conditioning. Skinner theorized that if a behavior is followed by reinforcement, that behavior is more likely to be repeated, but if it is followed by punishment, it is less likely to be repeated. He also believed that this learned association could end, or become extinct if the reinforcement or punishment was removed.

To prove this, he placed rats in a box with a lever that when tapped would release a pellet of food. Over time, the amount of time it took for the rat to find the lever and press it became shorter and shorter until finally, the rat would spend most of its time near the lever eating. This behavior became less consistent when the relationship between the lever and the food was compromised. This basic theory of operant conditioning is still used by psychologists, scientists, and educators today.

Shaping, Reinforcement Principles, and Schedules of Reinforcement

Operant conditioning can be viewed as a process of action and consequence. Skinner used this basic principle to study the possible scope and scale of the influence of operant conditioning on animal behavior. His experiments used shaping, reinforcement, and reinforcement schedules in order to prove the importance of the relationship that animals form between behaviors and results.

All of these practices concern the setup of an experiment. **Shaping** is the conditioning paradigm of an experiment. The form of the experiment in successive trials is gradually changed to elicit a desired target behavior. This is accomplished through reinforcement, or reward, of the segments of the target behavior, and can be tested using a large variety of actions and rewards. The experiments were taken a step further to include different schedules of reinforcement that become more complicated as the trials continued. By testing different reinforcement schedules, Skinner learned valuable information about the best ways to encourage a specific behavior, or the most effective ways to create a long-lasting behavior. Much of this research has been replicated on humans, and now informs practices in various environments of human behavior.¹⁷

Positive and Negative Reinforcement

Sometimes, adding something to the situation is reinforcing as in the cases we described above with cookies, praise and money. **Positive reinforcement** involves adding something to the situation in order to encourage a behavior. Other times, taking something away from a situation can be reinforcing. For example, the loud, annoying buzzer on your alarm clock encourages you to get up so that you can turn it off and get rid of the noise. Children whine in order to get their parents to do something and often, parents give in just to stop the whining. In these instances, negative reinforcement has been used.

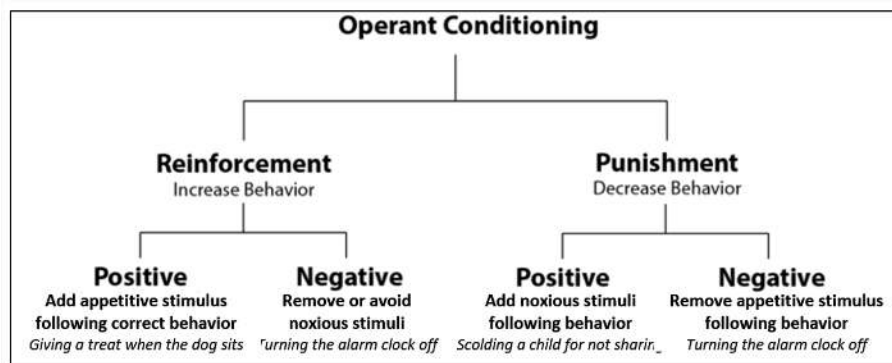


Figure 5.5.2: Reinforcement in operant conditioning. (Image by Curtis Neveu is licensed under CC BY-SA 3.0 and Modified from source image)

Operant conditioning tends to work best if you focus on trying to encourage a behavior or move a person into the direction you want them to go rather than telling them what not to do. **Reinforcers** are used to encourage a behavior; punishers are used to stop behavior. A **punisher** is anything that follows an act and decreases the chance it will reoccur. But often a punished behavior doesn't really go away. It is just suppressed and may reoccur whenever the threat of punishment is removed. For example, a child may not cuss around you because you've washed his mouth out with soap, but he may cuss around his friends. Or a motorist may only slow down when the trooper is on the side of the freeway. Another problem with punishment is that when a person focuses on punishment, they may find it hard to see what the other does right or well. And punishment is stigmatizing; when punished, some start to see themselves as bad and give up trying to change.

Reinforcement can occur in a predictable way, such as after every desired action is performed, or intermittently, after the behavior is performed a number of times or the first time it is performed after a certain amount of time. The schedule of reinforcement has an impact on how long a behavior continues after reinforcement is discontinued. So a parent who has rewarded a child's actions each time may find that the child gives up very quickly if a reward is not immediately forthcoming. Think about the kinds of behaviors that may be learned through classical and operant conditioning. But sometimes very complex behaviors are learned quickly and without direct reinforcement. Bandura's Social Learning covered later in the chapter explains how.¹⁹

Watson and Behaviorism

Another theorist who added to the spectrum of the behavioral movement was John B. Watson. Watson believed that most of our fears and other emotional responses are classically conditioned. He had gained a good deal of popularity in the 1920s with his expert advice on parenting offered to the public. He believed that parents could be taught to help shape their children's behavior and tried to demonstrate the power of classical conditioning with his famous experiment with an 18 month old boy named "Little Albert". Watson sat Albert down and introduced a variety of seemingly scary objects to him: a burning piece of newspaper, a white rat, etc. But Albert remained curious and reached for all of these things. Watson knew that one of our only inborn fears is the fear of loud noises so he proceeded to make a loud noise each time he introduced one of Albert's favorites, a white rat. After hearing the loud noise several times paired with the rat, Albert soon came to fear the rat and began to cry when it was introduced.

Watson filmed this experiment for posterity and used it to demonstrate that he could help parents achieve any outcomes they desired, if they would only follow his advice. Watson wrote columns in newspapers and in magazines and gained a lot of popularity among parents eager to apply science to household order. Parenting advice was not the legacy Watson left us, however. Where he really made his impact was in advertising. After Watson left academia, he went into the world of business and showed companies how to tie something that brings about a natural positive feeling to their products to enhance sales. Thus the union of sex and advertising!²⁰ Sometimes we do things because we've seen it pay off for someone else. They were operantly conditioned, but we engage in the behavior because we hope it will pay off for us as well. This is referred to as vicarious reinforcement (Bandura, Ross and Ross, 1963).



Figure 5.5.3: A photograph taken during Little Albert research. (Image is in the public domain)

Do parents socialize children or do children socialize parents?

Bandura (1986) suggests that there is interplay between the environment and the individual. We are not just the product of our surroundings, rather we influence our surroundings. There is interplay between our personality and the way we interpret events and how they influence us. This concept is called reciprocal determinism. An example of this might be the interplay between parents and children. Parents not only influence their child's environment, perhaps intentionally through the use of reinforcement, etc., but children influence parents as well. Parents may respond differently with their first child than with their fourth. Perhaps they try to be the perfect parents with their firstborn, but by the time their last child comes along they have very different expectations both of themselves and their child. Our environment creates us and we create our environment.



Figure 5.5.4: A smiling infant playing with toys. (Image by OmarMedinaFilms on Pixabay)

Social Learning Theory

Albert Bandura is a leading contributor to **social learning theory**. He calls our attention to the ways in which many of our actions are not learned through conditioning; rather, they are learned by watching others (1977). Young children frequently learn behaviors through imitation. Sometimes, particularly when we do not know what else to do, we learn by modeling or copying the behavior of others. A new employee, on his or her first day of a new job might eagerly look at how others are acting and try to act the same way to fit in more quickly. Adolescents struggling with their identity rely heavily on their peers to act as role-models. Newly married couples often rely on roles they may have learned from their parents and begin to act in ways they did not while dating and then wonder why their relationship has changed.

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5.6: Memory and Attention

If we want to remember something tomorrow, we have to consolidate it into long-term memory today. **Long-term memory** is the final, semi-permanent stage of memory. Unlike sensory and short-term memory, long-term memory has a theoretically infinite capacity, and information can remain there indefinitely. Long-term memory has also been called reference memory, because an individual must refer to the information in long-term memory when performing almost any task. Long-term memory can be broken down into two categories: explicit and implicit memory.

Explicit Memory

Explicit memory, also known as conscious or **declarative memory**, involves memory of facts, concepts, and events that require conscious recall of the information. In other words, the individual must actively think about retrieving the information from memory. This type of information is explicitly stored and retrieved—hence its name. Explicit memory can be further subdivided into **semantic memory**, which concerns facts, and **episodic memory**, which concerns primarily personal or autobiographical information.

Episodic Memory

Episodic memory is used for more contextualized memories. They are generally memories of specific moments, or episodes, in one's life. As such, they include sensations and emotions associated with the event, in addition to the who, what, where, and when of what happened. An example of an episodic memory would be recalling your family's trip to the beach. Autobiographical memory (memory for particular events in one's own life) is generally viewed as either equivalent to, or a subset of, episodic memory. One specific type of autobiographical memory is a **flashbulb memory**, which is a highly detailed, exceptionally vivid "snapshot" of the moment and circumstances in which a piece of surprising and consequential (or emotionally arousing) news was heard. For example, many people remember exactly where they were and what they were doing when they heard of the terrorist attacks on September 11, 2001. This is because it is a flashbulb memory.

Semantic and episodic memory are closely related; memory for facts can be enhanced with episodic memories associated with the fact, and vice versa. For example, the answer to the factual question "Are all apples red?" might be recalled by remembering the time you saw someone eating a green apple. Likewise, semantic memories about certain topics, such as football, can contribute to more detailed episodic memories of a particular personal event, like watching a football game. A person that barely knows the rules of football will remember the various plays and outcomes of the game in much less detail than a football expert.

Implicit Memory

In contrast to explicit (conscious) memory, **implicit** (also called "unconscious" or "procedural") **memory** involves procedures for completing actions. These actions develop with practice over time. Athletic skills are one example of implicit memory. You learn the fundamentals of a sport, practice them over and over, and then they flow naturally during a game. Rehearsing for a dance or musical performance is another example of implicit memory. Everyday examples include remembering how to tie your shoes, drive a car, or ride a bicycle. These memories are accessed without conscious awareness—they are automatically translated into actions without us even realizing it. As such, they can often be difficult to teach or explain to other people. Implicit memories differ from the semantic scripts described above in that they are usually actions that involve movement and motor coordination, whereas scripts tend to emphasize social norms or behaviors.



Figure 5.6.1: A toddler walking. (Image on [Public Domain Pictures](#))

Short-Term Memory Storage

Short-term memory is the ability to hold information for a short duration of time (on the order of seconds). In the process of encoding, information enters the brain and can be quickly forgotten if it is not stored further in the short-term memory. George A. Miller suggested that the capacity of short-term memory storage is approximately seven items plus or minus two, but modern researchers are showing that this can vary depending on variables like the stored items' phonological properties. When several elements (such as digits, words, or pictures) are held in short-term memory simultaneously, their representations compete with each other for recall, or degrade each other. Thereby, new content gradually pushes out older content, unless the older content is actively protected against interference by rehearsal or by directing attention to it.

Information in the short-term memory is readily accessible, but for only a short time. It continuously decays, so in the absence of rehearsal (keeping information in short-term memory by mentally repeating it) it can be forgotten.

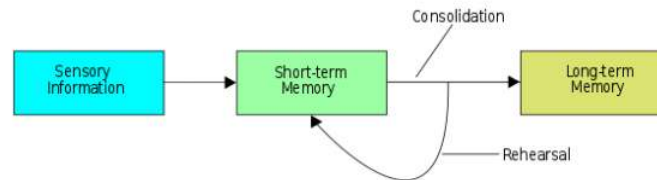


Figure 5.6.2: Diagram of the memory storage process. (Image by Wikipedia is licensed under [CC BY-SA 3.0](#))

Long-Term Memory Storage

In contrast to short-term memory, **long-term memory** is the ability to hold semantic information for a prolonged period of time. Items stored in short-term memory move to long-term memory through rehearsal, processing, and use. The capacity of long-term memory storage is much greater than that of short-term memory, and perhaps unlimited. However, the duration of long-term memories is not permanent; unless a memory is occasionally recalled, it may fail to be recalled on later occasions. This is known as forgetting.

Long-term memory storage can be affected by traumatic brain injury or lesions. Amnesia, a deficit in memory, can be caused by brain damage. Anterograde amnesia is the inability to store new memories; retrograde amnesia is the inability to retrieve old memories. These types of amnesia indicate that memory does have a storage process.²⁵

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