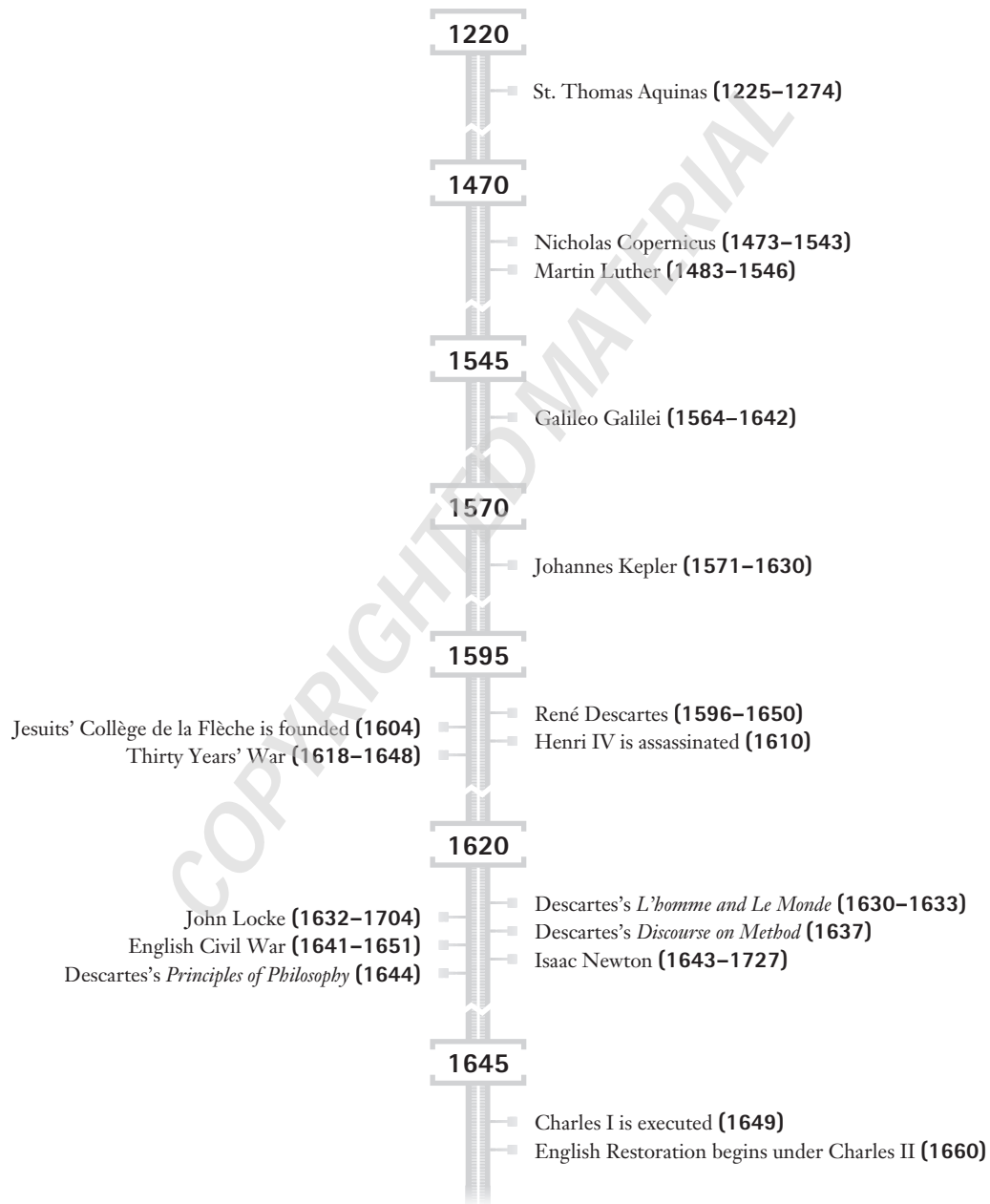


Chapter 1

TIMELINE 1220–1920

(In 25-year increments)





1670

- William III ascends to the English throne (1688)
- Newton's *Principia Mathematica* (1687)
- Glorious Revolution (1688)
- Locke's *An Essay Concerning Human Understanding* (1690)

1695

- Albrecht von Haller (1708–1777)
- David Hartley (1705–1757)
- Robert Whytt (1714–1766)

1720

- James Watt (1736–1819)
- Jean-Baptiste Lamarck (1744–1829)

1745

- Georg Prochaska (1749–1820)
- Hartley's *Observation of Man, His Frame, His Duty, and His Expectations* (1749)
- Franz Joseph Gall (1758–1828)
- Whytt's *On the Vital and Other Involuntary Motions of Animals* (1751)

1770

- François Magendie (1783–1855)
- Charles Bell (1774–1842)
- Marshall Hall (1790–1857)
- William Cullen (1794–1878)
- Jean-Pierre-Marie Flourens (1794–1867)

1795

- Jean-Baptiste Bouillaud (1796–1881)
- Gall develops his “science” of phrenology (1796)
- Charles Lyell (1797–1875)
- Johannes Müller (1801–1858)
- Charles Darwin (1809–1882)
- Lamarck proposes a theory of evolution (1809)





1820

Magendie helps create sensory-motor distinction (1822)
Lyell's *Principles of Geology* (1830–1833)
John Hughlings Jackson (1835–1911)

Gustav Fritsch (1837–1927)
Douglas Spalding (1840–1877)
Vestiges of the Natural History of Creation
(anonymous; 1844)

Hermann von Helmholtz (1821–1894)
Paul Broca (1824–1880)
Müller's *Handbuch der Physiologie des Menschen*
(1833–1840)
HMS *Beagle* docks at Falmouth, England (1836)
Eduard Hitzig (1839–1907)
David Ferrier (1843–1928)

1845

C. Lloyd Morgan (1852–1936)
Darwin's *Origin of Species* (1859)

Christine Ladd-Franklin (1847–1930)
Helmholtz's *Handbook of Physiological Optics*
(1856–1867)

1870

Darwin's *The Descent of Man* (1871)
Ladd-Franklin presents her theory of color (1892)

Broca uses postmortem autopsy (1870)
Darwin's *Expressions of the Emotions in Man and Animals* (1872)

1920

Ladd-Franklin's *Colour and Colour Theories* (1929)

Johns Hopkins awards Ladd-Franklin her PhD, earned in 1882 (1926)



CHAPTER 1

ORIGINS OF A SCIENCE OF MIND

Since it is the understanding that sets man above the rest of sensible beings, and gives him all the advantage and dominion which he has over them; it is certainly a subject, even for its nobleness, worth our labour to inquire into.

—John Locke, *An Essay Concerning Human Understanding*, 1690

INTRODUCTION

The discipline of Psychology, the history of which we explore in the following pages, did not exist before the mid- to late 19th century. Thus, to begin our history, we have to understand the intellectual and practical developments that made the emergence of such a field possible. As we discuss in this and the next chapter, at least four strands of thought and practice were important for the emergence of Psychology by the end of the 19th century: philosophy, physiology, evolution by natural selection, and creation of a psychological sensibility through everyday practices. Taken together, these four strands made possible both the science and the profession of Psychology, which Graham Richards has termed “big P” Psychology to differentiate the discipline from its subject matter, “little p” psychology (Richards, 2002). The latter includes the everyday psychology that people have used, and continue to use, to make sense of their lives.

The last strand, the creation of a psychological sensibility, is explained and elaborated in the next chapter. In this chapter, we unravel the first three strands by introducing you to basic ideas from the work of philosophers René Descartes and John Locke, the development of an experimental approach to understanding the relation between mind or brain and behavior in 19th-century physiology, and Charles Darwin’s work on evolution and how it included humans within the domain of natural laws.

We take as our point of departure the early modern period, that is, from the 17th century on, as the appropriate time to begin our analyses of the events that made possible the relatively recent emergence of Psychology. In terms of place, we begin with events and people in England and western Europe. This is not to claim that people in no other place or time wrote or thought psychologically about life; as we argue in later chapters, a background of thought relevant to psychology in other

cultures came to the fore nearer our own time. Rather, our aim is both pragmatic and historiographical. We are pragmatic because space is limited. Our historiographic rationale is that we think a sound argument can be made that the psychological sensibility characterizing our own time is of relatively recent origin, dating from changes in human experience and human society that were first directly noticeable in the early modern period in England and Europe, and then exacerbated by rapid social changes brought on by such macroscale events as the Industrial Revolution and the spread of Protestant religious beliefs and practices.

Lastly, we think it is useful to consider events and contributions to the development of a psychological sensibility from both elites—that is, those of the upper classes who had access to resources, education, and the power to disseminate their views—and everyday people. It is more usual in a textbook to consider only the contributions of elites, typically philosophers or “men

of science”; this chapter focuses on such contributions. The next chapter examines changes in everyday life that many people encountered and incorporated to make meaning in their lives. If, as we suggested in the introduction of this book, Psychology emerged from ways of living, then it follows that we should ask questions about when and how changes in everyday life occurred. While a full set of answers is not possible, since no complete record exists of how people lived and acted in earlier periods, we can provide at least a partial description and analysis based on extant records and writing. While we have an extensive record of philosophical thought from the early modern era, which we draw on in this chapter, in the next chapter we use what is available in the historical record to suggest how nonelites contributed to the emergence of practices that are also part of the lineage that led to the emergence of Psychology.

PHILOSOPHY: DESCARTES AND LOCKE AS EXEMPLARS

The gradual emergence of thought about man in naturalistic terms occurred, paradoxically, in the context of faith, both Protestant and Catholic. Religion and conflicts about correct beliefs and the proper conduct of daily life provided a background for this thinking that held both promise and threat. Nations went to war, and humans lost their livelihoods and often their lives over these matters. Both Descartes and Locke were profoundly affected by this context of religious and political strife, and each attempted to find ways to restore certainty of knowledge and order in civil society. Importantly, their thought also contributed to the eventual emergence of Psychology.

If any one word could characterize the 17th century in England and Europe, it might well be “uncertainty.” The modern nation-state was emerging, and war among nations was endemic. Civil strife that led to civil war in England brought horrors nearly unimaginable that left

their marks for generations afterward. The English civil war was directly related to religious beliefs and practices, but religion was also an important factor in changes elsewhere in Europe as the new orientation to personal faith and religious practice introduced by Martin Luther (1483–1546) in the 16th century spread unevenly across the continent. Families, as well as nations, were often divided over questions of faith, whether to follow the traditions of the Roman Catholic Church or one of the new Protestant faiths. When these faiths were linked to the power of the state, many people were persecuted and killed for their beliefs and many fled to other countries. So, on both the national and the personal levels, it was a time of uncertainty as the fabric of life was rewoven in a period of intense social upheaval.

Although no one event sparked the changes in the structure of life and thought in Europe, the assassination of the king of France, Henri IV (Henry of Navarre), in 1610, was crucial in that it made salient the need to find a new foundation for civil society. Henri IV was tolerant of religious diversity and provided guarantees for the civil rights of religious minorities, who were primarily Protestant. Powerful Catholics feared that he secretly planned to weaken Catholicism, and they arranged to have him killed. His assassination was a rejection of religious tolerance. Given the tensions between faiths across Europe and the high political stakes involved, Henri’s assassination was taken as evidence that only force could resolve religious disputes. In 1618, the Thirty Years’ War began that involved most states of Europe and led to widespread devastation and a marked reduction in population. Among the elites, those with time to reflect and write, a pressing concern became how we can find certainty for knowledge and living that religion seemingly failed to provide.

Not only was there religious conflict, but the challenges to orthodox understanding of the natural world by Nicholas Copernicus (1473–1543), Galileo Galilei (1564–1642), and Johannes Kepler (1571–1630) seemed to shake

the foundations of knowledge laid down by Aristotle and his 13th-century Christian interpreter, St. Thomas Aquinas (1225–1274). The calls by Sir Francis Bacon around the beginning of the 17th century for a science based on observation of the world and the collection of those observations into a coherent framework through inductive reasoning was also a challenge to orthodox thinkers. This context for the new philosophies placed the study of man within a naturalistic framework. While several philosophers were prominent, we have chosen two, Descartes and Locke, as our exemplars of the new natural philosophy. What linked these two preeminent thinkers was their quest to find a certainty that could underpin civil life.

René Descartes (1596–1650)

Descartes was 22 years old when the Thirty Years' War began. Descartes's mother died when he was young. He lived with his grandparents and his two older siblings because his father, a lawyer, worked some distance away. A precocious child, at age 8 he was placed in the Collège at La Flèche, a Jesuit school. When he graduated at age 16, he had probably received as excellent an education as was available at the time. He was schooled in the Aristotelian beliefs, for example, about the organic soul and the intellective soul. Only humans were blessed with the latter and its chief characteristic, reason.

Two cautions are needed as we proceed. First, Descartes was not a psychologist, nor was he a protopsychologist. He was a philosopher concerned with placing knowledge on a sure foundation and from that foundation constructing knowledge about how the Creation worked, including the human brain and body. Descartes's worry about the certainty of knowledge was with him even as he finished school. What compounded this worry was the state of his world as a young man. As the long period of conflict that became the Thirty Years' War continued,

Descartes, along with other thoughtful people, perceived that the underpinnings of society were inadequate to support an enduring civil society. This, combined with the disputatiousness and inconclusive arguments of the leading philosophers and theologians of the day, led Descartes to seek a way to have certain knowledge.

His search led him to the method of doubt. Descartes decided to accept only those things that were so clear and distinct to him that there could be no possibility of doubt. As he later wrote, "Immediately I noticed that while I was trying thus to think everything false, it was necessary that I, who was thinking this, was something" (cited in R. Smith, 1997, p. 129). This led him to the famous phrase, *cogito ergo sum*, "I am thinking, therefore I exist." For Descartes, the rational soul, the I, was central. From that point, then, an argument was made for the existence of God and God's perfection as expressed in natural law. These indubitable facts, Descartes argued, were the foundation stones that made certainty of knowledge possible.

Second, Descartes was very much a person of his culture, time, and place. That is, he was a Catholic who sought avidly to keep his work within the bounds of orthodox belief. His adherence to Catholicism can be seen in his insistence that the mind is immaterial and the province of God. This meant that the soul (mind) is entirely distinct from the body. The soul is the seat of reason and directly amenable to divine influence; it cannot be reduced to materiality or explained in terms of mechanics. However, the implication of this is that all that is not soul can be examined in terms of mechanics and is amenable to explanations based in natural law. Descartes proposed that many functions previously considered to be mental and immaterial should be considered properties of the body. These included memory, perception, imagination, dreaming, and feelings; all of these were properties of the body and so could potentially be understood in naturalistic terms. This is the basis of what came to be referred to as the mind-body split or **mind-body dualism**.

To explain these functions, Descartes relied on an understanding of mechanics derived partly from then-recent discoveries in medicine—William Harvey’s (1578–1657) articulation of the heart as a pump for the blood—and from the artists and craftsmen of his time who had refined automata. Automata are self-moving mechanical objects, such as robots. Evidence shows that automata date from early in Chinese history, but they had been refined and made newly popular in the 16th and 17th centuries. The word “automaton” was coined in the early 17th century. Some automata that Descartes would have been familiar with included dolls that seemed to play musical instruments or enact a play. He also knew the royal gardens at St. Germain-en-Laye, outside Paris. There, using hydraulic pressure activated when visitors stepped on hidden plates, statues would move seemingly on their own. Descartes used the principle of this mechanical movement as a generative metaphor for understanding the functions of the body, including memory and other properties of the nervous system. He supposed that the cavities in the brain, the ventricles, were filled with animal spirits, which could flow through (hollow) nerves to effect bodily movement, just as the water filled the pipes at St. Germain and caused the statues to move.

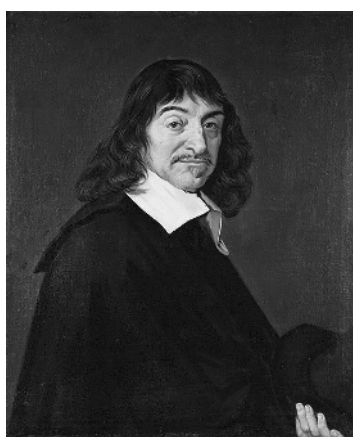


FIGURE 1.1 René Descartes

Still, the question remained as to how the body and soul interact. Descartes proposed the pineal gland in the center of the brain. The pineal gland, Descartes supposed, could both receive impressions of the body via the animal spirits and transmit motions to the body. This had the effect of reserving the soul as the seat of reason and the special province of divine influence. This approach fit with both the teachings of the Catholic Church and the new mechanical philosophy.

What is important about Descartes for the later development of both a psychological sensibility and the discipline of Psychology is that his work was critical for the transition to understanding humans in terms of natural law from the older conceptions that placed man at the apex of creation, a “little lower than the angels,” as the biblical psalmist had it. That is, his work was critical for a new articulation of man that placed his attributes firmly in the natural world, with what was increasingly referred to as human nature. His writings became a point of departure for many later writers who responded to his work, not always sympathetically. What emerged from his contributions was a legacy that led toward an understanding of man as fully part of nature.

John Locke (1632–1704)

How do we gain knowledge? For Locke, this was a fundamental question to which the answer was human experience. In proposing that human knowledge comes through sense experience, Locke laid the foundation for both empirical philosophy and, much later, the human sciences, including Psychology. As with Descartes, however, Locke was not a protopsychologist, nor did he seek to establish a discipline of Psychology. Locke was concerned with finding a basis for civil society that would diminish the likelihood of incessant conflict and loss of human life. For Locke, the way to do so was through helping people form clear and distinct ideas, free of the excesses of political and religious enthusiasms.

Locke's desire to find a new, less conflictual basis for human society is understandable given the political and religious context of his life.

When Locke was only 10 years old, the first English Civil War began, with the usual horrors that such wars bring. For the next 19 years, until the restoration of the monarchy in 1661, the British Isles were in near-constant conflict—political, military, or both. Religious differences were the contextual surround for the war, but political machinations between the king and Parliament were central. When King Charles I was captured and then beheaded, it marked perhaps the passing of an age in which it was thought that the monarch was God's representative on earth. The viciousness on both sides of the war must have brought great distress to Locke. When Charles II was crowned and the monarchy restored in 1661, Locke was still a young man, making his primary living as a tutor and adviser to the Earl of Shaftesbury. Locke was engaged with the politics of his age and was drawn into the political intrigues of the time. For a period in the 1680s, Locke had to leave England and live in Holland. He was there when the Glorious Revolution occurred, which deposed King James, brought William and Mary to the throne of England, and led to the establishment of a constitutional monarchy with enhanced power for the English Parliament.

Given these events, we can understand why Locke became so committed to finding a new basis for society. His ideas developed from the 1660s to the publication of his major work, *An Essay Concerning Human Understanding*, in 1690. The *Essay* is remarkable in many ways, but especially noteworthy is Locke's use of mind rather than soul. In doing so, he deliberately changed the terms of the debate about human knowledge. Descartes had reserved reason as an attribute of the soul, thus always leaving a space for the operation of divine influence, especially in regard to innate ideas given by God. Locke rejected the notion of innate ideas, such as God, although he did argue that humans have an innate power to reflect on their experiences. Instead of

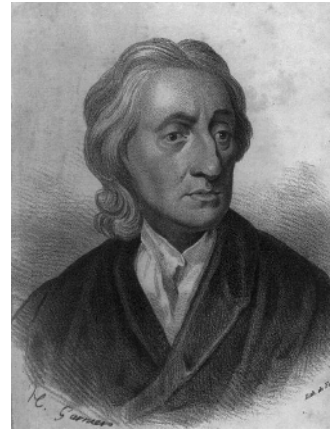


FIGURE 1.2 John Locke

innate ideas, Locke argued that all ideas come through experience. That is, at birth our minds are a *tabula rasa* (blank slate) on which sensory experiences are inscribed. The contents of the mind are those ideas that come from experiences.

Knowledge, then, is a matter of the mind gathering experiences, or ideas, from the material world. Locke proposed a way in which we could understand how ideas could move from simple to complex through association. In doing so, Locke seemed to offer a model of mental life that corresponded to Sir Isaac Newton's model of the mechanical basis of the physical world. Newton's *Principia Mathematica* was published in 1687, 3 years before Locke's *Essay*, and in some ways Locke's work echoes that of Newton. Just as Newton had proposed a model of how complex substances are due to the combination of less complex materials, so Locke's model suggested that complex ideas form from combinations of simple ideas, a position that became known as **associationism**. As he wrote, "As simple ideas are observed to exist in several combinations united together, so the mind has a power to consider several of them united together as one idea; and that not only as they are united in external objects, but as itself has joined them together. Ideas thus made up of several simple ones put together, I call complex; such as are

beauty, gratitude, a man, an army, the universe” (Locke, 1690, p. 159). Why is this so important for us today? First, Locke, like Newton, made human experience central to knowledge. This led to subsequent emphases by philosophers on what was later called epistemology, the study of the way we know. And it placed a premium on **empiricism**, that is, knowledge gained through the senses, which came to characterize British philosophy and led to later developments that were crucial for a discipline of Psychology.

Beyond this, Locke’s work made individual experience gained in the material world highly important. In the political and religious context of his time, this generated great debate, with some even labeling Locke an atheist. But the practical result was the privileging of the empirical world, thus strengthening arguments for natural religion and for a society predicated upon human experience. It is this emphasis on human experience that is arguably Locke’s greatest contribution and one that had the greatest import for later developments in political and scientific, including psychological, realms.

The Legacy of Descartes and Locke for Psychology

The time from the publication of Locke’s *An Essay Concerning Human Understanding* in 1690 to the early years of the 19th century is often called the “long” 18th century. Some scholars and texts have referred to it as the Age of Enlightenment or Age of Reason. Many people contributed to the debates about intellectual and practical issues that were conducted among educated people and were central to changes in governance and the way humans in Europe related to one another. The legacy of Descartes and Locke found in these contributions and debates is that now such issues about man are framed as part of nature and that the right way to understand and discuss them is in terms of human nature. This is not to say that religious beliefs and creeds played no part in these discussions. Especially in the case of

Descartes, the relationship of this new thinking to religious belief was much pondered. The outcome, however, was that man was increasingly seen as part of nature and was to be understood in terms of the natural world.

PHYSIOLOGY AND MEDICINE: THE SEARCH FOR MATERIAL EXPLANATIONS OF HUMAN NATURE

While philosophers and educated people engaged with notions of man as part of nature, efforts were also made to systematically explore what this would mean in terms of the functions of the human body, including the brain. The term “experiment” or “experimental” came into vogue to express this systematic exploration. By the end of the 19th century, the experiment became the method of discerning truth and the laboratory became the place where truth, through experimentation, was discovered. In terms of the human nervous system, this was a long and circuitous route with many points of contention and debate. The legacy of Descartes to this debate was that the higher mental powers—rationality, purposiveness, and so on—remained the province of divine influence. So while the functions of the body, including the “lower” centers of the brain and the nervous system, could be understood in naturalistic or mechanical terms, the higher powers, including the cerebrum, were off limits. The effort to extend naturalistic explanation to the higher mental powers—indeed, to equate the brain and the mind—became a major debate in the 19th century. Perhaps not surprisingly, medicine was an arena where this work first occurred.

Medicine and Naturalistic Explanation

Harvey had described the circulation of the blood in 1628, demonstrating empirically that circulation of the blood is due to the action of the

heart, thus potentially understandable in naturalistic terms. After Locke, in the 18th century, physicians began to describe the actions of the mind in physiological terms, thus opening the door to experimentation as a way to potentially demonstrate this. The British physician David Hartley in his *Observations on Man, His Frame, His Duty, and His Expectations* (1749), employed Newton's suggestion that vibrations in nervous tissue could be responsible for some visual effects to develop a physiology of the nervous system predicated on association of ideas that could account for relations between mind and body. However, it should be noted that Hartley's aim was religious, to inspire his fellow man to pursue God's design for humans.

The experimentation and writing of the 18th-century British physicians Robert Whytt (1714–1766) and William Cullen (1794–1878) both facilitated the public's understanding that mind and brain were intimately connected and offered a way to elide the old mind–body dualism that bedeviled research on mental processes. Whytt suggested in his 1751 book *On the Vital and Other Involuntary Motions of Animals* that an organism's response to stimuli involved the action of volition, a function of the higher mental powers, but this volitional response was not necessarily conscious. Whytt called this the principle of sentience, whose main function was the preservation of life and the unity of the organism. Before Whytt, only two kinds of action were thought possible: voluntary (rational) and physical (mechanical). Whytt's work proposed a third action, the action of stimuli on the organism. Thus, stimulated motion was best viewed as occurring on a continuum between voluntary and automatic, rather than as in absolute categories of free will or mechanism, and depended on the conditions necessary for preservation. The result of this stimulated motion was always to preserve the organism; thus, self-regulation was the effect. This implied the importance of function and offered an alternative to Cartesian dualism in understanding the relation of mind and body.

Why was this important for the later development of psychology? Whytt argued that the effect of a stimulus did not depend on whether it was a physical or mental event. The importance of the stimulus lay in its function. A mental event could function as a stimulus, just as a physical event could. This implied that the mind was intimately involved in bodily actions, not categorically separate as Cartesian dualism suggested. If mental and physical events were functionally equivalent, then perhaps psychological topics could be investigated without being bound by the old categories of Cartesian dualism. This, in fact, is what began to occur.

Cullen, who succeeded Whytt at the University of Edinburgh, advanced Whytt's work with an even greater emphasis on function and the role of stimulated motion as a self-regulatory principle. Cullen replaced Whytt's principle of sentience with the concept of energy as the vital principle. Energy was quantifiable, and the measure of excitation in the organism was possible. Gustav Theodor Fechner (1801–1887), who is discussed in Chapter 3, drew upon this work for his later development of psychophysiology. The impact of the work of Whytt and Cullen has not often been noted in histories of psychology because of their affiliation with medicine, but their work was crucial in that they provided a language and a group of principles that placed the role of the nervous system front and center in understanding how the mind and body are related.

Relatedly, the work of Whytt and Cullen was part of a broader movement in the late 18th and early 19th centuries toward emphasizing the importance of understanding the relation between the organism and the environment in terms of self-regulation. The latter principle came to the fore by the end of the 18th century in several fields, the political economy of Adam Smith (1723–1790) being a prime example with its invisible hand as the regulator of the market (see Chapter 2). Here, again, we see the relation between technology and science in terms of guiding or generative metaphors. In the 17th

century, we saw how Descartes drew upon the popular technology behind automata to explain how the body works. In the 18th century, the idea of a governor or self-regulator as found in the new steam engines of James Watt was employed to explain how the organism engaged in self-regulation via feedback loops between mental–physical events and their stimulation of the organism.

In Europe in this period, several physicians investigated the relationships among mind, brain, and body. Perhaps most notable was Albrecht von Haller, whose experiment-based theories suggested a way for the mind to act on the body through the nervous system. By the end of the 18th century, the Austrian physician and anatomist Franz Joseph Gall (1758–1828) had begun to argue that the brain was the organ of mind and that its faculties were empirically demonstrable. Gall was a major figure in what became a nearly century-long debate over the extent to which mental abilities, or the functions of the brain and nervous system, could be understood in naturalistic terms. An implication of this was the question of whether a soul or some higher power was needed to account for the most complex mental abilities, including the will. Some investigators sought to avoid the theological debate by contending that mechanical processes only extended as far as the subcortex. The cortex was reserved for the divine influence of some higher natural law. Gall's work called that contention into question.

Gall was born in Germany and settled in Vienna, where he received his medical degree. In Vienna he made his first scientific contributions when he demonstrated that two types of substance were found in the brain: gray matter (the cell bodies of nerve cells) and white matter (subcortical brain areas containing nerve cell axons). He also showed that the two hemispheres of the brain were connected by commissures. However, what Gall became known for was his organology, later renamed **phrenology** by some of his followers. **Organology** was Gall's method of discerning mental abilities by reading the bumps on



FIGURE 1.3 Franz Joseph Gall

someone's skull. Gall said that these ideas began when he was a schoolboy and noticed that some of his classmates who performed better on memory tasks than he did had bulging eyes. In his adult career, Gall further developed this schoolboy insight.

The brain, Gall argued, was composed of distinct parts, each of which had a function. Furthermore, the size of each of these parts, as observable through the examination of the skull, reflected the strength of the assigned function. Gall was not the first person to suggest that mental abilities or functions might occur at specific locales (the idea can be found in ancient medical texts), but his contention that the brain was the organ of mind and its workings could be understood entirely by empirical means did create controversy. First, it circumvented the duality of mind and body proposed by Descartes. Gall argued that all mental functions, including the higher powers reserved by Descartes as the province of divine influence, could be understood as the workings of the brain. In that sense, Gall was engaging in a philosophical argument, one that had important implications for future research. How was knowledge organized? Was it just a collection of sense impressions? Gall argued that there had to be a physical, innate foundation for organizing the knowledge that

came to us through our senses. Unlike the followers of Descartes, Gall's point was that there was no division of mind and body and no need to reserve higher mental functions for the providence of God.

Second, the search for a materialist basis for mind proved extremely important, although controversial. Perhaps the controversy helped make it important. Gall insisted that an empirical approach to the question of brain function was crucial. While Descartes had split the mind and body and set the terms for discussion of mental faculties, his approach was philosophical. As we have seen in the cases of Whytt and Cullen, investigators were increasingly seeking to account for mental abilities in terms of bodily processes. These investigators were relying on empirical rather than purely rational or philosophical methods. Their efforts were strongly resisted by some who felt they needed to allow for higher processes in terms of mental faculties that were uniquely human, for example, the will and the intellect.

But the movement begun by Descartes and Locke to study man as part of nature, to find natural laws to account for human mind and behavior, had already reset the agenda or the terms for what counted as fact. By the end of the 19th century, the investigation of the nervous system—of mind and brain—was firmly on the empirical and experimental basis on which Gall had insisted. Even those who sought to retain Descartes's division of mind and body were constrained to provide evidence gathered empirically and experimentally.

Jean-Pierre-Marie Flourens (1794–1867), a physiologist and member of the French medical and scientific establishment, was firmly committed to the Cartesian position that reserved the mind's higher faculties as the province of divine influence. He reacted strongly to what he perceived as Gall's materialist arguments. Flourens sought to discredit Gall and his followers by showing experimentally that no division of cerebral function existed. Using birds and a few mammalian species, Flourens systematically



FIGURE 1.4 Jean-Pierre-Marie Flourens

removed or ablated parts of the brain and then observed what happened when the animal recovered. He found no specific losses of function but rather general losses across several functions. He argued that this preserved the unity of the soul. What some critics, including Gall, pointed out was that Flourens had not been discriminate enough in carefully removing portions of the brain but had cut across several possibly distinct areas. Nevertheless, Flourens carried the day, at least among the medical and scientific establishment, because of the prestige of his social position, the compatibility of his findings with the established medical and philosophical views, and the usefulness of his results in discrediting the basis of what was now being called phrenology, which had become part of a social movement perceived as radical and antiestablishment (more on this in Chapter 2). Finally, and perhaps most importantly, Flourens's use of the experimental method fit with what was becoming the scientific norm for establishing fact—man could be understood in naturalistic terms as long as the investigation was experimental and laboratory based.

Flourens's championship of the unity of soul and mind and discounting of the localization of brain functions was the received view in French medicine and physiology for many years. There were dissenters such as the respected physiologist Jean-Baptiste Bouillaud (1796–1881), who collected more than 100 clinical cases that he suggested supported **localization of function**.

Bouillaud argued especially that language must be localized somewhere in the frontal lobes of the brain. It was the work of Paul Broca (1824–1880), however, that firmly established localization of articulate language through the case of Monsieur Leborgne, who had lost his ability to speak. Before the case of Leborgne, Broca had already established himself as a respected scientist. Like many other scientists of his day, he was influenced by scientists elsewhere in Europe, principally Germany, who were arguing that it was necessary to break phenomena down to their most essential elements to study them. Broca thought that perhaps the best way to understand the complexity of the nervous system was to look at the building blocks of mental activity; localization of function potentially offered a way to do this. Recent mapping of the surface of the cerebrum showed its diversity of form, and Broca argued that a law of physiology was that structure or form and function were related. Thus, different parts of the cortex may have different functions. When Leborgne died, six days after coming under Broca's care, an autopsy revealed damage to the rear portion of the left frontal lobe. Other cases soon were found where damage to the same area, second or third frontal convolution of the frontal lobe, was found with attendant loss of speech. While these findings did not settle the debate conclusively, they did sway medical and scientific opinion toward an acceptance of some sort of localization of function.

After Broca's work became widely known, other investigators began providing support for localization of cerebral function, thus extending naturalistic explanations to the highest levels of the nervous system. In Germany, two physicians, anatomist Gustav Fritsch (1837–1927) and psychiatrist Eduard Hitzig (1839–1907), used recent improvements in the control of electricity to stimulate what is now called the motor cortex of a dog. They found five sites that, when electrically stimulated, resulted in distinctive movements—on the opposite side of the body. Flourens had argued that the cortex had nothing to do with movement or motor control. Fritsch

and Hitzig understood their work as directly contributing support to cerebral localization. Perhaps paradoxically to 21st-century students, Fritsch and Hitzig were, like Flourens, committed to a Cartesian model of divine influence on higher centers of the brain and so restricted their conclusions on localization of motor control to motor centers and reserved other parts of the cortex for the higher mental powers.

David Ferrier (1843–1928) had no such compunctions. Ferrier, later knighted, built on the work of Gall and John Hughlings Jackson, a fellow neurologist, to demonstrate experimentally the wide extent of cerebral localization. Where Fritsch and Hitzig had found five areas of motor control, Ferrier found 15. His experimental animals included fish, birds, amphibians, monkeys, and chimpanzees. Ferrier quite self-consciously referred to his work as “scientific phrenology.” The title of his book summarizing his work on localization was *The Functions of the Brain*, and he dedicated it to Gall. Gall had predicted 50 years earlier, in his book *On the Functions of the Brain*, that someone would scientifically validate his insights in the next 50 years! Together with work in sensory–motor physiology, covered in the next section, this work on localization of function helped make a science of Psychology possible.

Research in the Physiology of the Nervous System

The discovery of the distinction between sensory and motor nerves, made independently by Charles Bell (1774–1842) in 1811 and François Magendie (1783–1855) in 1822, helped create the conditions for the exploration of the psychological implications of nervous system functions. Both Bell and Magendie pointed out that each type of sensory nerve was specific to a sensory modality—vision, hearing, touch, and so on. This became in the hands of Johannes Müller the doctrine of specific nerve energies, discussed later. Two research streams were linked

to this conceptualization. One was the concept of cerebral localization, already discussed. The other was work on the nervous system that led from the concept of specific nerve energies to a mechanistic model of human nervous system function. Both streams were part of the extension of a naturalistic model to encompass all of human nature. The concept of reflexes or reflex action was part of both streams. The discovery of specific sensory and motor nerves helped refine the previously ill-defined concept of reflex actions.

The concept of reflexes was not new to the 19th century. Whytt had employed the concept in his work on stimulated movement. The work of Whytt and his successor, Cullen, as noted, was critical in making it possible to link psychological questions to physiological methods. The Moravian-born physiologist Georg Prochaska employed the concept of reflexive action as part of his *vis nervosa* and *sensorium commune*. The former referred to the latent energy of the nerves that found expression in reflexes. *Sensorium commune* encompassed the medulla, basal ganglia, and spinal cord. Its role was to link sensory input to motor responses, without reliance on consciousness. These earlier uses of the reflex concept were typically not precise or precisely linked to physiological processes. But with the articulation of the sensory-motor distinction, the English physiologist Marshall Hall offered a specific connection between local nerve action and behavior. Hall's use of the reflex concept meant that behavior could be described in terms of nerve action, that consciousness does not have to be involved in behavior. This challenged the mentalistic conceptions of human behavior. If the brain and soul are equivalent, and the soul directs human behavior, then neurophysiology or experimentation is unnecessary. If, however, at least some aspects of human behavior are based in stimuli and responses at the physiological level, then experimental approaches to understanding human behavior are needed. Hall's proposal of reflex action and behavior was, at first, accepted only as accurate for the lower nerve centers. By the end of the 19th century, reflex action was

extended to the highest centers of the brain, as the work of Fritsch and Hitzig and that of Ferrier showed.

The Mechanization of the Brain

Johannes Müller (1801–1858) is often referred to as the person who made physiology a truly scientific field. His work occurred when German universities were expecting from professors original research by scholars devoted to specific topics. His handbook of physiology, published in several volumes from 1833 to 1840, fostered a critical, experimental approach to investigations of bodily processes that became the norm for other scientists. Müller extended the Bell-Magendie sensory-motor distinction with his **doctrine of specific nerve energies**. Each sensory modality, Müller argued, is specialized to respond in ways that are unique to it. So, visual nerves when stimulated give visual sensations. For example, pressing on the eye gives a visual sensation, just as looking at an object does. The doctrine also suggests that what determines our sensory experiences are not the objects-out-there in the physical world; rather, it is the structure and function of our nervous systems that determines what we sense. In this work and in his handbook, Müller promoted the importance of laboratory-based experimental work. In doing so, Müller



FIGURE 1.5 Johannes Müller

opened a line of research in physiology that led directly to Hermann von Helmholtz and Wilhelm Wundt and helped make a physiologically based Psychology possible.

Helmholtz (1821–1894), perhaps the greatest scientist of the 19th century, made contributions that changed physics, physiology, optics, audition, and psychology. While a student with Müller, Helmholtz joined with several fellow students—Emil du Bois-Reymond (1818–1896), Rudolf Virchow (1821–1902), and Ernst Brücke (1819–1892)—in committing himself to scientific explanations that relied only on physical and chemical explanations for all phenomena. Their work over the next half century made Germany the center of first-rank scientific work in several fields. The application of their mechanistic approach by others was also vital for helping transform Germany into an industrial and military powerhouse by the end of the century. It was also the background for the later development of Gestalt and holistic theories, especially after the defeat of Germany in World War I.

The contributions of Helmholtz to psychological topics included the measurement of the nerve impulse, previously thought to occur instantaneously. This indicated the possibility of measuring aspects of mental activity, using what was soon called the reaction time method. Helmholtz also showed that the **law of conservation of energy** applied to living organisms, including humans, as well as to the inorganic world. Using frogs as his experimental animal, Helmholtz showed that the energy and heat expended by a frog were equal to the calories available in the food the frog consumed. He went on to further work with these principles and eventually formulated the law of the conservation of energy: Energy cannot be created or destroyed; it can only be transformed from one kind to another. What this suggested was that machines, including the human machine, are devices for transforming energy from one kind to another kind. His work on optics led to a crucial distinction between sensation and perception. **Sensations** are, Helmholtz argued, merely the



FIGURE 1.6 Hermann von Helmholtz

Courtesy of the authors.

raw data that comes through our senses. These data are made meaningful by perception. In this account, **perception** is a psychological process that depends on the brain, prior learning, and our experiences.

In other psychologically related work, Helmholtz argued for a trichromatic theory of color vision. Like the earlier work of the English scientist Thomas Young, Helmholtz suggested that color vision resulted from the stimulation of specific receptors in the retina. It is a trichromatic theory because there are three primary receptor types—one each for red, green, and blue-violet. Other colors result from stimulation of more than one receptor; white results if all three receptor types are stimulated. One of American psychology's first-generation woman psychologists, Christine Ladd-Franklin (1847–1930), traveled to Germany to work

in Helmholtz's laboratory and subsequently published her own theory of color vision that was long regarded as the best available account of both the physical processes and the psychological experience of color perception. In 1892, she presented aspects of her theory to the International Congress of Psychology in London. Helmholtz was in attendance and received her paper extremely favorably. In 1929, her book *Colour and Colour Theories*, which reprinted over 37 years of her work on

color vision, was published. One reviewer for the *Saturday Review of Literature* characterized Ladd-Franklin's work as an account of the "evolution of the color sense from its beginnings to man" and proclaimed that "in the field of color and color theories she has no peer" (Helson, July 20, 1929). While not all aspects of Helmholtz's and Ladd-Franklin's theories have held up, both theories were, in their own time, considered quite successful in accounting for color vision.

Sidebar 1.1 Focus on *Christine Ladd-Franklin*

Christine Ladd was born in Windsor, Connecticut, on December 1, 1847, to a well-established New England family. When Vassar College, America's first college for women, was established in 1865, Ladd was ecstatic. After a vigorous campaign to convince her father and aunt (her mother had died when she was 12 years old) to let her attend the college, she was admitted to the second entering class in 1866. While at Vassar, her main academic interests were science and mathematics. She was particularly influenced by the prominent astronomer Maria Mitchell who was on faculty there. She graduated in 1869 and spent the next decade teaching science and math in secondary schools throughout the Northeast. She quickly came to abhor teaching, however, and she continued to study mathematics, occasionally publishing articles in the *Educational Times*.

In 1878, on the strength of her articles and her Vassar degree, she applied to Johns Hopkins University to pursue graduate studies in mathematics even though the university did not admit women. Her credentials were sufficient to convince the board of trustees to let her enroll as a special student. While at Johns Hopkins, she published several articles in the *American Journal of Mathematics*. Under the influence of the work of Charles Peirce, who acted as her dissertation adviser, she also became increasingly interested in symbolic logic. She turned her attention specifically to a long-standing problem in symbolic logic called the transformation of the syllogism. Her solution of this problem led prominent philosopher Josiah Royce of Harvard University to remark, "It is rather remarkable that the

(Continued)



FIGURE 1.7 Christine Ladd-Franklin
Courtesy of Rare Book and Manuscript Library, Columbia University, New York.

crowning activity in a field worked over since the days of Aristotle should be the achievement of an American woman" (as cited in Burr, June 24, 1922).

While at Johns Hopkins, Ladd also met and married Fabian Franklin, one of her graduate instructors in mathematics. In 1886 she conducted an investigation of a mathematical question concerning binocular vision, thus initiating her unfolding research on color vision. In 1891–1892, during her husband's sabbatical year in Europe, Ladd-Franklin studied in the Göttingen laboratory of George Elias Müller and then with Helmholtz in Berlin. In 1892, she delivered a paper outlining her own theory of color vision at the International Congress of Psychology in London. She spent much of the rest of her career elaborating upon and defending this theory.

Although Ladd-Franklin had completed all requirements for her doctorate in mathematics and logic in 1882, and had earned fellowships throughout her graduate training, she was not awarded the degree until 1926 on the 50th anniversary of Johns Hopkins. Although almost 80 years old, she attended the ceremony to receive her degree. Despite her impressive accomplishments, she never held a formal, full-time academic position. Determined to change the academic situation for other women, she was instrumental in establishing research fellowships for women and campaigned tirelessly for women's equal participation in academic life. For more on her efforts to fight sex discrimination in Psychology, see Chapter 11.

Like Müller before him, Helmholtz's theory placed importance on what happens within the human brain and nervous system rather than on the "real" physical properties of light waves. Again, this is part of the move toward placing all of nature, including humans in all their complex functions, within a framework of nature governed by definable natural laws. In Chapter 3, we show how the work in the physiological tradition of Müller and Helmholtz was directly linked to the emergence of Wundt's physiological psychology. Later in the book, we return to some issues raised by cortical localization when we explore the rise of neuroscience. Now, we turn to the work of Darwin to examine how it finally established human nature as just that, part of nature and thus subject to lawful relationships like the rest of nature.

DARWIN, NATURAL SELECTION, AND THE LAWS OF NATURE

Charles Darwin (1809–1882), naturalist, was a careful observer and thinker who was both a

person of his time and a person whose ideas transformed the course of history. His work affected many intellectual and scientific fields, including Psychology. At least four key contributions came to the development of Psychology from the work of Darwin. Perhaps most importantly, Darwin provided convincing evidence, both theoretical and practical, that humans are part of nature, subject to the same natural laws as all other creatures. Second, Darwin's approach called attention to the importance of considering the function of attributes and behaviors, thus making even more salient the role of functional explanations begun by earlier scientists like Whytt and Gall. Third, the scope and approach of Darwin's work created a space for the study of man in comparison with other animals (what became the field of comparative psychology) and the necessity of understanding the development of humans (what became the field of developmental psychology). Fourth, the emphasis on the role of natural selection of human variability facilitated thinking about individual differences, which became especially important in the development of American Psychology and

helped create applications of differential psychology to vastly diverse populations: students, criminals, the mentally disordered, and so on.

Darwin was born in the small village of Shrewsbury west of Birmingham, England, the son of a well-to-do physician, Robert Darwin, and his wife, Susannah. Darwin was of an impressive lineage. His father, Robert, was the son of Erasmus Darwin, a well-known physician of the late 18th century and author of a poetic treatise on evolution, *Zoonomia* (1794–1796). His mother was the daughter of Josiah Wedgwood, the founder of Wedgwood china. Charles Darwin married his cousin, Emma Wedgwood, in 1839.

By all accounts, Darwin was an indifferent student at the local Shrewsbury school, although he did have an insatiable appetite for nature—often going off on long hikes to collect worms, bugs, and other creatures. His father sent him to Edinburgh, Scotland, to be trained as a physician. Darwin had no stomach for the brutalities of surgery, and the medical training did not take. At last, he was sent to Christ College, Cambridge University, to become an Anglican clergyman. This seemed to suit Darwin fine, as he could easily envision himself as a country parson with plenty of free time to pursue his naturalist research.

While Darwin was not a great classroom student, his formal education was useful. He was an avid learner of those things that appealed to his interests in natural history both at Edinburgh and at Cambridge. For example, at Edinburgh, Darwin studied homologies, similarities due to a common descent, in marine animals with Robert E. Grant (1793–1874), who also espoused a theory of evolution proposed by Jean-Baptiste Lamarck (1744–1829). At Cambridge, where classwork was not necessarily the main engine of instruction and learning, Darwin came under the tutelage of John S. Henslow (1796–1861), professor of botany, and Adam Sedgwick (1785–1873), professor of geology. Both of these men, like the other professors at Cambridge, were Anglican priests. Neither of them believed in evolution,

but both were excellent instructors, not only formally but also in the many excursions and walks that Darwin participated in with them. In the summer of 1831, before he was to take Holy Orders, Darwin accompanied Sedgwick on a geological mapping tour of Wales. This experience and the close bond he had with both men were critically important in helping him move on to the next phase of his education and launch his professional life, as the onboard gentleman of science for the voyage of the HMS *Beagle*.

Journey to the Galapagos

In September 1831, Darwin interviewed with Captain Robert FitzRoy of the *Beagle* for the position of gentleman companion to the captain for a voyage to South America. The *Beagle* was commissioned to map the coasts of South America, and a 2-year voyage was planned. Instead, the voyage lasted nearly 5 years and became a trip around the world. Darwin, as the naturalist on board, busied himself collecting specimens and making careful geological observations throughout the trip. He sent home, via other returning ships, more than 2,000 specimens, including the fossils of previously unknown species. He filled a large scientific diary with thousands of geological and zoological data. While on the trip, Darwin sent back to his mentors in England numerous letters filled with his observations. Material excerpted from these letters was circulated in scientific circles and made Darwin a celebrated figure in British science even before he returned.

When Darwin set out on the voyage, he was a believer in what is called the **argument from design**. This was the view that all species had been designed by a Divine Creator for their specific place in nature. Darwin had also been exposed to theories of evolution, especially that of Lamarck, as noted earlier. Lamarck proposed a theory of evolution in 1809 that began with the spontaneous generation of living matter from nonliving matter. Since

then, Lamarck suggested, there has been a steady progression from simple forms of life to ever greater complexity. One mechanism for this progression, Lamarck posited, was the **inheritance of acquired characteristics**. This mechanism meant that changes in the adult organism can be passed on directly to the offspring. The well-worn example is the neck of a giraffe. According to the doctrine of inheritance of acquired characteristics, giraffes stretching their necks to reach higher leaves resulted in an increasingly elongated neck over many generations.

The implications of Lamarck's theory were quite unsettling to many people, especially those intensely vested in and privileged by the status quo. It suggested that life was not due to divine intervention and that human beings were just animals, although perhaps more developed than other animals. Lamarck's theory had a note of progress in it, that life and society were better characterized by change than by a static model. In the 1820s and 1830s in Britain, Lamarck's ideas were taken up by reformers, some of whom were radical. Many of the scientific elite, including Darwin's Cambridge instructors and his peers when he returned from his voyage, perceived these reformers as a threat to civil society and actively worked to discredit them. An extremely popular book in the 1840s, *Vestiges of the Natural History of Creation*, published anonymously, created a sensation with its claims of a naturalistic origin of life. Although technically not a natural history of evolution but instead a tract espousing a progressivist notion that change was necessary to have a society with greater equality of opportunity, the book did put the word "evolution" in the mouths and on the minds of much of the rapidly expanding reading public. It was also roundly condemned by all whom Darwin held in highest esteem. So, when he was developing his theory after the voyage, this was the context for his work.

No one event or observation on the voyage of the *Beagle* catapulted Darwin toward his eventual theory. Rather, and this was consistent

with his character, it was the accumulation of many observations and the careful pondering of what they meant that led him to slowly develop his theory over several years. However, the geological observations he made in South America, where it was clear that what had once been ocean floor or beach was now thousands of feet above sea level, and the myriad life forms on the Galapagos Islands were among the most important experiences he had. The former suggested that the earth had changed over a long period. This position was called the **uniformitarian hypothesis**, and it fit with the ideas of Charles Lyell, a geologist whose book, *Principles of Geology*, Darwin carried with him on the voyage. The uniformitarian hypothesis suggested that the physical geology of the earth was formed as a result of long, gradual processes. It contrasted with the notion that geological forms were the result of sudden, catastrophic changes, usually the result of divine intervention or handiwork—as in the biblical flood. Thus, the earth was much older than the literal reading

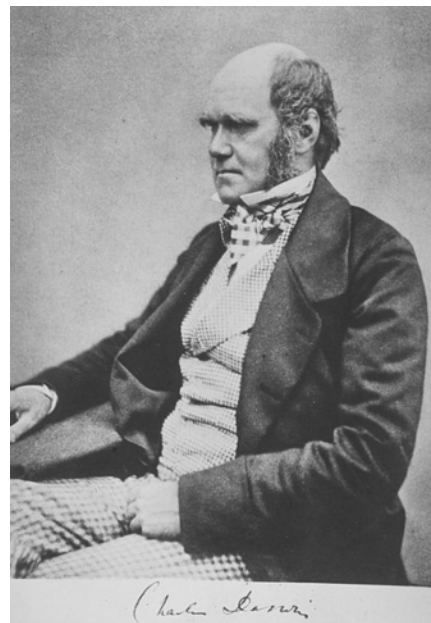


FIGURE 1.8 Charles Darwin

of the Bible would suggest and allowed enough time for the gradual change in organisms that could possibly result in new species.

The visit to the Galapagos Islands eventually provided Darwin with the material that he would use to articulate species change. The Galapagos are a series of small volcanic islands about 600 miles west of Ecuador on the equator. Darwin collected a large variety of species there and noticed the distribution of similar species, especially birds, across the islands. At the time, he did not see that many of the birds were of the same family. After his return to England, ornithologist John Gould pointed out that many of the birds were finches, each uniquely adapted to their island environments. When Darwin returned to England and began to develop his ideas about species change, the geographical distribution of the finches would become important for the development of his theory.

The *Beagle* docked at Falmouth, England, on October 2, 1836, nearly five years after it left Plymouth Sound. By the time it landed, Darwin's name was well known in British naturalist circles. His father arranged investments for him so that he could devote himself to a life of science. He soon launched a careful consideration of all data he had gathered and was puzzling over what it meant. We know from his notebooks—Darwin kept careful records of his observations and thoughts, which has proven a real boon for historians of science—that the question of species change emerged early in his puzzling.

Continuity: Humans and Natural Law

Darwin's theory of evolution by natural selection made humans subject to the same natural laws as other animals. This principle of the continuity of life was one of the most controversial aspects of Darwin's work, one he did not stress in the *Origin of Species* (1859). Yet, by insisting on continuity, Darwin helped make it possible to think of universal laws underlying behavior. If evolution occurs through a natural selection of variations that help an organism adapt to its environment,

then an important question becomes, What is the function of the characteristic under study, whether it be an elongated bird beak or human consciousness? How does the characteristic help the organism adapt and survive? We have seen that the question of function had become a topic of investigation in the research Whytt, Cullen, Prochaska, and others. Darwin made the question of function central to an evolutionary perspective. When the field of Psychology emerged some years after Darwin's work, questions of adaptation and function and of their derivative, learning, became central, especially in the utilitarian American context.

The possibility of using animals to understand human behavior emerged from Darwin's work and became the field of comparative psychology. Darwin himself explored this area in two books written later in life, *The Descent of Man* (1871), and *Expressions of the Emotions in Man and Animals* (1872). George Romanes, a protégé of Darwin's, extended the application of Darwin's evolutionary framework in an investigation of animal mental ability. While his writing about animals was fascinating, it suffered from a reliance on anecdotes about the supposedly amazing abilities or mental feats of various animals. It should be kept in mind that there was (and is) a long, time-honored tradition in Britain of anthropomorphizing animals (anthropomorphism is attributing human characteristics to animals). Others who followed, however, made the comparative method more rigorous, including C. Lloyd Morgan and Douglas Spalding. We explore these developments in later chapters, especially how studying animal behavior came to be used as a model for understanding how humans learn and adapt.

Darwin's theory also provided an impetus to the study of children as a way of understanding evolution. Darwin kept a diary of the development of his first son, William, and later published an article based on it, "Biographical Sketch of an Infant" (1877). Infants and young children, some thought, allowed us to see what humans were like earlier in the evolutionary process. A

more extreme version of this idea, although not espoused by Darwin, is captured in the phrase “ontogeny recapitulates phylogeny.” That is, the development of a human, beginning with conception, displays all stages of human evolution. The study of children’s lives and how such studies help us understand human behavior was an important aspect of the early years of the development of Psychology in North America and in Europe.

Finally, the notion that variability provides the material with which natural selection works gave rise in psychology to the idea of individual differences. Darwin’s cousin, Francis Galton (1822–1911), was captivated by the possibility of understanding human differences within an evolutionary framework. We explore Galton’s

work in a later chapter, especially in relation to the development of methods in psychology. Again, the development of Psychology in America facilitated a differential approach, and the idea of understanding different capacities (e.g., intellectual or academic) or different propensities (e.g., criminality and creativity) seemed important in managing a rapidly changing society. The idea of learning and adaptation that was inherent in Darwin’s theory lent itself to a focus on applied problems, both in research and in practice. So, especially in America, psychological expertise was viewed as having application to the diverse questions of how to improve schools and the performance of children in those schools, how to understand worker performance, and dozens of other applied questions.

SUMMARY

In this chapter, we sketched a history of some principal sources of a science of mind. These sources included philosophical debates, empirical and experimental work in medicine and physiology, and the naturalist work and evolutionary theory of Darwin. We hope we have indicated how deeply these sources were linked to one another. That is, work in physiology and medicine drew upon philosophical debates about the nature of being human and questions of epistemology, and philosophers were keenly interested in developments in science, often seeking to use research results in support of their own theories. Darwin was an inheritor of much prior work that had placed questions about humans in a framework of naturalism. In turn, he interpreted the data drawn from his naturalistic observations as showing that man was a creature subject to natural law like all other animals. His work, like that of others before him, helped place great emphasis on function. When the new Psychology developed a few years later, questions about the function of behavior and the mind

became crucial in the new science, especially in the United States. It would be going too far to say that by the end of the 19th century there was a consensus about human nature. What we can confidently say is that for most educated people in the Western world at the end of this era, humans were understood to be part of nature and, thus, subject to the laws of nature. By this time, the discipline of Psychology had begun (see Chapter 3), and many of these new psychologists saw their work as explaining just what these laws were in regard to human thinking and behavior.

Lastly, we also sought to indicate in this chapter just how deeply embedded these origins of a science of mind were in the social and cultural context of their times. War, political struggle, economics, religion, and technological changes were all critical parts of the cultural matrix from which modern science, including Psychology, emerged. In the next chapter, we turn to the practices of everyday life in this period to examine the emergence of the Western notion

of the self. This was the necessary counterpart to the developments outlined in this chapter in that the formation of an everyday psychology

was needed for the psychological sensibility upon which disciplinary Psychology could rely for its subject matter.

BIBLIOGRAPHIC ESSAY

A key text that has both inspired us and guided our thinking about the history of psychology in context, not only for this chapter but for all of our writing for this text, is Roger Smith's *Norton History of the Human Sciences* (1997). His 2007 volume, *Being Human*, has been equally helpful to us in how to think through the implications of historical narratives about human nature. Although idiosyncratic, Graham Richards's *Mental Machinery* (1992) is an immensely useful book for the philosophical background of this chapter. We also used his *Putting Psychology in its Place* (2002) for the contrast between "Big P Psychology" and "little p psychology." As part of our general overview, we also found useful several chapters in *The Cambridge History of Science* volume *The Modern Social Sciences*, edited by Theodore Porter and Dorothy Ross. For the early modern period and the roles of war, civil and religious strife, and philosophical problems engendered by the emerging nation-states, Stephen Toulmin's *Cosmopolis* (1990) has been influential. Our understanding of key events in the emergence of modern science owes a great deal to the work of Stephen Shapin, especially, *Leviathan and the Air-Pump* (1985), *A Social History of Truth* (1994), and *The Scientific Revolution* (1996), although any fault of interpretation is entirely ours. Roy Porter's *Flesh in the Age of Reason* (2003) helped us understand debates about body and mind in the 17th- and 18th-century contexts.

For work in physiology and medicine, we found many helpful articles and books,

chief among them were Anne Harrington's *Medicine, Mind and the Double Brain* (1987), Kurt Danziger's article "Origins of the Schema of Stimulated Motion" (1983), and Roger Smith's article "The Background of Physiological Psychology in Natural Philosophy" (1973). John van Wyhe's 2002 article on Gall helped us locate Gall's work in the context of medical debates about the functions of the brain. The philosophical and social implications of the localization of function debate have been superbly articulated by Robert Young's *Mind, Brain, and Adaptation in the 19th Century* (1991). *Origins of Neuroscience* (1994) by Stanley Finger is a useful encyclopedic approach to most of the major, and many of the minor, figures and events in the prehistory of the neurosciences.

For information on Ladd-Franklin's fascinating life and career, we recommend two publications by historian of psychology Laurel Furumoto: "Joining Separate Spheres" (1992), and "Christine Ladd-Franklin's Color Theory" (1994).

There is such a vast literature on Darwin that it is hard to know where to start or stop. Peter Bowler's short biographical study (1990) was helpful. *Darwin and the Emergence of Evolutionary Theories of Mind and Behavior* by Robert Richards (1987) and *From Darwin to Behaviourism* by Robert Boakes (1984) were both helpful and are drawn on again for later chapters.