MYSTERY HAS SHROUDED abstract art since it emerged in the late nineteenth century. Where did it come from? How did shape, color, and line—in and of themselves—come to be the vocabulary of the modern painter? I propose that two catalysts contributed to the precipitation of abstract art: the scientific worldview that developed after the publication in 1859 of Charles Darwin’s *On the Origin of Species by Means of Natural Selection* and the secular concepts of the spiritual that developed thereafter.¹ Darwin forever changed our sense of the universe; what had been static and eternal was now seen as constantly evolving. In the Enlightenment, Isaac Newton had cast the universe as a vast, immobile volume of space—the ether—in which the stars and planets move slowly and precisely, like a great clock, and Carolus Linnaeus organized the plants and animals of the natural world into a great “chain of being.” This metaphor, inherited from Aristotle, positioned all entities in order of ascending complexity, from mineral, plant, and animal to man and, ultimately, God.

This picture altered dramatically after Darwin presented overwhelming evidence that the links in the chain of being are not rigid but changeable over time. Bitter public debates erupted over the biblical and the Darwinian accounts of creation, and a new journalism emerged to meet the general public’s burgeoning fascination with science and its implications. Superbly illustrated science periodicals, books, and displays at public fairs brought science literacy to the general public and aesthetic inspiration to artists.² Within decades, most educated people of the West had adopted a scientific worldview.

This radical shift has long been recognized for its impact on science and culture; the purpose of this book is to demonstrate its infiltration into the visual arts and the resulting emergence of abstract art as part of the first wave of modern art in the late nineteenth century. By the 1870s painters were thinking of themselves as organisms responding to light; Monet’s landscapes became as fluctuating as the light falling on his retina. New high-powered microscopes were opening windows into hitherto invisible realms, and by the end of the century Art Nouveau and Jugendstil designers were working in biomorphic styles that captured the new evolutionary concept of life on the cellular level.
As artists in Munich and Moscow were creating the earliest abstract art, based in the new biology, the foundations of physics began to crumble. In the 1890s more windows were flung open into even smaller invisible worlds when X rays were discovered. In the first decade of the twentieth century, scientists realized that the basic building blocks of Newton’s clock—atoms—are not solid but mainly empty space and that they are not eternal but transmutable. In the 1920s the public grappled with the concept that the universe itself is in flux; indeed, that the universe is expanding. During the 1920s and ’30s, as Albert Einstein’s space-time cosmology was replacing Newton’s absolute space and time, artists in the second great wave of abstract art expressed the new quantum universe in geometric art and steel-and-glass architecture.

Modern art also responded to the new secular concepts of the spiritual that were formulated in the nineteenth century during major changes in religious beliefs. It would be too simple to describe this as a battle between science and religion because neither is a single-minded monolith, and there has been an ongoing dialogue between scientists and theologians. These important debates are outside the scope of this book, but a central thread woven into the fabric of modern art is the reformulation of theological questions in secular terms as artists and scientists have searched for new ways to understand the human condition during the first secular, scientific age in human history.3

I have organized this book around the history of modern science, tracing the major questions that have driven scientists and discussing related developments in the art world as the concerns of artists have intersected with—and been inspired by—those of scientists. My goal has been to begin with science and then, with this as background, to explore how artists have created symbols that express the modern scientific understanding of the natural world and the human condition. I begin the book in the early nineteenth century because the French Revolution was the political starting point for the rise of modern science and secularism. Before 1789 astronomy, physics, and natural history had been gentlemen’s pursuits, but as democratic reforms swept the West, chimney sweeps, seamstresses, and bankers also began to be attracted to the antiauthoritarian outlook underlying the scientific method, in which there were no preordained natural laws. When Darwin released Origin of Species in 1859, the burgeoning middle class was already primed to embrace a scientific worldview in which the truths of nature are determined by experiments that can be observed by all people equally. The French Revolution was also the spiritual starting point for modern art and science because it inspired the passionate quest for freedom and individualism that lies at the heart of psychology—the new science of the mind—and in the soul of Romanticism. The Romantic artists, philosophers, and scientists who took up the banner of liberty, equality, and fraternity also wrote the first creeds of the secular age—pantheism and positivism—variations of which are held to this day.

Historians of modern art have tended to focus on Paris as the art capital of the West. Following in the steps of trailblazers who have looked elsewhere, I argue that the core style of modernism—abstract art—originated and was sustained in the nation that led the world in science from the late nineteenth century to 1939—Germany—and in nations with a Germanic culture, especially Austria and Russia.4 The conceptual basis for both the art and the science, from Kant to Einstein, was provided by the philosophy of German Idealism—a powerful vision of the unity of nature. The destruction of German culture and the diaspora of intellectuals

© Copyright, Princeton University Press. No part of this book may be distributed, posted, or reproduced in any form by digital or mechanical means without prior written permission of the publisher.

For general queries, contact webmaster@press.princeton.edu
during World War II effectively ended German Idealism as a living tradition in the minds and hearts of artists and scientists; now a dead language, like Latin, it survives today in academia.

After 1945 the world center of science—and with it, avant-garde art—shifted to the United States. The subsequent history of the interface between the arts and sciences has been shaped by the disunity and diversity of American culture and by its tradition of utilitarianism. With the beginning of the nuclear age in 1945, the American public tended to be suspicious of science, and many new discoveries were greeted not with wonder but with dread. After the Cold War, the society of science was increasingly organized into interdisciplinary teams of scientists from around the world. Today it is common for research scientists, coming from diverse cultural backgrounds, to stress the disunity of the sciences and to be wary of the kind of overview—Weltanschauung—that guided German science for a century. As the immediacy of a nuclear threat has faded, the popularization of science has expanded, and younger generations of artists have begun to look again to science for inspiration. Citizens of today’s global culture routinely learn of extraordinary breakthroughs as astronomers look back in time at the early universe through telescopes positioned high above the earth’s atmosphere, and surgeons implant a life-saving tube, thinner than a human hair, into a patient’s artery. But this renewed wonder is tempered by ethical and social concerns also raised by discoveries, as artists, scientists, and the public grapple with troubling questions about cloning, bioterrorism, stem cell research, genetically modified crops, and euthanasia. And every educated person in the world lives with the uneasy awareness that at any moment the sleeping nuclear giant could be awakened.