

KNOWLEDGE IS POWER

FRANCIS BACON (1561–1626)

IN CONTEXT

BRANCH

Philosophy of science

APPROACH

Empiricism

BEFORE

4th century BCE Aristotle sets observation and inductive reasoning at the center of scientific thinking.

13th century English scholars Robert Grosseteste and Roger Bacon add experimentation to Aristotle's inductive approach to scientific knowledge.

AFTER

1739 David Hume's *Treatise of Human Nature* argues against the rationality of inductive thinking.

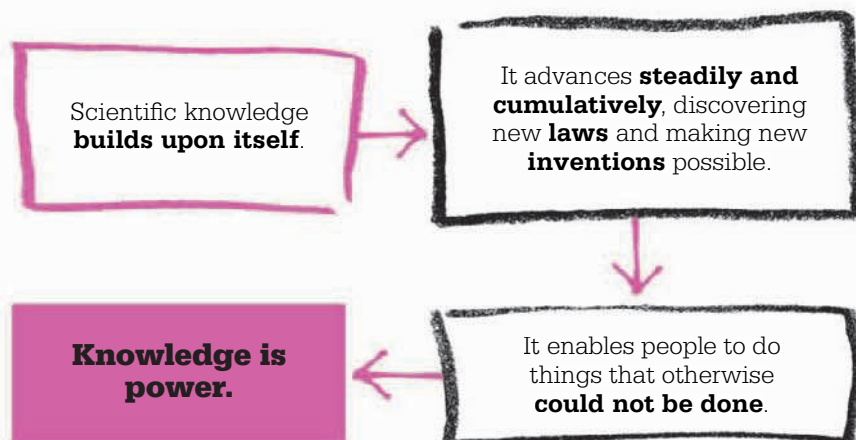
1843 John Stuart Mill's *System of Logic* outlines the five inductive principles that together regulate the sciences.

1934 Karl Popper states that falsification, not induction, defines the scientific method.

Bacon is often credited with being the first in a tradition of thought known as British empiricism, which is characterized by the view that all knowledge must come ultimately from sensory experience. He was born at a time when there was a shift from the Renaissance preoccupation with the rediscovered achievements of the ancient world toward a more scientific approach to knowledge. There had already been some innovative work by Renaissance scientists such as the astronomer Nicolaus Copernicus and the anatomist Andreas Vesalius, but this new period—sometimes called

the Scientific Revolution—produced an astonishing number of scientific thinkers, including Galileo Galilei, William Harvey, Robert Boyle, Robert Hooke, and Isaac Newton.

Although the Church had been broadly welcoming to science for much of the medieval period, this was halted by the rise of opposition to the Vatican's authority during the Renaissance. Several religious reformers, such as Martin Luther, had complained that the Church had been too lax in countering scientific challenges to accounts of the world based on the Bible. In response, the Catholic Church, which had already lost adherents to



See also: Aristotle 56–63 ■ Robert Grosseteste 333 ■ David Hume 148–53 ■ John Stuart Mill 190–93 ■ Karl Popper 262–65



Science, not religion, was regarded increasingly as the key to knowledge from the 16th century onward. This 1598 print depicts the observatory of Danish astronomer Tycho Brahe (1546–1601).

Luther's new form of Christianity, changed its stance and turned against scientific endeavor. This opposition, from both sides of the religious divide, hampered the development of the sciences.

Bacon claims to accept the teachings of the Christian Church. But he also argues that science must be separated from religion, in order to make the acquisition of knowledge quicker and easier, so that it can be used to improve the quality of people's lives. Bacon stresses this transforming role for science. One of his complaints is that science's ability to enhance human existence had previously been ignored, in favor of a focus on academic and personal glory.

Bacon presents a list of the psychological barriers to pursuing scientific knowledge in terms that he calls collectively the "idols of the mind." These are the "idols of the tribe", the tendency of human beings as a species (or "tribe") to generalize; the "idols of the cave", the human tendency to impose

preconceptions on nature rather than to see what is really there; the "idols of the marketplace", our tendency to let social conventions distort our experience; and the "idols of the theater", the distorting influence of prevailing philosophical and scientific dogma. The scientist, according to Bacon, must battle against all these handicaps to gain knowledge of the world.

Scientific method

Bacon goes on to argue that the advancement of science depends on formulating laws of ever-increasing generality. He proposes a scientific method that includes a variation of this approach. Instead of making a series of observations, such as instances of metals that expand when heated, and then concluding that heat must cause all metals to expand, he stresses the need to test a new theory by going on to look for negative instances—such as metals not expanding when they are heated.

Bacon's influence led to a focus on practical experimentation in science. He was, however, criticized for neglecting the importance of the imaginative leaps that drive all scientific progress. ■

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By far the best proof
is experience.

Francis Bacon

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Francis Bacon

Born in London, Francis Bacon was educated privately, before being sent to Trinity College, Cambridge, at the age of 12. After graduation, he started training as a lawyer, but abandoned his studies to take up a diplomatic post in France. His father's death in 1579 left him impoverished, forcing him to return to the legal profession.

Bacon was elected to parliament in 1584, but his friendship with the treasonous Earl of Essex held back his political career until the accession of James I in 1603. In 1618, he was appointed Lord Chancellor, but was dismissed two years later, when he was convicted of accepting bribes.

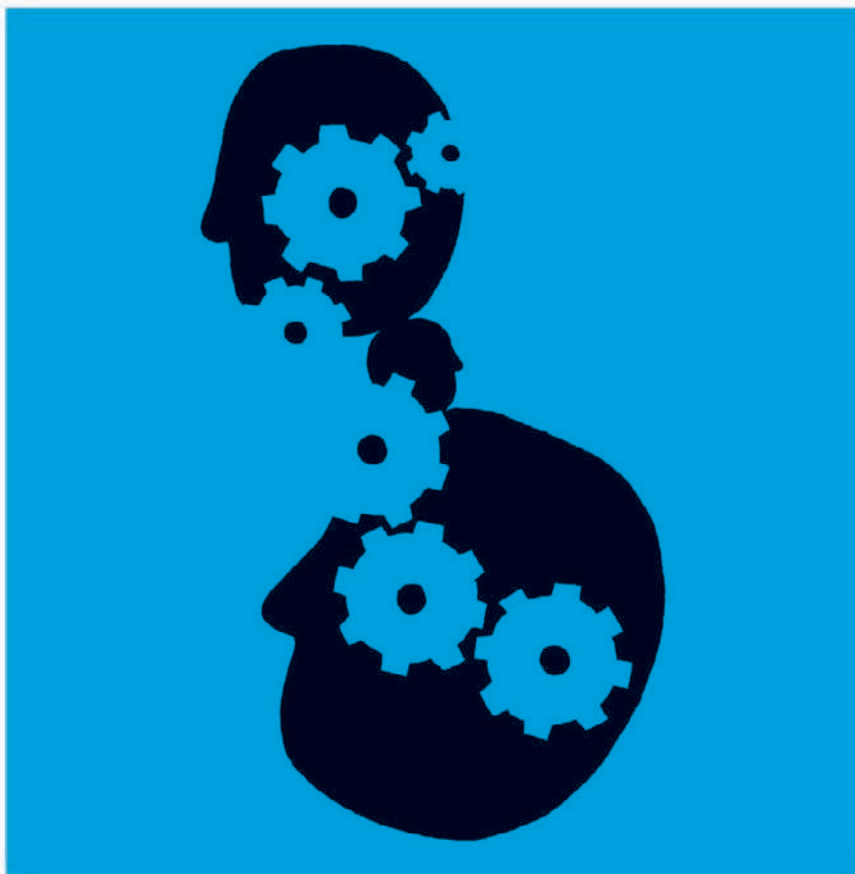
Bacon spent the rest of his life writing and carrying out his scientific work. He died from bronchitis, contracted while stuffing a chicken with snow, as part of an experiment in food preservation.

Key works

1597 *Essays*
1605 *The Advancement of Learning*
1620 *Novum Organum*
1624 *Nova Atlantis*

MAN IS A MACHINE

THOMAS HOBBES (1588–1679)



IN CONTEXT

BRANCH

Metaphysics

APPROACH

Physicalism

BEFORE

4th century BCE Aristotle disagrees with Plato's theory of a distinct human soul and argues that the soul is a form or function of the body.

1641 René Descartes publishes his *Meditations on First Philosophy*, arguing that mind and body are completely different and distinct entities.

AFTER

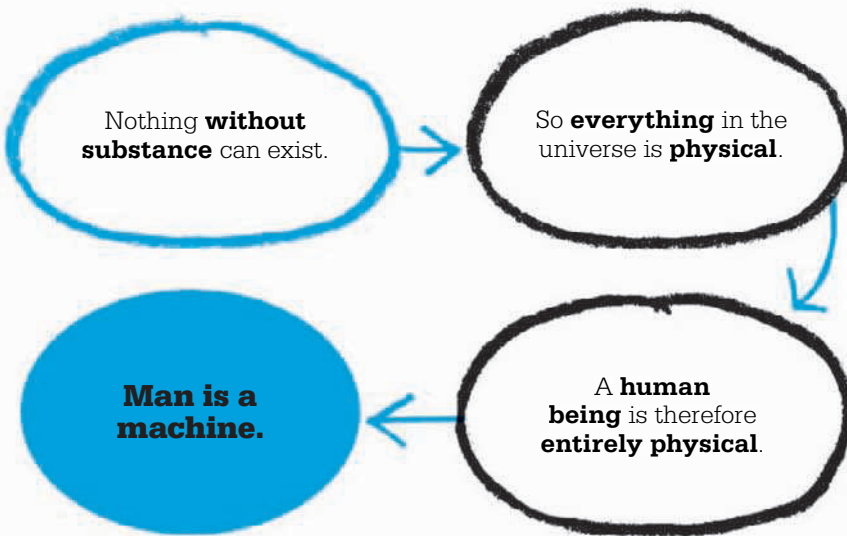
1748 Julien Offray de la Mettrie's *The Man Machine* presents a mechanistic view of human beings.

1949 Gilbert Ryle states that Descartes' idea that mind and body are separate "substances" is a "category mistake."

Although he is best known for his political philosophy, Thomas Hobbes wrote on a wide range of subjects. Many of his views are controversial, not least his defence of physicalism—the theory that everything in the world is exclusively physical in nature, allowing no room for the existence of other natural entities, such as the mind, or for supernatural beings. According to Hobbes, all animals, including humans, are nothing more than flesh-and-blood machines.

The kind of metaphysical theory that Hobbes favors was becoming increasingly popular at the time of his writing, in the mid-17th century. Knowledge in the physical sciences

See also: Aristotle 56–63 ■ Francis Bacon 110–11 ■ René Descartes 116–23 ■ Julien Offray de la Mettrie 335 ■ Gilbert Ryle 337



was growing rapidly, bringing clearer explanations of phenomena that had long been obscure or misunderstood. Hobbes had met the Italian astronomer Galileo, frequently regarded as the “father of modern science”, and had been closely associated with Francis Bacon, whose thinking had helped to revolutionize scientific practice.

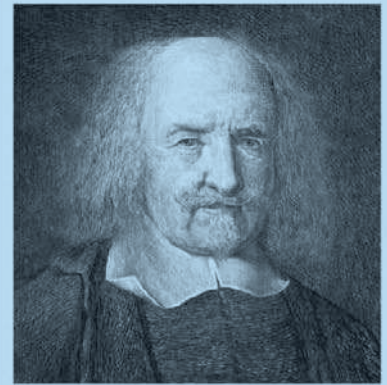
In science and mathematics, Hobbes saw the perfect counter to the medieval Scholastic philosophy that had sought to reconcile the apparent contradictions between reason and faith. In common with many thinkers of his time, he believed there was no limit to what science could achieve, taking it as a matter of fact that any question about the nature of the world could be answered with a scientifically formulated explanation.

Hobbes' theory

In *Leviathan*, his major political work, Hobbes proclaims: “The universe—that is, the whole mass of things that are—is corporeal,

that is to say, body.” He goes on to say that each of these bodies has “length, breadth, and depth”, and “that which is not body is no part of the universe.” Although Hobbes is stating that the nature of everything is purely physical, he is not claiming that because of this physicality everything can be perceived by us. Some bodies or objects, Hobbes declares, are imperceptible, even though they occupy physical space and have physical dimensions. These, he calls “spirits.” Some of them, »

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Life is but
a motion of limbs.
Thomas Hobbes



Thomas Hobbes

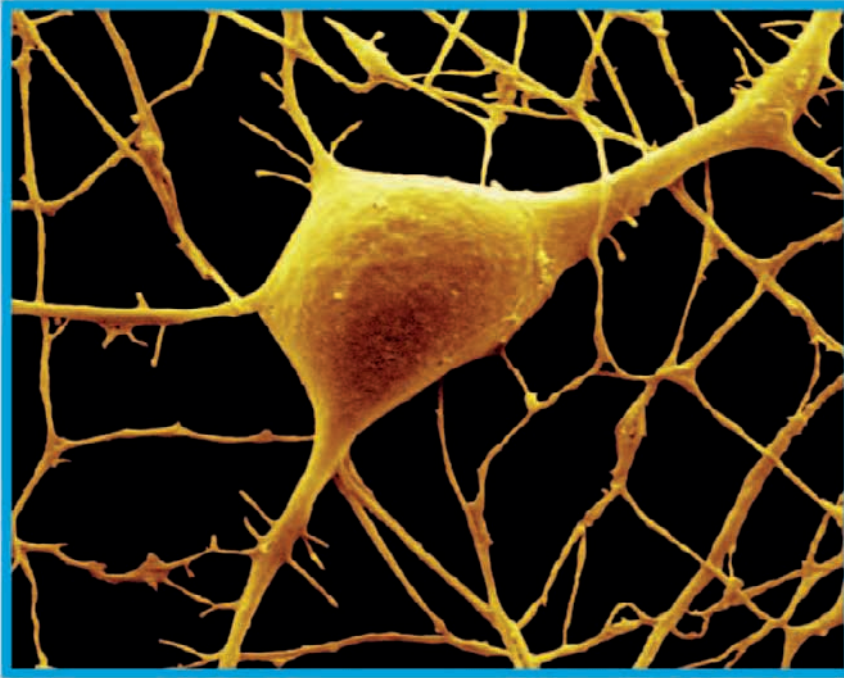
Orphaned in infancy, Thomas Hobbes was fortunately taken in by a wealthy uncle, who offered him a good education. A degree from the University of Oxford earned him the post of tutor to the sons of the Earl of Devonshire. This job gave Hobbes the opportunity to travel widely throughout Europe, where he met noted scientists and thinkers, such as the Italian astronomer Galileo Galilei as well as the French philosophers Marin Mersenne, Pierre Gassendi, and René Descartes.

In 1640, Hobbes fled to France to escape the English Civil War, staying there for 11 years. His first book, *De Cive*, was published in Paris in 1642. But it was his ideas on morality, politics, and the functions of society and the state, set out in *Leviathan*, that made him famous.

Also respected as a skilled translator and mathematician, Hobbes continued to write until his death at the age of 91.

Key works

1642 *De Cive*
1651 *Leviathan*
1656 *De Corpore*
1658 *De Homine*



labelled “animal spirits” (in line with a common view at the time) are responsible for most animal, and especially human, activity. These animal spirits move around the body, carrying with them and passing on information, in much the same way as we now think of the nervous system doing.

Sometimes, Hobbes seems to apply his concept of physical spirits to God and other entities found in religion, such as angels. However, he does state that God himself, but not other physical spirits, should be described as “incorporeal.” For Hobbes, the divine nature of God’s attributes is not something that the human mind is capable of fully understanding, therefore the term “incorporeal” is the only one that recognizes and also honors the unknowable substance of God. Hobbes does make clear, however, that he believes the existence and nature of all religious entities are matters for faith, not science, and that God, in particular, will remain

beyond our comprehension. All it is possible for human beings to know about God is that he exists, and that he is the first cause, or creator, of everything in the universe.

What is consciousness?

Because Hobbes considers that human beings are purely physical, and are therefore no more than biological machines, he is then faced with the problem of how to account for our mental nature. He makes no attempt to give an account of how the mind can be explained. He simply offers a general and rather sketchy account of what he thought science would eventually reveal to be the case. Even then, he only covers the mental activities such as voluntary motion, appetite, and aversion—all phenomena that can be studied and explained from a mechanistic point of view. Hobbes has nothing to say about what the modern-day Australian philosopher David Chalmers calls “the hard problem of

Hobbes believed that “spirits” carried information needed to function around the body. We now know that this is done by electrical signals, travelling along the neurons of the nervous system.

consciousness.” Chalmers points out that certain functions of consciousness—such as the use of language and the processing of information—can be explained relatively easily in terms of the mechanisms that perform those functions, and that physicalist philosophers have been offering variants of this approach for centuries. However, the harder problem of explaining the nature of subjective, first-person experience of consciousness remains unsolved by them. There seems to be a built-in mismatch between the objects of the physical sciences on the one hand and the subjects of conscious experience on the other—something that Hobbes does not seem to be aware of.

Hobbes’ account of his belief offers very little argument for his conviction that everything in the world, including human beings, is wholly physical. He appears not to notice that his grounds for the

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For what is the heart, but a spring; and the nerves, but so many strings; and the joints, but so many wheels, giving motion to the whole body.

Thomas Hobbes

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existence of imperceptible material spirits could equally be grounds for a belief in nonmaterial substances. To most people, something being imperceptible is more consistent with a mental than with a physical concept. In addition, because Hobbes' material spirits can only ever possess the same properties as other types of physical thing, they fail to offer any assistance toward an explanation of the mental nature of human beings.

Descartes' dualism

Hobbes also had to contend with the very different thinking about mind and body that Descartes set out in his *Meditations* of 1641. Descartes argues for the "Real Distinction" between mind and body—the notion that they are utterly distinct sorts of substance. In objections to Descartes' ideas that he expressed at the time, Hobbes makes no comment on this distinction. However, 14 years later, he addressed the problem again in a passage in his book *De Corpore*, presenting and criticizing what seems to be a muddled form of part of Descartes' argument. Here he rejects the conclusion Descartes came to—that mind and body are two distinct substances—on the basis that Descartes' use of the phrase "incorporeal substance" is an example of insignificant or empty language. Hobbes takes it to mean "a body without body", which appears to be nonsense. However, this definition must be based upon his own view that all substances are bodies; so what Hobbes appears to present as an

argument for his position that there can be no incorporeal minds, in fact depends upon his inaccurate assumption that the only form of substance is body, and that there is no possibility of incorporeal things existing at all.

A simple prejudice

As Hobbes' definition of physical spirits indicates, it is ultimately unclear exactly what he took "physical" or "corporeal" to mean. If it was meant to be simply anything that had three spatial dimensions, then he would be excluding much of what we, at the beginning of the 21st century, might regard as being "physical." For example, his theories about the nature of the world would rule out the science of sub-atomic physics.

In the absence of any truly clear notion of what his key term means, Hobbes' insistence that everything in the world can be explained in physical terms begins to look less and less like a statement of scientific principle. Instead, it starts to appear to be merely an unscientific—and

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Besides sense, and thoughts, and the train of thoughts, the mind of man has no other motion.

Thomas Hobbes

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unphilosophical—prejudice against the mental. But his mechanistic theories about the nature of our world were very much in keeping with the spirit of an age that was to radically challenge most of the prevailing views on human nature and social order, as well as those concerned with the substance and workings of the universe that we inhabit. It was this revolution in thinking that laid the foundations of our modern world. ■

While Hobbes was formulating his mechanistic ideas, scientists such as the physician William Harvey were using empirical techniques to explore the workings of the human body.

