

“On the Excellency and Grounds of  
the Corpuscular or Mechanical Philosophy”  
(Matthews, 109-118)

[The] philosophers and physicians of former days, who still savoured of the barbarism of their own age, and who today are justly despised ... [explained] appearances by explicitly fabricating suitable occult qualities or faculties, which were thought to be like little demons or spirits able to do what was required of them without any fuss, just as if pocket watches told time by some faculty of clockness without the need of wheels, or mills crushed grain by a fractive faculty without the need of anything like millstones.

- G.W. Leibniz

from the Preface to *New essays on human understanding* [Roger Ariew and Daniel Garber, trans. in G.W. Leibniz, *Philosophical Essays* (Indianapolis: Hackett, 1989), 306]

According to the traditional, Aristotelian view, change occurs when a body with an active potency to transmit a form comes into contact with another body with a corresponding passive potency to take on that form. As noted in the previous chapter, this view is still reflected in some of Bacon’s pronouncements. Bacon, too, remarked that change occurs when “actives” come into contact with “passives,” and he recommended the execution of an exhaustive research program, directed to uncovering just what “passives” undergo just what changes when brought into contact with just what “actives.” But, unlike Aristotle, Bacon lived in an age when the energy bottleneck had been traversed and people had acquired significantly more power to move things around. Their new power permitted them to construct devices that gave them even more power, these devices in turn allowed them to construct devices that gave them even more power, and it had come to seem like there might be no limit on the amount of power an ever expanding technology could place within people’s grasp. Adopting the standpoint of this age, Bacon believed that a knowledge of what actives produce what changes when brought into contact with what passives, combined with an increasing power to move both increasingly large and increasingly minute quantities of materials around, would put us in a position to change the course of nature so as to improve the material conditions of life.

But there was a problem standing in the way of the execution of this optimistic program. The active powers, forms and passive potencies that Aristotle supposed are behind all change in nature are mysterious. They work in hidden and often arbitrary ways. For example, sunlight melts wax but hardens clay. Why? The processes by which one and the same “active” brings about such different changes in two different “passives” are not evident to us. They result from “nature working within,” as Bacon said in one place. Saying, “The change occurs because sunlight has the active potency to transmit both the form of fluidity and the form of hardness, and that the wax is softened because it has a passive potency to take on the form of fluidity, but also a passive potency to resist taking on the form of hardness, while clay is the opposite,” does no more than report on the fact that one type of change, softening, occurs in one sort of circumstance, sunlight shining on wax, whereas another type of change, hardening, occurs in another sort of circumstance. Such knowledge is not to be disparaged. Even if you do not understand why working with an open spark or flame the vicinity of an open can filled with gasoline can suddenly cause the gasoline to explosively ignite, possession of the knowledge that



this change can occur in these circumstances can be of significant practical benefit. At the same time, however, if we are constrained to find out what things will happen in what circumstances only after the fact, by performing the experiment and waiting to see what happens, then we end up being confronted with an impossibly large research project. There are more different kinds of materials in nature than anyone could possibly count or classify (think of granite, sulphur, grass, wool, lamb's wool, wool of two-year old female lambs, wool of two-year old female lambs fed on grain from the region within 10km of Inverness, and so on). Combining all of these materials in all different ways in all different proportions under all possible circumstances (circumstances like temperature, time of day, circumstances of illumination, proximity to certain other objects) and waiting to see what happens after two minutes, ten minutes, three days, ten years, etc., is more than the largest and best funded research institution could possibly undertake.

Things would be much better if, instead of containing a large variety of different materials, differing in weight, solidity, hardness, elasticity, charge, explosiveness, and various other kinds of reactivity, nature contained just one kind of material. Things would be better yet if that one kind of material were totally inert — if it had no qualities to speak of, but was just cut up into little pieces of varying sizes and shapes, and these pieces were not attractive or repulsive, or charged or charmed in any way, but simply moved around and banged into one another. In that case there would be no mysterious forces or qualities that could only be discovered in materials by experience. All there would be would be pieces of inert stuff moving around as a consequence of the laws of motion and collision. In that case, we would have just a small job to perform: learn the laws of motion and collision and learn where each small piece happens to be located and how it happens to be moving, and from that we could calculate what would happen next and how to intervene in the course of nature to shape events.

Unfortunately, our world is not like that. It contains all sorts of different materials. Or does it? Already in ancient times there had been a minority view (that of Leucippus and Democritus, Epicurus and Lucretius), that everything just consists of inert “atoms,” all like one another except for their size, shape, location, and state of motion. The atomists took all the differences in weight, solidity, hardness, elasticity, and so on in the compound bodies we see around us to be consequences of how the small, inert particles composing those bodies are arranged and interlinked. Thinkers in early modern Europe, looking back at these ancient texts, saw that they presented a view of nature that, if correct, would significantly abbreviate the amount of empirical research we would otherwise need to do, would remove all the mysteries in nature (by reducing active forces and passive potencies to the effects of readily intelligible motions and collisions of particles), and would put us in an even better position to gain power over nature in order to improve the material conditions of life. That made the atomist view very attractive.

Another thing that made the atomist view attractive was its conformity to current technological practices. Devices like the wind mill, the printing press, and the mechanical clock, which had revolutionized life in the period, consisted of parts that worked by moving and pressing on or pulling one another. The effects produced by these devices were not mysterious. We could look into the machine and see how the originally impressed force traveled along the gears, axels, wheels, levers, and pulleys to produce the blast from the bellows, the printed page, or the motion of the hour and minute hands. It was attractive to think that all of nature might work like that.

Of course there were notable exceptions. The phenomena of magnetism exhibited in the workings of the compass and the explosive chemical reaction of gun powder resisted explanation



by mechanical means. In these cases there still seemed to be some hidden force of a non-mechanical kind responsible for the phenomena. But thinkers of the time hoped that the exceptions were merely apparent, and that further investigations would reveal a mechanism responsible for the operation rather than leave us having to accept the existence of further inexplicable powers residing in fundamentally different kinds of material. Bacon himself thought that a program of exhaustively combining all different kinds of materials in all different proportions and under all conceivable circumstances would be impossible to complete and unlikely to lead to any significant results in a reasonable span of time. Indeed, he went so far as to condemn such experimentation and suggested that we need some sort of guiding light to govern our choices of what tests to perform.

Some there are indeed who have committed themselves to the waves of experience, and almost turned mechanics; yet these again have in their very experiments pursued a kind of wandering inquiry, without any regular system of operations. And besides they have mostly proposed to themselves certain petty tasks, taking it for a great matter to work out some single discovery; — a course of proceeding at once poor in aim and unskillful in design. For no man can rightly and successfully investigate the nature of anything in the thing itself; let him vary his experiments as laboriously as he will, he never comes to a resting-place, but still finds something to seek beyond. And there is another thing to be remembered; namely, that all industry in experimenting has begun with proposing to itself certain definite works to be accomplished, and has pursued them with premature and unseasonable eagerness; it has sought, I say, experiments of Fruit, not experiments of Light; not imitating the divine procedure, which in its first day's work created light only and assigned to it one entire day; on which day it produced no material work, but proceeded to that on the days following. [*Works IV*, p.17]

Unfortunately, in this passage Bacon gave no indication of what he took the light that might guide us in our experiments to be. However, elsewhere, he suggested that, after conducting the right sequence of experiments, we might be able to get enough evidence to justify an inductive inference about the “latent constitution” that gives things their “forms” and their active and passive potencies to transmit or take on forms, as well as the “latent processes” whereby “actives” work on “passives” to change their forms. Indeed, he speculated that the “latent constitutions” of things might often or even always turn out to consist of an arrangement of differently shaped and moving but otherwise homogeneous particles, and that the “latent processes” might often or even always turn out to consist of mechanical interactions whereby the parts of one object alter the arrangement of the parts of another object as a result of motion and collision. And, just as it is possible to tell how a mechanical device like a clock or a bicycle will work just by looking at it and seeing how, through pushing and pulling of one part by another, the originally impressed collision leads the machine to move to produce the effect, so it would be possible to see the mechanism whereby actives bring about change in passives. Supposing we could develop fine enough instruments, it would become possible to modify the parts and the motions of “actives” and “passives” so that they would interact as we want in collision. And we could identify materials that could be known in advance (or “*a priori*,” to use a common expression for what can be known in advance of waiting to see it happen) to perform in a certain way were they combined.

However, the mechanical hypothesis was just a hypothesis. In Bacon's day, and for a long time afterward no one was able to peer into the insensibly small parts of matter and say for sure



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what makes “actives” work on “passives” as they do. Bacon himself proposed a series of experiments that he thought would suffice to prove the point for certain special cases, like the causes of heat. But a few successes of this sort were nothing more than a few successes. People had to be convinced that the mechanical hypothesis offered a more likely or more promising account of the workings of all actives and passives than the old, Aristotelian hylemorphic account. This is the job that Robert Boyle took on in the reading.

#### QUESTIONS ON THE READING

1. In what way is Boyle’s corpuscularianism unlike the atomism of Epicurus and Lucretius?
2. What is the cause of all change in the created world, according to Boyle?
3. What are the two grand principles of the corpuscular or mechanical philosophy?
4. What are the possible effects of one part of matter on another as Boyle envisioned them?
5. What are the properties of the parts of matter?
6. How many different kinds of matter are there, for Boyle?
7. Why did Boyle consider the fact that the parts of matter may be infinitely varied in motion and shape to be an advantage?
8. What is wrong with supposing that mechanical principles apply only to medium sized or large objects (like clocks or heavenly bodies) but not to the small parts of things?
9. Why did Boyle consider that the principles and explanations of the mechanical philosophy are clearer than those of the Aristotelians or other chemists?
10. What is required for one part of matter to be able to act upon another?
11. In what sense may the mechanical philosophy coexist with the supposition that change in nature is brought about by the agency of spirits?

#### NOTES ON THE READING

Boyle’s purpose was to demonstrate that what he called the corpuscular or mechanical philosophy was superior to two rival theories of nature: that of Aristotle and that of a group of “Hermetic chemists” (or alchemists), principally Paracelsus and Van Helmont, who had drawn on Neoplatonic writings and the works of a shadowy figure who called himself “Hermes Trismagistus.” (Boyle’s main target was in fact the latter group, Aristotelianism being largely defunct by the time he wrote.)

In presenting his case, Boyle was first careful to articulate a version of the mechanical philosophy that is explicitly compatible with the belief in the existence of a God who created the world. The seventeenth century was a profoundly religious time, and Boyle himself was a profoundly religious man. But Epicurus, the leading proponent of ancient atomism, to which the mechanical philosophy was closely allied, had denied the immortality of the soul, insisted that worlds evolve and decay like vegetables, and claimed that Gods are material beings who have no concern with human affairs and who could not intervene in the course of nature without losing their immortality. No Christian of the time could accept such views, and Boyle began by distancing his version of the mechanical philosophy from them. The mechanical philosophy he meant to endorse is one that holds that it would be impossible for a world fit for human habitation to evolve on its own. A world like ours could not arise from a chance collision of particles, but had to have been designed by a supremely intelligent being. However, having once arranged the parts of the world in an appropriate form and instituted certain laws of motion and collision, God does nothing more than constantly uphold these laws. The world is like a well-



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designed machine, that runs on its own after having once been set up and placed in motion, and it is so well designed that no further intervention is necessary in order to ensure that everything unfolds as it should. To suppose anything else would be an insult to the skill and intelligence of the Divine creator of the machine.

Thus, after the creation, all the phenomena of nature are, as Boyle put it, “physically produced by the mechanical properties of the parts of matter.” We need to consider what he meant by “physically produced,” and by “mechanical properties.”

On Boyle’s account, the mechanical philosophy involves just two basic explanatory concepts: matter, and motion. It is worth stressing that these constitute just two concepts. Were there different kinds of matter (e.g., hard matter, fluid matter, coloured matters, elastic or springy matter, heavy matter, brittle matter, sticky matter, earth, wood, iron, salt, and so on), then there would not just be two basic explanatory concepts. There would be more than two, as many more as there are fundamentally different kinds of matter.

The mechanical properties of matter derive from these two basic explanatory concepts. Motion is either fast or slow and is always directed in a certain way. It is linear, curvilinear, spiral, rotating, oscillating, or vibrating. When matter is put into motion it either all moves in the same way or different parts move in different ways. The effect of different parts moving in different ways is the separation of matter into particles of a determinate size and shape and state of motion. These particles may be knitted or interlocked so that they form compounds consisting of particles of various shapes and sizes and states of motion arranged in a certain order, giving a particular “texture” to the compound as a whole. Thus velocity, shape, size, and (in compound parts) texture constitute the “mechanical properties” of the parts of matter.

By “physical production” Boyle meant transmission of motion on impact. The effect of the impact of one body on another is to pull that other after it, or push it on ahead of it, or break it into parts that explode out in various directions, or alter the internal arrangement or state of vibration of the impacted parts.

To say that all the phenomena of nature are physically produced by the mechanical properties of the parts of matter is therefore to say that everything that happens in nature happens because of the way that differently shaped and moving but otherwise homogeneous parts are moving and banging into one another.

Besides describing what the mechanical philosophy maintains, Boyle attempted to convince his readers that the mechanical philosophy is superior to its rivals. To this end, he made the following claims:

1. **Simplicity.** The mechanical philosophy should be accepted, Boyle said, because it invokes fewer basic explanatory concepts. As noted above, it invokes just two basic concepts, matter and motion, from which all other properties are derived. The chemical or alchemical philosophy, in contrast, postulated three (salt, sulphur, mercury) as well as a number of “occult” active principles (called “occult” because it is not clear what makes them work as they are supposed to). The Aristotelian philosophy invoked form, matter, privation, substance, substratum, essence, action, potency, and final causes or purposes, to name just a few.

2. **Intelligibility.** The mechanical philosophy is easier to understand. Everyone can make sense of the notions of shape and velocity and the communication of motion as a result of collision. In contrast, the Aristotelian and alchemical explanatory principles and basic properties are unfamiliar and difficult to understand.



3. Comprehensiveness. There is nothing occult or hidden about the mechanical philosophy. A mechanical account makes it clear exactly how it is that one thing works upon another to bring about a change by showing us the machine that produces the effect (that is, the chain of transmission of impacts among shaped and moving parts that connects the motion brought in by the cause with the observed effect). The Aristotelian and alchemical philosophies, in contrast, leave the mechanism in “actives” that is responsible for bringing about the change in the form of “passives” hidden and unexplained and as a result they never get beyond treating change in nature as an ultimately magical effect.

4. Explanatory power. Despite having so few basic explanatory concepts and principles the mechanical philosophy is able to account for the widest range of different phenomena. The Aristotelians, for example, invoke a different form to account for each different kind of change. But on the mechanical account, the same thing is going on in all change: one object is hitting another.

This should strike any student of Bacon as a surprising list of reasons for recommending the mechanical philosophy. Recall that Bacon insisted that a theory ought to be justified by induction from the evidence and not by appeal to idols of the understanding. But the reasons Boyle invoked for accepting the mechanical philosophy are blatant appeals to the idols. To recommend a theory because it is simple is to appeal to an idol of the tribe. We have no reason to think a priori (that is, in advance of actually proving by induction from extensive experimentation) that nature is simple in its operations, so the simplicity of a theory cannot justly be cited as a reason for accepting it. The same can be said for intelligibility and explanatory power. These are features that make a theory easier for us to understand. But just because a theory is easy for us to understand that does not mean that it is correct. For a good Baconian, only an induction from the experiments can demonstrate the correctness of a theory. And to recommend a theory because it is comprehensive and allows us to deduce the effect from the cause is to worship an idol of the theatre. While it is a fine thing to be able to deduce the effect from the cause, to accept an account of the cause simply because it allows us to readily deduce the effect is to base one’s theory choice on wishful thinking. We ought to have some experimentally well-founded evidence to think that the cause is in fact constituted that way before making such a leap.

Yet, as unBaconian as Boyle’s defence of the mechanical philosophy may be, Boyle was a great admirer of Bacon and a serious student of Bacon’s works while Bacon, for his part, was very attracted to mechanical accounts of “latent constitutions” and “latent processes.” If pressed, both thinkers would probably have said that they regarded the mechanical philosophy as a “hypothesis” rather than as a fact, that is, as a speculation about the “latent constitutions” of materials and the “latent processes” governing all change in nature. They might further have remarked that they took the mechanical hypothesis to be an especially promising one, that is, one well worth investigating further, and Boyle might have said that appeals to its simplicity, intelligibility, comprehensiveness, and explanatory power are just reasons for investigating it further, not reasons for accepting it. After all, it seems a wise policy to focus our investigations to make sure that the simpler theories are not viable before looking at more complicated ones. But Boyle would probably have said something more as well, though it is only imperfectly and incompletely alluded to in the reading selection: He would probably have said that the mechanical philosophy *is* tolerably well justified by induction from the evidence.



He would have had two main reasons for saying this. One was the development of microscopy. People had begun grinding lenses and when they used them to magnify their view of apparently homogeneous things, like wood and water, they discovered these things to be made up of a complex assembly of often moving parts. This seemed to be direct proof of the existence of tiny, previously invisible machines inside the parts of macroscopic objects.

Boyle's second reason (one more explicitly alluded to in the text) has to do with the success of late Medieval, Renaissance, and 17th century technologists at constructing mechanical devices that could tell time, print books, raise weights up from the bottoms of mines, power huge bellows in smelters, and so on. Appealing to this success as evidence that change in the macroscopic world is brought about by mechanical means, Boyle claimed that it would be extraordinary if, as we descended to the microscopic level, we suddenly reached a point where change begins to be produced by other principles. After all, the laws of motion and collision do not appear to change as we move from a consideration of larger to smaller machines. The same principles that govern the operation of a huge mill are operative in the tiniest clock that our craft currently allows us to forge. Experience itself, therefore, gives us no warrant for supposing that, when we get down to a certain degree of smallness, change ceases to be produced by collision of shaped, moving parts, and instead starts to be produced by other means.

We have to wonder about how good a justification this was. Quite aside from the Baconian objection that we have no reason to suppose, a priori, that the laws that nature follows at the macroscopic scale are analogous to those followed at the microscopic (to appeal to analogy is to invoke another "idol of the tribe"), it is the case that even at the large and middle scale not all phenomena are obviously mechanical in nature. Think of burning, rusting, exploding and other chemical reactions, or of animal motion, vegetable growth and decay, gravitation and magnetism, emission of light and other forms of radiation, electrical discharges in lightning and static or the nuclear fusion happening in the sun. None of these are obviously produced by moving parts hitting one another. Moreover, these are the things that power machines. No machine runs simply on its own. All seem to ultimately have their power train initially moved by something that is not obviously mechanical, be that thing human or animal motion (as we know today, a product of chemical reaction rather than transmission of motion upon contact), the falling of weights or of water (due to a force of gravitation), the unwinding of springs (due to an apparent desire or endeavour of bent materials to return to their original shape), the blowing of winds (ultimately due to solar heating and hence to the causes of the burning of the sun), the expansion of gasses (another chemical reaction), and so on.

Even worse, the parts of machines are not obviously mechanical in nature. Archimedes had said that given a lever long enough and a fulcrum on which to put it he could move the Earth. But this is false. There is no known material that such a lever could be made of. A lever long enough to move the earth would either bend when pulled upon, or it would have to be so thick and massive that it would collapse under its own weight or be impossible to move simply because of its own weight. In claiming to be able to move the Earth with a lever, Archimedes had been thinking like the idealistic mathematician he was and failing to take account of what has been called "the refractory character of matter." The materials in nature are not ideally light and rigid but heavy, malleable, ductile, brittle, and so on. An engineer has to take account of these facts when designing a machine. It is simply not the case that a system of gears and wheels can be designed to move any load: a large enough load will strip the teeth off gears before they manage to lift it so that the gears have to be made of stronger and often heavier materials in order



to do the job and it becomes a challenge to find a material that is both light and strong enough to work. But features of materials such as ductility, hardness, brittleness, softness, viscosity, elasticity and so on are not obviously mechanical in nature. Indeed, it is very difficult to explain such features purely mechanically. Hardness is a good case in point. We could not say that the reason that certain materials are hard is that they are made of interlocked, hook-shaped parts that resist being moved relative to one another. This would simply beg the question. If the hook shaped-particles are not themselves hard to begin with, they would bend or separate and nothing would hold together.

Despite these difficulties, Boyle and other mechanists were unwilling to give up on the mechanical hypothesis. They hoped that, even though it was not then obvious that all or even most phenomena are mechanically produced, further research would uncover more convincing evidence in favour of this hypothesis, and they sought to do that research. Boyle himself, for example, is famous for his attempt to come up with a mechanistic account of the “spring” of air (its tendency to return to a certain volume after compression). Rejecting the Aristotelian view that the air endeavours to sustain a certain form, he accounted for “spring” as a consequence of the collision and rebound of particles of air enclosed in a volume and was led to discover the law of the relation between pressure and heating (which he reduced to the speed of motion of particles) as a consequence. He also did work on the spring of metals, noting that materials that could previously be bent into any of a number of shapes could be made springy by pounding. Since pounding is an operation that can only plausibly be supposed to alter the arrangement of the parts constituting the material, this seemed to be good inductive evidence for the conclusion that spring must somehow be a result of the manner in which the parts of bodies are arranged.

These successful mechanical explanations of apparently non-mechanical phenomena made Boyle and other mechanists optimistic that mechanical explanations could eventually be discovered for everything. Even recalcitrant phenomena like gravitation, cohesion, and hardness might, they speculated, be accounted for as consequences of the pressure of a surrounding ether.

Nonetheless, for Boyle and the other mechanists, it seems to have been the case that a conviction, or at least a hope in the truth of the mechanical hypothesis preceded a consideration of the evidence in favour of that hypothesis. Indeed, a consideration of what sort of experiments are required to justify the mechanical hypothesis, or to discriminate between rival mechanical explanations, seems to have been the guiding light that led them to undertake the sort of researches that they did, and this sits uneasily with the Baconian injunction to develop grand theories only as a consequence of a study of the evidence (though perhaps not that uneasily with some of Bacon’s own, tacit mechanistic convictions). For Boyle and the mechanists an antecedent commitment to the hypothesis directed the direction of research; the results of research did not lead to the formulation of a hypothesis. The ideals of an inductivist, “bottom-up” scientific methodology that dictates starting with experience and developing theories only as warranted, coexist with an a prioristic, “top-down” methodology that starts off with a commitment, however hypothetical, to a particular theory. Both Boyle and Bacon were attracted to mechanistic deductivism on the one hand and the ideals of an inductivist scientific methodology on the other (though Boyle is arguably more attracted to the former and Bacon to the latter), and their work contains interesting internal tensions as a result. Other early modern figures were more emphatic in their commitment to one side or the other, and their disagreements eventually forged a split between two opposed directions in epistemology and scientific methodology: the empiricist and the rationalist.



## ESSAY QUESTIONS AND RESEARCH PROJECTS

1. Consult a number of recent histories of technology and invention to ascertain what were the main technological innovations and inventions to be discovered in the sixteenth and seventeenth centuries. Attempt to determine what led to these discoveries. Were the chief inventions and innovations mechanical in nature (i.e., did they involve the invention of new types of mechanical devices) or were they chemical or biological (e.g. smelting of new alloys, breeding of new species, development of new agricultural techniques)? Did the inventor deduce how to build the device or make the technological innovation ahead of time, by applying some general theory (e.g. of mechanics) to the problem and only subsequently test to see if the device would work; was the invention or innovation designed only through a long process of trial and error; or was the invention or innovation the product of happenstance? Does your research support the claim, made at the outset of this chapter, that interest in and acceptance of the mechanical philosophy was spurred by the type of technological advances made in the 16th and 17th centuries?
2. Boyle held Bacon in high esteem, yet many of the reasons he offers for accepting the corpuscular or mechanical philosophy make what Bacon ought consistently to have condemned as an appeal to idols of the tribe and idols of the theatre, and in other works he makes remarks that might be interpreted as saying that he took the mechanical philosophy to be merely a hypothesis that had not yet been adequately confirmed by the evidence. This has led many scholars to question the extent of Boyle's commitment to the corpuscular or mechanical philosophy. In a classic paper, "Newton, Boyle, and the Problem of 'Transdiction'," (in his *Philosophy, Science, and Sense Perception* [Baltimore: Johns Hopkins Press, 1964], 61-117, esp. 88-112) Maurice Mandelbaum responded to these scholars by arguing that Boyle was able to reconcile a commitment to the corpuscular or mechanical philosophy with a fundamentally Baconian position on the need to justify a theory by induction from experience. Focusing on a reading of pp. 99-112 of Mandelbaum's paper, reconstruct his position in your own words. If you find his position to be unclear or unpersuasive on certain points, say so and explain why.
3. Undertake as extensive a survey of Boyle's works as possible and attempt to answer the following questions as best you can in the light of that survey: To what extent was Boyle committed to the truth of the mechanical hypothesis? Might his degree of commitment to that hypothesis have changed over time? If he was committed to it to any degree, what was the ground of his commitment to it? Be explicit about the influence (or lack of influence) of the following factors on his thought: the development of microscopy; the mechanistic (or non-mechanistic) character of important technological innovations and inventions of his time; the extent to which it really seemed to Boyle that all the phenomena of nature could be accounted for mechanistically, including such recalcitrant phenomena as gravitation, hardness, and cohesion.
4. Determine to what extent a concern to justify a mechanical account of the spring of air was foundational for Boyle's discoveries about the relation between the pressure, volume and temperature of a gas.

