

1 Galileo Galilei (1564–1642)

Introduction

The playwright Bertolt Brecht labored for two decades over his anti–Third Reich play *Leben des Galilei*. The seventh scene is set on March 5, 1616, just as the Inquisition has censured the Copernican texts positing the heliocentric model of the universe. Galileo learns of this event during a conversation with several cardinals at a dinner party in Rome. Brecht dramatically captures the heart of Galileo’s religious faith:

BARBERINI: He’s [i.e., Galileo is] really dreadful. In all innocence he accuses God of the juiciest boners in astronomy! I suppose God didn’t work hard enough at His astronomy before He wrote Holy Scripture? My dear friend!

BELLARMINE: Don’t you think it likely that the Creator knows more about His creation than any of His creatures?

GALILEO: But, gentlemen, after all we can misinterpret not only the movements of the heavenly bodies, but the Bible as well.

4 - CHAPTER 1

BELLARMINE: But wouldn't you say that after all the interpretation of the Bible is the business of the Holy Church?
(Galileo is silent.)¹

Galileo is silent because in fact he believes that the business of biblical interpretation, in the hands of fallible humans, can prove to be highly fallible. He is silent because he does not believe the Bible is meant to be read literally, and biblical literalism has been hardening into a new position within some circles of the Counter-reformation Catholic Church following the Council of Trent.

Far from being a biblical literalist, Galileo believed that the Bible was intentionally simplified by the Church so that lay people could access its meaning. In the letter excerpted to his student Benedetto Castelli, Galileo underscores the Brechtian point by clearly stating "though Holy Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways."² As the other texts selected in this chapter show, however, Galileo's strong religious faith is rooted in a conviction that truth is always one and cannot be at odds with itself. Knowledge of the truth is available through two avenues, one scientific and one religious. Reason and mathematics produce the exciting and disturbing astronomical data that Galileo regarded as a true reflection of the craftsmanship of the divine *work*, and Holy Scripture presents a true reflection of the divine *word*. Fallible humans can misinterpret both of these, as Brecht's Galileo observes, but neither one can ever be fundamentally in conflict with the other. If truth cannot be at odds with itself, then scientific truth and religious truth will never contradict each other, Galileo believed. When they appear to conflict, it is because one or the other has been mistakenly interpreted.

Galileo makes it still clearer, in the second excerpt, which is taken from his unpublished writings, that he champions the autonomy

¹ Bertolt Brecht, *Collected Plays*, vol. 5, *Life of Galileo*, trans. W. Sauerlander and R. Mainheim, ed. R. Manheim and J. Willet (New York: Vintage Books, 1972), 51.

² Maurice A. Finocchiaro, ed., *The Galileo Affair: A Documentary History* (Berkeley: University of California Press, 1989), 49.

of science with respect to faith. Science—then called “natural philosophy”—does not proceed from theology, Galileo declares, and in disputes about natural phenomena one must begin not with the authority of scriptural passages but with sensory experience and necessary demonstrations. Here he advances the argument that two truths cannot contradict one another, so that in cases where a known scientific fact is available, the Bible, an inspired text, ought to be interpreted in such a way as to be compatible with the scientific truth. Augustine had argued along similar lines in the fourth century, and many contemporary theologians take much the same position today, but Galileo was warned a year later, in 1616, not to teach or to defend the Copernican view except as a possible hypothesis.

Had he been content only to differentiate two senses in which biblical texts could be interpreted, either as commonsense language or as scientific language, Galileo’s position might have been as simple as that of Cardinal Cesare Baronio, the sixteenth-century Vatican librarian whose quip he quotes approvingly: the Bible is a book that tells us how one goes to heaven, not how the heavens go. If the sun were said to stand still during Joshua’s surprisingly long day, this should be given an allegorical meaning, not a scientific sense that would present a challenge to Copernican astronomy. But Galileo went further and argued for the mutual relevance of science and religion. In his letter to the grand duchess Christina in 1615, Galileo argued that known scientific truths should help *guide* biblical exegesis. It was as though he expected the theologians to become astronomers first! Creatively theologizing himself, Galileo interpreted Joshua’s command that the sun stand still in the middle of the heavens as referring to the sun’s axial rotation. His conclusion was unmistakable: it is the Copernican framework that preserves and best understands the biblical record.

Recent scholarship on the so-called “Galilean affair” dispels two popular myths about Galileo and his conflict with the Catholic Church. Both have persisted despite the lack of historical evidence for them. We might call these the “Myth of Galileo the Religious Rebel” and the “Myth of the Catholic Church as Arch-Enemy of

6 - CHAPTER 1

Science.” The more complex picture that now emerges in the work of contemporary historians of science depicts a Galileo who was generally committed to the Church and a Church that was traditionally committed to natural philosophy as a rational, independent route to truth. In other words, Galileo was far more inclined to a conservative religious position and the Church much better disposed to the new astronomical data than is commonly believed. Galileo was not eager to undermine the Church, especially not his once friendly ally Pope Urban VIII, and the Church, at least as represented by the Jesuits, was not especially eager to condemn the Copernican heliocentric cosmology adopted by Galileo, and also championed by Johannes Kepler as early as 1590. It is easy to see how Copernicus and Kepler escaped Galileo’s fate of virtual house arrest. Copernicus died soon after his heliocentric theory became public, and the actual printing of his six-volume, generally unreadable book, *On the Revolutions of the Heavenly Spheres*, did not get underway until his death in 1543; it took more than seventy years for it to create much of a storm in Europe. Johannes Kepler, on the other hand, enjoyed not only a different status as a Protestant, outside the jurisdiction of Rome, but also royal patronage once he was settled in Prague as official imperial astronomer.

Why then was Galileo sentenced to house arrest in the year 1633 and forced to abjure his former beliefs for the remaining nine years of his life? Part of the answer is that this was simply a tragically unnecessary outcome: Copernican heliocentrism was gaining the day within the Catholic hierarchy and might very well have succeeded on its own merits had Galileo not brought matters to a head with his forceful *Dialogue Concerning the Two Chief World Systems* in 1632. More deeply, this was a highly complex and ambiguous story involving multiple levels of faith and reason, political machinations in the Italian Renaissance court system, the gathering storm of the counter-reformation, and a personal sense of betrayal between Galileo and Pope Urban VIII, who had, as Maffeo Barberini, earlier assured Galileo he could write about Copernicus’s theory if he presented it as just that—a theoretical

hypothesis, not a truth. One of the most fascinating parts of the story is Galileo's growing conviction that science should stipulate or help determine theology. The modernization of Catholic teaching, he thought, could succeed best by replacing Aristotelian astronomy with Copernican. The new seat of authority was to be science, and those who could claim expertise in astronomy and mathematics ought to be allowed to pronounce on theology as well. Above all, the old seats of authority—whether Aristotelian or biblical—were no longer the arbiters of scientific truth.

An intemperate zeal for hermeneutics was perhaps finally responsible for Galileo's troubles with the Church hierarchy, but his very insistence on the inescapable need for interpretation, rather than any simple acceptance of literal readings of scripture, produced the most important statements of Galileo's own faith. Had he not allowed himself to be drawn into an argument about the proper interpretation of scripture, we would not have the fascinating document *Dialogue Concerning the Two Chief World Systems* (1632). The dialogue, excerpted here, engages three characters: Simplicio, a geocentric Aristotelian; Salviati, an obvious alter ego for Galileo and spokesman for the Copernican view; and Sagredo, an interested and intelligent bystander to the debate. In a masterful polemic, the *Dialogue* teaches that astronomy and the science of motion go hand in glove. There is no need to fear, Galileo explains, that earth's rotation will cause it to fly to pieces. Salviati systematically destroys Simplicio's arguments, and with a final flourish Sagredo concludes that Salviati is right, Aristotle is wrong, and wine and cheese are waiting.

Though marked by Galileo's characteristic caustic wit, the document is also somewhat marred by arguments so convoluted that one marvels that heliocentrism ever prevailed. For all its notoriety, Galileo's *Dialogue* offered no proof that the earth truly moved. Yet in religious matters, he exhibits a sophisticated form of faith. In his own words, Galileo is by turns poetic, didactic, reverent, combative, and witty. Whatever serious doubts he might harbor about the institutional Church and the rectitude of some of its interpretations, he has no doubt about faith itself. He can artfully

8 - CHAPTER 1

embrace all the elements of a typical Renaissance Roman Catholic piety with one remarkable exception, its Aristotelian cosmology.

In fact, Galileo was always much more an opponent of Aristotelian physics than of Church theology. And the Catholic Church, for its part, was committed to the role of reason in support of faith, and to philosophical thinking as an aid to reason. Far from opposing faith to reason, the Jesuits, if not the Dominicans, deliberated with, for, and against Galileo, all the while valuing natural philosophy and championing a reasonable faith. Perhaps the deepest difference between Galileo and those who opposed him was a very basic philosophical outlook. The longing for permanence over and against change defined the ancient and medieval worldview. Largely because of Plato and Aristotle, the assumption that perfection and permanence go hand in hand—as do imperfection and change—became axiomatic in Western thought. Galileo's challenge to that assumption was thorough, as seen in this emphatic passage from the *Dialogue*, where he states a philosophical belief every bit as fundamental to him as his religious beliefs: "I cannot without great wonder, nay, more, disbelief, hear it being attributed to natural bodies as a great honor and perfection that they are impassible, immutable, inalterable, etc.: as conversely, I hear it esteemed a great imperfection to be alterable, generable, and mutable. . . . These men who so extol incorruptibility, inalterability, and so on, speak, I believe, out of the great desire they have to live long and for fear of death. . . . These people deserve to meet with a Medusa's head that would transform them into statues of diamond and jade, so that they might become more perfect than they are."

Galileo was born in the same year that Michelangelo died, and he died in the same year that Isaac Newton was born. In that span, an entire cosmological worldview was overturned. Yet it was only in 1992 that the Roman Catholic Church formally admitted to having erred in dealing with Galileo. It is a remarkable irony that the very words used by Pope John Paul II come so close to those of Galileo himself, and that the two men seem to share an almost identical position on the relation between science and

religion. “There exist two realms of knowledge,” the pope explained, “one which has its source in revelation and one which reason can discover by its own power. To the latter belong especially the experimental sciences . . . the distinction . . . ought not to be understood as opposition. The two realms are not altogether foreign to each other; they have points of contact. The methodologies proper to each make it possible to bring out different aspects of reality. So there we have it. Science and religion do not conflict, but they describe two different aspects of reality.”³

Galileo’s Contribution to Science

Galileo Galilei discovered new features on the moon’s surface, four of the moons of Jupiter, the rays of Saturn, sunspots, and the fact that Venus undergoes a regular series of phases similar to the phases of Earth’s moon. He determined the parabolic path of projectiles, calculated the law of free fall, invented a microscope, advocated the relativity of motion, and created a mathematical physics.

Galileo in His Own Words

Letter from Galileo to Benedetto Castelli, (December 21, 1613)⁴

Very Reverend Father and My Most Respectable Sir:

Yesterday Mr. Niccolò Arrighetti came to visit me and told me about you. Thus I took infinite pleasure in hearing about what I did not doubt at all, namely, about the great satisfaction you have been giving to the whole University. . . . However, the seal of my pleasure was to hear him relate the arguments which through the

³ John Paul II, “Lessons of the Galileo Case,” Address to the Pontifical Academy of Sciences, October 31, 1992, in *Origins* v. 22, no. 22 (November 12, 1992): 371.

⁴ Finocchiaro, 49–54.

10 - CHAPTER 1

great kindness of their Most Serene Highness, you had the occasion of advancing at their table and then of continuing in the chambers of the Most Serene Ladyship, in the presence also of the Grand Duke and the Most Serene Archduchess, the Most Illustrious and Excellent Don Antonio and Don Paolo Giordano, and some of the very excellent philosophers there. What greater fortune can you wish than to see their Highnesses themselves enjoying discussing with you, putting forth doubts, listening to your solutions, and finally remaining satisfied with your answers?

After Mr. Arrighetti related the details you had mentioned, they gave me the occasion to go back to examine some general questions about the use of the Holy Scripture in disputes involving physical conclusions and some particular other ones about Joshua's passage, which was presented in opposition to the earth's motion and sun's stability by the Grand Duchess Dowager with some support by the Most Serene Archduchess.

In regard to the first general point of the Most Serene Ladyship, it seems to me very prudent of her to propose and of you to concede and to agree that the Holy Scripture can never lie or err, and that its declarations are absolutely and inviolably true. I should have added only that, though the Scripture cannot err, nevertheless some of its interpreters and expositors can sometimes err in various ways. One of these would be very serious and very frequent, namely, to want to limit oneself always to the literal meaning of the words; for there would thus emerge not only various contradictions but also serious heresies and blasphemies, and it would be necessary to attribute to God feet, hands and eyes, as well as bodily and human feelings like anger, regret, hate and sometimes even forgetfulness of things past and ignorance of future ones. Thus in the Scripture one finds many propositions which look different from the truth if one goes by the literal meaning of the words, but which are expressed in this manner to accommodate the incapacity of common people; likewise, for the few who deserve to be separated from the masses, it is necessary that wise interpreters produce their true meaning and indicate the particular reasons why they have been expressed by means of such words.

Thus, given that in many places the Scripture is not only capable but necessarily in need of interpretations different from the apparent meaning of the words, it seems to me that in disputes about natural phenomena it should be reserved to the last place. For the Holy Scripture and nature both equally derive from the divine Word, the former as the dictation of the Holy Spirit, the latter as the most obedient executrix of God's commands; moreover, in order to adapt itself to the understanding of all people, it was appropriate for the Scripture to say many things which are different from absolute truth, in appearance and in regard to the meaning of the words; on the other hand, nature is inexorable and immutable, and she does not care at all whether or not her recondite reasons and modes of operations are revealed to human understanding, and so she never transgresses the terms of the laws imposed on her; therefore, whatever sensory experience places before our eyes or necessary demonstrations prove to us concerning natural effects should not in any way be called into question on account of scriptural passages whose words appear to have a different meaning, since not every statement of the Scripture is bound to obligations as severely as each effect of nature. Indeed, because of the aim of adapting itself to the capacity of unrefined and undisciplined peoples, the Scripture has not abstained from somewhat concealing its most basic dogmas, thus attributing to God himself properties contrary to and very far from his essence; so who will categorically maintain that, in speaking even incidentally of the earth or the sun or other creatures, it abandoned this aim and chose to restrict itself rigorously within the limited and narrow meanings of the words? This would have been especially problematic when saying about these creatures things which are very far from the primary function of the Holy Writ, indeed, things which, if said and put forth in their naked and unadorned truth, would more likely harm its primary intention and make people more resistant to persuasion about the articles pertaining to salvation.

Given this, and moreover it being obvious that two truths can never contradict each other, the task of wise interpreters is to strive to find the true meanings of scriptural passages agreeing with those

12 - CHAPTER 1

physical conclusions of which we are already certain and sure from clear sensory experience or from necessary demonstrations. Furthermore, as I already said, though the Scripture was inspired by the Holy Spirit, because of the mentioned reasons many passages admit of interpretations far removed from the literal meaning, and also we cannot assert with certainty that all interpreters speak by divine inspiration; hence I should think it would be prudent not to allow anyone to oblige scriptural passages to have to maintain the truth of any physical conclusions whose contrary could ever be proved to us by the senses and demonstrative and necessary reasons. Who wants to fix a limit for the human mind? Who wants to assert that everything which is knowable in the world is already known? Because of this, it would be most advisable not to add anything beyond necessity to the articles concerning salvation and the definition of the Faith, which are firm enough that there is no danger of any valid and effective doctrine ever rising against them. If this is so, what greater disorder would result from adding them upon request by persons of whom we do not know whether they speak with celestial inspiration, and of whom also we see clearly that they are completely lacking in the intelligence needed to understand, let alone to criticize, the demonstrations by means of which the most exact sciences proceed in the confirmation of some of their conclusions?

I should believe that the authority of the Holy Writ has merely the aim of persuading men of those articles and propositions which are necessary for their salvation and surpass all human reason, and so could not become credible through some other science or any other means except the mouth of the Holy Spirit itself. However, I do not think it necessary to believe that the same God who has furnished us with senses, language, and intellect would want to bypass their use and give us by other means the information we can obtain with them. This applies especially to those sciences about which one can read only very small phrases and scattered conclusions in the Scripture, as is particularly the case for astronomy, of which it contains such a small portion that one does not even find in it the names of all the planets; but if the first

sacred writers had been thinking of persuading the people about the arrangement and the movements of the heavenly bodies, they would not have treated of them so sparsely, which is to say almost nothing in comparison to the infinity of very lofty and admirable conclusions contained in such a science.

So you see, if I am not mistaken, how disorderly is the procedure of those who in disputes about natural phenomena that do not directly involve the Faith give first place to scriptural passages, which they quite often misunderstand anyway. However, if these people really believe they have grasped the true meaning of a particular scriptural passage, and if they consequently feel sure of possessing the absolute truth on the question they intend to dispute about, then let them sincerely tell me whether they think that someone in a scientific dispute who happens to be right has a great advantage over another who happens to be wrong. I know they will answer Yes, and that the one who supports the true side will be able to provide a thousand experiments and a thousand necessary demonstrations for his side, whereas the other person can have nothing but sophisms, paralogisms, and fallacies. But if they know they have such an advantage over their opponents as long as the discussion is limited to physical questions and only philosophical weapons are used, why is it that when they come to the meeting they immediately introduce an irresistible and terrible weapon, the mere sight of which terrifies even the most skillful and expert champion? If I must tell the truth, I believe it is they who are the most terrified, and that they are trying to find a way of not letting the opponent approach because they feel unable to resist his assaults. However, consider that, as I just said, whoever has truth on his side has a great, indeed, the greatest, advantage over the opponent, and that it is impossible for two truths to contradict each other; it follows, therefore, that we must not fear any assaults launched against us by anyone, as long as we are allowed to speak and to be heard by competent persons who are not excessively upset by their own emotions and interests.

To confirm this I now come to examining the specific passage of Joshua, concerning which you put forth three theses for their

14 - CHAPTER 1

Most Serene Highnesses. I take the third one, which you advanced as mine (as indeed it is), but I add some other considerations that I do not believe I have ever told you.

Let us then assume and concede to the opponent that the words of the sacred text should be taken precisely in their literal meaning, namely, that in answer to Joshua's prayers God made the sun stop and lengthened the day, so that as a result he achieved victory; but I request that the same rule should apply to both, so that the opponent should not pretend to tie me and to leave himself free to change or modify the meanings of the words. Given this, I say that this passage shows clearly the falsity and impossibility of the Aristotelian and Ptolemaic world system, and on the other hand agrees very well with the Copernican one.

I first ask the opponent whether he knows with how many motions the sun moves. If he knows, he must answer that it moves with two motions, namely, with the annual motion from west to east and with the diurnal motion in the opposite direction from east to west.

Then, secondly, I ask him whether these two motions, so different and almost contrary to each other, belong to the sun and are its own to an equal extent. The answer must be No, but that only one is specifically its own, namely, the annual motion, whereas the other is not but belongs to the highest heaven, I mean the Prime Mobile; the latter carries along with it the sun as well as the other planets and the stellar sphere, forcing them to make a revolution around the earth in twenty-four hours, with a motion, as I said, almost contrary to their own natural motion.

Coming to the third question, I ask him with which of these two motions the sun produces night and day, that is, whether with its own motion or else with that of the Prime Mobile. The answer must be that night and day are effects of the motion of the Prime Mobile and that what depends on the sun's own motion is not night or day but the various seasons and the year itself.

Now, if the day derives not from the sun's motion but from that of the Prime Mobile, who does not see that to lengthen the day one must stop the Prime Mobile and not the sun? Indeed, is there

anyone who understands these first elements of astronomy and does not know that, if God had stopped the sun's motion, He would have cut and shortened the day instead of lengthening it? For, the sun's motion being contrary to the diurnal turning, the more the sun moves toward the east the more its progression toward the west is slowed down, whereas by its motion being diminished or annihilated the sun would set that much sooner; this phenomenon is observed in the moon, whose diurnal revolutions are slower than those of the sun inasmuch as its own motion is faster than that of the sun. It follows that it is absolutely impossible to stop the sun and lengthen the day in the system of Ptolemy and Aristotle, and therefore either the motions must not be arranged as Ptolemy says or we must modify the meaning of the words of the Scripture; we would have to claim that, when it says that God stopped the sun, it meant to say that He stopped the Prime Mobile, and that it said the contrary of what it would have said if speaking to educated men in order to adapt itself to the capacity of those who are barely able to understand the rising and setting of the sun.

Add to this that it is not believable that God would stop only the sun, letting the other spheres proceed; for He would have unnecessarily altered and upset all the order, appearances, and arrangements of the other stars in relation to the sun, and would have greatly disturbed the whole system of nature. On the other hand, it is believable that He would stop the whole system of celestial spheres, which could then together return to their operations without any confusion or change after the period of intervening rest.

However, we have already agreed not to change the meaning of the words in the text; therefore it is necessary to resort to another arrangement of the parts of the world, and to see whether the literal meaning of the words flows directly and without obstacle from its point of view. This is in fact what we see happening.

For I have discovered and conclusively demonstrated that the solar globe turns on itself, completing an entire rotation in about one lunar month, in exactly the same direction as all the other heavenly revolutions; moreover, it is very probable and reasonable

16 - CHAPTER 1

that, as the chief instrument and minister of nature and almost the heart of the world, the sun gives not only light (as it obviously does) but also motion to all the planets that revolve around it; hence, if in conformity with Copernicus's position the diurnal motion is attributed to the earth, anyone can see that it sufficed stopping the sun to stop the whole system, and thus to lengthen the period of the diurnal illumination without altering in any way the rest of the mutual relationships of the planets; and that is exactly how the words of the sacred text sound. Here then is the manner in which by stopping the sun one can lengthen the day on the earth, without introducing any confusion among the parts of the world and without altering the words of the Scripture.

I have written much more than is appropriate in the view of my slight illness. So I end by reminding you that I am at your service, and I kiss your hands and pray the Lord to give you happy holidays and all you desire.

Florence, 21 December 1613
To Your Very Reverend Paternity.
Your Most Affectionate Servant,
Galileo Galilei.

***On Truth in Science and in Scripture (1615)*⁵**

The mobility of the earth and the stability of the sun could never be contrary to the faith or to Scripture, if this were ever actually proven to be true in nature by philosophers, astronomers, and mathematicians by means of sense experience, exact observations, and necessary demonstrations. In such a case, if any passages of Scripture seem to say the opposite, we should say that this is due to the weakness of our intellect, which has not been able to penetrate into the true meaning of Scripture on this point. For it is a

⁵ From Galileo's unpublished notes, in Richard J. Blackwell, *Galileo, Bellarmine, and the Bible* (Notre Dame, IN: Notre Dame University Press, 1991), 273–76.

common and most correct teaching to say that one truth cannot be contrary to another truth. Therefore those who would juridically condemn something need first to prove that it is false in nature by challenging the arguments to the contrary.

Now as a protection against error, let us ask from what starting point should one begin; that is, from the authority of the Scriptures or from the refutation of the demonstrations and evidence of the philosophers and astronomers. I answer that we ought to begin from the place which is more secure and far removed from any occasion of scandal; and this is the starting point of natural and mathematical arguments. I claim that if the arguments to prove the mobility of the earth are found to be fallacious and demonstrative of the contrary, then we will have firmly established the falsity of that proposition and the truth of the contrary, which we now say is in agreement with the meaning of the Scriptures. Indeed, one could freely and without danger condemn that proposition as false.

On the other hand, if these arguments are found to be true and necessary, there will not be any occasion of prejudice against the authority of Scripture. For this will cause us to remain cautious that in our ignorance we have not penetrated into the true meaning of the Scripture, which we can then pursue aided by the newly discovered natural truth. Thus the starting point of reason is secure in every way. But on the contrary, if we stand solely on what seems to us to be the true and most certain sense of Scripture, and if we proceed to condemn such a proposition without examining the force of the demonstrations, then how great a scandal will follow when sense experience and arguments prove the contrary? And who will have plunged the Holy Church into confusion; those who have given the highest importance to demonstrations, or those who have neglected them? Thus we see which path is more secure.

We maintain that a natural proposition which is proven to be true by natural and mathematical demonstrations can never be contrary to the Scriptures; rather in such a case it is the weakness of our intellect which prevents us from penetrating into the true meaning of the Scriptures themselves. On the other hand, those

18 - CHAPTER 1

who try to refute and falsify that same type of proposition by using the authority of the same passages of Scripture will commit the fallacy called “begging the question.” For since the true sense of the Scripture will already have been put in doubt by the force of the argument, one cannot take it as clear and secure for the purpose of refuting that same proposition.

Rather, one needs to take the demonstrations apart and find their fallacies with the aid of other arguments, experiences, and more certain observations. And when the truth of fact and of nature has been found in this way, then, but not before, can we confirm the true sense of Scripture and securely use it for our purposes. Thus again the secure path is to begin with demonstrations, confirming the true and refuting the false.

If as a matter of fact the earth does move, then we cannot change nature so that it does not move. But we can easily eliminate inconsistency with Scripture simply by admitting that we have not penetrated into its true meaning. Thus the secure way to avoid error is to begin with astronomical and natural investigations, and not with Scripture.

I realize that in their explanation of the passages of Scripture pertaining to this issue, all the Fathers agree in interpreting them in the most simple sense and according to the direct meaning of the words; and that therefore it would not be proper, in response to a different point of view, to alter their common interpretation, because that would accuse the Fathers of inadvertence or negligence. I respond by admitting that this is a reasonable and proper concern, but add that we have a most ready excuse for the Fathers. It is that they never explained the Scriptures differently from the direct meaning of the words on this issue because the opinion of the mobility of the earth was totally buried in their day. It was not discussed or written about or defended. Hence no charge of negligence can fall on the Fathers for not reflecting on something which was hidden from all of them. That they did not reflect on this is clear from the fact that in their writings there is not found one word about such an opinion. To the contrary, if anyone says that they did consider it, that would make it much more dangerous to

try to condemn it; for after considering it, they not only did not condemn it, but no one even raised a doubt about it.

The defense of the Fathers is, then, quite easy and quick. But on the other hand it would be most difficult, if not impossible, to excuse and defend from a similar charge of inadvertence, the popes, councils, and reformers of the *Index* who for eighty continuous years have failed to notice an opinion and a book which was originally written by order of a pope, which was later printed by order of a cardinal and a bishop, which was dedicated to another pope, which was so unique in regard to this doctrine that it cannot be said to have remain hidden, and which was accepted by the Holy Church, while supposedly its teaching was false and condemned. Thus if the notion of agreeing not to charge our ancestors with negligence should be defended and held in the highest regard, as indeed it should, then beware that in trying to flee from one absurdity, you do not fall into a greater one.

But if someone were still to think that it is improper to abandon the common interpretation of the Fathers, even in the case of natural propositions which they did not discuss and whose opposites have not come under their consideration, then I ask what one ought to do if necessary demonstrations were to conclude that the opposite is a fact in nature. Which of these two rules ought to be altered? That which says that no proposition can be both true and false? Or that which obliges us to take as a “matter of faith” natural propositions learned from the common interpretation of the Fathers? If I am not mistaken, it seems to me to be more secure to modify the second rule, i.e., the one which tries to oblige us to hold as a “matter of faith” a natural proposition which could by conclusive arguments be demonstrated to be false in fact and in nature. Furthermore it should be said that the common interpretation of the Fathers ought to have absolute authority for propositions which they examined and which do not have, and certainly never possibly could have, demonstrations to the contrary. Let me add that it seems to be abundantly clear that the council obliges agreement with the common explanation of the Fathers only “in matters of faith and morals, etc.”

***From Dialogue Concerning the Two Chief
World Systems (1632)*⁶**

Præfatio

To the Discerning Reader:

Several years ago there was published in Rome a salutary edict which, in order to obviate the dangerous tendencies of our present age, imposed a seasonable silence upon the Pythagorean opinion that the earth moves. There were those who impudently asserted that this decree had its origin not in judicious inquiry, but in passion none too well informed. Complaints were to be heard that advisers who were totally unskilled at astronomical observations ought not to clip the wings of reflective intellects by means of rash prohibitions.

Upon hearing such carping insolence, my zeal could not be contained. Being thoroughly informed about that prudent determination, I decided to appear openly in the theater of the world as a witness of the sober truth. I was at that time in Rome; I was not only received by the most eminent prelates of that Court, but had their applause; indeed this decree was not published without some previous notice of it having been given to me. Therefore I propose in the present work to show to foreign nations that as much is understood of this matter in Italy, and particularly in Rome, as transalpine diligence can ever have imagined. Collecting all the reflections that properly concern the Copernican system, I shall make it known that everything was brought before the attention of the Roman censorship, and that there proceed from this clime not only dogmas for the welfare of the soul, but ingenious discoveries for the delight of the mind as well.

To this end I have taken the Copernican side in the discourse, proceeding as with a pure mathematical hypothesis and striving

⁶ *Galileo Galilei, Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican*, trans. S. Drake (New York: Modern Library, 2001), 5–7, 425–28, 537–39.

by every artifice to represent it as superior to supposing the earth motionless—not, indeed absolutely, but as against the arguments of some professed Peripatetics. These men indeed deserve not even that name, for they do not walk about; they are content to adore the shadows, philosophizing not with due circumspection but merely from having memorized a few ill-understood principles.

Three principal headings are treated. First, I shall try to show that all experiments practicable upon the earth are insufficient measures for proving its mobility, since they are indifferently adaptable to an earth in motion or at rest. I hope in so doing to reveal many observations unknown to the ancients. Secondly, the celestial phenomena will be examined strengthening the Copernican hypothesis until it might seem that this must triumph absolutely. Here new reflections are adjoined which might be used in order to simplify astronomy, though not because of any necessity imposed by nature. In the third place, I shall propose an ingenious speculation. It happens that long ago I said that the unsolved problem of the ocean tides might receive some light from assuming the motion of the earth. This assertion of mine, passing by word of mouth, found loving fathers who adopted it as a child of their own ingenuity. Now, so that no stranger may ever appear who, arming himself with our weapons, shall charge us with want of attention to such an important matter, I have thought it good to reveal those probabilities which might render this plausible, given that the earth moves.

I hope that from these considerations the world will come to know that if other nations have navigated more, we have not theorized less. It is not from failing to take count of what others have thought that we have yielded to asserting that the earth is motionless, and holding the contrary to be a mere mathematical caprice, but (if for nothing else) for those reasons that are supplied by piety, religion, the knowledge of Divine Omnipotence, and a consciousness of the limitations of the human mind I have thought it most appropriate to explain these concepts in the form of dialogues, which, not being restricted to the rigorous observance of mathematical laws, make room also for digressions which are sometimes no less interesting than the principal argument.

22 - CHAPTER 1

Many years ago I was often to be found in the marvelous city of Venice, in discussions with Signore Giovanni Francesco Sagredo, a man of noble extraction and trenchant wit. From Florence came Signore Filippo Salviati, the least of whose glories were the eminence of his blood and the magnificence of his fortune. His was a sublime intellect which fed no more hungrily upon any pleasure than it did upon fine meditations. I often talked with these two of such matters in the presence of a certain Peripatetic philosopher whose greatest obstacle in apprehending the truth seemed to be the reputation he had acquired by his interpretations of Aristotle.

Now, since bitter death has deprived Venice and Florence of those two great luminaries in the very meridian of their years, I have resolved to make their fame live on in these pages, so far as my poor abilities will permit, by introducing them as interlocutors in the present argument. (Nor shall the good Peripatetic lack a place; because of his excessive affection toward the *Commentaries* of Simplicius, I have thought fit to leave him under the name of the author he so much revered, without mentioning his own). May it please those two great souls, ever venerable to my heart, to accept this public monument of my undying love. And may the memory of their eloquence assist me in delivering to posterity the promised reflections.

It happened that several discussions had taken place casually at various times among these gentlemen, and had rather whetted than satisfied their thirst for learning. Hence very wisely they resolved to meet together on certain days during which, setting aside all other business, they might apply themselves more methodically to the contemplation of the wonders of God in the heavens and upon the earth. They met in the palace of the illustrious Sagredo; and, after the customary but brief exchange of compliments, Salviati commenced as follows.

The Third Day

SALVIATI: Simplicio, I wish you could for a moment put aside your affection for the followers of your doctrines and tell me

frankly whether you believe that they comprehend in their own minds this magnitude which they subsequently decide cannot be ascribed to the universe because of its immensity. I myself believe that they do not. It seems to me that here the situation is just as it is with the grasp of numbers when one gets up into the thousands of millions, and the imagination becomes confused and can form no concept. The same thing happens in comprehending the magnitudes of immense distances; there comes into our reasoning an effect similar to that which occurs to the senses on a serene night, when I look at the stars and judge by sight that their distance is but a few miles, or that the fixed stars are not a bit farther off than Jupiter, Saturn, or even the moon.

But aside from all this, consider those previous disputes between the astronomers and the Peripatetic philosophers about the reasoning as to the distance of the new stars in Cassiopeia and Sagittarius, the astronomers placing these among the fixed stars and the philosophers believing them to be closer than the moon. How powerless are our senses to distinguish large distances from extremely large ones, even when the latter are in fact many thousands of times the larger!

And finally I ask you, O foolish man: Does your imagination first comprehend some magnitude for the universe, which you then judge to be too vast? If it does, do you like imagining that your comprehension extends beyond the Divine power? Would you like to imagine to yourself things greater than God can accomplish? And if it does not comprehend this, then why do you pass judgment upon things you do not understand?

SIMPLICIO: These arguments are very good, and no one denies that the size of the heavens may exceed our imaginings, since God could have created it even thousands of times larger than it is. But must we not admit that nothing has been created in vain, or is idle, in the universe? Now when we see this beautiful order among the planets, they being arranged around the earth at distances commensurate with their producing upon it their effects for our benefit, to what end would there then be interposed between the highest of their orbits (namely, Saturn's), and the

24 - CHAPTER 1

stellar sphere, a vast space without anything in it, superfluous, and vain? For the use and convenience of whom?

SALVIATI: It seems to me that we take too much upon ourselves, Simplicio, when we will have it that merely taking care of us is the adequate work of Divine wisdom and power, and the limit beyond which it creates and disposes of nothing.

I should not like to have us tie its hand so. We should be quite content in the knowledge that God and Nature are so occupied with the government of human affairs that they could not apply themselves more to us even if they had no other cares to attend to than those of the human race alone. I believe that I can explain what I mean by a very appropriate and most noble example, derived from the action of the light of the sun. For when the sun draws up some vapors here, or warms a plant there, it draws these and warms this as if it had nothing else to do. Even in ripening a bunch of grapes, or perhaps just a single grape, it applies itself so effectively that it could not do more even if the goal of all its affairs were just the ripening of this one grape. Now if this grape receives from the sun everything it can receive, and is not deprived of the least thing by the sun simultaneously producing thousands and thousands of other results, then that grape would be guilty of pride or envy if it believed or demanded that the action of the sun's rays should be employed upon itself alone.

I am certain that Divine Providence omits none of the things which look to the government of human affairs, but I cannot bring myself to believe that there may not be other things in the universe dependent upon the infinity of its wisdom, at least so far as my reason informs me; yet if the facts were otherwise, I should not resist believing in reasoning which I had borrowed from a higher understanding. Meanwhile, when I am told that an immense space interposed between the planetary orbits and the starry sphere would be useless and vain, being idle and devoid of stars, and that any immensity going beyond our comprehension would be superfluous for holding the fixed stars, I say that it is brash for our feebleness to attempt to judge the reason

for God's actions, and to call everything in the universe vain and superfluous which does not serve us.

SAGREDO: Say rather, and I think you will be speaking more accurately, "which we do not know to serve us." I believe that one of the greatest pieces of arrogance, or rather madness, that can be thought of is to say, "Since I do not know how Jupiter or Saturn is of service to me, they are superfluous, and even do not exist." Because, O deluded man, neither do I know how my arteries are of service to me, nor my cartilages, spleen, or gall, I should not even know that I had gall, or a spleen, or kidneys, if they had not been shown to me in many dissected corpses. Even then I could understand what my spleen does for me only if it were removed. In order to understand how some celestial body acted upon me (since you want all their actions to be directed at me), it would be necessary to remove that body for a while, and say that whatever effect I might then feel to be missing in me depended upon that star.

Besides, what does it mean to say that the space between Saturn and the fixed stars, which these men call too vast and useless, is empty of world bodies? That we do not see them, perhaps? Then did the four satellites of Jupiter and the companions of Saturn come into the heavens when we began seeing them, and not before? Were there not innumerable other fixed stars before men began to see them? The nebulae were once only little white patches; have we with our telescopes made them become clusters of many bright and beautiful stars? Oh, the presumptuous, rash ignorance of mankind!

The Fourth Day

SALVIATI: Now, since it is time to put an end to our discourses, it remains for me to beg you that if later, in going over the things that I have brought out, you should meet with any difficulty or any question not completely resolved, you will excuse my deficiency because of the novelty of the concept and the limitations of my abilities; then because of the magnitude of the

26 - CHAPTER 1

subject; and finally because I do not claim and have not claimed from others that assent which I myself do not give to this invention, which may very easily turn out to be a most foolish hallucination and a majestic paradox.

To you, Sagredo, though during my arguments you have shown yourself satisfied with some of my ideas and have approved them highly, I say that I take this to have arisen partly from their novelty rather than from their certainty, and even more from your courteous wish to afford your assent that pleasure which one naturally feels from approbation and praise of what is one's own. And as you have obligated me to you by your urbanity, so Simplicio has pleased me by his ingenuity. Indeed, I have become very fond of him for his constancy in sustaining so forcibly and so undauntedly the doctrines of his master. And I thank you, Sagredo, for your most courteous motivation, just as I ask pardon of Simplicio if I have offended him sometimes with my too heated and opinionated speech. Be sure that in this I have not been moved by any ulterior purpose, but only by that of giving you every opportunity to introduce lofty thoughts, that I might be the better informed.

SIMPLICIO: You need not make any excuses; they are superfluous, and especially so to me, who, being accustomed to public debates, have heard disputants countless times not merely grow angry and get excited at each other, but even break out into insulting speech and sometimes come very close to blows.

As to the discourses we have held, and especially this last one concerning the reasons for the ebbing and flowing of the ocean, I am really not entirely convinced; but from such feeble ideas of the matter as I have formed, I admit that your thoughts seem to me more ingenious than many others I have heard. I do not therefore consider them true and conclusive; indeed, keeping always before my mind's eye a most solid doctrine that I once heard from a most eminent and learned person, and before which one must fall silent, I know that if asked whether God in His infinite power and wisdom could have conferred upon the watery element its observed reciprocating motion using some other means than moving its containing vessels, both of you

would reply that He could have, and that He would have known how to do this in many ways which are unthinkable to our minds. From this I forthwith conclude that, this being so, it would be excessive boldness for anyone to limit and restrict the Divine power and wisdom to some particular fancy of his own.

SALVIATI: An admirable and angelic doctrine, and well in accord with another one, also Divine, which, while it grants to us the right to argue about the constitution of the universe (perhaps in order that the working of the human mind shall not be curtailed or made lazy) adds that we cannot discover the work of His hands. Let us, then, exercise these activities permitted to us and ordained by God, that we may recognize and thereby so much the more admire His greatness, however much less fit we may find ourselves to penetrate the profound depths of His infinite wisdom.

SAGREDO: And let this be the final conclusion of our four days' arguments, after which if Salviati should desire to take some interval of rest, our continuing curiosity must grant that much to him. But this is on condition that when it is more convenient for him, he will return and satisfy our desires—mine in particular—regarding the problems set aside and noted down by me to submit to him at one or two further sessions, in accordance with our agreement. Above all, I shall be waiting impatiently to hear the elements of our Academician's new science of natural and constrained local motions.

Meanwhile, according to our custom, let us go and enjoy an hour of refreshment in the gondola that awaits us.

End of the Fourth and Final Day

Letter from Galileo to Elia Diodati (January 15, 1633)⁷

Very Illustrious Sire and Most Honorable Patron:

I owe answers to two letters, one from you and the other from Mr. Pierre Gassendi, written 1 November of last year but received

⁷ Finocchiaro, 223–26.

28 - CHAPTER 1

by me only ten days ago. Because I am extremely preoccupied and burdened, I should like this to serve as an answer to both of you, who are very good friends and whose letters deal with the same subject; that is, your having received my *Dialogue*, sent to both, and your having quickly looked at it with praise and approval. I thank you for that and feel obliged, though I shall be waiting for a more frank and critical judgment after you have reread it more calmly, for I fear you will find in it many things to contest.

I am sorry I did not get Morin's and Froidmont's book until six months after the publication of my *Dialogue*, since I would have had the occasion to say many things in praise of both and also to make some observations on certain details, primarily one in Morin and another in Froidmont. As regards Morin, I am surprised by the truly great respect he shows toward judicial astrology and that he should pretend to establish its certainty by his conjectures (which seem to me very uncertain, not to say most uncertain). It will really be astonishing if he has the cleverness to place astrology in the highest seat of the human sciences, as he promises; I shall be waiting with great curiosity to see such a stunning novelty. As for Froidmont, though he appears to be a man of great intellect, I wish he had not committed what I think is a truly serious error, albeit extremely common; that is, to confute Copernicus's opinion, he first begins with sneering and scornful barbs against those who hold it to be true, then (more inappropriately) he wants to establish it primarily with the authority of Scripture, and finally he goes so far as to label it in that regard little less than heretical.

It seems to me one can prove very clearly that this manner of proceeding is far from laudable. For if I ask Froidmont whose works are the sun, the moon, the earth, the stars, their arrangement, and their motions, I think he will answer they are works of God; and if I ask from whose inspiration Holy Scripture derives, I know he will answer that it comes from the Holy Spirit, namely, again God. Thus, the world is the works, and the Scripture is the words, of the same God. Then let me ask him whether the Holy Spirit has ever used, spoken, or pronounced words which, in

appearance, are very contrary to the truth, and whether this was done to accommodate the capacity of the people, who are for the most part very uncouth and incompetent. I am very sure he will answer, together with all sacred writers, that such is the habit of the Scripture; in hundreds of passages the latter puts forth (for the said reason) propositions which, taken in the literal meaning of the words, would not be mere heresies, but very serious blasphemies, by making God himself subject to anger, regret, forgetfulness, etc. However, suppose I ask him whether, to accommodate the capacity and belief of the same people, God has ever changed his works; or whether nature is God's inexorable minister, is deaf to human opinions and desires, and has always conserved and continues to conserve her ways regarding the motions, shapes, and locations of the parts of the universe. I am certain he will answer that the moon has always been spherical, although for a long time common people thought it was flat; in short, he will say that nothing is ever changed by nature to accommodate her works to the wishes and opinions of men. If this is so, why should we, in order to learn about the parts of the world, begin our investigations from the words rather than from the works of God? Is it perhaps less noble and lofty to work than to speak? If Froidmont or someone else had established that it is heretical to say the earth moves, and that demonstrations, observations, and necessary correspondences show it to move, in what sort of plot would he have gotten himself and the Holy Church? On the contrary, were we to give second place to Scripture, if the works were shown to be necessarily different from the literal meaning of the words, then this would in no way be prejudicial to Scripture; and if to accommodate popular abilities the latter has many times attributed the most false characteristics to God himself, why should it be required to limit itself to a very strict law when speaking of the sun and the earth, thus disregarding popular incapacity and refraining from attributing to these bodies properties contrary to those that exist in reality? If it were true that motion belongs to the earth and rest to the sun, no harm is done to Scripture, which speaks in accordance with what appears to the popular masses.

30 - CHAPTER 1

Many years ago, at the beginning of the uproar against Copernicus, I wrote a very long essay showing, largely by means of the authority of the Fathers, how great an abuse it is to want to use Holy Scripture so much when dealing with questions about natural phenomena, and how it would be most advisable to prohibit the involvement of Scripture in such disputes; when I am less troubled, I shall send you a copy. I say less troubled because at the moment I am about to go to Rome, summoned by the Holy Office, which has already suspended my *Dialogue*. From reliable sources I hear the Jesuit Fathers have managed to convince some very important persons that my book is execrable and more harmful to the Holy Church than the writings of Luther and Calvin. Thus I am sure it will be prohibited, despite the fact that to obtain the license I went personally to Rome and delivered it into the hands of the Master of the Sacred Palace; he examined it very minutely (changing, adding, and removing as much as he wanted), and after licensing it he also ordered it to be reviewed again here. This reviewer did not find anything to modify, and so, as a sign of having read and examined it most diligently, he resorted to changing some words; for example, in many places he said *universe* instead of *nature*, *title* instead of *attribute*, *sublime* mind in place of *divine*; and he asked to be excused by saying that he predicted I would be dealing with very bitter enemies and very angry persecutors, as indeed it followed. The publisher essays that so far this suspension has made him lose a profit of 2000 scudi, since not only could he have sold the thousand volumes he had already printed, but he could have reprinted twice as many. As for me, to my other troubles is added the following very serious one—namely, to be unable to pursue the completion of my other works (especially the one on motion), so as to publish them before I die.

I read with special pleasure Mr. Pierre Gassendi's Disquisition against Fludd's philosophy, as well as the Appendix on celestial observations. I was unable to observe Mercury or Venus in front of the sun because of rain; but in regard to their smallness, I have been certain of it for a long time, and I am glad that Mr. Gassendi

has found this to be a fact. Please share this information with the said gentleman, to whom I send warm greetings, as I also do to the Reverend Father Mersenne. Finally, I kiss your hands with all my heart and pray for your happiness.

Florence, 15 January 1633

To You Very Illustrious Sir.

*Your Most Devout and Most Obligated Servant,
Galileo Galilei.*

Reports from the Fourth Deposition (June 21, 1633)⁸

Called personally to the hall of Congregations in the palace of the Holy Office in Rome, fully in the presence of the Reverend Father Commissary General of the Holy Office, assisted by the Reverend Father Prosecutor, etc.

Galileo Galilei, Florentine, mentioned previously, having sworn an oath to tell the truth, was asked by the Fathers the following:

Q: Whether he had anything to say.

A: I have nothing to say.

Q: Whether he holds or has held, and for how long, that the sun is the center of the world and the earth is not the center of the world but moves also with diurnal motion.

A: A long time ago, that is, before the decision of the Holy Congregation of the Index, and before I was issued that injunction, I was undecided and regarded the two opinions, those of Ptolemy and Copernicus, as disputable, because either the one or the other could be true in nature. But after the above-mentioned decision, assured by the prudence of the authorities, all my uncertainty stopped, and I held, as I still hold, as very true and undoubted Ptolemy's opinion, namely, the stability of the earth and the motion of the sun.

⁸ Finocchiaro, 286–87.

32 - CHAPTER 1

Having been told that he is presumed to have held the said opinion after that time, from the manner and procedure in which the said opinion is discussed and defended in the book he published after that time, indeed from the very fact that he wrote and published the said book, therefore he was asked to freely tell the truth whether he holds or has held that opinion.

A: In regard to my writing of the *Dialogue* already published, I did not do so because I held Copernicus's opinion to be true. Instead, deeming only to be doing a beneficial service, I explained the physical and astronomical reasons that can be advanced for one side and for the other; I tried to show that none of these, neither those in favor of this opinion or that, had the strength of a conclusive proof and that therefore to proceed with certainty one had to resort to the determination of more subtle doctrines, as one can see in many places in the *Dialogue*. So for my part I conclude that I do not hold and, after the determination of the authorities, I have not held the condemned opinion.

Having been told that from the book itself and the reasons advanced for the affirmative side, namely, that the earth moves and the sun is motionless, he is presumed, as it was stated, that he holds Copernicus's opinion, or at least that he held it at the time, therefore he was told that unless he decided to proffer the truth, one would have recourse to the remedies of the law and to appropriate steps against him.

A: I do not hold this opinion of Copernicus, and I have not held it after being ordered by injunction to abandon it. For the rest, here I am in your hands; do as you please.

And he was told to tell the truth; otherwise one would have recourse to torture.

A: I am here to obey, but I have not held this opinion after the determination was made, as I said.

And since nothing else could be done for the execution of the decision, after he signed he was sent to his place.

I, Galileo Galilei, have testified as above.

Further Reading

The primary sources consist of the twenty volumes of *Le Opere di Galileo Galilei, Edizione Nazionale*, edited by Antonio Favaro (Florence: Barbera, 1890–1909; reprinted 1929–39 and 1964–66). The following English translations are available: *On Motion*, translated by I. E. Drabkin (Madison: University of Wisconsin Press, 1960); *On Mechanics*, translated by Stillman Drake (Madison: University of Wisconsin Press, 1960); *Sidereus Nuncias, or The Sidereal Messenger*, translated by Albert van Helden (Chicago: University of Chicago Press, 1989); *Discoveries and Opinions of Galileo: Including the Starry Messenger (1610), Letter to the Grand Duchess Christina (1615), and Excerpts from Letters on Sunspots (1613), the Assayer (1623)*, translated with an introduction and notes by Stillman Drake (Garden City, NY: Doubleday, 1957); *Dialogue Concerning the Two Chief World Systems: Ptolemaic and Copernican*, 2d ed., translated by Stillman Drake (Berkeley: University of California Press, 1967); *Galileo's Logical Treatises: A Translation, with Notes and Commentary, of His Appropriated Latin Questions on Aristotle's Posterior Analytics*, by William A. Wallace (Boston: Kluwer Academic Publishers, 1992). The best translation of Galileo's 1638 *Dialogues Concerning Two New Sciences* is considered to be Stillman Drake's: *Discourses on the Two New Sciences* (Madison: University of Wisconsin, 1974). An important documentary history with an authoritative introduction is *The Galileo Affair: A Documentary History*, edited by Maurice A. Finocchiaro (Berkeley: University of California Press, 1989). Other works of interest are Richard J. Blackwell, *Galileo, Bellarmine, and the Bible* (Notre Dame, IN: University of Notre Dame Press, 1991); Stillman Drake, *Galileo* (Oxford: Oxford University Press, 1980); Rivka Feldhay, *Galileo and the Church: Political Inquisition or Critical Dialogue?* (Cambridge: Cambridge University Press, 1995); James Reston, *Galileo: A Life* (New York: HarperCollins, 1994); and David B. Wilson, "Galileo's Religion Versus the Church's Science? Rethinking the History of Science and Religion," *Physics in Perspective* 1 (1999): 65–84.