

Startling as such a claim may have been at the time, so universal a view of mechanics continues a tradition reaching back to Heron and Pappus of Alexandria. The first line of Newton's preface to the first edition calls attention to the eighth book of Pappus' *Synagoge*. It is in Pappus that this massive extension of the mechanical imperium can be located. Mechanical theory surpasses Aristotle's physics, contended Pappus, because mechanics deals not just with the natural movement of bodies, but also with those locomotions effected by violent efforts contrary to natural, "physical" tendencies. It further overmatches the Aristotelian science because it treats the subject-matter of physics mathematically, a procedure which the Second Book of the *Physics* indicates is incommensurate with the kind of hypothetical necessity intrinsic to natural things. One can mathematize the study of natural things, of course; one can do mechanics. As a matter of fact, Aristotle is credited with a book by that name now lost. But if one confuses this kind of inquiry with physics properly so called, one will lose the uniqueness of nature. Precisely wrongheaded, countered Pappus. This change of the subject-matter to include all movement and the introduction of mathematics directly into the heart of the method unleashed the genius of mechanics. The School of Heron made mechanics into a universal discipline, and it divided this mechanics precisely as Newton would later do into the rational (*λογικόν*) and the manual (*χειρουργικόν*). The sweep was enormous: physics and astronomy, geometry and arithmetic — all of those sciences which would later form the medieval quadrivium and constitute the disciplines that dealt with things as opposed to the disciplines that dealt with words. The manual included a mastery in painting and carpentering, metal work and architecture, and "anything that would involve manual skill," or all of the "arts" which would be called, in the most narrow sense, the mechanical arts. Placed together, they bestowed a universality on mechanics which would give it "perhaps first place (*σχεδόν πρώτη*) among the natural inquiries which deal with the matter of the elements in the world."⁹ Mechanics did stride the Alexandrian world of Heron and Pappus like a Colossus. Newton explicitly aligns himself with this intellectual tradition, changing the somewhat modest *σχεδόν πρώτη* to the prouder claim of *maximi* and elaborating a mechanics which would not only give mathematics its foundational elements but theology its subject-matter.

From Mechanics to the First Cause

And this takes us to the third issue: to the scandal of the Cartesians. Newton did not formulate or indeed have any patience with a first philosophy that would establish the existence of God and eliminate the skepticism of Montaigne. Newton's scientific temperament possessed its own liabilities, but skepticism would not find a place among them. He did not need God to guarantee the existence of the world. Quite the contrary. He needed the world to demonstrate the existence of God. And as for this demonstration, it was to be brought under the competencies of a mechanics now coming into its universality.

Newton concludes the extensive discussion of the divine existence conducted in the General Scholium with this assertion: "And thus much concerning God: to discourse of whom from the appearance of things certainly does belong to Natural Philosophy."¹⁰ He considered this demonstration to be included within the "main business of natural philosophy," and the defense of his theological interests usually occurs in those rare places in his published works where he sets the method of his mechanics in sharp contrast with that of the Cartesians:

The main Business of natural Philosophy is to argue from Phaenomena without feigning Hypotheses, and to deduce Causes from Effects, till we come to the very first Cause, which certainly is not mechanical; and not only to unfold the Mechanism of the World, but chiefly to resolve these and such like Questions.

Note the questions that Newton maintains belong to mechanics "chiefly to resolve:"

What is there in places almost empty of Matter, and whence is it that the Sun and Planets gravitate towards one another, without dense Matter between them? Whence is it that Nature doth nothing in vain; and whence arises all that Order and Beauty which we see in the world? To what end are Comets, and whence is it that Planets move all one and the same way in Orbs concentrick, while Comets move all manner of ways in Orbs very excentrick; and what hinders the fix's Stars from falling upon one another?

Newton continues in a manner that will allow Mechanics to incorporate the discoveries of William Harvey and Marcello Malpighi in providing evidence for the divine existence:

How came the Bodies of Animals to be contrived with so much Art, and for what ends were their several Parts? Was the Eye contrived without Skill in Opticks, and Ear without Knowledge of Sounds? How do the Motions of the Body follow from the Will, and whence is the Instinct in Animals? Is not the Sensory of Animals that place to which the sensitive Substance is present, and into which the sensible Species of Things are carried through the Nerves and Brain, that there they may be perceived by their immediate presence to that Substance?

Such questions inevitably force mechanics into consideration of a first cause that is non-mechanical:

And these things being rightly dispatch'd, does it not appear from Phaenomena that there is a Being incorporeal, living, intelligent, omnipresent, who in infinite Space, as it were in his Sensory, sees the things themselves intimately, and thoroughly [sic] perceives them, and comprehends them wholly by their immediate presence to himself.

Mechanics is not theology, but it serves to ground theology, especially by establishing the existence of its fundamental subject-matter. Me-