

Ancient Jewish Sciences and
the History of Knowledge in
Second Temple Literature

Edited by
Jonathan Ben-Dov and Seth Sanders

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Editors

Jonathan Ben-Dov

and

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New York University Press

and

Institute for the Study of the Ancient World

2014

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At the time of publication, the full-text of this work was available at:
<http://dlib.nyu.edu/awdl/isaw/ancient-jewish-sciences/> .

Library of Congress Cataloging-in-Publication Data

Ancient Jewish sciences and the history of knowledge in Second Temple literature / editors Jonathan Ben-Dov and Seth Sanders.
volumes cm

Includes bibliographical references and index.

ISBN 978-1-4798-2304-8 (cloth) -- ISBN 978-1-4798-7397-5 (ebook) -- ISBN 978-1-4798-6398-3

1. Science, Ancient--History. 2. Astronomy, Ancient. 3. Astrology, Hebrew. 4. Judaism and science. 5. Physiognomy--Religious aspects--Judaism. I. Ben-Dov, Jonathan, editor. II. Sanders, Seth L., editor.

Q124.95.A53 2013

509.33'09014--dc23

2013016449

ISBN 978-1-47982-304-8 (cloth)

ISBN 978-1-47987-397-5 (ebook)

ISBN 978-1-47986-398-3 (ebook)

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Acknowledgments

Jonathan Ben-Dov and Seth L. Sanders

This book was an unexpected positive side effect of our fellowship at the Institute for the Study of the Ancient World in New York University during 2010/11. What started as a small adventure turned out to be a meaningful conference—both for us and we hope also for the attendees and the readers of the present book. We are especially glad to present the volume in the ISAW series through NYU Press, both as a printed book and as an electronic document, with free access to the public via Creative Commons.

It is a pleasant duty to acknowledge the help we received from people at ISAW, who did not outright reject our idea for a spontaneous conference but rather embraced it with enthusiasm. ISAW director, Roger Bagnall, accepted the conference to ISAW's schedule and supported the preparations in many ways. Alexander Jones lent a helpful hand and priceless advice in the organizing the conference, as well as delivering a response to one of the sessions. His presence at the lecture hall gave us the much desired perspective of the 'general' history of science outside the Jewish sources. Kate Lawson from ISAW was enormously helpful in putting the conference together, never tiring of our strange requests and special needs. Sebastian Heath has been an alert and graceful editor, who has a great impact on the book. Last but not least, we thank Shelby White, director of the Leon Levy Foundation, for her support of and engagement with the conference.

We thank John Collins, Seth Schwartz, and Lawrence Schiffman for chairing sessions and leading lively discussions at the conference. The issues each raised have had a significant impact in the pages of this book. Irene Soto, a graduate student from ISAW, quickly did most of the copy-editing, for which we are greatly indebted to her. Ross Teasler was instrumental in preparing the index.

Philip Alexander's 2002 article is reprinted here courtesy of Peeters Press (Leuven). We are grateful for both the author and the press for permission to include the paper in the present volume.

Jonathan Ben-Dov acknowledges the help of the Israel Science Foundation, as well as the kind hospitality and scholarly discussion on the part of the following people during 2010/11: Dan Machiela, Steven Fraade, Max Grossman, Hayim Lapin, and Eileen Schuller. Seth Sanders thanks Trinity College for research support and Joseph Angel, Michael Barany, Jacco Dieleman and Mathieu Ossendrijver for enlightenment.

1. Introduction

Jonathan Ben-Dov and Seth L. Sanders

1. *The Idea of Ancient Jewish Science*

Sometime after the end of the Judahite monarchy, Jewish writers opened their eyes to the universe in an unprecedented way.¹ A new interest in the cosmos and its patterns appears in late-Persian and Hellenistic apocalyptic literature. For the first time in Jewish literature, we find astronomy and cosmic geography—secrets lying beyond the traditionally understood and immediately visible world—in the *Astronomical Book* of Enoch and the *Book of Watchers*. Texts like the Aramaic Levi document and the Qumran physiognomies extend these interests from the stars to the measurement of materials and the human body. In these sources we find precise new ways to divide up and understand the world. The knowledge they present is of a sort unprecedented in Jewish sources because it contains detailed, systematic rules and observations about the physical world—what scholars of Greece and Babylon have long studied as ancient science.

But how did a type of science emerge in early Judaism when the Bible shows no interest in it, apparently prohibiting even inquiry into the stars (Deut. 4:19)? Why does this new Jewish science appear in such complex forms, intertwined with stories of biblical patriarchs and

¹ The present book and hence also this introduction address the systematic representation of scientific themes in literature from the Persian and Hellenistic periods. By doing this we leave aside the discussion of the themes of Nature and Creation in the Hebrew Bible. While mid-twentieth century scholarship downplayed the intensity of this involvement, highlighting instead the idea of divine involvement in history, it is now clear that some biblical authors entertained a comprehensive *Weltbild*, including an interest in the regularities and irregularities of nature. See *Das biblische Weltbild und seine altorientalischen Kontexte* (ed. B. Janowski and B. Ego; FAT 32; Tübingen: Mohr Siebeck, 2001); J. Ben-Dov, “Is there a Worldview in the Hebrew Bible?,” *Shnaton* 15 (2005): 297-307 (Hebrew). Baruch Halpern argues for the existence of explicit cosmological paradigms in the Hebrew Bible resembling pre-Socratic cosmologies in *idem*, “The Assyrian Astronomy of Genesis 1 and the Birth of Milesian Philosophy,” in *From Gods to God: the Dynamics of Iron Age Cosmologies* (FAT 63; Tübingen: Mohr Siebeck, 2009) 427-442.

“irrational” religious elements such as mystical visions? Who were these early searchers after knowledge, and what can we learn from the distribution of the earliest evidence, which is known only from the Qumran caves? Were the sectarians merely scribes copying traditional knowledge by rote or researchers doing experiments and formulating laws? Were their sources Babylonian, Aramean or Jewish—or is this distinction ahistorical? And what was the fate of their knowledge—does it ultimately dissolve into apocalyptic fantasy, or is it the beginning of a long and complex relationship between Judaism and science?

In this book, we outline this remarkable new kind of ancient knowledge. In addition to attempting to explain its rise, we also investigate the parameters of ancient Jewish science: the ways it might—and might not—be usefully understood as ‘science;’ how it might be understood as ‘Jewish;’ whether as a somehow inherently Jewish phenomenon, or simply science practiced by Jews.²

This book is the first to bring major scholars together to explore the relationship between science and early Judaism. It addresses a set of essential problems which traditional scholarship has rarely recognized and is perhaps not well suited to address. So it is fitting that it emerged from a conversation in the hallway of the Institute for the Study of the Ancient World, an institution dedicated to crucial but sometimes invisible interconnections, not only between ancient cultures but between modern disciplines.

If this book’s specific questions are new, its larger issues are not. The work presented here rests on the foundations of an established discipline, which has studied the role of Jews in the formation of medieval and early modern science. Beginning with Amos Funkenstein’s pioneering studies and continuing with Ruderman’s now classic *Jewish Thought and Scientific Discovery in Early Modern Europe*, it is by now an established fact that Jews not only took part in scientific activity in these periods but felt compelled to provide a theological basis for that activity.³ Following the establishment of this

² See the reasoning in the landmark book by Murray J. Rosman, *How Jewish is Jewish History?* (Oxford: Littman Library of Jewish Civilization, 2007).

³ Amos Funkenstein, *Theology and the Scientific Imagination from the Middle Ages to the Seventeenth Century* (Princeton: Princeton University Press, 1986);

discipline for the early modern period, it was carried further by scholars of medieval Jewish literature.⁴ This branch of historiography draws attention to the blurred borderlines, and often actual continuity, between what we would call ‘science’ and other disciplines often classified as esoteric, mainly Kabbalah. It is one of the aims of the present volume to carry this research agenda forward. Not surprisingly, the conflicted boundaries of science and esotericism constitute a central focus of interest in the ancient material too. This connection with secret knowledge is especially clear in our case, because the scientific trend in early Judaism arose in the framework of apocalyptic groups and their reflection on world order. But in fact, the interplay between science and esotericism has been as relevant to non-Jewish scientists as to their Jewish contemporaries throughout the historical periods mentioned above.⁵

A clarification is due about the title chosen for this book: *Ancient Jewish Sciences*. The studies mentioned above focus on Jewish *scientists* rather than on Jewish *science*. Modern science is typically understood as a universal and objective venture, with no meaningful distinction between Jewish and Christian, European or Asian science. Indeed, the term ‘Jewish Science’ appeared as an allegation against Jews during the Third Reich, to undermine their role in science as ethnically distinct, and therefore suspect.⁶

David B. Ruderman, *Jewish Thought and Scientific Discovery in Early Modern Europe* (New Haven and London: Yale University Press, 1995).

⁴ Gad Freudenthal, *Science in Medieval Jewish Cultures* (New York: Cambridge University Press, 2011); Y.T. Langermann, *The Jews and the Sciences in the Middle Ages* (New York: Ashgate, 1999); S. Sela, *Abraham Ibn Ezra and the Rise of Medieval Hebrew Science* (Leiden: Brill, 2003).

⁵ See for example A. Yarbro-Collins, *Cosmology and Eschatology in Jewish and Christian Apocalypticism* (JSJSup 50; Leiden: Brill, 1996).

⁶ See Dirk Rupnow, *Judenforschung im dritten Reich. Wissenschaft zwischen Politik, Propaganda und Ideologie* (Baden-Baden: Nomos, 2011). Thanks are due to Amos Morris-Reich and to Dirk Rupnow for this reference.

Earlier, a spiritualist movement called ‘Jewish Science’ arose as a creative response to the problems of secularizing American Jewish life in the early 20th century. On this movement see Ellen Umansky, *From Christian Science to Jewish Science: Spiritual Healing and American Jews* (Oxford: Oxford University Press, 2005). Needless to say, while this volume’s title has some remote and complex historical resonance with both of these dramatically different 20th-century terms, there is no direct connection.

But things were different in ancient times, when the Jewish nature of a science could be part of the point. In the Hellenistic period, when the search for indigenous *protos heuretes* (“first discoverers”) was at its height, some practitioners of ancient science declared themselves to be searching for a specifically Jewish contribution to the field of cosmology and science, as attested for example in Pseudo-Eupolemus’ famous claim that Enoch “discovered” astronomy (engaged below in the articles by Sanders and Reed). Thus the title “Ancient Jewish Sciences” fits quite loyally with the spirit of our objects of research. More profoundly, there is something inherently Jewish in the disciplines studied here, which depart from the practice of, say, Jewish medieval scholars like Abraham Ibn-Ezra. The modes of production and articulation of scientific material by ancient Jewish apocalyptic groups were often specifically geared to the needs of the community and to its theological worldview. Thus, as Ben-Dov points out in his article, the organizational needs of the Yahad required the development of a special branch of science, hitherto unattested in other ancient literature. In this way, therefore, the subject-matter of the present volume deserves to be called ‘Jewish Science’.

In the present volume we seek to present a more intricate view of the tension between the universality of scientific knowledge and the uniqueness of local traditions. This tension has been restudied in recent decades within the discipline of the history of science.⁷ It is increasingly clear, first, that scientific traditions develop in non-modern societies according to the unique circumstances of each and every one of them. Indeed, this has also been demonstrated for the politically and economically central aspects of “hard” sciences in modern societies such as nuclear physics and petroleum geology.⁸

⁷ See especially the theme issue “Nature and Empire. Science and the Colonial Enterprise,” edited by Roy MacLeod, *Osiris* n.s. 15 (2000).

⁸ Probably the most direct impact of physics on 20th-century politics was the creation of the controlled atomic fission reactions that destroyed Hiroshima and Nagasaki, helping end World War II and lay the grounds for the “Cold War” that defined the next four decades of geopolitics. Concern over the military value of this science resulted in the remarkable approach to knowledge signed into law as the 1946 Atomic Energy Act, which the eminent historian of science Peter Galison has described as an “anti-epistemology.” As Galison puts it, “Nuclear weapons knowledge is born secret ... [it] becomes classified the instant it is written down.” P.

Second, each of these local traditions maintains a mutual relationship with the prevalent scientific culture, at once absorbing elements from and leaving its mark on it. It is thus enlightening to examine a peripheral manifestation of scientific culture in antiquity according to these newly available tools. This methodological aspect proves to be especially relevant with respect to the ancient Jewish material, due to its unique location in space and time; it lies between the great centers of Mesopotamia and Hellenistic Egypt, at a time when the encounter between cuneiform science and the West is in full swing. The Jewish material lies in time between Hipparchus and Ptolemy, who both used cuneiform data in various ways, while its contents float somewhere between cuneiform and Greek scientific traditions.⁹ The formation of a

Galion, "Removing Knowledge" *Critical Inquiry* 31 (2004): 232. Howard Morland describes the remarkable implications of this law: "When the Atomic Energy Act became law, it defined a new legal term 'restricted data' as 'all data concerning the manufacture or utilization of atomic weapons, the production of fissionable material, or the use of fissionable material in the production of power,' unless the information has been declassified. The phrase 'all data' included every suggestion, speculation, scenario, or rumor—past, present, or future, regardless of its source, or even of its accuracy—unless it was declassified. All such data were born secret and belonged to the government. [In terms of the original Act, i]f you related a dream about nuclear weapons, you were breaking the law." —Morland, "Born Secret," *Cardozo Law Review* 25 (2005): 1402. Even after significant modification, this essential anti-epistemology, in which types of nuclear knowledge are inherently classified, is retained in U.S. Law: "a positive action is not required to put information into the [Restricted Data] category. If information falls within the Act's definition of RD, it is in this category from the moment of its origination; that is, it is 'born classified,'" as classifier Arvin Quist wrote in a 2002 report commissioned by the Oak Ridge National Laboratory, *Security Classification of Information*, 2 vols., <http://www.fas.org/sgp/library/quist/index.html>, vol. 1, p. 88. For the Nuclear Regulatory Commission's current definition of inherently classified "Restricted Data," and the rules by which it can be declassified, see sections 11 and 142 of the Atomic Energy Act of 1954 (P.L. 83-703) at <http://www.nrc.gov/about-nrc/governing-laws.html#aea-1954>. Similarly, in the oil industry, perhaps the most powerful business in the world, significant geological research is both created and concealed from the public because it concerns whether there is oil in a given area and is thus the trade secret of the company that sponsored it. For petrogeological secrets see Timothy Mitchell, *Carbon Democracy: Political Power in the Age of Oil* (New York: Verso, 2011), 244 and for a case study Geoffrey Bowker, *Science on the Run: Information Management and Industrial Geophysics at Schlumberger, 1920-1940* (Cambridge, MA: MIT Press, 1994).

⁹ See especially Jonathan Ben-Dov, *Head of all Years: Astronomy and Calendars at Qumran in their Ancient Context* (STDJ 78; Leiden: Brill, 2008) and Mladen

national narrative of scientific discovery in this context constitutes a particularly valuable case study which we aim to pursue here.

In what follows, we will introduce a few of the most interesting problems that the scientific elements in Ancient Judaism present, and the essays in this volume that contribute to solving them.

2. Why “Science”? The Demarcation Problem and the Danger of Reinventing the Wheel

In the Second Temple period, remarkable new types of knowledge and genres of text appear in Jewish culture. These include astronomical calculations of the movements of the heavenly bodies and length of the days, sexagesimal (base-60) metrology, simple forms of zodiacal astrology, and physiognomic interpretation of the body. They systematically describe aspects of the physical world in a precise new way—usually a way first developed in Mesopotamia. And all these modes of knowledge have at some point in modern European history been understood as natural science: astronomy and mathematics are of course still understood this way, but as late as the mid-19th-century a form of physiognomy known as “phrenology” was taken seriously by scholars across Europe.¹⁰

But is it science? It seems intuitively correct to us to define mathematics and astronomy as exact science, but is it science to observe someone’s hair to predict their character and destiny, as the Qumran physiognomic text 4Q186 does?¹¹ As Sanders shows in his essay, the history and philosophy of science provide a surprising but clear answer: there is no rigorous way to tell.

Popović, *Reading the Human Body: Physiognomics and Astrology in the Dead Sea Scrolls and Hellenistic-Early Roman Period Judaism* (STDJ 67; Leiden: Brill, 2007).

¹⁰ On the lives and deaths of phrenology and related physical and quantitative approaches to human character, see the lively study of Stephen Jay Gould, *The Mismeasure of Man* (New York: Norton, 1996, Rev. and expanded ed).

¹¹ An illustrative passage comes from 4Q186 1 ii 5-8, which we translate: “[And anyone] whose thighs are long and slender, whose toes are slender and long, and he is from the second column: he possesses a spirit with six parts light, but three parts in the House of Darkness. This is the birth sign (horoscope) under which he was born: the foot of Taurus. He will be humble/poor. This is his animal: the bull.”

In an influential 1983 article, the philosopher of science Larry Laudan explained that the problem of distinguishing scientific knowledge from other types has loomed large in Western philosophy for a long time:

From Plato to Popper, philosophers have sought to identify those epistemic features which mark off science from other sorts of belief and activity.¹²

In the philosophy of science, the task of defining the boundaries of science became known as the “demarcation problem,” and after well over a century of heated debate it is now generally agreed to be insoluble:

... it is probably fair to say that there is no demarcation line between science and non-science, or between science and pseudo-science, which would win assent from a majority of philosophers (112).

It appears that historically, no necessary and sufficient definition of science (or its ancestors such as Aristotle’s *episteme*) has ever been devised. As Laudan explains, definitions have at some points focused on science as proceeding deductively from *a priori* principles and at other points as proceeding inductively from observed phenomena. Science has also been defined as being “falsifiable” (a definition that includes the “falsified” flat earth theory) or as proceeding from a “scientific method”, the rules of which were never successfully explained. And as Francesca Rochberg has shown, ancient science has also been defined in contradictory ways. It has been described as inhering in explanation without accurate observation (Greek), or accurate observation without explanation (Mesopotamia and Egypt).¹³

But this very debate over the nature of ancient science suggests a more promising avenue of inquiry. While there has been a tremendous amount of successful science done in the modern world, most

¹² “The Demise of the Demarcation Problem” in *Physics, Philosophy, and Psychoanalysis: Essays in Honor of Adolf Grünbaum* (ed. R.S. Cohan and L. Laudan; Boston Studies in the Philosophy of Science 76; Dordrecht: D. Reidel, 1983), 111.

¹³ *The Heavenly Writing: Divination, Horoscopy, and Astronomy in Mesopotamian Culture* (Cambridge, UK & New York, NY: Cambridge University Press, 2004).

philosophers of science now agree that “science” itself is not something we can clearly and rigorously define. Most influentially, Larry Laudan showed that nobody has yet been able to find a set of conditions that is both necessary and sufficient to characterize everything we now consider “science.” Instead, Laudan emphasizes “strong confirmation”—a standard of proof that may apply to disciplines like history or philology as well.

When scholars of early Judaism improvise definitions of science, we freshly encounter an old problem now usually considered by philosophers and historians of science to be insoluble because its object is so heterogeneous. As Laudan writes, “... it may just be that there are no epistemic features which all and only the disciplines we accept as ‘scientific’ share in common.” The historian of science Steven Shapin concludes, “You could say that science is not one, indivisible, and unified, but that *the sciences* are many, diverse, and disunified.”¹⁴

Awareness of this long debate in the philosophy of science can save us from reinventing the wheel: if neither Karl Popper nor Imre Lakatos could come up with a solid, broadly applicable definition of science, we should not be embarrassed if our own attempts come to grief as well.¹⁵ And this awareness may help us shift our focus to the question of what we seek to learn. If we do invent a wheel, it should help take us someplace we want to go.

If we find the category of “science” to be a useful one for early Judaism, a second question arises, this one concerning its historical emergence. Would the appearance of such a pattern represent a rupture from long-term Judean/Jewish/Hebrew¹⁶ discourses and

¹⁴ Laudan, “Demise” 112; Steven Shapin, *Never Pure: Historical Studies of Science as if it was Produced by People with Bodies, Situated in Time, Space, Culture, and Society, and Struggling for Credibility and Authority* (Baltimore, Md.: Johns Hopkins University Press, 2010), 5.

¹⁵ For Lakatos’ theory of scientific progress and critiques of Kuhn and Feyerabend, see Larry Laudan, “Reconciling Progress and Loss,” in *Beyond Positivism and Relativism: Theory, Method, and Evidence* (Boulder: Westview, 1996), 113-122.

¹⁶ *n.b.* not a smoothly overlapping series—surely part of the point, and perhaps part of the solution? As Michael Stone points out in his response to Ben-Dov’s article, “Émile Puech [argues that] the linguistic milieu of Qumran was no different from that of the rest of contemporary Judea. I

traditions? If there are no biblical genres of mathematics or astronomy, for example, and divination is explicitly taboo, the extensive use of Babylonian astral science in Qumran Aramaic texts would represent a radical break.¹⁷ This would foreground the problem of historical change: what forces led to this break? Should we see it emerging from a cosmopolitan Aramaic world of exact descriptive knowledge in opposition to or initial isolation from Priestly and Deuteronomistic categorizations?¹⁸ If, on the other hand, Jewish science is bound up with scriptural exegesis, this would draw attention to emergent “scriptural” Hebrew texts like Genesis 1-2:4a, Exodus 25-31 (cf. Ex 35-40 and Ezekiel 40-48), and Leviticus 12-15, with their exact descriptions of cosmos, temple, and human phenomena (and in Leviticus, with the explicit command to closely observe physical signs to “diagnose” them as “symptoms,” primarily of *šara’at*). Again, do

propose considering that the same is true of the ‘scientific’ milieu. In fact, we have very little information about the greater culture in which the Jews in the land of Israel lived, either in the First or Second Temple periods. If we were dependent on the Hebrew Bible, virtually nothing, for the Hebrew Bible does not deal with scientific issues ... All considered, however, it is probable that the “larger culture” in which the Jews lived was basically Mesopotamian.” Stone *apud* Ben-Dov “Scientific Writings in Aramaic and Hebrew at Qumran: Translation and Concealment” in *Aramaica Qumranica: Proceedings of the Conference on the Aramaic Texts from Qumran in Aix-en-Provence 30 June - 2 July 2008* (eds. K. Bertholet and D. Stoeckl Ben Ezra; STDJ 94; Leiden: Brill, 2010), 400.

¹⁷ For Deuteronomistic prohibitions of divination see Dt 18:10, 14; I Sam 15:23; 2 Kings 17:17 and for further discussion see the chapter by Sanders in this volume. By contrast, study of the heavenly bodies is presented as an impetus to both obedience and disobedience (1 En 2) and blasphemy (1 En 7-9) in the editorially complex *Book of Watchers*. Annette Reed explores this tension in *Fallen angels and the History of Judaism and Christianity: The Reception of Enochic Literature* (New York: Cambridge University Press, 2005), 37-44.

¹⁸ Baruch Halpern has argued for the influence of Assyrian astronomy and cosmology already in the Priestly source of Genesis 1-2:4a; for a brief critique see Sanders in this volume. For the intertwining of the Babylonian and Aramaic script-languages and intellectual worlds see the rich presentation of Paul-Alain Beaulieu, “Official and Vernacular Languages: The Shifting Sands of Imperial and Cultural Identities in First-Millennium B.C. Mesopotamia” in *Margins of Writing, Origins of Cultures* (ed. S. L. Sanders; University of Chicago Oriental Institute Seminars 2; Chicago: Oriental Institute, 2006), 187-216.

these texts belong on the far side of a pre-science/science divide?¹⁹ And if so how was it bridged?

3: Science between Local Tradition and the Discovery of Universals

Sanders and Ben-Dov intended the conference as the beginning of a public conversation. Held April 4, 2011 at ISAW in New York,²⁰ the conference began by addressing the most fundamental evidence through an in-depth discussion of the *Astronomical Book* of Enoch, the earliest known Jewish—and Aramaic—scientific work, and closely related texts. The second half of the conference worked outward to the earliest Jewish communities in which science could have been conducted and concluded with a wide-ranging discussion of the stakes of understanding these early Jewish activities as scientific practice.

The rest of this introduction will sketch the contributions and suggest their possible significance. The *Astronomical Book* of Enoch, an originally independent Aramaic treatise better known from its present position in chapters 72-82 of 1 Enoch, is the subject of discussion between the first four contributors, Philip Alexander, James VanderKam, Seth Sanders and Loren Stuckenbruck. They apply a variety of methods to this core text of the scientific—and apocalyptic—tradition, thus making the present book an outstanding laboratory of attitudes for dealing with a single proof text.

An article by Philip Alexander from 2002 is reprinted here because it in many ways set the stage for the present discussion by contextualizing the *Astronomical Book* in the study of ancient science. As is often the case with pioneering studies, Alexander's essay created

¹⁹ Michael Stone noted the continuities with geographical and cosmographical lists in his "Lists of Revealed Things in the Apocalyptic Literature" in *Magnalia Dei, the Mighty Acts of God: Essays on the Bible and Archaeology in Memory of G. Ernest Wright* (ed. Frank Moore Cross, Werner Lemke, and Patrick D. Miller; Garden City N.Y.: Doubleday, 1976, 1st ed.), 414-452; for further discussion see Sanders' essay in this volume.

²⁰ The original lineup was: James VanderKam (University of Notre Dame) and Seth Sanders (Trinity College and ISAW), with Loren Stuckenbruck (Princeton Theological Seminary) as respondent; Jonathan Ben-Dov (University of Haifa and ISAW) and Mladen Popović (University of Groningen), with Alexander Jones (ISAW) as respondent; and Annette Yoshiko Reed (University of Pennsylvania), with Lawrence Schiffman (NYU) as final respondent. John Collins (Yale) and Seth Schwartz (Columbia) chaired the two sessions.

a point of departure for later authors. Even detailed critiques (see e.g. Reed, this volume) tend to uphold the general framework it established. Alexander attempted to outline a distinct Jewish tradition, which began already in biblical literature and continued into the apocalyptic tradition, whose main interest was in a systematic study of nature. Using methods from the History of Ideas, Alexander aligns this tradition with forerunners of Greek science in other parts of the Mediterranean shore, with the Ionian philosophers of nature as a prime example. Alexander's thesis is based on the distinction—criticized by some later authors—between the scientific Enoch tradition and the Mosaic tradition, which was less interested in the natural sciences. Alexander initiated the discussion of the Jewish narrative on the history of knowledge by claiming that the myth of the Watchers was designed to disguise the alien origin of sciences like astrology and astronomy by attributing them to a 'Jewish' Enoch. Taken together with Alexander's previous studies on astrology, physiognomy, and magic in the Qumran writings, these studies established a basis for the study of the sciences in Early Judaism, and supplied both the textual and the theoretical infrastructure for the present book.

James VanderKam, a foundational figure in the study of Enochic literature and of its calendars and astronomy in particular, sets out to summarize the scientific teaching of the *Astronomical Book* and analyze its key scientific concepts. The reader is led here along the winding path of Enochic wisdom in its long history of transmission. VanderKam surveys the astronomical teaching of Enoch in the variant textual traditions—Aramaic and Ethiopic—and goes beyond narrower philological concerns to raise two central theoretical questions. He wonders whether the concept of a regular, legalized cosmos as promoted in most of the *Astronomical Book* is compatible with the apocalyptic threat to this order, as demonstrated in the admonition of 1 Enoch 80. This discussion offers a different view of the theme, so central in the present volume, of the encounter between science and its theological infrastructure. After all, for a modern reader it is quite unusual to see science in an apocalyptic framework, and contradictions are certainly due to arise. VanderKam claims that the