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Squaring the Circle and Saving the Phenomena: Reading Science in the Greek Language Classroom

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Abstract

Our students live in a world where scientific achievement and knowledge are profoundly significant, just as they were to the Greeks, and it becomes increasingly important to ensure that the language requirement is as enriching an experience as possible for all students, not only for students in the humanities, but also for those pursuing STEM tracks. Here we explore the significance of science in Greek culture together with the incorporation of Greek scientific texts in the beginning and intermediate Greek language classroom. Science (knowledge) was a seminal component of the Greek intellectual experience, and approachable "scientific" texts can be found in authors identified strictly as "scientists" (e.g., Euclid), as well as in the literary canon (e.g., Homer, Aeschylus). Appended is an extensive, generously annotated appendix of "scientific" texts drawn from a variety of authors and treating the major scientific discipline.

Keywords

Aristotle, culture, epistemology, Greek pedagogy, Homer, medicine, Presocratics, science

Greek "Science"

Our students live in a world where scientific achievement and knowledge are profoundly important, as it no less was to the Greeks. And, even at liberal arts colleges, the lure of lucrative careers in STEM fields draws many students away from the humanities. Thus it becomes increasingly important to ensure that the language requirement becomes as enriching an experience as possible, not only for the students in the humanities, but also for those pursuing medical and engineering tracks. The Greek legacy includes a vast repository of fascinating texts that cover many

1 My sincere thanks to the students who so sanguinely participated in these experimental classes (Spring 2009, Fall 2012, Spring 2013) and to the anonymous reviewer for thorough, perspicacious, and salutary observations from which this article has greatly benefited. Any errors or omissions that remain are my own.

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topics of interest and relevance to the modern reader. And, with a little imagination and care, language instructors can incorporate these riches to augment the canon in language classes at all levels. Of particular interest is the Greek "scientific" corpus. Employing scientific passages in the Greek language classroom helps restore the totality of the Greek intellectual experience, exposes the student to a variety of authors and styles, and resonates with the many students in STEM fields of study.

"Science" derives from the Latin verb *scio* ("I know"), whose Greek analog is ἐπιστήμη (understanding, skill, knowledge). The term is broad, vague, and anachronistic within the context of ancient Mediterranean thought, but nonetheless serves as a convenient shorthand. "Science" ("knowledge, understanding") and philosophy arise when thinkers begin to inquire into the natural world, substituting vague assumptions for critical questions such as What is the nature of the world? What is the source of knowledge? What is the nature of existence, change, and coming-to-be? What is the nature and place of humankind within the cosmos?

Mindful of the world around them, the Greeks sought to explain the cosmos in order to take control over it and establish the primacy of humanity within the universe in accord with rational laws of physics. Heliocentrism, for example, was rejected on several grounds. Heliocentrism contradicts Aristotelian physics, according to which objects settle at their natural place, thus making the earth (the heaviest element) motionless at the center of the cosmos (Aristotle [384-322 BCE], *Physics* 3.8 [208b9-19]; *On the Heavens* 4.3 [310a30-35]). A moving earth, furthermore, should affect the motion of objects through the air, rendering it impossible for clouds or missiles, for example, to overcome atmospheric force and travel eastward against the earth's westward rotation. Heliocentrism, additionally, contradicts common sense. We see and feel no affects of the earth travelling at high speed. And we observe no change in the relative position of the stars from year to year (stellar parallax) —the so-called "sphere of fixed stars" swirls as a unit around the poles annually like clockwork. Geocentrism was a perfectly adequate explanation for the workings of the cosmos (planetary retrograde motion, aside). Finally, heliocentrism undermined the Greek sense of self-worth. On the geocentric model, humans are at the center. Heliocentrism, contrarily, renders humans insignificant, like a "fleck of stellar dust" (Rihll 1999: 73).

Nonetheless, the Greeks were eager to understand the natural world, and their inquiries into natural philosophy resulted in thoughtful and imaginative theories of physics, cosmogony, astronomy, geography, anthropology, and many other

categories that today we classify as "science". This inquisitive trajectory permeated every aspect of Greek technology,[2] art, and literature. Aristotle opened his discussion of human epistemology with the telling phrase that "all humans naturally seek to know" (πάντες ἄνθρωποι τοῦ εἰδέναι ὀρέγονται φύσει: *Metaphysics* 1[980a22]). Aristotle's point was adroitly proven by Odysseus, Homer's (750-700 BCE) clever, inquisitive, and "much-turning" (πολύτροπος) hero. In the epic's prologue we hear that Odysseus had "seen the cities and learned minds of many men" (πολλῶν δ' ἀνθρώπων ἴδεν ἄστεα καὶ νόον ἔγνω: *Odyssey* 1.3), a curiosity that is borne out in his encounters with the Lotus eaters (9.86-87), Polyphemus (9.172-176), the Laestrygones (10.100-101), and Circe (10.151-152). Furthermore, despite warnings to the contrary, Odysseus told his men that Circe had instructed him to listen to the Siren's song (οἷον ἔμ' ἠνώγει ὅπ' ἀκουέμεν: *Odyssey* 12.160). Odysseus' epic flaw is perhaps not his pride, but rather his curiosity.

"Science", moreover, transcends genre. Spheres of knowledge in antiquity were fluid, defying the imposition of modern disciplinary labels, and "science," as the Greeks envisioned it, dovetails with other intellectual pursuits, such as technology (the application of scientific principles) and medicine (whose methods synthesized rational approaches with religion and magic). Intellectual specialization, moreover, was anathema to the ancients. Few ancient scholars explored any one area of research exclusively. There is much "science" (e.g., geography, astronomy, botany) and medicine in Homer. And many philosophers and scientists of the natural world wrote in verse, including Empedocles of Acragas (fl. 460-430 BCE), Xenophanes of Kolophon (fl. ca. 540-478 BCE), and Eratosthenes of Cyrene (276-194 BCE)—the choice of Anaximander of Miletus [fl. ca. 580-545 BCE] to employ prose was a bold one). The interests of Democritus of Abdera (fl. 440-380 BCE) included not only mathematics and physics (atomic theory), but also music and ethics. And Galen (129-215 CE), who considered himself a philosopher, explored the connection between "medicine" and "philosophy" in a treatise entitled "*That the best Physician is also a Philosopher*" (1.53-63K; see also Brain 1977). It is impossible to categorize an intellect like Aristotle who lectured widely on most areas of scientific inquiry, eschewing only mathematics, or Archimedes of Syracuse (fl. ca. 250-212

2 Monumental buildings adhered to a strict theory of aesthetics and mathematical ratio. The 4:9 integral ratio was common in the 5th century (Mertens 1984: 137, 144-145; 1993: 80-87; 2006: 143; Beard 2003; Senseney 2016: 639-40); the Parthenon's many columnar refinements (entasis, curvature, inclination) resulted in perhaps the most spectacular example of *trompe l'oeil* created by human design.

BCE) who considered himself primarily a mathematician but is popularly known as a siege-craft engineer. Scholars are beginning now also to appreciate Aeschylus' (ca. 525/524 - ca. 456/455 BCE) engagement with natural philosophy (Irby-Massie 2008; Rose 2009; Glauthier forthcoming). Correlatively, works that are more purely "scientific" are often as elegant and stylish as works that we consider "literary." Archimedes' *Spiral Lines* is a complex multi-dimensional text that incorporates variety and suspense, straddling the physical and abstract, aiming to disorient and surprise the reader while stylistically paralleling the very mathematics that the author sought to explicate (Netz 2009).

Just like religion, art, and literature, scientific traditions develop from the social fabric of the cultures which produce and employ them. Rejected now is the triumphant emergence of "Greek rationality" out of intellectual infancy (Dodds 1951): the Greeks never dismissed the supernatural, but instead, as for example in the case of Plato's (ca. 390-348/7 BCE) Demiurge, they "rationalize[d] it, turning it paradoxically into the very source of the natural order, restricting its operation to a single primordial creative act which insures that the physical world would be not chaos but cosmos forever after" (Vlastos 1975: 97). While offering mechanistic explanations of natural phenomena (thunder or earthquakes) that were often ascribed to theistic causes, the Milesians maintained the divine nature of their first principles (thus positing a "reformed" theology: Lloyd 1979: 11; e.g. Anaximenes [fl. ca. 555-535 BCE], *TEGP* 36). Even in the "scientific" Aristotelian corpus, matters of theology received considerable attention (Barnes 1995: 67, 106). "Science" in the ancient world never lost its sense of wonder nor its connection with ethics and the divine, and "science" was perpetually negotiating the pervasive tension between tradition and innovation.

The agonistic nature of Greek society, furthermore, shaped the timbre, methods, and principles of Greek science, which was, above all, an exercise in debate and persuasion (Rihll 1999: 8-9). Greek thinkers aimed to sway their audiences of the truth of their (largely unprovable) theories. Greek thinkers, many of whom were autodidacts, also valued autonomy. And philosophical schools, where they did exist, were not formalized in the modern sense, but, rather, they represented groups of sympathetic thinkers. Even those who had studied under famous scholars often rejected the teachings of their mentors, preferring instead to carve out their own paths, citing, disputing, or ignoring the views of predecessors. Scientific methods were primarily theoretical, and experimentation was largely, though not exclusively, rejected, in accord with the long-standing prejudice against the baunistic occupations

(e.g., Plutarch [ca 46-120 CE], *Life of Marcellus* 14.6). In the framework of natural philosophy, however, Aristotle recognized and recommended empirical data and observation, long valued by medical practitioners and theorists (Mithridates VI's notorious immunity to all known poisons and venoms was the result of a long program of toxicological research combined with empirical trials on death-row prisoners: Pliny, *NH* 25.3, 5-7). But theory almost always persuaded, even when it was refuted by empirical evidence.

Employing "Scientific Texts" in the Greek Classroom

Although Archimedes may be better reserved for an advanced class in Greek, many "scientific" texts are accessible to intermediate (and even beginning) Greek students. Only through reading unadapted texts of different styles does the student acquire any facility with the language, syntax, or vocabulary. And the efficacy of learning in context is recognized as a powerful pedagogical tool (Hoover 2000). More texts survive from antiquity that can be classified as "scientific" than of any other genre; the ancients considered these texts interesting, relevant, and useful, and reading them directly enhances the student's experience of Greek culture, history, and literature. Such texts, carefully selected, allow for discussions on culture and values, and they emphasize that the rules of syntax and prosody are not restricted to the canonical literary authors, but rather they are universally employed by authors who explore many topics. Presocratic fragments, in particular, are attractive for their brevity.[3] They can challenge but do not overwhelm. And they can spark interesting discussions regarding the preservation and transmission of Greek texts (and biases therein). As with all Greek scientific thought, many of the primary sources are fragmentary and uncontextualized, and the earliest writers are distilled through later, often hostile, redactions: for example, Aristotle severely criticized his predecessors. What survives is a mere selection, and it may be impossible to determine how much has been lost.

For any instructor who may be apprehensive about Greek science, we strongly recommend Tracy Rihll's 1999 survey which includes a preface entitled "To the Scientifically Faint-Hearted Reader" (x-xii). Three points, in particular, merit mention here:

3 For Presocratic texts, the interested instructor is directed to Daniel Graham's excellent collection of Greek texts, commentaries, and translations in *Texts of Early Greek Philosophy* (*TEGP*), Cambridge, 2010.

- "Understanding what is going on in most of Greek science is well within the competence of any intelligent person" (Rihll 1999: x).

- "Our task consists precisely in bringing the content of Greek mathematics (science) to light not by externally transposing it into another mode of presentations but rather by comprehending it in the one way which seemed comprehensible to the Greeks" (Klein 1968/1992: 127).

- "Not knowing much modern science can be an advantage, for then you do not have to unlearn what you have been taught in order to comprehend ancient science" (Rihll 1999: x).

Thus, anyone with a knowledge of ancient Greek is more than qualified to tackle Greek "science".

I have successfully included units on Greek scientific texts with groups of elementary and intermediate level Greek language students at the College of William and Mary. Thus my students have engaged with a seminal component of Greek culture which they otherwise would not have explored. In devoting several weeks of an intermediate-level Greek poetry class exclusively to "scientific" passages, my aim was two-fold: 1) to investigate the scientific content of standard "literary" writers; and 2) to scrutinize the literary merit of so-called scientific writers. Students were able to draw from scholarly commentaries and professorial notes to help them navigate the exigencies of "advanced," fragmentary, or Presocratic Greek.

I offer a few caveats. Vocabulary can be obscure and technical. Thus prudent glossing is paramount. Additionally, students often find philosophy enigmatic, not so much in terms of grammar and syntax (Platonic and Aristotelian prose is fairly straightforward) but in trying to unpack layers of meaning and interpret elliptical philosophical thought. Thus meaningful contextual notes are essential. Finally, although it is no task to find interesting selections brimming with compelling accounts of science, its sociology, its successes and failures, passages must be selected with circumspection in order to ensure comprehensibility. The lengthy, complex sentences of Strabo of Amaseia (ca. 30 BCE - 24 CE), for example, meander as the author distilled centuries of geographical knowledge handed down through 2nd- and 3rd-hand layers of aggregate and contradictory sources, a stylistic paradigm that can challenge even the expert and is needlessly daunting to the beginner.

In order to explore the scientific merit of the literary canon, my students tackled Prometheus' exhortation on his gifts to humanity (the sciences and technology) in

Aeschylus' *Prometheus Bound* 436-506 (we do not here raise the question of authorship: see further Irby-Massie 2008: 135-136); and Sophocles' choral ode to humanity (*Antigone* 334-383). Sophocles' ode emphasizes the inquisitiveness and cleverness of mankind, the very traits that define "philosophy" (love of wisdom) and provide the cornerstone of ἐπιστήμη. Both passages succinctly and eloquently lay the foundations for appreciating what science was in the ancient world. Prometheus enabled the human race to understand the natural world, and, with his gift of rational thought (γνώμης: 456), he rescued humankind from an intellectual infancy (νηπίους: 443): "First of all, though they had eyes to see, they saw to no avail (βλέποντες ἔβλεπον μάτην); they had ears, but they did not understand (κλύοντες οὐκ ἤκουον); but, just as shapes in dreams (ὀνειράτων), throughout their length of days, without purpose they wrought all things in confusion" (447-50). Prometheus' greatest gift to humankind was the gift of discernment (ἔθηκα καὶ φρενῶν ἐπηβόλους: 444). Although mythology guides the plot, this passage is, fundamentally, about the intellectual, rational, and scientific development of humankind. In tandem with Aeschylus, we read selections from Heraclitus (fl. ca. 510-490 BCE), whose contemporaries "could not recall" what they had done while they slept. Even when awake, Heraclitus' men grasped *Logos* only through channels of perception "as though through windows" (διά τινων θυρίδων: *TEGP* 171), calling to mind Aeschylus' "shapes in dreams."

We also spent several sessions on Empedocles, looking at one short fragment (*TEGP* 26, on the four roots that comprise the material world) and one long fragment (*TEGP* 41, on the cycle of change). We read the texts aloud in meter—dactylic hexameters, a meter familiar to students who had translated lengthy selections from Homer. And we analyzed the poem syntactically and rhetorically, finding much of the grammar and syntax employed by Homer and the tragedians, and many familiar rhetorical devices: anaphora, hyperbaton, polysyndeton, and others. The vocabulary is sufficiently repetitive, and the Greek is reasonably straightforward. Empedocles, in fact, makes an excellent thematic and stylistic counterpoint to the epic poets, especially Hesiod. Empedocles' fragments are epic in tone and meter, treating not only the creation and nature of the world, but also the fall of man and the steps necessary for humankind's restoration to grace. In other words, Empedocles (who, nonetheless, promoted himself as a living god: *TEGP* 174) offers a "rational" version of Hesiod's five ages.

Scientifically relevant passages can be found in the familiar, canonical authors: references to the stars abound in Homer, the tragedians, and lyric poets, among

others. Supplementary material can inform class discussion on astronomy, scientific astrology, or even celestial navigation. For example, the beautiful star-cluster the Pleiades became a standard in star-lore: it appeared on the shield of Achilles (*Iliad* 18.486), and was observed by Odysseus on his journey from Calypso's island (5.272). It quickly became an important constellation in the agricultural calendar (Hesiod, *Works and Days* 383, 572), as well as a seasonal sign (as in Theocritus 13.25), etc. Although six stars are visible, there was robust debate on the number of stars in the cluster—most authorities have seven, but Ptolemy designated only four stars (*Almagest* 7.5 [H90]). Additionally, there was no agreement on the nature of the Pleiades: cluster or constellation. Aratus of Soloi (ca. 300-240 BCE) recognized the Pleiades as a discrete star cluster (*Phaenomena* 254-55), as Hipparchus of Nicea (fl. ca. 140-120 BCE) seemed to do. Geminus (1st c. BCE) attached the Pleiades to Taurus' back (3.3) while Nicander of Colophon (fl. 150-110 BCE) associated the cluster with Taurus' tail (*Theriaca* 122-23). Here we have a simple, almost perfunctory, image, a "star", the Pleiades, which in turn is relevant to agriculture, astronomy, astrology, pharmacy, and navigation.

Let us consider another discipline, botany, evoked by plant names widely cited in the literary canon. For example, in the *Homeric Hymn to Demeter* 208-209, Demeter drank κυκεῶν, a cocktail of barley and water mixed with "delicate pennyroyal" (γλήχωνι τερείνῃ), a subtle, almost off-hand, detail. But a deeper look is in order. The pharmaceutical writer Dioscorides of Anazarbos (fl. ca. 40-80 CE) (3.31) informs us that pennyroyal (γλήχων—the same word used by the author of the *Homeric Hymn*) is a warming and thinning botanical with a number of useful applications including some that are gynecologically specific (see also Richardson 1974: ad loc; van de Walle and Renne 2001: 5-7): pennyroyal was recommended for drawing out the menses, the afterbirth, and embryos or fetuses. While pretending to be a post-menopausal woman, Demeter was, in fact, in the prime of her life—and the irony should not be lost on the careful reader. Demeter was mourning the loss of a child, perhaps—semiotically—a miscarriage. Dioscorides' remedies derive from a rich tradition of folk medicine of which the poet of the *Homeric Hymn* was no doubt aware. It is possible that this detail, Demeter's draught of κυκεῶν with its simple, specific, and frankly unappetizing ingredients, is meant to evoke a woman who has just given birth, or a woman who has just miscarried. Κυκεῶν, like so much in Greek literature, works in multiple registers. Incidentally, other uses for pennyroyal, according to Dioscorides, include relieving spasms and nausea, driving down dark

bowel matter, aiding those bitten by wild animals, and—applied to the nostrils like smelling salts—reviving people who have fainted. Pennyroyal also strengthens the gums, soothes inflammations, stops itching, and is suitable for gout and pimples, none of which, we can be almost certain, afflicted Demeter as Metaneira welcomed the goddess to the Eleusinian court. Although Dioscorides' vocabulary is technical and often obtuse, his syntax is straightforward, and the text is now accessible through an excellent English translation (Beck 2005).

Zoology is triggered by references to animals, easily augmented by Aristotle (especially *History of Animals*; *Parts of Animals*) or Aelian (*On the Nature of Animals*). Geography is elicited by almost omnipresent toponyms. The *Odyssey* and *Argonautica* are both tales of travel; in the catalogue of ships (*Iliad* 2.494-759), the poet lists by name 175 separate towns and places. Both Eratosthenes and Strabo considered Homer the "father of Geography" (1.1.11), and Strabo included geographical, cartographical, and topographical exegesis of most (if not all) of the places that are mentioned in the *Iliad* and *Odyssey*.

Additionally, a standard author for intermediate Greek, Euripides (480-406 BCE) tackled the intellectual tensions prevalent in Athens of the late 5th century BCE. For the playwright, intellectual ferment "was the air he breathed" (Ferguson 1972: 235-236). Euripides was deeply influenced by his contemporary, Anaxagoras of Clazomenae (fl. 480-428 BCE), a rationalist, materialist thinker who removed the gods further from the current understanding of the Attic world (Anaxagoras, for example, demythologized the sun by claiming that, far from being divine, it was merely a large, fiery stone: *TEGP* 37). Moreover, the agnosticism and skepticism that characterized Presocratic (Protagorean) initiatives to explain matter and motion were manifested in Euripides' realistic approach to drama and his exploration of human psychology (to give examples would be to list the entire corpus). And Euripides' treatment of the gods was complex and nuanced. Lefkowitz 2016 argues that, through his portrayal of the gods as "brutally fickle," Euripides aimed not to undermine state religion but instead to remind the audience of the limitations of human cognizance. This sets Euripides firmly within the intellectual milieu that fostered, for example, the arguments of Parmenides of Elea (fl. ca. 490-450 BCE) against motion and true perception (*TEGP* 11). In addition, medical references (*pharmaka*, regimen, diet, exercise) abound in Euripides. And the language and ideas expressed in Euripides mirror the Hippocratic Corpus. Following the plague at Athens (430-26 BCE), Euripides' work became more deeply tinctured with compelling and graphic

medical imagery, and the *Hippolytus*, which seems to date to this period, contains some highly specialized medical terminology (Craik 2001).

The Appendix

The principles and theories of Greek "science" permeate Greek literature, and the possibilities for incorporating Greek scientific texts into a language class are myriad. In the appendix the reader will find a collection of passages, organized, for convenience, according to modern scientific/philosophical disciplines (Intellectual Inquiry, Cosmogony, Physics, Arithmetic and Geometry, Astronomy, Meteorology, Geography and Cartography, The Origin of Life, Botany, Zoology, Medicine and Healing, Pharmacy). In each section, a brief paragraph outlines the principal themes of the discipline together with several grammatical/syntactical (and rhetorical) "tags" to aid the instructor in planning lessons. Each section contains 5-8 annotated passages that present key themes or engaging examples. All technical vocabulary, specialized usage of common words, and any term not in the Dickinson College Greek Core has been glossed. Full principal parts are limited to adjectives and 3rd declension nouns. Glosses are also included for particularly challenging syntax. The notes have been constructed with an aim to elucidate both the language and the science of the texts for a language-learning audience, but not to overwhelm. They merely introduce, and, hopefully, the passages will inspire the reader to probe more deeply into the fascinating texts and topics presented below.

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Appendix. A Brief Selection of Scientific Passages.

Note

The utility of the Dickinson College Greek Core Vocabulary cannot be overemphasized.

Many texts are available digitally:

Perseus Hopper

Lacus Curtius

and the Loeb Classical Library (available online to members of the *Classical Association of the Middle West and South)*.

Further Reading

General Introductions and Handbooks

Irby, G. L., ed. *A Companion to Science, Technology, and Medicine in Ancient Greece and Rome*. 2 volumes. Boston, 2016. A collection of 60 chapters that explore many aspects of Greek and Roman mathematical and biological sciences in addition to topics in medicine, engineering, and the reception and transmission of Greco-Roman science.

Irby-Massie, G. L., and P. T. Keyser. *Greek Science of the Hellenistic Era: A Sourcebook*, with Paul Keyser. London, 2002. A collection of intriguing, key passages illustrating many aspects of the scientific advances in the two centuries following the death of Alexander of Macedon.

Keyser, P. T., and G. L Irby-Massie, eds. *Encyclopedia of Ancient Natural Scientists: The Greek Tradition and Its Many Heirs*. London, 2008. An extensive collection of biographies of Greco-Roman scientific thinkers.

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Wright, M. R. *Empedocles: The Extant Fragments.* Duckworth, 1981. Greek text with extensive commentary.

Wright, M. R. *The Presocratics*. Duckworth, 1985. The major fragments in Greek with commentary, suitable as a primary textbook.

For the Presocratics Online

Unicode texts of Anaximander, Heraclitus, Parmenides, Zeno of Citium (fl. ca. 305-263 BCE), Empedocles (with translations in French and English).

For Heraclitus (with Greek text and English translation).

For Medical Writers

Many Hippocratic and Galenic texts can be found through the *Corpus Medicorum Graecorum/Latinorum*.

The Perseus Hopper has Greek texts and English translations of about twenty Hippocratic texts (including the oath) but only one Galenic treatise (*On the Natural Faculties*).

The Loeb Classical Library features 10 volumes of Hippocratic texts and 5 volumes from Galen's body of work.

I. Intellectual inquiry and Human Ignorance: Epistemology

A complex and nuanced topic, epistemology aims to determine the nature of knowledge, its methods, how it relates to truth and belief, and its sources and scope.

The virtue of intellectual inquiry, which permeates Greek literature, is the hallmark of the Greek philosophical achievement. Greek thinkers were eager to explain the nature and source of knowledge, and soon they questioned whether sensory perception was reliable or fallible. Parmenides, an Eleatic philosopher in southern Italy, was perhaps the first to call into question the reliability of sensory perception, positing two co-existing versions of the cosmos: "the way of truth" (wherein change cannot occur) and "the way of persuasion" (the world of sensory perception in which humanity exists). Parmenides recognized that scientific investigation is a process of interpretation, as did Protagoras of Abdera (487-412 BCE) who had argued that human sensory perception was the best and most credible guide to "truth", but that the sensory world appears differently to different people, thus there is no baseline for determining what is "true." These questions were further investigated by Plato who recognized a distinction between Opinion (culled from the transitory world of the senses) and Knowledge (derived from timeless Forms, and represented by innate Ideas buried within the soul: see, e.g., *Theaetetus*, *Republic* 514a-520a). For Plato, the universal prototypes (Forms) existed apart from particular objects which were at best pale imitations. For Aristotle, however, who appreciated the value of empiricism and autopsy, knowledge of the particular guides and advances knowledge of the Universal (of essence). Epistemology remained a robust locus of debate for Stoic, Epicurean, Skeptic, and Neoplatonic thinkers.

The following passages explore the theme of human curiosity.

I.1. Aristotle, *Metaphysics* 1.1 (980a22). On the inquisitive nature of human beings.

Grammar/Syntax Tags: dative of specification, articular infinitive.

πάντες ἄνθρωποι τοῦ εἰδέναι ὀρέγονται φύσει.

Notes: **εἰδέναι**: infinitive of οἶδα; **ὀρέγω**: extend, reach at.

I.2. Homer, *Odyssey* 1.3. Odysseus' curiosity.

Grammar/Syntax Tags: genitive of possession, aorist.

πολλῶν δ᾽ ἀνθρώπων ἴδεν ἄστεα καὶ νόον ἔγνω.

Notes: **εἶδον**: see (Homeric aorist); **τό ἄστυ**: town; **ἔγνω**: aorist of γιγνώσκω.

I.3. Aeschylus, *Prometheus Bound* 447-458. Prometheus' gifts to humanity include rational thought, science, and technology.

Grammar/Syntax Tags: subjective/objective genitives, uses of the dative case, substantives, pluperfect tense, concessive participles, α-privative.

οἳ πρῶτα μὲν βλέποντες ἔβλεπον μάτην,

κλύοντες οὐκ ἤκουον, ἀλλ᾽ ὀνειράτων

ἀλίγκιοι μορφαῖσι τὸν μακρὸν βίον

ἔφυρον εἰκῇ πάντα, κοὔτε πλινθυφεῖς

δόμους προσείλους, ἦσαν, οὐ ξυλουργίαν:

κατώρυχες δ᾽ ἔναιον ὥστ᾽ ἀήσυροι

μύρμηκες ἄντρων ἐν μυχοῖς ἀνηλίοις.

ἦν δ᾽ οὐδὲν αὐτοῖς οὔτε χείματος τέκμαρ

οὔτ᾽ ἀνθεμώδους ἦρος οὔτε καρπίμου

θέρους βέβαιον, ἀλλ᾽ ἄτερ γνώμης τὸ πᾶν

ἔπρασσον, ἔστε δή σφιν ἀντολὰς ἐγὼ

ἄστρων ἔδειξα τάς τε δυσκρίτους δύσεις.

Notes: **βλέπω**: see; **μάτην**: at random, without reason; **κλύω**: hear; **ὁ ὄνειρος**: dream; **ἀλίγκιος, -α, -ον** (+ dative): resembling, like; **ἡ μορφή**: shape; **φύρω**: mix, confound, jumble; **εἰκῇ**: without a plan; **κοὔτε: και οὔτε**; **πλινθυφής, -ές**: brick-built; **ὁ δόμος**: home, house; **πρόσειλος, -ον**: towards the sun, sunny; **ᾔσαν**: 3rd plural Attic pluperfect of οἶδα ("know how to [build]…"); **ἡ ξυλουργία**: wood-working, carpentry; **κατῶρυξ (-υχος)**: dug out, quarried, underground place; ναίω: dwell, inhabit; **ἀήσυρος, -ον**: springing lightly, blowing softly, light as air; **ὁ μύρμηξ**: ant; **τό ἄντρον**: cave; **ὁ μυχός**: nook, innermost corner; **ἀνήλιος**: sunless.

τό χεῖμα, -ατος: weather, winter; **τό τέκμαρ**: fixed sign; **ἀνθεμώδης, -ες**: blooming; **τό ἔαρ**: spring; **κάρπιμος, -ον**: fruit-bearing; **τό θέρος, -εος**: summer; **βέβαιος, -ον**: steady, firm (substantive); **ἄτερ** (+ genitive): without, apart from; **πράσσω**: pass through, pass over; **ἔστε**: up to the time that; **ἡ ἀντολή**: rising; **τό ἄστρον**: star; **δύσκριτος, -ον**: hard to interpret, difficult to discern; **ἡ δύσις, -εως**: setting.

I.4. Heraclitus, *TEGP* 10 = Clement of Alexandria (150-215 CE), *Miscellanies* 2.8.1. Heraclitus' contemporaries resemble Aeschylus' pre-Promethean humans.

Grammar/Syntax Tags: uses of the dative case, aorist participle, Ionic dialect.

οὐ γὰρ φρονέουσι τοιαῦτα πολλοί, ὁκοίσοι ἐγκυρεῦσιν, οὐδὲ μαθόντες γινώσκουσιν, ἑωυτοῖσι δὲ δοκέουσι.

Notes: **ὁκοίσοι**: perhaps a variant of οἷοι; **ἐγκύρω**: meet with, come upon; **μαθόντες**: aorist participle of μανθάνω; **γινώσκουσιν**: Ionic present tense of

γιγνώσκω; **ἑωυτοῖσι**: Ionic variant of ἑαυτοῦ, ἑαυτῆς, ἑαυτοῦ.

I.5. Sophocles, *Antigone* 343-360. In the famous "Ode to Man," humanity's cleverness is congenital. This passage contrasts with the views of Heraclitus and Prometheus but complements those of Aristotle and Odysseus.

Grammar/Syntax Tags: uses of the genitive case, instrumental dative, participles, middle/passive, contract verbs.

κουφονόων τε φῦλον ὀρνίθων ἀμφιβαλὼν ἄγει
καὶ θηρῶν ἀγρίων ἔθνη πόντου τ᾽ εἰναλίαν φύσιν
σπείραισι δικτυοκλώστοις,
περιφραδὴς ἀνήρ:
κρατεῖ δὲ μηχαναῖς ἀγραύλου
θηρὸς ὀρεσσιβάτα, λασιαύχενά θ᾽
ἵππον ὀχμάζεται ἀμφὶ λόφον ζυγῶν
οὔρειόν τ᾽ ἀκμῆτα ταῦρον.

καὶ φθέγμα καὶ ἀνεμόεν φρόνημα καὶ ἀστυνόμους
ὀργὰς ἐδιδάξατο καὶ δυσαύλων
πάγων ὑπαίθρεια καὶ δύσομβρα φεύγειν βέλη
παντοπόρος: ἄπορος ἐπ᾽ οὐδὲν ἔρχεται
τὸ μέλλον: Ἅιδα μόνον φεῦξιν οὐκ ἐπάξεται.

Notes: **κουφόνοος, -ον**: light minded, thoughtless; **τό φῦλον**: race, tribe; **ὁ ὄρνις**: bird; **ἀμφιβάλλω**: throw, snare (aorist participle); **ὁ θήρ, θηρός**: beast of prey; **ἄγριος, -α, -ον**: wild; **ὁ πόντος**: sea; **ἐνάλιος, -α, -ον**: in the sea; **ἡ σπεῖρα**: twisted net; **δικτυόκλωστος, -ον**: woven in meshes; **περιφραδής, -ές**: very thoughtful, very skillful; **κρατέω**; to overpower, subdue; **ἡ μηχανή**: contrivance, machine, craft; **ἄγραυλος, -ον**: dwelling in the field; **ὀρεσσιβάτης**: mountain-roaming (substantive); **λασιαύχην, -ενος**: with a shaggy neck; **ὀχμάζω**: grip, bear, carry; **ἀμφὶ**: on both sides; **ὁ λόφος**: withers, nape of the neck; **τό ζυγόν**: yoke; **ὄρειος, -α, -ον**: of the mountains; **ἀκμής, -ῆτος**: untiring; **ὁ ταῦρος**: bull.

τό φθέγμα, -ατος: voice, speech; **ἀνεμόεις, -εσσα, -εν**: airy, windy, "swift"; **τό φρόνημα, -ατος**: mind, spirit, thought; **ἀστυνόμος**: city-protecting; **ἡ ὀργή**: natural impulse; **δυσαυλος, -ον**: unhappy, inhospitable; **ὁ πάγος**: frost; **ὑπαίθρειος, -ον**: under the air; **δύσομβρος, -ον**: stormy; **τό βέλος, -εος**: missile, dart; **παντοπόρος, -ον**: all-inventive; **ἄπορος, -ον**: without resources; **τό μέλλον**: "what might occur"; **ὁ Ἀίδας -α**: Hades (Doric genitive); **ἡ φεῦξις, -εως**: escape; **ἐπάγω**: bring on, urge on, teach, convince.

II. Cosmogony

One of the organizing principles of Greek mythology is the creation of the world and how its various parts fit together. Hesiod's cycle of Five Ages was replicated in some thinkers who envisioned multiple worlds (Democritus) or a cycle of worlds (Empedocles). Others questioned whether the world and its physical matter are created or eternal and if creation is static (Parmenides) or in a state of flux (Heraclitus).

II.1. Hesiod, *Theogony* 108-112. Hesiod's *Theogony* is the seminal text for cosmological questions in the framework of Greek mythology. His account derives from near eastern traditions where the different elements are separated from each other as the world takes shape.

Grammar/Syntax Tags: objective genitive, substantive adjectives, participles, middle/passive, unaugmented aorist, uncontracted contract verb.

εἴπατε δ', ὡς τὰ πρῶτα θεοὶ καὶ γαῖα γένοντο

καὶ ποταμοὶ καὶ πόντος ἀπείριτος, οἴδματι θυίων,

ἄστρα τε λαμπετόωντα καὶ οὐρανὸς εὐρὺς ὕπερθεν

οἵ τ᾽ ἐκ τῶν ἐγένοντο θεοί, δωτῆρες ἐάων

ὥς τ᾽ ἄφενος δάσσαντο καὶ ὡς τιμὰς διέλοντο.

Notes: **εἶπατε**: aorist imperative of εἶπον, "tell"; **ὡς**: how; **πρῶτα**: first; **ὁ πόντος**: sea; **ἀπείριτος, -ον**: boundless; **τό οἶδμα, -ατος**: swell; **θυίω**: be inspired; **τό ἄστρον**: star; **λαμπετάω**: shine (uncontracted participle); **εὐρὺς, εὐρεῖα, εὐρύ**: broad; **ὕπερθεν**: from above; **οἵ τ᾽ ἐκ τῶν**: "and the gods [born] from them"; **ὁ δωτήρ, -ῆρος**: giver; **ὁ ἐύς, ἐῆος**: good, brave, noble (substantive); **τό ἄφενος, -εος**: wealth, riches; **δατέομαι**: divide among (themselves) (un-augmented middle aorist); **διαιρέω**: divide (un-augmented aorist).

II.2. Heraclitus, *TEGP* 51 = Clement of Alexandria (150-215 CE), *Miscellanies* 5.104.3-5. Heraclitus believed in a world of flux.

Grammar/Syntax Tags: subjective genitive, partitive genitive.

πυρὸς τροπαὶ: πρῶτον θάλασσα, θαλάσσης δὲ τὸ μὲν ἥμισυ γῆ, τὸ δὲ ἥμισυ πρηστήρ.

Notes: **ἡ τροπή**: turn, change, alternation; **ἥμισυς, -εια, -υ**: half; **ὁ πρηστήρ, -ῆρος**: hurricane, waterspout with lightening.

II.3. Empedocles, *TEGP* 41.6-8 = Simplicius of Cilicia (ca. 490-560 CE), *Physics* 158. Empedocles posited a world of flux that vacillates not between elements (as in Heraclitus) but organizing principles (total mixture/total separation).

Grammar/Syntax Tags: neuter plural subject with singular verb, dative with compound verbs, participles, contract verbs.

καὶ ταῦτ᾽ ἀλλάσσοντα διαμπερὲς οὐδαμὰ λήγει,

ἄλλοτε μὲν Φιλότητι συνερχόμεν᾽ εἰς ἓν ἅπαντα,

ἄλλοτε δ᾽ αὖ δίχ᾽ ἕκαστα φορεύμενα Νείκεος ἔχθει.

Notes: **ἀλλάσσω**: give in exchange; **διαμπερές**: through and through, continually; **οὐδαμά**: never; **λήγω**: cease, abate, leave off; **ἄλλοτε . . . ἄλλοτε**: at one time . . . at another time; **ἡ Φιλότης, -ητος**: Love, Friendship; **συνέρχομαι**: come together; **δίχη**: in two, asunder; **φορέω**: bear along, shift (Doric, present middle participle); **τό Νεῖκος, -εος**: Strife; **τό ἔχθος, -εος**: hate.

II.4. Democritus, *TEGP* 53 = Hippolytus of Rome (170-235 CE), *Refutation* 1.13.3-4. Democritus envisioned a universe that supported several co-existing cosmoi.

Grammar/Syntax Tags: uses of the genitive case, dative of specification, irregular comparison, substantive adjectives, pronouns, passive infinitives, participles, indirect statement.

ἀπείρους δὲ εἶναι κόσμους καὶ μεγέθει διαφέροντας. ἔν τισι δὲ μὴ εἶναι ἥλιον μηδὲ σελήνην, ἔν τισι δὲ μείζω τῶν παρ᾽ ἡμῖν και ἔν τισι πλείω. εἶναι δὲ τῶν κόσμων ἄνισα τὰ διαστήματα, καὶ τῆι μὲν πλείους, τῆι δὲ ἐλάττους, καὶ τοὺς μὲν αὔξεσθαι, τοὺς δὲ ἀκμάζειν, τοὺς δὲ φθίνειν, καὶ τῆι μὲν γίνεσθαι, τῆι δὲ ἐκλείπειν. φθείρεσθαι δὲ αὐτοὺς ὑπ᾽ ἀλλήλων προσπίπτοντας. εἶναι δὲ ἐνίους κόσμους ἐρήμους ζώιων καὶ φυτῶν καὶ παντος ὑγροῦ.

Notes: the entire passage is an extended indirect statement depending on an understood Δημόκριτος ἔλεγε; **ἀπείρος, -ον**: boundless, infinite; **τό μεγέθος**: size; **διαφέρω**: differ; **ἡ σελήνη**: moon; **μείζω**: comparative of μέγας (alternate form of μείζονα); **πλείω**: comparative of πολύς; **ἄνισος, -η, -ον**: unequal; **τό διαστήμα**: interval; **τῆι** = τῇ; **ἐλάττους**: comparative of μικρός; **αὐξάνω**: increase, strengthen, grow; **ἀκμάζω**: be in full bloom, be in their prime (cf. acme); **φθίνω**: decay, wane; **ἐκλείπω**: fail, die; **φθείρω**: destroy; ***προσπίπτω***: fall upon, strike against; **ἔνιοι, -αι, -α**: some; **ἐρήμος, -ον** (+ genitive): destitute of; **τό ζῷον**: living creature; **τό φυτόν**: plant; **ὑγρός, -ά, -όν**: moist (substantive).

II.5. Aristotle, *On the Heavens* 2.1 (283b26-32). In contrast with Democritus, Aristotle posited an uncreated, eternal world.

Grammar/Syntax Tags: uses of the genitive case, pronouns, impersonal verbs, Aorist passive.

> Ὅτι μὲν οὖν οὔτε γέγονεν ὁ πᾶς οὐρανὸς οὔτ᾽ ἐνδέχεται φθαρῆναι, καθάπερ τινές φασιν αὐτόν, ἀλλ᾽ ἔστιν εἷς καὶ ἀΐδιος, ἀρχὴν μὲν καὶ τελευτὴν οὐκ ἔχων τοῦ παντὸς αἰῶνος, ἔχων δὲ καὶ περιέχων ἐν αὑτῷ τὸν ἄπειρον χρόνον, ἔκ τε τῶν εἰρημένων ἔξεστι λαβεῖν τὴν πίστιν, καὶ διὰ τῆς δόξης τῆς παρὰ τῶν ἄλλως λεγόντων καὶ γεννώντων αὐτόν·

Notes: **ἐνδέχομαι**: accept, admit, approve; **φθείρω**: destroy (aorist passive infinitive); **καθάπερ**: according as; **ἀΐδιος, -ον**: eternal; **ἡ ἀρχή**: beginning; **ἡ τελευτή**: end; **τοῦ παντός**: (in the attributive position) whole, entire; **ὁ αἰών, -ῶνος**: lifetime, epoch, era; **περιέχω**: embrace; **ἀπείρος, -ον**: boundless, infinite; **ὁ χρόνος**: time; **εἰρημένων**: perfect middle participle of εἴρω: say; **ἔξεστι**: it is possible; **ἄλλως**: otherwise; **γεννάω**: produce, generate.

III. Physics

The study of the natural world, physics, is the purview of all Greek thinkers, from Homer and Hesiod onward (in the poets, for example, we learn that earthquakes are caused by Poseidon, thunderbolts are under Zeus' authority). According to tradition, Thales of Miletus (fl. ca. 600-545 BCE) was the first Greek thinker to offer rational, atheistic explanations about what the world is made of and how it works. Subsequent thinkers, including his own students, contradicted and built on his theory—that one substance, water, can explain the physical universe and change within it. This sustained dialogue inspired a number of imaginative and clever hypotheses, culminating in the four element theory, approved by Aristotle, and the atomic theory, embraced by the Epicureans. Despite the fact that explanations were rational, no Greek thinker denied the existence of the gods or their role in the workings of the cosmos.

III.1. Anaximenes, *TEGP* 11 = Plutarch, *Miscellanies* 3. How all matter is created from air, which is divine by nature.

Grammar/Syntax Tags: dative of specification, extended prepositional phrases,

middle perfect participles, contract verbs, indirect statement, embedded clauses.

> Ἀναξιμένην δέ φασι τὴν τῶν ὅλων ἀρχὴν τὸν ἀέρα εἰπεῖν, καὶ τοῦτον εἶναι τῷ μὲν μεγέθει ἄπειρον, ταῖς δὲ περὶ αὐτὸν ποιότησιν ὡρισμένον· γεννᾶσθαί τε πάντα κατά τινα πύκνωσιν τούτου (ἀέρος) καὶ πάλιν ἀραίωσιν.
>
> ***Notes***: the entire passage is an extended indirect statement depending on φασι; **ὁ ἀήρ, ἀέρος**: air; **ἄπειρος, -ον**: boundless; **ἡ ποιότης, -ητος**: quality; **ὡρισμένον**: middle perfect participle of ὁρίζω: divide, define, limit; **γεννάω**: produce, generate; **ἡ πύκνωσις, -εως**: condensation; **ἡ ἀραίωσις, -εως**: thinning, rarefaction.

III.2. Xenophanes, *TEGP* 50 = John Philoponus (ca. 490-570 CE), *Physics* 125.27-32. Xenophanes posited a two element theory.

Grammar/Syntax Tags: middle/passive, correlative clauses.

> γῆ καὶ ὕδωρ πάντ᾽ ἔσθ᾽ ὅσα γίνοντ᾽ ἠδὲ φύονται.

III.3. Heraclitus, *TEGP* 49 = Aristotle, *On the Heavens* 1.10 (279b12-17). To simplify Heraclitus' thought, fire seems to be both the essential element and cause of change in the physical world.

Grammar/Syntax Tags: γίγνομαι, indirect statement.

> ὥσπερ Ἡράκλειτός φησιν ἅπαντα γίνεσθαί ποτε πῦρ.
>
> ***Notes***: **ὥσπερ**: like, even as.

III.4. Empedocles, *TEGP* 26 = Aëtius (1st/2nd c CE) P 1.3.20; Sextus Empiricus (ca. 160-210 CE), *Against the Professors* 9.362, 10.315; Ioannes Stobaeus (5th c CE) 1.10.11; Hippolytus of Rome (170-235 CE), *Refutation* 7.29.4, 10.7.3; Eusebius of Caesarea (260/265 - 339/340 CE), *Preparation for the Gospel* 14.14.6; Diogenes Laërtius (180-240 CE) 8.76. The four-root theory was first expressed in Empedocles, where each element was associated with a god.

Grammar/Syntax Tags: instrumental datives, imperatives, relative clauses, ellipses of εἰμι.

> τέσσαρα γὰρ πάντων ῥιζώματα πρῶτον ἄκουε·
>
> Ζεὺς ἀργὴς Ἥρη τε φερέσβιος ἠδ' Ἀιδωνεύς
>
> Νῆστίς θ' ἣ δακρύοις τέγγει κρούνωμα βρότειον.

Notes: **τέσσαρες, -α**: four; **τό ῥίζωμα, -ατος**: root, stem; **ἀργής, -ῆτος**: shining; **φερέσβιος, -ον**: life-giving; **Ἀιδωνεύς**: representing earth, perhaps identified with Hades (Wright, fragment 7, ad loc.); **Νῆστίς**: a water goddess from Sicily (Empedocles' homeland), perhaps associated with Persephone (Wright, ad loc.); **τό δάκρυον**: tear; **τέγγω**; soak, moisten; **τό κρούνωμα**: spring, fountain (a hapax legomena?); **βρότειος, -ον**: mortal, human.

III.5. Democritus, *TEGP* 10 = Aristotle, *Metaphysics* 1.4 (985b4-20). Democritus and his teacher Leucippus developed an atomic theory in the 4th century BCE. Having failed to secure Aristotle's imprimatur, atomism was widely rejected in favor of the four element theory.

Grammar/Syntax Tags: dative of specification, pronouns, substantives, τίθημι, εἰμι, ellipses of contract verbs, participial phrases, indirect statement.

> Λεύκιππος δὲ καὶ ὁ ἑταῖρος αὐτοῦ Δημόκριτος στοιχεῖα μὲν τὸ πλῆρες καὶ τὸ κενὸν εἶναί φασι, λέγοντες τὸ μὲν ὂν τὸ δὲ μὴ ὄν, τούτων δὲ τὸ μὲν πλῆρες καὶ στερεὸν τὸ ὄν, τὸ δὲ κενὸν τὸ μὴ ὄν (διὸ καὶ οὐθὲν μᾶλλον τὸ ὂν τοῦ μὴ ὄντος εἶναί φασιν, ὅτι οὐδὲ τοῦ κενοῦ τὸ σῶμα), αἴτια δὲ τῶν ὄντων ταῦτα ὡς ὕλην.
>
> καὶ καθάπερ οἱ ἓν ποιοῦντες τὴν ὑποκειμένην οὐσίαν τἆλλα τοῖς πάθεσιν αὐτῆς γεννῶσι, τὸ μανὸν καὶ τὸ πυκνὸν ἀρχὰς τιθέμενοι τῶν παθημάτων, τὸν αὐτὸν τρόπον καὶ οὗτοι τὰς διαφορὰς αἰτίας τῶν ἄλλων εἶναί φασιν.

ταύτας μέντοι τρεῖς εἶναι λέγουσι, σχῆμά τε καὶ τάξιν καὶ θέσιν: διαφέρειν γάρ φασι τὸ ὂν ῥυσμῷ καὶ διαθιγῇ καὶ τροπῇ μόνον: τούτων δὲ ὁ μὲν ῥυσμὸς σχῆμά ἐστιν ἡ δὲ διαθιγὴ τάξις ἡ δὲ τροπὴ θέσις: διαφέρει γὰρ τὸ μὲν A τοῦ N σχήματι τὸ δὲ AN τοῦ NA τάξει τὸ δὲ Z τοῦ H θέσει.

Notes: **ὁ ἑταῖρος**: companion, student; **τό στοιχεῖον**: a small upright post; in physics, referring to the irreducible components of the material world (e.g., "atoms"), first principle, element; **τό πλῆρες**: the full; **τό κενόν**: the empty; **τό ὄν**: "what-is"; **στερεός, -ά, -όν**: solid; **διό**: wherefore, on which account; **οὐθέν**: not one; **ἡ ὕλη**: wood, matter, sediment.

καθάπερ: according as, just as; **ὑποκειμένος, -η, -ον**: underlying; **τό πάθος, -εος**: that which happens; **γεννάω**: produce, beget; **τό μανόν**: the rare; **τό πυκνόν**: the solid, the dense; **τό πάθημα, -ατος**: suffering, change; **ἡ διαφορά**: dislocation, moving here and there; **μέντοι**: indeed, to be sure.

τό σχῆμα, -ατος: shape, form; **ἡ τάξις, -εως**: order, arrangement; **ἡ θέσις, -εως**: situation, placement; **διαφέρω**: differ; **ὁ ῥυσμός**: regular motion; **ἡ διαθιγή**: contact; **ἡ τροπή**: rotation; A and N are points on one line, representing two qualities of matter; Z and H are points on a second line.

IV. Arithmetic and Geometry

Polis (community) life is impossible without number, which was among Prometheus' gifts. Number is essential for equitable trade, fair taxes (see Herodotus [fl. ca. 445-420 BCE] 2.109), and for the management of households, businesses, and states. Accurate mensuration underlies the magnificent architectural achievements of the Greek world. Although Mesopotamia and Egypt had a strong tradition in the numerical arts, geometry was formalized in Greece in the 6th century BCE when Greek philosophers sought to determine general formulae for geometrical shapes and prove why those particular formulae were correct (the Egyptians could calculate volumes and verify their results, but only *ad hoc*). Consequently geometry was applied to other problems, as we shall see below, as well as to other sciences, especially astronomy. Among the interesting theoretical foci were the calculation of very large numbers (as in Archimedes' *Sand Reckoner*), estimating the value of π, and "squaring the circle" (constructing a square with the same area as a given circle).

IV.1. Homer, *Odyssey* 4.411-413. Proteus, the shape-shifting old man of the sea, counted his seals by fives.

Grammar/Syntax Tags: compounds of εἶμι, middle/passives, reduplication, subjunctives.

φώκας μέν τοι πρῶτον ἀριθμήσει καὶ ἔπεισιν:

αὐτὰρ ἐπὴν πάσας πεμπάσσεται ἠδὲ ἴδηται,

λέξεται ἐν μέσσῃσι, νομεὺς ὣς πώεσι μήλων.

Notes: **ἡ φώκη**: seal; **ἀριθμέω**: count; **ἔπειμι**: go over; **αὐτὰρ**: but; **ἐπήν**: when; **πεμπάζω**: count on five fingers; **ἴδηται**: aorist middle subjunctive of ὁράω; **λέγω**: lay; **μέσσῃσι**, epic dative plural of μέσος -η -ον; **ὁ νομεύς, -έως**: herdsman; **τό πῶυ**, **-εος**: flock; **τό μῆλον**: sheep, goat.

IV.2. Aeschylus, *Prometheus Bound* 459-460. Among Prometheus' gifts to humankind were numbers and arithmetic.

Grammar/Syntax Tags: partitive genitive, ethical dative.

καὶ μὴν ἀριθμόν, ἔξοχον σοφισμάτων,

ἐξηῦρον αὐτοῖς.

Notes: **ἔξοχος, -η, -ον**: excellent, mightiest, pre-eminent; **τό σόφισμα**, **-ατος**: device, artifice, trick; **ἐξευρίσκω**: discover (aorist indicative).

IV.3. Plato, *Timaeus* 54b6-d3. A geometrical atomic theory consisting of four geometrical shapes—tetrahedron, octahedron, icosahedron, and cube—the first three of which can be broken down into component triangles and then recombined in order to form various solids.

Grammar/Syntax Tags: partitive genitive, midlle/passives, participles, complementary infinitives, perfect tense, genitive absolute, relative clauses.

τὰ γὰρ τέτταρα γένη δι᾽ ἀλλήλων εἰς ἄλληλα ἐφαίνετο

πάντα γένεσιν ἔχειν, οὐκ ὀρθῶς φανταζόμενα: γίγνεται μὲν γὰρ ἐκ τῶν τριγώνων ὧν προῃρήμεθα γένη τέτταρα, τρία μὲν ἐξ ἑνὸς τοῦ τὰς πλευρὰς ἀνίσους ἔχοντος, τὸ δὲ τέταρτον ἓν μόνον ἐκ τοῦ ἰσοσκελοῦς τριγώνου συναρμοσθέν.

οὔκουν δυνατὰ πάντα εἰς ἄλληλα διαλυόμενα ἐκ πολλῶν σμικρῶν ὀλίγα μεγάλα καὶ τοὐναντίον γίγνεσθαι, τὰ δὲ τρία οἷόν τε: ἐκ γὰρ ἑνὸς ἅπαντα πεφυκότα λυθέντων τε τῶν μειζόνων πολλὰ σμικρὰ ἐκ τῶν αὐτῶν συστήσεται, δεχόμενα τὰ προσήκοντα ἑαυτοῖς σχήματα, καὶ σμικρὰ ὅταν αὖ πολλὰ κατὰ τὰ τρίγωνα διασπαρῇ, γενόμενος εἷς ἀριθμὸς ἑνὸς ὄγκου μέγα ἀποτελέσειεν ἂν ἄλλο εἶδος ἕν. ταῦτα μὲν οὖν λελέχθω περὶ τῆς εἰς ἄλληλα γενέσεως.

Notes: **ἡ γένεσις, -εως**: origin, generation; **ὀρθῶς**: rightly, clearly; **φανταζόμαι**: become visible, appear; **τριγώνος, -ον**: triangular; **προαιρέω**: bring forth, produce, prefer (perfect middle/passive); **ἡ πλευρά, -ᾶς**: rib, side; **ἀνίσος, -ον**: unequal; **ἰσοσκελής, -ές**: with two equal legs, isosceles; **συναρμόζω**: fit together (aorist passive participle).

δυνατός, -ή, -όν: able, strong, powerful; **διαλύω**: break off, dissolve (into elements); **σμικρός** = μικρός; **τοὐναντίον** = τοὐ ἐναντίον; **πεφυκότα**: perfect participle of φύω; **λυθέντων**: aorist passive participle of λύω; **μειζόνων**: comparative of μέγας; **συνίστημι**: combine; **προσήκω**: be at hand, be present, belong to; **τό σχῆμα, -ατος**: form, shape; **διασπείρω**: scatter, disperse (aorist subjunctive passive); **ὁ ὄγκος**: mass, body; **ἀποτελέω**: complete, render; **λελέχθω**: perfect middle/passive imperative of λέγω.

IV.4. Euclid (fl. 360-260 BCE), Definitions 1-4. Points and lines.

Grammar/Syntax Tags: dative with special adjectives, relative clauses, recessive accent.

σημεῖόν ἐστιν, οὗ μέρος οὐθέν. γραμμὴ δὲ μῆκος ἀπλατές.

γραμμῆς δὲ πέρατα σημεῖα. εὐθεῖα γραμμή ἐστιν, ἥτις ἐξ ἴσου τοῖς ἐφ᾽ ἑαυτῆς σημείοις κεῖται.

Notes: **τό σημεῖον**: point; **οὗ**: where; **οὐθέν**: from οὐδείς; **ἡ γραμμή**: stroke, line; **τό μῆκος, -εος**: length; **ἁπλατής, -ές**: without breadth; **τό πέρας-ατος**: limit, boundary; **κεῖμαι**: lie.

IV.5. Aristophanes (445-385 BCE), *Birds* 1001-1009. When two middle-aged Athenian men, frustrated at the litigious lifestyle of their city-state, decided to establish their own utopia in the sky, Νεφελοκοκκυγία ("Cloud Cuckoo Land"), a string of dissatisfied citizens came to seek asylum, including (a caricature of) the famous geometer Meton of Athens (fl. 440-410 BCE). Below is Meton's proposed division of Νεφελοκοκκυγία into lots by using traditional surveying tools and techniques, where Aristophanes also alludes to the paradox of "squaring the circle."

Grammar/Syntax Tags: uses of the dative case, future tense, subjunctives, contract verbs, genitive absolute, purpose clauses.

Μέτων: προσθεὶς οὖν ἐγὼ
τὸν κανόν᾽ ἄνωθεν τουτονὶ τὸν καμπύλον,
ἐνθεὶς διαβήτην—μανθάνεις;

Πισθέταιρος: οὐ μανθάνω.

Μέτων: ὀρθῷ μετρήσω κανόνι προστιθείς, ἵνα
ὁ κύκλος γένηται σοι τετράγωνος κἀν μέσῳ
ἀγορά, φέρουσαι δ᾽ ὧσιν εἰς αὐτὴν ὁδοὶ
ὀρθαὶ πρὸς αὐτὸ τὸ μέσον, ὥσπερ δ᾽ ἀστέρος
αὐτοῦ κυκλοτεροῦς ὄντος ὀρθαὶ πανταχῇ
ἀκτῖνες ἀπολάμπωσιν.

Notes: **ὁ ἀήρ, ἀέρος**: air; **προστίθημι**: put or place on or beside, impose, apply (aorist active participle); **ὁ κανών, -όνος**: rod, bar, ruler; **ἄνωθεν**: from above; **καμπύλος, -ον**: bent, curved (the "curved ruler" may sound like an oxymoron or refer to a sort of protractor); **ἐντίθημι**: insert, engraft (aorist active participle); **ὁ διαβήτης, -ου**: compass.

μετρέω: measure; **τετράγωνος, -η, -ον**: something with four angles (a square); **κἀν** = καὶ ἐν; **ὦσιν**: present subjunctive of εἰμί (continuing the purpose clause); **ὁ ἀστήρ, -έρος**: star; **κυκλοτερής, -ές**: round, circular (genitive singular); **πανταχῇ**: everywhere, in all directions; **ἡ ἀκτίς, -ῖνος**: ray, spoke; **ἀπολάμπω**: shine from, reflect light.

IV.6. Zeno, *TEGP* 16 = Aristotle, *Physics* 5.2 (233a21-28). The dichotomy argument against motion: an object cannot move because it must first touch an infinite number of points in a finite amount of time. Aristotle's counter-argument is that nothing, neither time nor space, is composed of strictly indivisible elements.

Grammar/Syntax Tags: uses of the genitive case, articular infinitive, perfect tense, middle/passive infinitive, indirect statement.

διὸ καὶ ὁ Ζήνωνος λόγος ψεῦδος λαμβάνει τὸ μὴ ἐνδέχεσθαι τὰ ἄπειρα διελθεῖν ἢ ἅψασθαι τῶν ἀπειρων καθ' ἕκαστον ἐν πεπερασμένῳ χρόνῳ. διχῶς γὰρ λέγεται καὶ τὸ μῆκος καὶ ὁ χρόνος ἄπειρον, καὶ ὅλως πᾶν τὸ συνεχές, ἤτοι κατὰ διαίρεσιν ἢ τοῖς ἐσχάτοις. τῶν μὲν οὖν κατὰ ποσὸν ἀπείρων οὐκ ἐνδέχεται ἅψασθαι ἐν πεπερασμένῳ χρόνῳ, τῶν δὲ κατὰ διαίρεσιν ἐνδέχεται· καὶ γὰρ αὐτὸς ὁ χρόνος οὕτως ἄπειρος.

Notes: **διό**: wherefore, on which account; **ψεῦδος**: false (modifying λόγος, but referring to the idea expressed by τὸ μὴ ἐνδέχεσθαι; **λαμβάνω**: to take, receive, understand; **ἐνδέχομαι**: admit, accept, assume, be possible (articular infinitive); **ἄπειρος, -ον**: boundless; **διέρχομαι**: pass through (aorist active infinitive); **ἅπτω** (+ genitive): fasten, join, engage with, touch; **περαίνω**: bring to an end, complete, "finite" (perfect middle/passive participle); **ὁ χρόνος**: time; **διχῶς**: doubly, in two ways; **τό μῆκος,**

-εος: length; **συνεχής, -ές**: continuous; **ἡ διαίρεσις, -εως**: division, divisibility; **ἔσχατος, -η, -ον**: uttermost, extreme, furthest; **ποσός, -ή, -όν**: of any number, of a certain quantity.

V. Astronomy

The night sky has always been a source of wonder and curiosity. In practical terms, observing the heavens facilitates time-keeping (in order to regulate the civic and religious calendars) and enables an understanding of the connection between celestial bodies (sun, moon, planets) and natural phenomena (seasons and tides). But Greek curiosity transcended the mundane, and thinkers were eager to construct a model of the heavens that explained the seemingly erratic retrograde motion of the planets ("wanderers") within the framework of a geocentric cosmos (i.e., "saving the phenomena"). Such a model also facilitated the prediction of eclipses, another of the goals of ancient astronomy. Although heliocentrism was suggested (famously by Aristarchus, ca. 280 BCE, but also by Seleucus of Seleucia, fl. 165-135 BCE), it was flatly rejected because of the lack of visible stellar parallax (the apparent displacement of stationary objects that results when the observer moves). The notion of a moving earth, furthermore, contradicted Aristotelian physics. The enduring model was developed by Plato's contemporary, Eudoxus of Cnidus (fl. ca. 365-340 BCE), who proposed a complicated system of 27 concentric circles governing the motions of the heavenly bodies.

V.1. Homer, *Iliad* 18.483-89. The chief constellations are rendered on Achilles' shield.

Grammar/Syntax Tags: uses of the genitive case, perfect tense, relative clauses, ellipses, anaphora.

ἐν μὲν γαῖαν ἔτευξ', ἐν δ' οὐρανόν, ἐν δὲ θάλασσαν,

ἠέλιόν τ' ἀκάμαντα σελήνην τε πλήθουσαν,

ἐν δὲ τὰ τείρεα πάντα, τά τ' οὐρανὸς ἐστεφάνωται,

Πληϊάδας θ' Ὑάδας τε τό τε σθένος Ὠρίωνος

Ἄρκτόν θ', ἣν καὶ Ἅμαξαν ἐπίκλησιν καλέουσιν,

ἥ τ᾽ αὐτοῦ στρέφεται καί τ᾽ Ὠρίωνα δοκεύει,

οἴη δ᾽ ἄμμορός ἐστι λοετρῶν Ὠκεανοῖο.

Notes: **ἐν**: construe the shield as the object; **τεύχω**: produce, make, fashion (Hephaistus is the subject); **ἠέλιόν** = ἥλιον; **ἀκάμος (-αντος)**: untiring; **ἡ σελήνη**: moon; **πλήθω**: be or become full; **τείρεα** Ionic form of τό τέρας, -ατος: sign, marvel, portent; **τὰ τ'**: "with which" (internal accusative or accusative of respect); **στεφανόω**: crown, put around as a rim (perfect indicative middle/passive); **αἱ Πληϊάδες**: the Pleiades, "seven Sisters", a star cluster at Taurus' nape, so-called because they rise at the beginning of the sailing season (πλέω); **αἱ Ὑάδες**: the Hyades, a star cluster in Taurus' head; **τό σθένος, -εος**: strength; **ὁ Ὠρίων, -ωνος**: the constellation Orion; **ἡ Ἄρκτος**: the Bear, Ursa Major (Callisto); **ἡ Ἅμαξα**: wagon (Ursa Major); **ἡ ἐπίκλησις, -εως**: additional name, "nickname"; **αὐτοῦ**: (adverb) in the same place, here, there; **στρέφω**: turn, twist, rotate (on an axis); **δοκεύω**: keep an eye, watch closely; **οἶος, -α, -ον**: alone, "most notably," according to Aristotle, *Poetics* 25 [1461a21])—the problem is that other constellations, likewise, remained above the horizon throughout the year; **ἄμμορός, -ον** (+ genitive): without a share in; **τό λοετρόν**: bath, bathing place; **ὁ Ὠκεανός**: Ocean, the river that encircles the world in the Homeric cosmos.

V.2. Homer, *Odyssey* 5.269-275. Odysseus used the stars to navigate away from Calypso's island.

Grammar/Syntax Tags: uses of the dative case, middle/passive, imperfect tense, perfect tense, relative clauses, participial clauses.

γηθόσυνος δ᾽ οὖρῳ πέτασ᾽ ἱστία δῖος Ὀδυσσεύς.

αὐτὰρ ὁ πηδαλίῳ ἰθύνετο τεχνηέντως

ἥμενος, οὐδέ οἱ ὕπνος ἐπὶ βλεφάροισιν ἔπιπτεν

Πληιάδας τ᾽ ἐσορῶντι καὶ ὀψὲ δύοντα Βοώτην

Ἄρκτον θ᾽, ἣν καὶ ἅμαξαν ἐπίκλησιν καλέουσιν,

ἥ τ᾽ αὐτοῦ στρέφεται καί τ᾽ Ὡρίωνα δοκεύει,

οἵη δ᾽ ἄμμορός ἐστι λοετρῶν Ὠκεανοῖο.

Notes: **γηθόσυνος, -η, -ον**: joyful, glad; **ὁ οὖρος**: breeze, fair wind; **πέτομαι**: fly, make fly, "spread"; **τό ἱστίον**: sail (Odysseus probably had a single sail on his "raft": see L. Casson who argues that the craft is actually a ship: *Ships and Seamanship in the Ancient World*. Baltimore, 1971); **δῖος, -α, -ον**: noble, divine; **αὐτὰρ**: but; **τό πηδαλίον**: steering oar (an early incarnation of the tiller); **ἰθύνω**: make straight, run straight, guide straight (imperfect); **τεχνηέντως**: skillfully; **ἧμαι**: sit (perfect middle participle); **οἱ**: dative of the reflexive pronoun ἑ; **ὁ ὕπνος**: sleep (we note that Odysseus' shipboard naps inevitably led to disaster, see *Odyssey* 10.31-49, 12.338-365); **τό βλέφαρον**: eyelid; **Πληιάδας**: see passage above; **ἐισοράω**: look on (dative participle modifying οἱ); **ὀψὲ**: after a long time, late; **δύω**: sink, plunge, set; **ὁ Βοώτης**; a constellation in the northern sky that seems to chase Ursa Major (replacing the Hyades in the passage above); note the formulaic nature of the last three lines of this passage which are identical to the passage above.

V.3. Aratus, *Phaenomena* 254-258. Aratus' work, composed in dactylic hexameters, was perhaps the most widely read book in antiquity (with translations into Latin penned by both Cicero and Germanicus). The Pleiades.

Grammar/Syntax Tags: dative of possession, passive, uses of the infinitive.

ἄγχι δέ οἱ σκαιῆς ἐπιγουνίδος ἅλιθα πᾶσαι

Πληϊάδες φορέονται. ὁ δ᾽ οὐ μάλα πολλὸς ἁπάσας

χῶρος ἔχει, καὶ δ᾽ αὐταὶ ἐπισκέψασθαι ἀφαυραί.

ἑπτάποροι δὴ ταί γε μετ᾽ ἀνθρώπους ὑδέονται,

ἓξ οἷαί περ ἐοῦσαι ἐπόψιαι ὀφθαλμοῖσιν.

Notes: **ἄγχι** (+ genitive): near; **οἱ**: referring to the constellation Perseus (Homeric dative, see V.2); **σκαιός, -ά, -όν**: left, westward; **ἡ ἐπιγουνίς,**

-ίδος: thigh; **ἥλιθα**: (adverb) very much, "tightly", "in a cluster"; **ἁπάσας**: "all together"; **ὁ χῶρος**: space; **ἐπισκέπτομαι**: number, count, consider (aorist middle/passive infinitive); **ἀφαυρός, -ά, -όν**: feeble, weak, faint; **ἑπτάπορος, -ον**: with seven paths; **ὑδέω**: call; **ἕξ**: six; **οἶος, -α, -ον**: alone; **περ**: all; **ἐπόψιος, -η, -ον**: visible.

V.4. Anaximander, *TEGP* 20 = Hippolytus of Rome (170-235 CE), *Refutation* 1.6.4. Eclipses.

Grammar/Syntax Tags: middle/passives, indirect statement, relative clauses, genitive absolute.

τὰ δὲ ἄστρα γίνεσθαι κύκλον πυρός, ἀποκριθέντα τοῦ κατὰ τὸν κόσμον πυρός, περιληφθέντα δ' ὑπὸ ἀέρος. ἐκπνοὰς δ' ὑπάρξαι πόρους τινὰς αὐλώδεις, καθ' οὓς φαίνεται τὰ ἄστρα· διὸ καὶ ἐπιφρασσομένων τῶν ἐκπνοῶν τὰς ἐκλείψεις γίνεσθαι.

Notes: construe the passage with an understood Ἀναξίμανδρος λέγει; **τό ἄστρον**: star; **γίνεσθαι**: present middle/passive infinitive of γίγνομαι (Ionic form); **ὁ κύκλος**: ring, circle; **ἀποκρίνω**: separate (aorist passive participle); **περιλαμβάνω**: encompass, surround (aorist passive participle); **ὁ ἀήρ, ἀέρος**: air; **ἡ ἐκπνοή**: exhalation, vent (in apposition with the subject); **ὑπάρχω**: begin, exist; **ὁ πόρος**: narrow, straight, passageway; **αὐλώδεις**: flute-like passage; **διό**: wherefore, on which account; **ἐπιφράσσω**: block up; **ἡ ἔκλειψις, -εως**: failing, "eclipse".

V.5. Democritus, *TEGP* 64 = Aëtius (1st/2nd c CE) P 2.15.3, S 1.24.1e. The nature of the sun.

Grammar/Syntax Tags: indirect statement, participial clauses.

Δημόκριτος [τὸν ἥλιον] μύδρον ἢ πέτρον διάπυρον. τροπὴν δέ γίγνεσθαι ἐκ τῆς περιφερούσης αὐτὸν δινήσεως.

Notes: **ὁ μύδρος**: anvil, red-hot iron; **ὁ πέτρος**: stone, rock; **διάπυρος, -ον**: red-hot, enflamed, fiery; **ἡ τροπή**: turning, "solstice"; **περιφέρω**: carry around; **ἡ δίνησις, -εως**: whirling, rotation (the vortex is presumably caused

by the motion of the sun around the earth).

V.6. Archimedes, *Sand-Reckoner* 1.4-5. Aristarchus' astronomical theories, including heliocentrism.

Grammar/Syntax Tags: perfect tense, uses of the participle, indirect statement, relative clauses, alpha-privative.

Ἀρίσταρχος δὲ ὁ Σάμιος ὑποθεσίων τινῶν ἐξέδωκεν γραφάς, ἐν αἷς ἐκ τῶν ὑποκειμένων συμβαίνει τὸν κόσμον πολλαπλάσιον εἶμεν τοῦ νῦν εἰρημένου. ὑποτίθεται γὰρ τὰ μὲν ἀπλανέα τῶν ἄστρων καὶ τὸν ἅλιον μένειν ἀκίνητον, τὰν δὲ γᾶν περιφέρεσθαι περὶ τὸν ἅλιον κατὰ κύκλου περιφέρειαν, ὅς ἐστιν ἐν μέσῳ τῷ δρόμῳ κείμενος, τὰν δὲ τῶν ἀπλανέων ἄστρων σφαῖραν περὶ τὸ αὐτὸ κέντρον τῷ ἁλίῳ κειμέναν τῷ μεγέθει ταλικαύταν εἶμεν, ὥστε τὸν κύκλον, καθ᾽ ὃν τὰν γᾶν ὑποτίθεται περιφέρεσθαι, τοιαύταν ἔχειν ἀναλογίαν ποτὶ τὰν τῶν ἀπλανέων ἀποστασίαν, οἵαν ἔχει τὸ κέντρον τᾶς σφαίρας ποτὶ τὰν ἐπιφάνειαν.

Notes: **Σάμιος, -η, -ον**: from the island of Samos, in the eastern Aegean; **ἡ ὑπόθεσις**: proposal, hypothesis; **ἐξέδωκεν**: aorist of ἐκδίδωμι: give out, "publish"; **ὑποκειμένων**: perfect middle/passive substantive participle of ὑπόκεμαι: lie under ("underlying principles"); **πολλαπλάσιος**: many times as, as large as; **εἶμεν**: Doric present infinitive of εἰμι; **εἰρημένων**: perfect middle participle of εἴρω: say ("what is now said"); **ὑποτίθημι**: place under, assume, suppose; **ἀπλανής, -ές**: not wandering (the planets are so-called because they seem to "wander" erratically in the comparison with the sphere of fixed stars); **τό ἄστρον**: star; **τὸν ἅλιον**: Doric for ἥλιος; **ἀκίνητος**: unmoved, motionless; **τὰν γᾶν**: Doric for γῆ; **περιφέρω**: carry round; **ὁ δρόμος**: course; **ἡ σφαῖρα**: ball, sphere; **τό κέντρον**: sharp point, center; **ταλικαύταν**: Doric for τηλικοῦτος: of such an extent; **ἡ ἀναλογία**: mathematical proportion; **ποτὶ**; Doric for πρὸς; **ἡ ἀποστασία**: revolt,

departure, distance; **ἡ ἐπιφάνεια**: appearance, surface.

VI. Meteorology

The ancient science of "Meteorology", the study of μετέωρα ("things high up"), was much broader in scope than the modern discipline, focusing not on predicting weather patterns (they lacked the tools to measure temperature and barometric pressure with any accuracy), but instead on explaining meteorological phenomena, including comets, precipitation, rainbows (and even moonbows), winds, as well as phenomena that were not so "high up"—volcanic eruptions, for example, and earthquakes, thought to be caused by winds. Aristotle's *Meterology* survives, as does Theophrastus' *On Winds* and pseudo-Theophrastus' *On Weather Signs*. Among other things, Aristotle theorized that rainbows occur when sunlight is reflected at fixed angles from clouds. He also explained comets, meteors, the aurora borealis, and the Milky Way as phenomena of the upper atmosphere, caused by hot, dry exhalations from accreting air that occasionally burst into flame.

VI.1. Anaximenes, *TEGP* 26 = Aëtius (1st/2nd c CE) P 3.4.1, S 1.31.1. On the formation of clouds, rain, and snow (compare III.1, illustrating Anaximenes' physics).

Grammar/Syntax Tags: genitive absolute, indirect statement, temporal clauses.

> Ἀναξιμένης νέφη μὲν γίνεσθαι παχυνθέντος ἐπὶ πλεῖον τοῦ ἀέρος, μᾶλλον δ'ἐπισυναχθέντος ἐκθλίβεσθαι τοὺς ὄμβρους, χιόνα δὲ ἐπειδὰν τὸ καταφερόμενον ὕδωρ παγῆι, χάλαζαν δ'ὅταν συμπεριληφθῆι τι τῶι ὑγρῶι πνευματικόν.

Notes: **Ἀναξιμένης** (ἔφη); **τό νέφος, -εος**: cloud; **παχύνω**: thicken; **ὁ ἀήρ, ἀέρος**: air; **ἐπισυνάγω**: collect (aorist passive participle in genitive absolute; understand ἀέρος); **ἐκθλίβω**: squeeze, press; **ὁ ὄμβρος**: storm, thunder shower; **ἡ χιών, -όνος**: snow; **ἐπειδὰν**: whenever; **τό καταφέρω**: fall down; **ὕδωρ**: "rain"; **πήγνυμι**: stick, fix, "freeze" (aorist passive subjunctive); **ἡ χάλαζα**: hail; **συμπεριλαμβάνω**: gather together (aorist passive subjunctive); **ὑγρός, -ά, -όν**: moist; **πνευματικός, -ή, -όν**: of wind/air, windy, airy.

VI.2. Anaximander, *TEGP* 30 = Aëtius (1st/2nd c CE) P 3.3.1, S 1.291.1. The causes of various violent weather phenomena.

Grammar/Syntax Tags: genitive with prepositions, participles, aorist passive, indirect statement.

> περὶ βροντῶν, ἀστραπῶν, κεραυνῶν, πρηστήρων, τε καὶ τυφώνων. Ἀναξίμανδρος ἐκ τοῦ πνεύματος ταυτὶ πάντα συμβαίνειν· ὅταν γὰρ περιληφθὲν νέφει παχεῖ βιασάμενον ἐκπέσῃ τῇ λεπτομερείαι καὶ κουφότητι, τόθ' ἡ μὲν ῥῆξις τὸν ψόφον, ἡ δὲ διαστολὴ παρὰ τὴν μελανίαν τοῦ νέφους τὸν διαυγασμὸν ἀποτελεῖ.

Notes: **ἡ βροντή**: thunder; **ἡ ἀστραπή**: lightning flash; **ὁ κεραυνός**: thunderbolt; **ὁ πρηστήρ, -ῆρος**: windstorm, whirlwind, hurricane; **ὁ τυφῶν, -ῶνος**: typhoon; **Ἀναξίμανδρος** (ἔφη); **ταυτί:** strengthened Attic form of ταῦτα**; συμβαίνω**: be joined, meet, correspond with, happen, result; **περιλαμβάνω**: encompass, surround (aorist passive participle); **τό νέφος, -εος**: cloud; **παχύς, -εῖα**: thick; **βιάζω**: overpower by force; **ἐκπίπτω**: fall out, drive out; **ἡ λεπτομέρεια**: property of being composed of small particles; **ἡ κουφότης, -ητος**: lightness, **ἡ ῥῆξις, -εως**: breaking, bursting; **ὁ ψόφος**: noise; **ἡ διαστολή**: separation; **ἡ μελανία**: blackness; **ὁ διαυγασμός**: bright burst (of lightening); **ἀποτελέω**: bring to an end, complete, accomplish, effect.

VI.3. Pseudo-Theophrastus, *On Weather Signs* 32. How to determine weather conditions by observing thunder and lightening.

Grammar/Syntax Tags: genitive of time, superlatives, future tense, subjunctives, conditionals, temporal clauses.

> Ἐὰν ἀστραπὴ πανταχόθεν γίνηται, ὕδωρ σημαίνει, καὶ ὅθεν ἂν αἱ ἀστραπαὶ πυκναὶ γίνωνται, ἐντεῦθεν πνεύματα γίνεται. θέρους ὅθεν ἂν ἀστραπαὶ καὶ βρονταὶ γίνωνται, ἐντεῦθεν πνεύματα γίνεται ἰσχυρά· ἐὰν μὲν σφόδρα καὶ ἰσχυρὸν ἀστράπτῃ, θᾶττον καὶ σφοδρότερον πνεύσουσιν, ἐὰν δ᾽ ἠρέμα καὶ μανῶς, κατ᾽ ὀλίγον. τοῦ δὲ χειμῶνος καὶ φθινοπώρου τοὐναντίον· παύουσι γὰρ τὰ πνεύματα αἱ

ἀστραπαί· καὶ ὅσῳ ἂν ἰσχυρότεραι γίνωνται ἀστραπαὶ καὶ βρονταί, τοσούτῳ μᾶλλον παύονται· τοῦ δ᾽ ἔαρος ἧττον ἂν ταὐτὰ σημεῖα λέγω, ὥσπερ καὶ χειμῶνος.

Notes: **ἡ ἀστραπή**: lightening flash; **πανταχόθεν**: from all sides; **ὕδωρ**: "rain"; **σημαίνω**: indicate; **πυκνός, -ή, -όν**: thick, close; **ὅθεν . . . ἐντεῦθεν**: from where . . . from that place; **τό θέρος, -εος**: summer; **ἡ βροντή**: thunder; **σφόδρα**: (adverb) violently, excessively; **θᾶττον**: comparative of ταχύς; **πνεύω**: blow; **ἠρέμα**: (adverb) softly, gently; **μανῶς**: infrequently; **κατ᾽ ὀλίγον**: gradually; **ὁ χειμών, -ῶνος**: winter; **τό φθινόπωρον**: autumn; **τό ἔαρ**: spring; **ἧττων, -ον**: weaker.

VI.4. Xenophanes, *TEGP* 72 = Scholium BLT on *Iliad* 11.27. The rainbow.

Grammar/Syntax Tags: objects complement, passive infinitives, relative clauses.

ἥν τ᾽ Ἶριν καλέουσι, νέφος καὶ τοῦτο πέφυκε,

πορφύρεον καὶ φοινίκεον καὶ χλωρὸν ἰδέσθαι.

Notes: **ἡ Ἶρις, -ιδος**: rainbow; **τό νέφος, -εος**: cloud; **πέφυκε**: perfect of φύω; **πορφύρεος, -η, -ον**: bright, glittering, dark red, purple, crimson; **φοινίκεος, -έα, -εον**: purple-red, purple, crimson; **χλωρός, -ά, -όν**: pale, pale-green, yellow; **εἶδον**: see (aorist middle infinitive).

VI.5. Aristotle, *Meteorology* 3.4 (375a18-22; 376b25-28). Moon Rainbows.

Grammar/Syntax Tags: objective genitive, comparatives, superlatives, relative clauses, temporal clauses.

μέγιστον δὲ σημεῖον τούτων ἡ ἀπὸ τῆς σελήνης ἶρις· φαίνεται γὰρ λευκὴ πάμπαν. γίγνεται δὲ τοῦτο ὅτι ἔν τε τῷ νέφει ζοφερῷ φαίνεται καὶ ἐν νυκτί. ὥσπερ οὖν πῦρ ἐπὶ πῦρ, μέλαν παρὰ μέλαν ποιεῖ τὸ ἠρέμα λευκὸν παντελῶς φαίνεσθαι λευκόν·

γίγνεσθαι δὲ καὶ νύκτωρ ἀπὸ τῆς σελήνης ὀλιγάκις·

οὔτε γὰρ ἀεὶ πλήρης, ἀσθενεστέρα τε τὴν φύσιν <ἢ> ὥστε κρατεῖν τοῦ ἀέρος.

Notes: **τούτων**: i.e., contrasting colors in rainbows; **ἡ σελήνη**: moon; **λευκός, -ή, -όν**: light, bright; **πάμπαν**: wholly, altogether; **τό νέφος, -εος**: cloud; **ζοφερός, -ά, -όν**: dusky, gloomy; **μέλας, μέλαινα, μέλαν**: dark, black; **τὸ ἠρέμα**: the soft, the "dim"; **παντελῶς**: completely.

νύκτωρ: (adverb) by night; **ὀλιγάκις**: seldom; **πλήρης, πλῆρες**: full; **ἀσθενής, -ές**: without strength, weak; **τὴν φύσιν**: in respect to its nature, naturally (accusative of respect); **ὁ ἀήρ, ἀέρος**: air.

VII. Geography and Cartography

In antiquity, describing the world was a way of understanding the earth, and understanding was a way of imposing control over it. For the Greeks, geography followed three primary trajectories: human (straddling what we would call ethnography and anthropology), physical or descriptive (the nature and shape of the earth, and human's place in it), and mathematical (size and distance between places). The Greeks believed that the earth was a sphere (Plato's perfect geometrical shape: *Timaeus* 32c-34b), and many ancient thinkers calculated the earth's circumference. Using simple trigonometry, Eratosthenes determined the earth's circumference at 250,000 *stadia*, approximately 24,662 miles, just under the modern figure of 24,901 miles).

Several challenges obstruct our reconstruction of ancient geographical and cartographical thought. Representing the culmination of centuries of Greek geographical investigation, the only extant work of mathematical geography is the *Guide to Drawing Maps of the World* (more commonly, *Geography*) of Claudius Ptolemy (fl. ca. 127- after 146 CE). In addition, aside from the Roman *passus mille,* units of measurement were not standardized. At least three values for the *stadion* are known: Athenian (185 meters); Olympian (192.8 meters); Egyptian (157.5 meters). Also, because of the earth's sphericity, cartographic data become distorted in two-dimensional formats. Thus, aiming to produce a more accurate map using new information gained by expansion of empire and trade links, Ptolemy devised a sophisticated grid of curved meridians and parallels in order to improve the accuracy of positioning distant locations.

Finally, there is also robust debate regarding whether physical maps, as we understand them, existed at all. Literary evidence, however, strongly suggests pictoral maps in monumental contexts (see Aristophanes VII.8, below), but it is likely that ancient maps lacked scale, and details attenuated as the map spiraled away from its center.

VII.1. Aristotle, *On the Heavens* 2.14 (297b24-31). Lunar eclipses prove the earth's sphericity.

Grammar/Syntax Tags: prepositions, imperfect tense, supplementary participles, optatives, causal clauses, ellipses.

> Ἔτι δὲ καὶ διὰ τῶν φαινομένων κατὰ τὴν αἴσθησιν· οὔτε γὰρ ἂν αἱ τῆς σελήνης ἐκλείψεις τοιαύτας ἂν εἶχον τὰς ἀποτομάς· νῦν γὰρ ἐν μὲν τοῖς κατὰ μῆνα σχηματισμοῖς πάσας λαμβάνει τὰς διαιρέσεις (καὶ γὰρ εὐθεῖα γίνεται καὶ ἀμφίκυρτος καὶ κοίλη), περὶ δὲ τὰς ἐκλείψεις ἀεὶ κυρτὴν ἔχει τὴν ὁρίζουσαν γραμμήν, ὥστ᾽ ἐπείπερ ἐκλείπει διὰ τὴν τῆς γῆς ἐπιπρόσθησιν, ἡ τῆς γῆς ἂν εἴη περιφέρεια τοῦ σχήματος αἰτία σφαιροειδὴς οὖσα.

Notes: **ἔτι**: further ("there is further proof"); **ἡ αἴσθησις, -εως**: sense perception; **οὔτε γὰρ**: "if the earth were not spherical"; **ἡ σελήνη**: moon; **ἡ ἔκλειψις, -εως**: failing, "eclipse"; **ἡ ἀποτομή**: division into segments; **ἡ μήνη**: moon; **ὁ σχηματισμός**: configuration; **ἡ διαίρεσις, -εως**: division; **ἀμφίκυρτος, -ον**: convex (gibbous); **κοῖλος, -η, -ον**: hollow, concave; **κυρτός, -ή, -όν**: bulging, convex; **ὁρίζω**: divide, separate, define, limit; **ἡ γραμμή**: stroke, line; **ἐπείπερ**: since; **ἐκλείπω**: an eclipse occurs; **ἡ ἐπιπρόσθησις, -εως**: interposition; **ἡ περιφέρεια**: circumference; **τό σχῆμα, -ατος**: shape; **σφαιροειδής, -ές**: spherical.

VII.2. Plato, *Phaedo* 109b. The extent of the inhabitable earth.

Grammar/Syntax Tags: pronouns, participles in indirect statement.

> ἔτι τοίνυν, ἔφη, πάμμεγά τι εἶναι αὐτό, καὶ ἡμᾶς οἰκεῖν

τοὺς μέχρι Ἡρακλείων στηλῶν ἀπὸ Φάσιδος ἐν σμικρῷ τινι μορίῳ, ὥσπερ περὶ τέλμα μύρμηκας ἢ βατράχους περὶ τὴν θάλατταν οἰκοῦντας, καὶ ἄλλους ἄλλοθι πολλοὺς ἐν πολλοῖσι τοιούτοις τόποις οἰκεῖν.

Notes: **πάμμεγας, -άλη, -α**: immense; **αὐτό**: refers to the earth; **ἡ στήλη**: block, monument, boundary post (here, the Strait of Gibraltar, where, according to tradition, Heracles opened up a passage between the Mediterranean and the Atlantic); **ὁ Φᾶσις, -ιδος**: a river in Colchis, on the eastern Black Sea, marking the eastern extent of Greek geographical knowledge in Plato's day; **σμικρός** = μικρός; **τό μόριον**: piece, portion; **τό τέλμα, -ατος**: swamp, marsh; **ὁ μύρμηξ, -ηκος**: ant; **ὁ βάτραχος**: frog; **ἄλλοθι**: elsewhere.

VII.3. Plato, *Phaedo* 110b. The earth is like a ball.

Grammar/Syntax Tags: dative of specification, perfect tense, subjunctives, conditional clauses, relative clauses.

λέγεται τοίνυν, ἔφη, ὦ ἑταῖρε, πρῶτον μὲν εἶναι τοιαύτη ἡ γῆ αὐτὴ ἰδεῖν, εἴ τις ἄνωθεν θεῷτο, ὥσπερ αἱ δωδεκάσκυτοι σφαῖραι, ποικίλη, χρώμασιν διειλημμένη, ὧν καὶ τὰ ἐνθάδε εἶναι χρώματα ὥσπερ δείγματα, οἷς δὴ οἱ γραφῆς καταχρῶνται.

Notes: **ὁ ἑταῖρος**: companion, friend; **ἰδεῖν**: aorist active infinitive of εἶδον; **ἄνωθεν**: from above; **θεάομαι**: gaze; **δωδεκάσκυτος, -ον**: with twelve strips of leather; **ἡ σφαῖρα, -ας**: ball; **ποικίλος, -η, -ον**: many colored, dappled; **τό χρῶμα, -ατος**: color; **διαλαμβάνω**: divide, distinguish (perfect middle/passive participle); **ἐνθάδε**: here; **τό δεῖγμα, -ατος**: sample, pattern; **ὁ γραφεύς, -έως**: painter; **καταχράομαι**: make use of, apply.

VII.4. Strabo 1.1.11. Homer was the "father of geography."

Grammar/Syntax Tags: genitive with special verbs, aorist passive participle, 3rd person imperative.

Νυνὶ δὲ ὅτι μὲν Ὅμηρος τῆς γεωγραφίας ἦρξεν, ἀρκείτω

τὰ λεχθέντα.

Notes: **ἡ γεωγραφία**: geography; **ἦρξεν**: aorist active indicative of ἄρχω (+ genitive); **ἀρκέω**: suffice, avail, defend (present, 3rd person imperative); **τὰ λεχθέντα**: aorist passive participle of λέγω.

VII.5. Anaximander, *TEGP* 6 = Agathemeros 1.1.1. The earliest maps.

Grammar/Syntax Tags: complementary infinitive, aorist of a compound verb, contract verbs, relative clauses, result clauses.

Ἀναξίμανδρος ὁ Μιλήσιος ἀκουστὴς Θάλεω πρῶτος ἀπετόλμησε τὴν οἰκουμένην ἐν πίνακι γράψαι, μεθ' ὅν Ἑκαταῖος ὁ Μιλήσιος ἀνὴρ πολυπλανὴς διηκρίβωσεν ὥστε θαυμασθῆναι τὸ πρᾶγμα.

Notes: **ὁ ἀκουστής, -οῦ**: listener, student; **ὁ Θάλης, Θάλεω**: Thales of Miletus; **ἀποτολμάω**: dare, make a presumptuous attempt to; **ἡ οἰκουμένη**: inhabited region of the world; **ὁ πίναξ, -ακος**: board, plank, writing tablet (see also Herodotus 5.49.1, who used the same term to describe Aristagoras' map, with which the tyrant tried to generate support for a revolt against Persian rule in Ionia in 499/98 BCE); **Ἑκαταῖος**: ca. 550-475 BCE, wrote the first history of the world in Greek (in prose); **πολυπλανής, -ές**: far-roaming, widely travelled; **διηκριβόω**: render exactly; **θαυμάζω**: wonder, marvel (aorist passive infinitive).

VII.6. Homer, *Odyssey* 10.504-515. Circe's directions to the underworld.

Grammar/Syntax Tags: vocative, future tense, perfect tense, imperatives, subjunctives, contract verbs, ἵστημι.

διογενὲς Λαερτιάδη, πολυμήχαν' Ὀδυσσεῦ,

μή τί τοι ἠγεμόνος γε ποθὴ παρὰ νηὶ μελέσθω,

ἱστὸν δὲ στήσας, ἀνά θ' ἱστία λευκὰ πετάσσας

ἧσθαι: τὴν δέ κέ τοι πνοιὴ Βορέαο φέρῃσιν.

ἀλλ᾽ ὁπότ᾽ ἂν δὴ νηὶ δι᾽ Ὠκεανοῖο περήσῃς,
ἔνθ᾽ ἀκτή τε λάχεια καὶ ἄλσεα Περσεφονείης,
μακραί τ᾽ αἴγειροι καὶ ἰτέαι ὠλεσίκαρποι,
νῆα μὲν αὐτοῦ κέλσαι ἐπ᾽ Ὠκεανῷ βαθυδίνῃ,
αὐτὸς δ᾽ εἰς Ἀίδεω ἰέναι δόμον εὐρώεντα.
ἔνθα μὲν εἰς Ἀχέροντα Πυριφλεγέθων τε ῥέουσιν
Κώκυτός θ᾽, ὃς δὴ Στυγὸς ὕδατός ἐστιν ἀπορρώξ,
πέτρη τε ξύνεσίς τε δύω ποταμῶν ἐριδούπων.

Notes: **διογενής, -ές**: Zeus-born; **Λαερτιάδης**: son of Laërtes; **πολυμήχανος, -ον**: resourceful, inventive; **ἡ ποθή**: desire; **μέλω**: be a matter of concern (present imperative); **ὁ ἱστός**: mast; **στήσας**: aorist of ἵστημι; **τὸ ἱστίον**: sail; **λευκός, -ή, -όν**: light, bright, white; **πετάννυμι**: spread wide (aorist active participle); **ἧμαι**: lie; **κέ** = ἄν; **ἡ πνο(ι)ή**: blowing, blast; **ὁ Βορέας, -ου**: North Wind (Doric genitive).

ὁπότε: when; **ὁ Ὠκεανός**: Ocean; **περάω**: drive through (aorist subjunctive); **ἡ ἀκτή**: promontory, headland; **λάχεια**: fertile; **τό ἄλσος, -εος**: grove; **ἡ Περσεφόνεια**: the queen of the underworld; **ἡ αἴγειρος**: black poplar; **ἡ ἰτέα**: willow; **ὠλεσίκαρπος, -ον**: shedding their fruit (before ripening); **αὐτοῦ**: (adverb) here; **κέλλω**: drive on, push ashore (aorist imperative); **βαθυδίνης, -ες**: deep-eddying; **ὁ Ἅιδης, -εω**: the lord and realm of the underworld; **ὁ δόμος**: house; **εὐρώεις, -εσσα, -εν**: moldy, dank; **ὁ Ἀχέρων, -οντος**: river of pain; **ὁ Πυριφλεγέθων**: the river flaming with fire; **ῥέω**: flow; **ὁ Κώκυτός**: river of shrieking; **ἡ Στύξ, Στυγός**: Styx, the river of hate; **ὁ ἀπορρώξ, -ῶγος**: branch; **ἡ πέτρη**: rock; **ἡ ξύνεσίς, -εως**: intersection; **ἐρίδουπος, -ον**: resounding.

VII.7. Herodotus 4.36.2. Old fashioned maps.

Grammar/Syntax Tags: dative with special adjectives, contract verbs, future tense,

circumstantial participles, participial clauses.

> γελῶ δὲ ὁρέων γῆς περιόδους γράψαντας πολλοὺς ἤδη καὶ οὐδένα νοονεχόντως ἐξηγησάμενον: οἳ Ὠκεανόν τε ῥέοντα γράφουσι πέριξ τὴν γῆν ἐοῦσαν κυκλοτερέα ὡς ἀπὸ τόρνου, καὶ τὴν Ἀσίην τῇ Εὐρώπῃ ποιεύντων ἴσην. ἐν ὀλίγοισι γὰρ ἐγὼ δηλώσω μέγαθός τε ἑκάστης αὐτέων καὶ οἵη τις ἐστὶ ἐς γραφὴν ἑκάστη.

Notes: **γελάω**: laugh; **ὁρέων**: Ionic form of the present participle ὁρῶν: **ἡ περιόδος**: a going around, way around, circuit (a narrative "map" of the world); **νοονεχόντως**: rationally, mindfully; **ἐξηγέομαι**: relate in full, dictate, explain; **ῥέω**: flow; **πέριξ**: all around (+ accusative); Herodotus rejected the theory of the circumambient Ocean; **ἐοῦσαν**: Ionic for οὖσαν; **κυκλοτερής, -ές**: made by round by turning (also rejected was the theory that the inhabited world was completely round); **ὁ τόρνος**: compass; **ἐν ὀλίγοισι** (λόγοις); **αὐτέων**: Ionic genitive plural of αὐτός; **ἡ γραφή**: representation with lines (i.e., a drawing).

VII.8. Aristophanes, *Clouds* 202-215. Worried about his son's expensive habits and hoping the boy would learn a trade (e.g., talking himself out of his mounting debts), a working Athenian man, Strepsiades, toured Socrates' Φπροντιστήριον ("think-tank"). While awaiting the headmaster there, a student explicated a map of the world on display in the school's courtyard. The Peloponnesian War was in full swing when the *Clouds* was first produced, and this passage shows how maps could be manipulated to political ends.

Grammar/Syntax Tags: dative of specification, neuter (adverbial) adjectives, pronouns, contract verbs, infinitives of purpose.

> **Στρεψιάδης**: τουτὶ δὲ τί;
>
> **Μαθητής**: γεωμετρία.
>
> **Στρεψιάδης**: τοῦτ᾽ οὖν τί ἐστι χρήσιμον;
>
> **Μαθητής**: γῆν ἀναμετρῆσαι.

Στρεψιάδης: πότερα τὴν κληρουχικήν;

Μαθητής: οὔκ, ἀλλὰ τὴν σύμπασαν.

Στρεψιάδης: ἀστεῖον λέγεις.

τὸ γὰρ σόφισμα δημοτικὸν καὶ χρήσιμον.

Μαθητής: αὕτη δέ σοι γῆς περίοδος πάσης. ὁρᾷς;

αἵδε μὲν Ἀθῆναι.

Στρεψιάδης: τί σὺ λέγεις; οὐ πείθομαι,

ἐπεὶ δικαστὰς οὐχ ὁρῶ καθημένους.

Μαθητής: ὡς τοῦτ᾽ ἀληθῶς Ἀττικὸν τὸ χωρίον.

Στρεψιάδης: καὶ ποῦ Κικυννῆς εἰσὶν οὐμοὶ δημόται;

Μαθητής: ἐνταῦθ᾽ ἔνεισιν. ἡ δέ γ᾽ Εὔβοι, ὡς ὁρᾷς,

ἠδὶ παρατέταται μακρὰ πόρρω πάνυ.

Στρεψιάδης: οἶδ᾽: ὑπὸ γὰρ ἡμῶν παρετάθη καὶ Περικλέους.

ἀλλ᾽ ἡ Λακεδαίμων ποῦ ’σθ᾽;

Μαθητής: ὅπου ‘στίν; αὐτηί.

Στρεψιάδης: ὡς ἐγγὺς ἡμῶν. τοῦτο πάνυ φροντίζετε,

ταύτην ἀφ᾽ ἡμῶν ἀπαγαγεῖν πόρρω πάνυ.

Notes: **τουτί**: the deictic suffix –ι, which occurs several times in this passage,

indicates where the student is pointing on the map; **ἀναμετρέω**: measure carefully; **ἡ κληρουχική**: land for allotments; **σύμπας**, **σύμπασα, σύμπαν**: all, whole (earth); **ἀστεῖος, -α, -ον**: refined, elegant, witty, urbane; **τό σόφισμα, -ατος**: method; **δημοτικός**: common, for the people, democratic; **ἡ περιόδος**: see VII.7; **ἐπεὶ**: since; **ὁ δικαστής, -οῦ**: judge, juror; **κάθημαι**: sit, be seated; **ἀληθῶς**: truly, indeed; **Κικυννῆς**: the deme Kikynna; we observe that the student remained unperturbed by Strepsiades' irrelevant questions; **οὐμοὶ** = ο(ἰ) ἐμοὶ; **ὁ δημότης**: fellow demesman; **ἡ Εὐβοί(α)**: the island of Euboea lies along the coast of Attica and Boiotia; **παρατείνω**: stretch alongside; **πόρρω**: forward, in the distance; **ὁ Περικλῆς**, **Περικλέους**: when the cities of Euboea revolted in 446 BC, Pericles as commander and the men of Strepsiades' generation quashed their rebellion from the Delian League; **ἡ Λακεδαίμων, -ονος**: the territory ruled by Sparta, Athens' foe in the Peloponnesian War; **ἐγγὺς**: near; **φροντίζω**: take thought, consider; **ἀπάγω**: lead off, carry off, lead away (aorist infinitive).

VIII. The Origin of Life

Where one comes from was (and remains) an important question, answered in a variety of ways, from migration to agricultural metaphors (see Botany, section IX). And this was among the topics considered in some detail by the Presocratics who sought to find rational explanations of how life began and how different species came to exist in their present forms. The most-developed theory was advanced by Empedocles, who envisioned several stages of life before whole-bodied creatures appeared. His system, however, relied on chance mutation, and was thus rejected by Aristotle (and later thinkers) who believed in an eternal universe populated with unchanging forms. Nonetheless, robust curiosity about the origin of life endured.

VIII.1. Anaximander, *TEGP* 20 = Hippolytus of Rome (170-235 CE), *Refutation* 1.6.6. On the origins of human and animal life.

Grammar/Syntax Tags: genitive with prepositions, dative with special adjectives.

τὰ δὲ ζῶια γίνεσθαι <ἐξ ὑγροῦ> ἐξατμιζομένου ὑπὸ τοῦ ἡλίου. τὸν δὲ ἄνθρωπον ἑτέρῳ ζώιῳ γεγονέναι, τουτέστι ἰχθύι, παραπλήσιον κατ' ἀρχάς.

Notes: construe the passage with an understood Ἀναξίμανδρος λέγει; **τό ζῷον**: living creature, life form; **γίνεσθαι**: present middle/passive infinitive

of γίγνομαι (Ionic form); **ὑγρός, -ά, -όν**: moist; **ἐξατμίζω**: turn into vapor, draw up as vapor, evaporate; **γεγονέναι**: perfect active infinitive of γίγνομαι; **τουτέστι**: that is to say; **ὁ ἰχθῦς, -ύος**: fish; **παραπλήσιος –ον**: coming close beside, resembling.

VIII.2. Empedocles, *TEGP* 118 = Simplicius of Cilicia (ca. 490-560 CE), *On the Heavenes* 586.12, 587.1-2. Disembodied body parts joined in random ways to create living beings.

Grammar/Syntax Tags: genitive with special adjectives, genitive with special verbs, imperfect tense, contract verbs.

ἦι πολλαὶ μὲν κόρσαι ἀναύχενες ἐβλάστησαν,

γυμνοὶ δ’ ἐπλάζοντο βραχίονες εὔνιδες ὤμων,

ὄμματα’ τ’ οἶα ἐπλανᾶτο πενητεύοντα μετώπων.

Notes: **ἦι**: there; **ἡ κόρση**: temple, forehead; **ἀναύχην, -ενος**: without a neck or throat; **βλαστάνω**: bud, sprout; **γυμνός, -ή, -όν**: naked, bare; **πλάζω**: wander, rove; **ὁ βραχίων, -ονος**: arm; **εὔνις, εὔνιν (εὔνιδος)** (+ genitive): bereft, bare; **ὁ ὦμος**: shoulder; **τό ὄμμα**, **ὄμματος**: eye; **οἶος -η –ον**: alone, solitary, only; **πλανάω**: wander, roam; **πενητεύω**: be poor, lack, be bereft; **τό μέτωπον**: space between the eyes, forehead.

VIII.3. Empedocles, *TEGP* 121 = Aelian (Claudius Aelian of Praeneste [ca. 175-235 CE]), *On Animals* 16.299. Monstrous early life forms.

Grammar/Syntax Tags: imperfect tense, perfect participles.

πολλὰ μὲν ἀμφιπρόσωπα καὶ ἀμφίστερν’ ἐφύοντο,

βουγενῆ ἀνδρόπρωιρα, τὰ δ’ ἔμπαλιν ἐξανέτελλον

ἀνδροφυῆ βούκρανα, μεμιγμένα τῆι μὲν ἀπ’ ἀνδρῶν

τῆι δὲ γυναικοφυῆ, σκιεροῖς ἠσκημένα γυίοις.

Notes: **ἀμφιπρόσωπος, -ον**: double-faced; **ἀμφίστερνος, -ον**:

double-breasted; **φύω**: bring forth, produce; **βουγενής**, **-ές**: ox-natured; **ἀνδρόπρωιρος, -α, -ον**: man-faced; **ἔμπαλιν**: back, in return; **ἐξανατέλλω**: cause to spring up; **ἀνδροφυής**, **-ές**: man-natured; **βούκρανα**: cow-headed; **μίγνυμι**: mix; **τῆι**: here, there; **γυναικοφυής**, **-ές**: woman-natured, **σκιερός, -α, -ον**: shady, dark-colored, shade-giving; **ἀσκέω**: adorn, furnish with; **τό γυῖον**: limb.

VIII.4. Plato, *Symposium* 189d-190a. In the *Symposium*, Plato explored many theories regarding the nature of love, including one here attributed to the comic-playwright Aristophanes on the original "third gender."

Grammar/Syntax Tags: genitives, imperfect tense, perfect tense, contract verbs, aorist optatives, relative clauses.

πρῶτον μὲν γὰρ τρία ἦν τὰ γένη τὰ τῶν ἀνθρώπων, οὐχ ὥσπερ νῦν δύο, ἄρρεν καὶ θῆλυ, ἀλλὰ καὶ τρίτον προσῆν κοινὸν ὂν ἀμφοτέρων τούτων, οὗ νῦν ὄνομα λοιπόν, αὐτὸ δὲ ἠφάνισται. ἀνδρόγυνον γὰρ ἓν τότε μὲν ἦν καὶ εἶδος καὶ ὄνομα ἐξ ἀμφοτέρων κοινὸν τοῦ τε ἄρρενος καὶ θήλεος, νῦν δὲ οὐκ ἔστιν ἀλλ᾽ ἢ ἐν ὀνείδει ὄνομα κείμενον.

ἔπειτα ὅλον ἦν ἑκάστου τοῦ ἀνθρώπου τὸ εἶδος στρογγύλον, νῶτον καὶ πλευρὰς κύκλῳ ἔχον, χεῖρας δὲ τέτταρας εἶχε, καὶ σκέλη τὰ ἴσα ταῖς χερσίν, καὶ πρόσωπα δύ᾽ ἐπ᾽ αὐχένι κυκλοτερεῖ, ὅμοια πάντῃ: κεφαλὴν δ᾽ ἐπ᾽ ἀμφοτέροις τοῖς προσώποις ἐναντίοις κειμένοις μίαν, καὶ ὦτα τέτταρα, καὶ αἰδοῖα δύο, καὶ τἆλλα πάντα ὡς ἀπὸ τούτων ἄν τις εἰκάσειεν.

ἐπορεύετο δὲ καὶ ὀρθὸν ὥσπερ νῦν, ὁποτέρωσε βουληθείη: καὶ ὁπότε ταχὺ ὁρμήσειεν θεῖν, ὥσπερ οἱ κυβιστῶντες καὶ εἰς ὀρθὸν τὰ σκέλη περιφερόμενοι κυβιστῶσι κύκλῳ, ὀκτὼ τότε οὖσι τοῖς μέλεσιν ἀπερειδόμενοι ταχὺ ἐφέροντο κύκλῳ.

Notes: **ἄρρην, -εν**: male; **θῆλυς, θήλεια, θῆλυ**: female; **πρόσειμι**: be added to; **ἀφανίζω**: cause to vanish, destroy (perfect middle/passive); **ὁ ἀνδρόγυνος**: hermaphrodite, androgyn; **τό ὄνειδος, -εος**: reproach, rebuke, insult.

στρογγύλος, -η, -ον: round, spherical; **τό νῶτον**: back; **ἡ πλευρά, -ᾶς**: rib, side; **τό σκέλος, -εος**: leg; **τό πρόσωπον**: face; **ὁ αὐχήν, -ένος**: neck, throat; **κυκλοτερής**, -ές: made round by turning, stretched in a circle, round; **πάντῃ**: in every direction, in every way; **τό οὖς ὠτός**: ear; **τό αἰδοῖον**: genitalia; **εἰκάζω**: liken, compare, estimate, make a guess, imagine.

ὁποτέρωσε: in either of two directions; **βουληθείη**: aorist passive optative of βούλομαι; **ὁπότε**: when; **ὁρμήσειεν**: aorist passive optative of ὁρμάω; **θέω**: run; **κυβιστάω**: tumble head first; **περιφέρω**: carry around; **τό μέλος, -εος**: limb; **ἀπερείδω**: fix, settle, support.

VIII.5. Pausanias, *Description of Greece* 10.4.4. At Panopeus (near Chaeronea and Daulis in Boeotia), we can see the very origins of the human race.

Grammar/Syntax Tags: dative of possession, aorist optative, aorist passive infinitive, participles, contract verbs.

λίθοι κεῖνταί σφισιν ἐπὶ τῇ χαράδρᾳ, μέγεθος μὲν ἑκάτερος ὡς φόρτον ἀποχρῶντα ἀμάξης εἶναι, χρῶμα δέ ἐστι πηλοῦ σφισιν, οὐ γεώδους ἀλλ᾽ οἷος ἂν χαράδρας γένοιτο ἢ χειμάρρου ψαμμώδους, παρέχονται δὲ καὶ ὀσμὴν ἐγγύτατα χρωτὶ ἀνθρώπου· ταῦτα ἔτι λείπεσθαι τοῦ πηλοῦ λέγουσιν ἐξ οὗ καὶ ἅπαν ὑπὸ τοῦ Προμηθέως τὸ γένος πλασθῆναι τῶν ἀνθρώπων.

Notes: **σφεῖς**: they, them (Pausanias' sources); **ἡ χαράδρα**: ravine, mountain stream; **ὁ φόρτος**: freight, cargo, load; **ἀποχράω**: suffice; **ἡ ἅμαξα**: wagon; **τό χρῶμα, -ατος**: color; **ὁ πηλός**: clay, earth; **σφισιν**: referring to the stones; **γεώδης**, -ες: earthy; **χειμάρρους**, **-ουν**: swollen in winter by melting snow, torrent; **ψαμμώδης**, -ες: sandy; **ἡ ὀσμή**: scent, odor; **ἐγγύς**: near; **ὁ χρώς, χρωτός**: skin; **λείπω**: leave, remain; **ἅπας**, **ἅπασα**, **ἅπαν**: all; **πλάσσω**: form, mould (aorist passive infinitive).

IX. Botany

Humankind cannot exist without plant life, and the Greeks depended on the "Mediterranean triad" (grain, olives, grapes) for both sustenance and economic livelihood. Many city foundation myths were inspired by agricultural motifs: e.g., the sown-men ("spartoi") of Corinth, and the autochthonous Athenians. Athena's very hegemony over her eponymous city, furthermore, was attributed to an agricultural gift—the cultivated olive. Plants had (and have) many uses—cooking, religion, medicine, cloth-dying, and perfume-making. It is thus important to recognize them, and to know their uses, how to collect and cultivate them, and how to prepare them. In Homer we find about fifty different plant names, and in Hesiod's *Works and Days* botanicals mark the seasons. Herodotus and Xenophon commented on unusual plants or the absence of familiar plants in distant lands, and their accounts show an awareness of their differing climatological needs. Aristotle's student Theophrastus was the first to consider plants in a systematic way, classifying them on analogy with his mentor's organization of the animal world. Theophrastus described various parts of plants (roots, stems, branches, twigs, leaves, seeds) and their types (trees, shrubs, undershrubs, herbaceous plants).

There are challenges, however, to identifying plants cited by Greek authors. In Theophrastus (and others), some wild plants are nameless, foreign plants might lack Greek names, and vocabulary could be ambiguous (see Irwin in Irby, ed. 2016: 266)—one common word might be applied to plants of different species (there are three all-heals, *panacea*, in Theophrastus, *History of Plants* 9.11.1), different plants might have the same name (black versus white violet: Theophrastus, *History of Plants* 6.6.7), or a plant might have different names according to locality (narkissos/leirion: Theophrastus, *History of Plants* 6.8.3—lilies were also called leirion). Finally, the Linnaean system of classification adds an additional layer of remove from the Greek botanical approach.

IX.1. Homer, *Iliad* 14.346-349. The earth blooms when Hera seduces Zeus.

Grammar/Syntax Tags: genitive of source, ethical dative, unaugmented aorist, relative clauses of result.

ἦ ῥα καὶ ἀγκὰς ἔμαρπτε Κρόνου παῖς ἣν παράκοιτιν:

τοῖσι δ᾽ ὑπὸ χθὼν δῖα φύεν νεοθηλέα ποίην,

λωτόν θ᾽ ἑρσήεντα ἰδὲ κρόκον ἠδ᾽ ὑάκινθον

πυκνὸν καὶ μαλακόν, ὃς ἀπὸ χθονὸς ὑψόσ᾽ ἔεργε.

Notes: **ἦ**: 3rd person imperfect of ἠμί speak; **ἀγκὰς**: into his arms; **μάρπτω**: take hold; **Κρόνου**: Cronus; **ὅς, ἥ, ὅν:** (possessive adjective) his, her, its; **ἡ παράκοιτις, -ιος**: bedmate, wife; **ἡ χθών, χθονός**: earth; **δῖος, δῖα, δῖον**: godlike, divine; **νεοθηλής**, **-ές**: fresh-budding; **ἡ πό(ι)α**: grass; **ὁ λωτός**: clover, trefoil, melilot; **ἑρσήεις, -εσσα, -εν**: dewy; **ἰδέ**: and; **ὁ κρόκος**: crocus, saffron; **ἠδέ**: and; **ὁ ὑάκινθος**: hyacinth; **πυκνός, -ή, -όν**: thick, close; **μαλακός, -ή, -όν**: soft; **ὑψόσε**: aloft; **ἔργω**: enclose, shut in, confine (them).

IX.2. Theocritus, *Idyll* 13.39-43. The pool of the nymphs who abducted Hylas, Herakles' young companion. Theocritus' learned botanical catalogue is appropriate to the marsh setting.

Grammar/Syntax Tags: Doric dialect, imperfect tense.

τάχα δὲ κράναν ἐνόησεν

ἡμένῳ ἐν χώρῳ: περὶ δὲ θρύα πολλὰ πεφύκει,

κυάνεόν τε χελιδόνιον χλωρόν τ᾽ ἀδίαντον

καὶ θάλλοντα σέλινα καὶ εἰλιτενὴς ἄγρωστις.

ὕδατι δ᾽ ἐν μέσσῳ Νύμφαι χορὸν ἀρτίζοντο.

Notes: **τάχα**: presently; **ἡ κράνα** (Doric of ἡ κρήνη): well, spring, fountain; **νοέω**: perceive, take notice of (construe Hylas as the subject); **ἡμένῳ**: seated, "low-lying"; **ὁ χῶρος**: place; **τό θρύον**: reed, rush; **κυάνεος, -α, -ον**: dark blue, glossy; **τό χελιδόνιον**: celandine; **χλωρός, -ά, -όν**: pale, pale-green, yellow; **ὁ ἀδίαντος**: maidenhair ("unwetted" because moisture does not cling to the plant's surface); **θάλλω**: sprout, grow; **τό σέλινον**: celery; **εἰλιτενής, -ές**: spreading through the marshes; **ἡ ἄγρωστις, -ιδος**: dog's tooth grass; see also the commentary in R. Hunter, *Theocritus: A Selection*, Cambridge, 1999 (ad loc.) who notes that the "lushness" of the plants "grow over the normal division of the hexameter;" **ὁ χορός**: dance; **ἀρτίζω**: prepare.

IX.3. Theophrastus, *Causes of Plants* 2.11.7. Why crooked trees live longer.

Grammar/Syntax Tags: comparatives, middle/passives, adverbs, relative clauses, indirect statement.

ὡς δὲ Δημόκριτος αἰτιᾶται, τὰ εὐθέα τῶν σκολιῶν βραχυβιώτερα καὶ πρωϊβλαστότερα διὰ τὰς αὐτὰς ἀνάγκας εἶναι—τοῖς μὲν γὰρ ταχὺ διαπέμπεσθαι τὴν τροφήν, ἀφ᾽ ἧς ἡ βλάστησις καὶ οἱ καρποί, τοῖς δὲ βραδέως, διὰ τὸ μὴ εὔρουν εἶναι τὸ ὑπὲρ γῆς, ἀλλ᾽ αὐτὰς τὰς ῥίζας ἀπολαύειν, καὶ γὰρ μακρόρριζα ταῦτα εἶναι καὶ παχύρριζα—δόξειεν ἂν οὐ καλῶς λέγειν.

καὶ γὰρ τὰς ῥίζας ἀσθενεῖς φησιν εἶναι τῶν εὐθέων, ἐξ ὧν ἀμφοτέρων θᾶττον γίνεσθαι τὴν φθοράν, ταχὺ γὰρ ἐκ τοῦ ἄνω διιέναι καὶ τὸ ψῦχος καὶ τὴν ἀλέαν ἐπὶ τὰς ῥίζας διὰ τὴν εὐθυπορίαν, ἀσθενεῖς δ᾽ οὔσας, οὐχ ὑπομένειν· ὅλως δὲ τὰ πολλὰ τῶν τοιούτων κάτωθεν, ἄρχεσθαι γηράσκειν διὰ τὴν ἀσθένειαν τῶν ῥιζῶν.

ἔτι δὲ τὰ ὑπὲρ γῆς, διὰ τὴν λεπτότητα καμπτόμενα ὑπὸ τῶν πνευμάτων, κινεῖν τὰς ῥίζας, τούτου δὲ συμβαίνοντος ἀπορρήγνυσθαι καὶ πηροῦσθαι, καὶ ἀπὸ τούτων τῷ ὅλῳ δένδρῳ γίγνεσθαι τὴν φθοράν.

Notes: **αἰτιάομαι**: offer a reason, allege, accuse; **εὐθύς, εὐθέα, εὐθύ**: straight (understand δένδρα: trees); **σκολιός, -ά, -όν**: curved, crooked (σκολιῶν [ῥιζωμάτων]: "as compared with curved…"); **βραχύβιος, -ον**: short-lived; **πρωϊβλάστος, -η, -ον**: early-sprouting; **ἡ ἀνάγκη**: constraint, necessity; **διαπέμπω**: send up; **ἡ βλάστησις, -εως**: bud, sprout; **ὁ καρπός**: fruit; **βραδύς, -εῖα, -ύ**: slow; **τό εὔρουν**: good flow, abundance; **ἡ ῥίζα**: root; **ἀπολαύω**: have enjoyment of, have benefit of; **μακρόρριζος, -η, -ον**: with long roots; **παχύρριζος, -η, -ον**: with thick roots; **δόξειεν**: construe Democritus as the subject.

ἀσθενής, **-ές**: weak; **ἀμφοτέρων** (αἰτίων) **θᾶττον**: comparative of ταχύς; **ἡ φθορά**: destruction, ruin; **δίειμι**: pass through, traverse; **τό ψῦχος, -εος**: cold; **ἡ ἀλέα**: heat; **ἡ εὐθυπορία**: straightness of the course; **ὑπομένω**: remain, survive, persist; **κάτωθεν**: from below; **γηράσκω**: grow old.

ἡ λεπτότης, -ητος: fineness, thinness; **κάμπτω**: bend; **συμβαίνω**: happen; **ἀπορρήγνυμι**: break, snap; **πηρόω**: maim, mutilate; **τό δένδον**: tree.

IX.4. Theophrastus, *Causes of Plants* 1.6.2. On grafting.

Grammar/Syntax Tags: superlatives, adverbs, substantives.

εὐλόγως δὲ καὶ ἡ ἀντίληψις μάλιστα τῶν ὁμοφλοίων, ἐλαχίστη γὰρ ἡ ἐξαλλαγὴ τῶν ὁμογενῶν, καὶ ὥσπερ μετάθεσις γίνεται μόνον·

Notes: **εὐλόγως**: reasonably; **ἡ ἀντίληψις, -εως**: exchange, receiving in return, reciprocation, "graft"; **ὁμοιόφλοιος**, **-ον**: with similar bark; **ἐλαχίστος, -η, -ον**: smallest; **ἡ ἐξαλλαγή**: alteration, change, variation; **ὁμογενής**, **-ές**: of the same kind, of the same character; **ἡ μετάθεσις, -εως**: change, transposition.

IX.5. Athenaeus, *Learned Banqueters* 2.61d-e. Mushrooms.

Grammar/Syntax Tags: superlatives, attributive articles, objective genitive, articular infinitive, contract verbs, indirect statement, circumstantial participles, recessive accent.

Δίφιλός φησι τοὺς μύκητας εἶναι εὐστομάχους, κοιλίας διαχωρητικούς, θρεπτικούς, δυσπέπτους δὲ καὶ φυσώδεις. τοιούτους δὲ εἶναι τοὺς ἐκ Κέω τῆς νήσου. πολλοὶ μέντοι καὶ κτείνουσι. δοκοῦσι δὲ οἰκεῖοι εἶναι οἱ λεπτότατοι καὶ ἁπαλοὶ καὶ εὔθρυπτοι οἱ ἐπὶ πτελέαις καὶ πεύκαις γινόμενοι·

ἀνοίκειοι δὲ οἱ μέλανες καὶ πελιοὶ καὶ σκληροὶ καὶ οἱ μετὰ τὸ ἐψηθῆναι καὶ τεθῆναι πησσόμενοι, οἵτινες

λαμβανόμενοι κτείνουσι. βοηθοῦνται δ᾽ ἀπὸ ὑδρομέλιτος πόσεως καὶ ὀξυμέλιτος, νίτρου καὶ ὄξους· μετὰ τὴν πόσιν δὲ ἐμεῖν δεῖ. διόπερ καὶ δεῖ μάλιστα σκευάζειν αὐτοὺς μετὰ ὄξους καὶ ὀξυμέλιτος ἢ μέλιτος ἢ ἁλῶν· οὕτω γὰρ αὐτῶν τὸ πνιγῶδες ἀφαιρεῖται.

Notes: **ὁ Δίφιλός**: a third century BCE poet of New Comedy; **ὁ μύκης, -ητος**: mushroom; **εὐστόμαχος, -ον**: be good for the stomach; **ἡ κοιλία**: belly; **διαχωρητικός, -ή, -όν**: laxative; **θρεπτικός, -ή, -όν**: nourishing; **δυσπέπτος, -ον**: hard to digest; **φυσώδης**, -**ες**: flatulence causing; **ἡ Κέως, Κέω** (Doric genitive): Ceos, one of the Cycladic islands; **μέντοι**: indeed; **κτείνω**: kill, be fatal; **λεπτός, -ή, -όν**: peeled, husked, slender, delicate; **ἁπαλός, -ή, -όν**: soft to the touch, tender; **εὔθρυπτος, -ον**: easily broken; **ἡ πτελέα**: elm; **ἡ πεύκη**: pine.

ἀνοίκειος, -ον: not of the family, not suitable (i.e., these mushrooms are poisonous); **μέλας, μέλαινα, μέλαν**: dark, black; **πελιός, -ά, -όν**: black and blue, bruised; **σκληρός, -ά, -όν**: hard, unyielding; **ἕψω**: boil (aorist passive infinitive); **τεθῆναι**: aorist passive infinitive of τίθημι; **πήσσω**: harden, freeze; **τό ὑδρομέλι, -ίτος**: hydromel, honey and water; **ἡ πόσις**, -**εως**: drink; **τό ὀξυμέλι, -ίτος**: honey and vinegar; **τό νίτρον**: sodium bicarbonate; **τό ὄξος**, -**εος**: vinegar; **ἐμέω**: vomit; **διόπερ**: on which account; **σκευάζω**: prepare; **τό μέλι, -ίτος**: honey; **ὁ ἅλς, ἁλός**: salt; **τό πνιγῶδες**: (threat of) choking; **ἀφαιρέω**: take away, remove, diminish.

IX.6. Athenaeus, *Learned Banqueters* 2.61e-f. More on mushrooms.

Grammar/Syntax Tags: objects complement, neuter plural nominative with singular verb, relative clauses, indirect statement.

Θεόφραστος δὲ ἐν τῷ *Περὶ Φυτῶν Ἱστορίας* γράφει· ὑπόγεια δὲ τὰ τοιαῦτά ἐστι καὶ ἐπίγεια, καθάπερ οὓς καλοῦσί τινες πέζιας, ἅμα τοῖς μύκησι γινομένους· ἄριζοι γὰρ καὶ αὐτοὶ τυγχάνουσιν. ὁ δὲ μύκης ἔχει προσφύσεως δίκην τὸν καυλὸν εἰς μῆκος, καὶ ἀποτείνουσιν ἀπ᾽ αὐτοῦ ῥίζαι. φησὶ δὲ καὶ ὅτι ἐν τῇ περὶ Ἡρακλέους στήλας

θαλάσσῃ ὅταν ὕδατα πλείω γένηται, μύκητες φύονται πρὸς τῇ θαλάσσῃ, οὓς καὶ ἀπολιθοῦσθαι ὑπὸ τοῦ ἡλίου φησί.

Notes: **Περὶ Φυτῶν Ἱστορίας**: Theophrastus' *Research on Plants* (fragment 399); **ὑπόγειος, -ον**: underground; **ἐπίγειος, -ον**: above ground; **καθάπερ**: according as, just as; **ἡ πέζις, -εως**: bullfist, "puff ball," "smoke ball"; **ἄριζος, -ον**: rootless; **ἡ πρόσφυσις, -εως**: growth, "rider"; **δίκην**: in the manner of; **ὁ καυλός**: stem; **τό μῆκος, -εος**: length, "stem"; **ἀποτείνω**: stretch out, extend; **ἡ ῥίζα**: root; **φησὶ**: Theophrastus, *History of Plants* 4.7.2; **Ἡρακλέους στήλας**: Straits of Gibralter (see above); **πλείω**: comparative adverb of πολύς; **φύω**: bring forth, produce; **ἀπολιθόομαι**: become stone.

X. Zoology

Greek thinkers would certainly have agreed with Claude Levi-Strauss, the French anthropologist who famously remarked that "animals are good to think [with]" (*Totemism*; London, 1964, p. 89). Animals were associated with gods who both protected them and accepted them as sacrifices (Poseidon, the father of horses, for example, was worshipped with offerings of horses by drowning, especially at Argos: Pausanias 8.7.2; see also Walter Burkert, *Structure and History in Greek Mythology and Ritual*, Berkeley, 1979: 113.). The hunt for a wild, dangerous beast (usually a lion or boar) was part of the standard heroic quest. Animals were bred, hunted, and eaten, and they were kept as pets (songbirds, goats, Maltese dogs). Dogs were admired for their loyalty (especially Argos, Odysseus' dog: *Odyssey* 17.300-27), and horses were cherished (the immortal horses of Achilles mourned for their deceased master: *Iliad* 17.426-56). Whether animals were ensouled was an early topic of debate, providing an argument in favor of vegetarianism for Pythagoras and Empedocles (*TEGP* 189). Although compassion was rare and most people believed that animals lacked reason (and therefore would not merit justice), Plutarch expressed concern over animal suffering and mistreatment, and he ascribed a rational soul to non-human animals.

Aristotle was the first thinker to study animals methodically, and he devised a taxonomy that prevailed until the Renaissance. Identifying more than 500 species of mammals and birds, 120 varieties of fish, and 60 types of insects, he categorized animals according to the presence or absence of various features (claws,

beaks, feathers, scales); what they ate; whether they were land- or sea- dwelling. He divided animals into two categories: blooded (viviparous and oviparous quadrupeds, marine mammals, birds, fish) and bloodless (mollusks, crustacea, testacea, insects).

X.1. Aristotle, *History of Animals* 2.1-2 (501b3-17). Teeth.

Grammar/Syntax Tags: partitive genitive, comparatives, articular infinitives, indirect statement, relative clauses, impersonal passives, correlatives, polysyndeton.

> Ἄνθρωπος μὲν οὖν βάλλει τοὺς ὀδόντας, βάλλει δὲ καὶ ἄλλα τῶν ζῴων, οἷον ἵππος καὶ ὀρεὺς καὶ ὄνος. βάλλει δ᾽ ἄνθρωπος τοὺς προσθίους, τοὺς δὲ γομφίους οὐδὲν βάλλει τῶν ζῴων. ὗς δ᾽ ὅλως οὐδένα βάλλει τῶν ὀδόντων.
>
> περὶ δὲ τῶν κυνῶν ἀμφισβητεῖται, καὶ οἱ μὲν ὅλως οὐκ οἴονται βάλλειν οὐδένα αὐτούς, οἱ δὲ τοὺς κυνόδοντας μόνον· ᾧπται δ᾽ ὅτι βάλλει καθάπερ καὶ ἄνθρωπος, ἀλλὰ λανθάνει διὰ τὸ μὴ βάλλειν πρότερον πρὶν ὑποφυῶσιν ἐντὸς ἴσοι. ὁμοίως δὲ καὶ ἐπὶ τῶν ἄλλων τῶν ἀγρίων εἰκὸς συμβαίνειν, ἐπεὶ λέγονταί γε τοὺς κυνόδοντας μόνον βάλλειν. τοὺς δὲ κύνας διαγιγνώσκουσι τοὺς νεωτέρους καὶ πρεσβυτέρους ἐκ τῶν ὀδόντων· οἱ μὲν γὰρ νέοι λευκοὺς ἔχουσι καὶ ὀξεῖς τοὺς ὀδόντας, οἱ δὲ πρεσβύτεροι μέλανας καὶ ἀμβλεῖς. ἐναντίως δὲ πρὸς τἆλλα ζῷα καὶ ἐπὶ τῶν ἵππων συμβαίνει· τὰ μὲν γὰρ ἄλλα ζῷα πρεσβύτερα γιγνόμενα μελαντέρους ἔχει τοὺς ὀδόντας, ὁ δ᾽ ἵππος λευκοτέρους.

Notes: **βάλλει**: shed, "lose"; **ὁ ὀδούς, ὀδόντος**: tooth; **τό ζῷον**: living creature, life form; **ὁ ὀρεύς, -έως**: mule; **ὁ ὄνος**: donkey; **πρόσθιος, -α, -ον**: foremost, front (tooth); **ὁ γομφίος**: molar; **ὁ/ἡ ὗς, ὑός**: swine, pig; **ὅλως**: altogether, entirely.

ὁ/ἡ κύων, κυνός: dog; **ἀμφισβητέω**: disagree, dispute; **ὁ κυνόδους, -οντος**: dogtooth, canine; **ὦπται**: perfect middle/passive of ὁράω, "it has been observed"; **καθάπερ**: according as, just as; **ὑποφύω**: grow up from underneath; **ἐντός**: within; **ὁμοίως**: similarly; **ἄγριος, -α, -ον**: wild, savage; **διαγιγνώσκω**: discern exactly; **πρεσβυτέρος, -α, -ον**: older; **λευκός, -ή, -όν**: light, bright, clear, white; **ὀξύς, -εῖα, -ύ**: sharp; **μέλας, μέλαινα, μέλαν**: dark, black; **ἀμβλύς, -εῖα, -ύ**: dull; **ἐναντίως**: on the contrary, in reverse.

X.2. Herodotus 2.71. The Hippopotamus.

Grammar/Syntax Tags: attributive articles, genitive of description, possessive genitive, result clauses.

οἱ δὲ ἵπποι οἱ ποτάμιοι νομῷ μὲν τῷ Παπρημίτῃ ἱροί εἰσι, τοῖσι δὲ ἄλλοισι Αἰγυπτίοισι οὐκ ἱροί. φύσιν δὲ παρέχονται ἰδέης τοιήνδε: τετράπουν ἐστί, δίχηλον, ὁπλαὶ βοός, σιμόν, λοφιὴν ἔχον ἵππου, χαυλιόδοντας φαῖνον, οὐρὴν ἵππου καὶ φωνήν, μέγαθος ὅσον τε βοῦς ὁ μέγιστος: τὸ δέρμα δ᾽ αὐτοῦ οὕτω δή τι παχύ ἐστι ὥστε αὔου γενομένου ξυστὰ ποιέεσθαι ἀκόντια ἐξ αὐτοῦ.

Notes: **ὁ νομός**: pasture, abode, district; **Πάπρεμις**: a city in the western Nile delta; **ἱρός** = ἱερός; **ἡ ἰδέα**: form, shape, appearance; **τετράπους, -πουν**: four-footed; **δίχηλος, -ον**: cloven-hooved; **ἡ ὁπλή**: hoof; **σιμός, -ή, -όν**: snub-nosed; **ἡ λοφιά**: mane; **ὁ χαυλιόδους, -όδοντος**: tusk; **φαῖνον**: neuter present participle of φαίνω; **ἡ οὐρά**: tail; **τό δέρμα, -ατος**: skin, hide; **παχύς, -εῖα**: thick; **αὖος, -η, -ον**: dried; **τό ξυστόν**: spear, lance, shaft; **τό ἀκόντιον**: javelin, spear.

X.3. Aelian, *On the Nature of Animals* 1.31. The porcupine.

Grammar/Syntax Tags: ethical dative, perfect middle/passives, contract verbs, indirect statement.

τὴν δὲ ὕστριχα ἀκούω ταῦτα μὲν οὐκ ἔχειν, οὐ μὴν ὅπλων ὑπὸ τῆς φύσεως ἀμυντηρίων ἀπολελεῖφθαι ἐρήμην. τοῖς γοῦν ἐπιοῦσιν ἐπὶ λύμῃ τὰς ἄνωθεν τρίχας οἱονεὶ

βέλη ἐκπέμπει, καὶ εὐστόχως βάλλει πολλάκις, τὰ νῶτα φρίξασα· καὶ ἐκεῖναί γε πηδῶσιν, ὥσπερ οὖν ἔκ τινος ἀφειμέναι νευρᾶς.

Notes: **ὁ/ἡ ὕστριξιχος**: porcupine; **ταῦτα**: i.e., claws and fangs; **ἀμυντήριος, -ον**: defensive; **ἀπολείπω**: leave, fail, fall short (perfect middle/passive infinitive); **ἐρῆμος, -ον**: destitute of; **γοῦν**: at any rate, at least; **ἔπειμι**: go toward, approach, attack, threaten (dative plural participle); **ἡ λύμη**: outrage, harm, "attack"; **ἄνωθεν**: from above; **ἡ θρίξ, τριχός**: hair; **οἱονεί**: as if, just like; **τό βέλος, -εος**: missile, arrow, dart; **ἐκπέμπω**: send out, discharge; **εὐστόχως**: aiming successfully; **πολλάκις**: often; **τό νῶτον**: back; **φρίσσω**: be rough, bristle (aorist active participle); **πηδάω**: leap; **ἀφίημι**: send forth (perfect middle/passive participle); **ἡ νευρά**: string, bowstring.

X.4. Strabo 16.4.14. Elephants as hydraulic engineers in East Africa.

Grammar/Syntax Tags: objective genitive, instrumental dative, genitive absolute.

ὑπέρκειται δὲ ἡ Λίχα, θήρα τῶν ἐλεφάντων: πολλαχοῦ δ᾽ εἰσὶ συστάδες τῶν ὀμβρίων ὑδάτων, ὧν ἀναξηρανθεισῶν οἱ ἐλέφαντες ταῖς προβοσκίσι καὶ τοῖς ὀδοῦσι φρεωρυχοῦσι καὶ ἀνευρίσκουσιν ὕδωρ.

Notes: **ὑπέρκειμαι**: lie above, be situated above; **ἡ Λίχα**: Licha is located near Deire and Arsinoe in Eritrea near the entrance to the Red Sea; **ἡ θήρα**: hunting area; **πολλαχοῦ**: in many places; **ἡ συστάς, -άδος**: cistern, resevoir; **ὄμβριος, -ον**: rainy, of rain; **ἀναξηραίνω**: dry up (aorist passive participle); **ἡ προβοσκίς, -ίδος**: trunk; **ὁ ὀδούς, -όντος**: tooth, tusk; **φρεωρυχέω**: dig a well; **ἀνευρίσκω**: discover, come upon, find.

X.5. Hanno, *Periplus Beyond the Pillars of Heracles* 18. In the 5th century BCE, the Carthaginian king Hanno led an expedition through the Pillars of Herakles and down the western coast of Africa for the purpose of founding colonies. The adventure was commemorated on an inscription consecrated in a Carthaginian temple of Cronus and eventually translated into Greek, preserved in a ninth century manuscript (*Codex Palatinus graecus* 398). Here we have the Gorilla women near Mt Cameroon.

Grammar/Syntax Tags: genitive with special adjectives, uses of the dative case,

imperfect tense, participles, complementary infinitives.

> ἐν δὲ τῷ μυχῷ νῆσος ἦν ἐοικυῖα τῇ πρώτῃ, λίμνην ἔχουσα, καὶ ἐν ταύτῃ νῆσος ἦν ἑτέρα, μεστὴ ἀνθρώπων ἀγρίων· πολὺ δὲ πλείους ἦσαν γυναῖκες, δασεῖται τοῖς σώμασιν, ἃς οἱ ἑρμηνέες ἐκάλουν Γορίλλας.
>
> διώκοντες δὲ ἄνδρας μὲν συλλαβεῖν οὐκ ἠδυνήθημεν, ἀλλὰ πάντες μὲν ἐξέφυγον κρημνοβάται ὄντες καὶ †τοῖς μετρίοις† ἀμυνόμενοι, γυναῖκας δὲ τρεῖς, αἳ δάκνουσαί τε καὶ σπαράττουσαι τοὺς ἄγοντας οὐκ ἤθελον ἔπεσθαι·
>
> ἀποκτείναντες μέντοι αὐτὰς ἐξεδείραμεν, καὶ τὰς δορὰς ἐκομίσαμεν εἰς Καρχηδόνα.

Notes: **ὁ μυχός**: nook, corner, recess; **ἡ λίμνη**: pool, marsh; **μεστός, -ή, -όν**: full; **ἐοικυῖος, -α, -ον** (+ dative): similar (to); **τῇ πρώτῃ** (νῆσῳ); **δασύς, -εῖα, -ύ**: hairy, shaggy; **ὁ ἑρμηνεύς, -έως**: interpreter.

συλλαμβάνω: collect, gather, catch; **ἀδύναμαι**: not be able; **ἐκφεύγω**: flee away, escape; **ἡ κρημνοβάτη, -ης**: step-climber, rope-climber; **τοῖς μετρίοις**: the reading as preserved makes no sense; supply πετρίοις (a variant of τό πετραῖον: rock) for μετρίοις; **ἀμύνω**: keep off, ward off, defend; **δάκνω**: bite, sting; **σπαράσσω**: tear, rend.

ἀποκτείνω: slay, kill; **ἐκδέρω**: strip the skin, flay; **ἡ δορά, -ας**: skinned hide; **κομίζω**: carry away, preserve, carry off as a prize; **ἡ Καρχηδόνα**: Carthage.

X.6. Plutarch, *Beasts are Rational* 991e-f. Animals are autodidactic self-healers.

Grammar/Syntax Tags: pronouns, contract verbs, participles, complementary infinitives, indirect statement, questions.

> παρὰ τίνος γὰρ ἡμεῖς ἐμάθομεν νοσοῦντες ἐπὶ τοὺς ποταμοὺς χάριν τῶν καρκίνων βαδίζειν; τίς δὲ τὰς χελώνας ἐδίδαξε τῆς ἔχεως φαγούσας τὴν ὀρίγανον ἐπεσθίειν; τίς

δὲ τὰς Κρητικὰς αἶγας, ὅταν περιπέσωσι τοῖς τοξεύμασι, τὸ δίκταμνον διώκειν, οὗ βρωθέντος ἐκβάλλουσι τὰς ἀκίδας;

Notes: **ἐμάθομεν**: the speaker is Gryllus, one of Circe's pigs; **νοσέω**: be sick; **χάριν**: for the sake of (+ genitive); **ὁ καρκίνος**: crab (Dioscorides 2.10 cites eating river crabs as a treatment for venomous bites, and Pliny the Elder, *NH* 32.119 suggests crab oil to heal burns); **βαδίζω**: go, proceed; **ἡ χελώνη**: tortoise; **ὁ/ἡ ἔχις, -εως**: viper; **φαγεῖν**: to eat; **τό ὀρίγανον**: marjoram (see also Aristotle, *History of Animals* 9.6 [612a24] and Aelian, *On the Nature of Animals* 6.12); **ἐπεσθίω**: eat in addition; **ὁ/ἡ αἴξ, αἰγός**: goat; **περιπίπτω**: fall in with, fall afoul of, be wrecked; **τό τόξευμα, -ατος**: arrow; **τό δίκταμνον**: dittany; **βιβρώσκω**: eat (aorist passive participle); **ἐκβάλλω**: eject, expel; **ἡ ἀκίς, -ίδος**: point, barb, arrow.

XI. Medicine and Healing

Health is a universal concern. A patient's first recourse was usually the extensive body of traditional folk remedies, handed down through the generations, but two professionalized, symbiotic approaches were developed nearly simultaneously in the 5th century BCE in order to establish medical orthodoxy over magical alternatives (Nutton 2013: 105): rational, Hippocratic medicine; and incubation sanctuaries to Asclepius. The divine was never divorced from rational medicine, as evident in the Hippocratic Oath (excerpted in XI.5, below). Herophilus called drugs "the hands of the gods" (T249 vonStaden), and Galen, who joined the profession because Asclepius appeared to his ill father in a dream (*On Anatomical Procedures* 9.4 [10.609K)]; *On the Order of my Books* [19.59K]), identified himself as a worshipper (θεραπευτής) of Asclepius. Theodicy (illness as divine punishment) was widely embraced, as we see in the opening episode of the *Iliad* (1.33-100) where Apollo had punished the Greeks with a plague for Agamemnon's offense to his priest. This is evident also in the case of Phineus who was blinded for his *hubris* (Apollonius of Rhodes, *Argonautica* 2.236-237), among many other examples.

A rich body of medical writings survives from antiquity, concentrated primarily in two large collections: the Hippocratic and Galenic *corpora*. Around sixty treatises are attributed to the Hippocratic school, ranging in date from the mid-5th to the 4th century BCE. Most are anonymous, and none is securely attributable to the historic Hippocrates of Cos. The Hippocratic texts preserve numerous approaches

from the philosophic and theoretical (e.g., *Airs, Waters, Places*) to the systematic recording of case histories (e.g., *Epidemics*). Although the Alexandrian *Museion* was a center of intellectual fervor in all academic areas, including medicine, and despite the advances in anatomical knowledge afforded by a brief window that legitimized human dissection (it is now debated if dissection was entirely abandoned after the Hellenistic era: Lesley Dean-Jones "Galen and the Culture of Dissection," College of William and Mary, October 13, 2016), the works of Praxagoras of Cos, Herophilus of Chalcedon, Erasistratus of Ceos, and others are mostly lost, surviving only as scant fragments distilled through Galen's hostile pen. A strict humouralist and great admirer of Hippocrates, Galen may have composed nearly 500 treatises covering many topics in medicine and pharmacy, systematizing and synthesizing previous medical theory. Perhaps a third of these survive in Greek or translated into Arabic, Syriac, and other languages.

XI.1. Aeschylus, *Eumenides* 656-667. Apollo's defense of Orestes against the charge of murdering a kinsman (his mother) derives from contemporary embryological theory. The god even offered proof (in this passage) that the mother is NOT related to her child.

Grammar/Syntax Tags: objective genitive, ethical dative, future tense, aorist imperative, aorist subjunctive, aorist optative, substantive participles.

καὶ τοῦτο λέξω, καὶ μάθ᾽ ὡς ὀρθῶς ἐρῶ.

οὐκ ἔστι μήτηρ ἡ κεκλημένη τέκνου

τοκεύς, τροφὸς δὲ κύματος νεοσπόρου.

τίκτει δ᾽ ὁ θρῴσκων, ἡ δ᾽ ἅπερ ξένῳ ξένη

ἔσωσεν ἔρνος, οἷσι μὴ βλάψῃ θεός.

τεκμήριον δὲ τοῦδέ σοι δείξω λόγου.

πατὴρ μὲν ἂν γέναιτ᾽ ἄνευ μητρός: πέλας

μάρτυς πάρεστι παῖς Ὀλυμπίου Διός,

οὐδ᾽ ἐν σκότοισι νηδύος τεθραμμένη,

ἀλλ᾽ οἷον ἔρνος οὔτις ἂν τέκοι θεά.

Notes: **μάθ**᾽: aorist imperative of μανθάνω; **ὀρθῶς**: correctly; **ἐρῶ**; future of λέγω; **κεκλημένη**: perfect middle/passive participle of καλέω; **ὁ τοκεύς, -έως**: one who begets, parent; **ὁ/ἡ τροφός**: feeder, rearer, nourisher, nurse; **τό κῦμα, -ατος**: anything swollen, wave, billow, pregnancy; **νεόσπορος, -ον**: newly sown (i.e., fetus); **θρῴσκω**: mount, impregnate; **ἅπερ**: as (relative pronoun); **σώζω**: keep, preserve, protect; **τό ἔρνος, -εος**: sprout, shoot, embryo, fetus; **βλάπτω**: harm, injure; **τό τεκμήριον**: proof; **πέλας**: at hand, nearby; **ὁ μάρτυς**: witness; **ὁ σκότος**: darkness, gloom; **ἡ νηδύς, -ύος**: cavity, womb; **τεθραμμένη**: perfect middle/passive participle of τρέφω; **τέκοι**: aorist active optative of τίκτω.

XI.2. Galen, *On the Natural Faculties* 2.9. Four Humour Theory.

Grammar/Syntax Tags: partitive genitive, τις/τίς, participles, imperfect tense, contract verbs, indirect statement.

Ἀλλ᾽ οὔθ᾽ Ἱπποκράτης οὔτ᾽ ἄλλος τις ὧν ὀλίγῳ πρόσθεν ἐμνημόνευσα φιλοσόφων ἢ ἰατρῶν ἄξιον ᾤετ᾽ εἶναι παραλιπεῖν· ἀλλὰ τὴν κατὰ φύσιν ἐν ἑκάστῳ ζῴῳ θερμασίαν εὔκρατόν τε καὶ μετρίως ὑγρὰν οὖσαν αἵματος εἶναί φασι γεννητικὴν καὶ δι᾽ αὐτό γε τοῦτο καὶ τὸ αἷμα θερμὸν καὶ ὑγρὸν εἶναί φασι τῇ δυνάμει χυμόν, ὥσπερ τὴν ξανθὴν χολὴν θερμὴν καὶ ξηρὰν εἶναι, εἰ καὶ ὅτι μάλισθ᾽ ὑγρὰ φαίνεται. (διαφέρειν γὰρ αὐτοῖς δοκεῖ τὸ κατὰ φαντασίαν ὑγρὸν τοῦ κατὰ δύναμιν.)

ἢ τίς οὐκ οἶδεν, ὡς ἅλμη μὲν καὶ θάλαττα ταριχεύει τὰ κρέα καὶ ἄσηπτα διαφυλάττει, τὸ δ᾽ ἄλλο πᾶν ὕδωρ τὸ πότιμον ἑτοίμως διαφθείρει τε καὶ σήπει; τίς δ᾽ οὐκ οἶδεν, ὡς ξανθῆς χολῆς ἐν τῇ γαστρὶ περιεχομένης

πολλῆς ἀπαύστῳ δίψει συνεχόμεθα καὶ ὡς ἐμέσαντες αὐτὴν εὐθὺς ἄδιψοι γιγνόμεθα μᾶλλον ἢ εἰ πάμπολυ ποτὸν προσηράμεθα; θερμὸς οὖν εὐλόγως ὁ χυμὸς οὗτος εἴρηται καὶ ξηρὸς κατὰ δύναμιν, ὥσπερ γε καὶ τὸ φλέγμα ψυχρὸν καὶ ὑγρόν.

Notes: **πρόσθεν**: before; **μνημονεύω**: call to mind, mention; **ὁ φιλοσόφος**: lover of wisdom, philosopher; **ὁ ἰατρός**: healer, physician; **ᾤετ᾽**: imperfect middle/passive indicative of οἴομαι; **παραλείπω**: leave aside, omit (i.e., a discussion of the nature of the four humours); **τό ζῷον**: living creature, animal; **ἡ θερμασία**: heat, warmth; **εὔκρατος, -ον**: well-mixed, well-tempered; **μετρίως**: moderately; **ὑγρός, -ά, -όν**: moist; **τό αἷμα, -ατος**: blood; **γεννητικός, -ή, -όν**: generative, productive; **θερμός, -ή, -όν**: warm, hot; **ὁ χυμός**: juice, humour; **ἡ ξανθός, -ή, -όν**: yellow, red, brown, auburn, golden; **ἡ χολή**: bile; **ξηρός, -ά, -όν**: dry; **μάλιστα**: especially, for the most part; **διαφέρω**: differ; **ἡ φαντασία**: appearance.

ἡ ἅλμη: sea water, salt water; **ταριχεύω**: preserve, embalm; **τό κρέας**: flesh; **ἄσηπτος, -ον**: uncorrupted, not liable to decay; **διαφυλάσσω**: guard carefully, "preserve"; **πότιμος, -ον**: drinkable; **ἑτοίμως**: readily, immediately; **διαφθείω**: destroy utterly; **σήπω**: make rotten; **ἡ γαστήρ, -έρος**: belly; **περιέχω**: surround, embrace, contain; **ἄπαυστος, -ον**: inceasing, never ending; **τό δίψος, -εος**: thirst; **συνέχω**: constrain, oppress; **ἐμέω**: vomit, throw up; **ἄδιψος, -η, -ον**: quenched, not thirsty; **πάμπολυς, -πόλλη, -πολυ**: very great; **ὁ ποτός**: (quantity of) drink; **προσαίρω**: take up (aorist middle indicative); **εὐλόγως**: reasonably; **τό φλέγμα, -ατος**: inflammation, heat, "phlegm"; **ψυχρός, -ά, -όν**: cold.

XI.3. Hippocratic *Regimen in Health* 1. Diet should correlate with the season in order to ensure a healthy balance of humors in the body.

Grammar/Syntax Tags: genitive of time when, superlative adverb with ὡς, contract verbs, impersonal verbs.

Τοὺς ἰδιώτας ὧδε χρὴ διαιτᾶσθαι· τοῦ μὲν χειμῶνος ἐσθίειν ὡς πλεῖστα, πίνειν δ᾽ ὡς ἐλάχιστα, εἶναι δὲ τὸ πόμα οἶνον ὡς ἀκρητέστατον, τὰ δὲ σιτία ἄρτον καὶ τὰ

ὄψα ὀπτὰ πάντα, λαχάνοισι δὲ ὡς ἐλαχίστοισι χρῆσθαι ταύτην τὴν ὥρην· οὕτω γὰρ ἂν μάλιστα τὸ σῶμα ξηρόν τε εἴη καὶ θερμόν.

Notes: **διαιτάω**: conduct one's life; **ὁ χειμών, -ῶνος**: winter (the recommended diet balances out winter's cold, wet properties); **ἐσθίω**: eat; **ἐλάχιστα**: superlative of μικρός; **τό πόμα** = τό πῶμα, -ατος: drink, draught; **ὁ οἶνος**: wine; **ἄκρατος, -η, -ον**: unmixed; **τό σιτίον**: grain, bread; **ὁ ἄρτος**: loaf; **τό ὄψον**: prepared food, meat; **ὀπτός, -ή, -όν**: roasted, broiled; **τό λάχανον**: garden herb, vegetable; **ἡ ὥρα**: season; **ξηρός, -ά, -όν**: dry; **θερμός, -ή, -όν**: warm, hot.

XI.4. Hippocratic, *Airs, Waters, Places* 12. Asia's climate is healthier than Europe's.

Grammar/Syntax Tags: partitive genitive, comparative adjectives, superlative adjectives, relative clauses, causal clause.

πολὺ γὰρ καλλίονα καὶ μέζονα πάντα γίνεται ἐν τῇ Ἀσίῃ, ἥ τε χώρη τῆς χώρης ἡμερωτέρη καὶ τὰ ἤθεα τῶν ἀνθρώπων ἠπιώτερα καὶ εὐοργητότερα. τὸ δὲ αἴτιον τούτων ἡ κρῆσις τῶν ὡρέων, ὅτι τοῦ ἡλίου ἐν μέσῳ τῶν ἀνατολέων κεῖται πρὸς τὴν ἠῶ τοῦ τε ψυχροῦ πορρωτέρω. τὴν δὲ αὔξησιν καὶ ἡμερότητα παρέχει πλεῖστον ἁπάντων, ὁκόταν μηδὲν ᾖ ἐπικρατέον βιαίως, ἀλλὰ παντὸς ἰσομοιρίη δυναστεύῃ.

Notes: **καλλίονα**: comparative of καλός; **μέζονα**: comparative of μέγας; **ἥμερος, -α, -ον**: tame, gentle, civilized; **τό ἦθος, -εος**: haunt, abode, disposition, character; **ἤπιος, -α, -ον**: gentle, favorable; **εὐόργητος, -η, -ον**: good-tempered; **ἡ κρῆσις, -εως**: mixing, blending; **ἡ ὥρα**: season; **ἡ ἀνατολή**: rising; **ἡ ἠώς, ἠοῦς**: dawn; **ψυχρός, -ά, -όν**: cold; **πορρωτέρω**: forward; **ἡ αὔξησις, -εως**: growth, increase; **ἡ ἡμερότης, -ητος**: cultivation, mildness; **ἅπας, ἅπασα, ἅπαν**: all; **ὁκόταν**: whenever; **ἐπικρατέος, -η, -ον**: dominant; **βιαίως**: violently, forcibly; **ἡ ἰσομοιρίη**: equal share; **δυναστεύω**: hold power over (present subjunctive).

XI.5. The Hippocratic oath is essentially a Pythagorean, religious document, wherein

Hippocratic physicians swore a binding vow to honor all the various Greek gods of health and healing and to avoid the religious crime of miasma (the act of shedding bodily fluids on the earth: see further, R. Parker. 1977. *Miasma*. Oxford). Here we have the opening lines.

Grammar/Syntax Tags: accusative of respect, objects complement, future infinitive, infinitive of purpose, genitive absolute.

> ὄμνυμι Ἀπόλλωνα ἰητρὸν καὶ Ἀσκληπιὸν καὶ Ὑγείαν καὶ Πανάκειαν καὶ θεοὺς πάντας τε καὶ πάσας, ἵστορας ποιεύμενος, ἐπιτελέα ποιήσειν κατὰ δύναμιν καὶ κρίσιν ἐμὴν ὅρκον τόνδε καὶ συγγραφὴν τήνδε.
>
> ***Notes***: **ὄμνυμι**: swear; **ὁ ἰητρός**: healer, physician; **ὁ Ἀσκληπιός**: son of Apollo and the mortal woman Coronis, he was rescued from the womb of his unfaithful mother and raised by the centaur Chiron who taught him the art of healing; **ἡ Ὑγεία**: one of Asclepius's six daughters, the personification of "Health"; **ἡ Πανάκεια**: one of Asclepius's six daughters, "Universal Remedy"; **ὁ ἵστωρ, -ορος**: one who knows, judge, expert; **ἐπιτελής, -ές**: brought to an end, fulfilled, completed; **ἡ κρίσις, -εως**: judgment, choice, interpretation; **ὁ ὅρκος**: oath, vow, object by which one swears; **ἡ συγγραφή**: writing, contract.

XII. Pharmacy

Intersecting with medicine, botany, zoology, geology, and cosmetics (e.g., perfumes, dandruff treatments), pharmacy is one of the oldest of the sciences. Drugs, "the hands of the gods" (Herophilus T249 von Staden), were compounded from simple and complex recipes of botanical, animal, and mineral substances that were used to heal (or harm) the body. Opium, for example, was among the many substances employed to treat aches and pains, including headaches. Salves were developed to improve vision or enhance the efficacy of bandages. Recipes are preserved for relieving hangovers, ringing in the ears, liver complaints, envenoming bites, and myriad other maladies. The notorious king Mithridates VI of Pontus (ruled ca. 120-63 BCE) reputedly immunized himself against all poisons by ingesting small amounts of toxins over time (Pliny, *NH* 25.3, 5-7). His name was bestowed on a

class of antidotes credited as his inventions (see Celsus 5.23.3 for an expensive, multi-ingredient compounded mithridatium).

Although many authors investigated the medicinal properties of common (and exotic) substances, one extant ancient text was devoted exclusively to pharmacy, *de Materia Medica* of Dioscorides of Anazarbus (1st century CE), who described over 1,000 botanicals, animal, and mineral products arranged according to their affects on the human body.

Pharmacy was never entirely divorced from folklore, and superstitions guided the collection and preparation of medicals. Theophrastus gave precise instructions for collecting botanicals, including standing to windward when gathering the fruit of the wild rose, gathering honeysuckle before the sun strikes the blossoms, eating garlic and drinking unmixed wine before collecting hellebore, but he rejected as superstitious the folk belief that peonies must be collected at night (*History of Plants* 9.8).

XII.1. *Homeric Hymn to Demeter* 206-209. Cykeon.

Grammar/Syntax Tags: genitive with special adjectives, dative with special adjectives, imperfect tense, indirect object, δίδωμι.

τῇ δὲ δέπας Μετάνειρα δίδου μελιηδέος οἴνου
πλήσασ᾽: ἣ δ᾽ ἀνένευσ᾽: οὐ γὰρ θεμιτόν οἱ ἔφασκε
πίνειν οἶνον ἐρυθρόν: ἄνωγε δ᾽ ἄρ᾽ ἄλφι καὶ ὕδωρ
δοῦναι μίξασαν πιέμεν γλήχωνι τερείνῃ.

Notes: **τῇ**: Demeter; **τό δέπας, -αος**: goblet, bowl; **Μετάνειρα**: the queen of Eleusis; **δίδου**: imperfect indicative of δίδωμι; **μελιηδής, -ές**: honey-sweet; **ὁ οἶνος**: wine; **πίμπλημι**: fill; **ἀνανεύω**: throw head back in refusal; **θεμιτός, -ή, -όν**: in accord with divine law; **οἱ**: dative of the reflexive pronoun ἑ; **φάσκω**: say, affirm; **ἐρυθρός, -ά, -όν**: red; **ἄνωγα**: command; **τό ἄλφιτον**: barley groats; **μίγνυμι**: mix (modifies Metaneira, understood as the object of ἄνωγε); **πιέμεν**: aorist infinitive of πίνω; **ἡ γλήχων, -ωνος**: pennyroyal; **τέρην, -εινα, -εν**: soft, delicate.

XII.2. Dioscorides 3.31. Pennyroyal.

Grammar/Syntax Tags: aorist passive participle.

> γλήχων· πόα γνώριμος, θερμαντική, λεμτυντική, πεπτική. ποθεῖσα δὲ ἔμμηνα καὶ δεύτερα καὶ ἔμβρυα ἄγει·

Notes: **ἡ γλήχων -ωνος**: pennyroyal; **ἡ πόα**: grass, herb; **γνώριμος, -ον**: well-known; **θερμαντικός, -ή, -όν**: warming; **λεμτυντικός, -ή, -όν**: thinning; **πεπτικός, -ή, -όν**: promoting digestion; **ποθεῖσα**: aorist passive participle of πίνω; **τό ἔμμηνον**: menses, something that lasts or occurs monthly; **τό δεύτερον**: a second thing, "afterbirth"; **τό ἔμβρυον**: embryo, fetus.

XII.3. Hippocratic Corpus, *On Barrenness in Women* 30.1. Expelling an aborted fetus.

Grammar/Syntax Tags: 3rd person imperative, participial clauses.

> μετὰ δὲ πινέτω ὀρίγανον καὶ γλήχωνα καὶ ἄλφιτον ἐν ὕδατι ἐπιπάσσουσα, δάφνης φύλλα κόψας καὶ τρίψας λεῖα, κόμμι παραμίξας, καὶ διεὶς ὕδατι, πίνειν διδόναι.

Notes: **μετά**: here the author has offered a third solution; **τό ὀρίγανον**: marjoram; **ἐπιπάσσω**: sprinkle on; **ἡ δάφνη**: sweet bay, laurel; **τό φύλλον**: leaf; **κόπτω**: cut, grind; **τρίβω**; rub, pound, grind; **λεῖος -α -ον**: smooth, minced, crushed (the author intends the mixture to be ground up very finely); **τό κόμμι**: gum; **παραμίγνυμι**: mix up together; **διΐημι**: send through, let go through, dissolve.

XII.4. Aristotle, *On Marvelous Things Heard* 4. Goats self-medicate with dittany.

Grammar/Syntax Tags: aorist subjunctives.

> Αἱ ἐν Κρήτῃ αἶγες ὅταν τοξευθῶσι, ζητοῦσιν, ὡς ἔοικε, τὸ δίκταμον τὸ ἐκεῖ φυόμενον. ὅταν γὰρ φάγωσιν, εὐθὺς ἐκβάλλουσι τὰ τοξεύματα.

Notes: **ὁ/ἡ αἶξ, αἰγός**: goat; **τοξεύω**: shoot with an arrow (aorist passive subjunctive); **τό δίκταμον**: dittany; **φαγεῖν**: to eat (aorist subjunctive); **εὐθύς**: immediately; **ἐκβάλλω**: expel, drop; **τό τόξευμα, -ατος**: arrow.

XII.5. Homer, *Odyssey* 10.302-306. Hermes offers the magical antidote moly to Odysseus about to encounter Circe.

Grammar/Syntax Tags: dative of specification, ethical dative, aorist participle.

ὣς ἄρα φωνήσας πόρε φάρμακον Ἀργεϊφόντης

ἐκ γαίης ἐρύσας, καί μοι φύσιν αὐτοῦ ἔδειξε.

ῥίζῃ μὲν μέλαν ἔσκε, γάλακτι δὲ εἴκελον ἄνθος:

μῶλυ δέ μιν καλέουσι θεοί: χαλεπὸν δέ τ᾽ ὀρύσσειν

ἀνδράσι γε θνητοῖσι, θεοὶ δέ τε πάντα δύνανται.

Notes: **φωνέω**: speak; **πόρω**: offer; **τό φάρμακον**: a drug that can either heal or harm; **Ἀργεϊφόντης**: Argos-slayer, Hermes; **ἐρύω**: draw, pull, pluck; **μοι**: Odysseus (Odysseus is here recounting his adventures to the Phaeacian court); **ἡ ῥίζα**: root; **μέλας, μέλαινα, μέλαν**: dark, black; **ἔσκε**: imperfect Ionic form of εἰμί; **τό γάλα, γάλακτος**: milk, milky sap; **εἴκελος, -η, -ον**: like; **τό ἄνθος, -ους**: flower, bloom; **τό μῶλυ**: moly; **μιν**: him, her, it; **ὀρύσσω**: dig; **θνητός, -ή, -όν**: mortal, dying.

XII.6. Theophrastus, *History of Plants* 9.15.7. Moly. Notice how Theophrastus has described this exotic plant by comparing it with more familiar ones.

Grammar/Syntax Tags: dative with special adjectives, indirect statement, relative clauses.

τὸ δὲ μῶλυ (γίνεται) περὶ Φενεὸν καὶ ἐν τῇ Κυλλήνῃ. φασὶ δ᾽ εἶναι καὶ ὅμοιον ᾧ ὁ Ὅμηρος εἴρηκε, τὴν μὲν ῥίζαν ἔχον στρογγύλην προσεμφερῆ κρομύῳ, τὸ δὲ φύλλον ὅμοιον σκίλλῃ· χρῆσθαι δὲ αὐτῷ πρός τε τὰ ἀλεξιφάρμακα καὶ τὰς μαγείας· οὐ μὴν ὀρύττειν γ᾽ εἶναι χαλεπόν, ὡς Ὅμηρός φησι.

Notes: **Φενεόν**: west of Corinth in the Peloponnese; **τῇ Κυλλήνῃ**: the second

tallest mountain in the Peloponnese; **εἴρηκε**: perfect active indicative of λέγω; **ἡ ῥίζα**: root; **στρογγύλος, -η, -ον**: rounded, spherical; **προσεμφερής, -ές** (+ dative): resembling; **τό κρομύον**: onion; **τό φύλλον**: leaf; **ἡ σκίλλα**: squill, sea onion; **τό ἀλεξιφάρμακον**: antidote, remedy; **ἡ μαγεία**: magic.