

"Between Mathematics and Mythology: The Heroic Figure of Pythagoras"

Abstract

This thesis looks at the ways in which Pythagoras was admired in the world. While he is frequently thought of as a mathematician, he also has a reputation of being a mystical figure capable of performing miracles. As a mystical figure, Pythagoras shares with the Greek Mythological heroes the ability to travel to the underworld. The thesis recognizes that Pythagoras is a unique figure and that Pythagoras could be admired as a demi-god.

The research begins with Pre-Socratic fragments. These are closest to the research begins with Pythagoras's assumed date of origin, 550 B.C.E. The next testimony comes from the Academic and Peripatetic Schools who discuss the Pythagorean society and Pythagorean Philosophy. Neo-Pythagoreans of the 1st century A.D., especially Iamblichus, are analyzed. Some references to Pythagoras in contemporary art and literature are included to further show that he is revered as a hero who promotes a system of understanding that is both scientific and religious.

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Josh Kutz, November 19, 2002

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Between Mathematics and Mythology: The Heroic Figure of Pythagoras

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May 3rd, 1999

Introduction

Much can be learned about a culture by examining its heroes. A hero is someone who appears larger than life, someone who embodies the qualities and virtues which his or her culture values. A hero is an individual who did what others around them could not, or would not, do. The heroic actions of that individual change the world forever. The most important heroes are those who are credited with making the greatest improvements to society. In this way, a hero represents a period of change in the history of humanity; the world was made a better place because of the actions of that person.

Throughout history many different types of people have been admired and treated heroically. When looking backwards in time, the values of a culture will determine which figures from the past are recalled as heroes and which characteristics are particularly emphasized. One figure who is seen as a hero for many different reasons is Pythagoras, a Greek of the sixth century before the common era. Although many things are not known about Pythagoras, wherever he is admired it is for his intelligence and his teachings. Pythagoras is remembered as a hero because of his intellect. When people today refer to Pythagoras, he is most commonly thought of as a groundbreaking mathematician. After some digging into the body of material that praises Pythagoras, additional reasons for his heroic status arise. In the classical world, Pythagoras had the reputation of a miracle-worker, a man capable of performing feats of mythical proportion. These two different abilities, superior intelligence and supernatural power, combine to form a unique heroic figure.

The intent of this paper is to determine how Pythagoras came to be associated with both mathematics and mythology, and to understand what the fusion of these concepts says about the

way that the Greeks saw their world. Pythagoras represents the concept that humans, through reason and intelligence, can uncover the true nature of the universe. To Pythagoreans this uncovering is by no means a transgression against the divine; it is the way for humans to become more godlike. Pythagoras, as the supreme human intelligence, is closer to the divine and therefore displays godlike characteristics.

Before proceeding with the body of this paper, it is necessary to state some of the problems facing modern Pythagorean research. In the ancient world, Pythagoras was a man about whom more was said than was known. His period of influence is the 6th century B.C.E., when the written record was in its infancy. Scholarly attempts to create a historical picture can prove the existence of the cult of Pythagoreans in the 6th century, but details surrounding the man himself are scarce and most late stories apocryphal. Even the name Pythagoras comes into question. Some late authors explain it as a combination of the words 'Pythia' (), the oracle of Apollo at Delphi, and *agoreuein* (), from the Greek verb to speak. ¹

Pythagoras was said to have left no writings², and no works have survived which can be successfully linked to his hand.³ The texts of his that are mentioned are lost or spurious. One source of confusion comes from the numerous Orphic texts that date to the 6th century.

Diogenes Laertius points to a fragment from Ion of Chios, a mid 5th century writer, as proof of Pythagoras's writings (D.L., *Lives*, 8.8). Ion says that Pythagoras ascribed some writings to Orpheus. ⁴ This fragment shows that Ion was trying to find the author behind some Orphic poems, but it does not prove that he knew of texts that were definitely written by Pythagoras.⁵

The Pythagorean and Orphic cults had similarities which will be discussed later. They were frequently confused by Greeks. Herodotus, who omits mention of Pythagoras from most of his

history, makes an attempt to clarify this overlap.⁶

Another fragment used by Diogenes Laertius comes from Heraclitus who says
Pythagoras, son of Mnesarchus, practiced research most of all men, and making extracts from these treatises, he compiled a wisdom of his own, an accumulation of learning, a harmful craft.⁷
This fragment mentions treatises that Pythagoras examined, but it does not conclusively state that they were written by Pythagoras, only that Pythagoras used other writings to assist his own efforts.

Attempts to connect sayings and concepts to Pythagoras are further muddled by the practice of the cult members to attribute all discoveries to the master.⁸ This was their way of paying respect to their founder and it was also their way of explaining Pythagoras's amazing abilities. The later cult members would not have been able to make inquiries into mathematics and philosophy if Pythagoras had not begun the process.

Since Pythagoras left no written words behind, everything which is said about him has the quality of hearsay. The earliest references to Pythagoras can be found in pre-Socratic writers of the late 6th century and 5th century. These men are closest in time to the historical person Pythagoras, but few fragments survive which mention Pythagoras, and even fewer details are related. Heraclitus of Ephesus, who was in his prime around 500 BCE, mentions Pythagoras twice. Both times he is expressing criticism of Pythagoras's knowledge. Heraclitus does relate the detail that Pythagoras was the son of Mnesarchus (Heraclitus, *Ancilla*, D-K 22, fr. 129). Heraclitus and Ion are the only pre-Socratics to mention Pythagoras by name.

There are other important findings from this period that scholars both ancient and modern relate to Pythagoras, but in those cases no proper name survives within the fragment, so

the connection to Pythagoras must be extrapolated.⁹ Nevertheless, because of his influence on later Greek thinkers, the Pre-Socratic fragments, and the existence of the cult in his name, Pythagoras must be thought of as an historical person of the 6th century.¹⁰

Pythagoras s connection to Mathematics

Pythagoras will forever hold a place in the history of Greek thinkers. The most famous discovery attributed to him is the theorem equating the sides of a right triangle. Known as the Pythagorean Theorem, it states: In right-angled triangles the square on the side sub-tending the right angle is equal to the squares on the sides containing the right angle.¹¹ Since the third or possibly fourth century B.C.E., this theorem has born the name of Pythagoras.¹² Modern scholarship has uncovered evidence that this theorem may have originated in Egypt or Babylon, at dates much earlier than Pythagoras s period of activity (Heath, 1931, p. 96-7). Historical accuracy aside, Pythagoras s name remains attached to a theorem which is taught in most secondary schools and has applications in many branches of modern science, from geometry to Einstein s theory of General Relativity.¹³

If Pythagoras did not discover this theorem himself, he must have been familiar with it and included it in his teachings in geometry and arithmetic. These subjects are aspects of the philosophy that Pythagoras is associated with. Our records of Pythagoras show that he was not a mathematician in the modern sense, but was interested in using mathematics and number theory to explain human life and other general phenomena. Pythagoras was interested in applying mathematics to a broad range of subjects that cannot be easily replicated. He is most famous for expounding a philosophy in which numbers were the building blocks of the universe.

Greek philosophy is concerned with learning the true nature of reality, the undeniable truths that lie beyond the range of mere sense perception. Plato, who lived after Pythagoras, solved this puzzle by positing the existence of Forms : pure and unchangeable principles which exist far away from human senses. The world that humans inhabit consists of glimmers and

reflections of these forms that control the universe. Only through intense study and philosophy do humans perceive these Platonic Forms, and then the true nature of reality can be perceived. Greeks commenting on Plato indicate that he was heavily influenced by Pythagorean philosophy and may have borrowed some important elements.¹⁴ The major distinction between the two philosophies is that, to a Pythagorean, numbers are the controlling force of the universe, not forms.

The first description of Pythagorean philosophy come from the fragments of Philolaus, a man who was active in the late fifth century. He says: Actually, everything that can be known has a Number; for it is impossible to grasp anything with the mind or to recognize it without this (*Number*).¹⁵ The Pythagorean way of understanding the world was that it was made out of numbers, and those numbers governed how the universe functioned.

The first tenet of Pythagorean philosophy is that the universe begins with unity. Unity then breaks down into Limited (*peras*,) and Un-Limited (*apeiron*,) components. These components oppose one another. The Limited component symbolizes the order in the universe: it introduces a definite boundary where previously there was nothing. The Un-Limited component is symbolic of the chaos in the universe; it creates plurality. The Un-Limited component is infinite in a negative sense: it can be divided an infinite number of times.¹⁶ The Limited and Un-Limited components recombine to create numbers. In Pythagorean philosophy, everything in the world consists of number. F. M. Cornford, in his essay on Pythagorean philosophy, offers a lucid explanation of the abstraction behind this cosmogony: There is (1) an undifferentiated unity. (2) From this unity two opposite powers are separated out to form the world order. (3) The two opposites unite again to generate life.¹⁷ To

Pythagoreans, the Monad is the original, undifferentiated unity. It unites the entire world because the rest of the universe is formed from it. To Pythagoreans, numbers, which create all things, are formed from the Monad.

The Monad refers to the number one, but it also refers to the numbers from one to ten. These ten numbers, collectively known as the Decad, constitute the unified continuum (Fideler, 1988, p. 21), a spectrum of different attributes (numbers) that is the essence of all things. The idea that the entire universe is somehow connected to a single, unified origin is necessary for a successful system of thought. If everything in the universe is connected, then it is possible to understand everything in the universe. By studying a particular aspect of the universe, it is possible to learn about the universe as a whole. Archytas of Tarentum, one of the earliest Greeks to be called a Pythagorean, offers this analysis of the connection between the universal and the particular:

Mathematicians seem to me to have excellent discernment, and it is in no way strange that they should think correctly concerning the nature of particular existences. For since they have passed an excellent judgement on the nature of the Whole, they were bound to have an excellent view of separate things.¹⁸

By correctly understanding the way that the universe functions as a whole, it is easier to understand each smaller part.

The ten Pythagorean numbers of the Decad were thought to be different from the numbers that appear as part of everyday life. They share attributes with the numbers used to measure quantities and conduct trade, but are fundamentally different. In Pythagorean philosophy, the Pythagorean numbers of the Decad are the mystical source of the numbers observed throughout the universe.

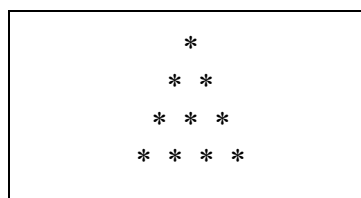
The Monad was described as being both even and odd, also known as even-odd.¹⁹ These are the two opposite powers present in unity which separate and recombine to form the rest of the world. The Un-Limited component is present in even numbers; the Limited component is present in odd numbers. The Monad is the first Pythagorean number; it represents the unity of the cosmos and that is why it is both Limited and Un-Limited. The combination of these two powers results in the subsequent symbols after the Monad.

The Indefinite Dyad is the next Pythagorean number and it is Un-Limited. This first Un-limited number signifies a step away from unity, into the chaotic world of duality, of cause and effect, subject and object.

After the Dyad comes the Triad, the sum of the numbers one and two. Because the Triad can be represented as the combination of Limit and the Un-limited, it signifies harmony and relation. The number three is the first number which can be broken down into two other numbers, so it symbolizes the beginning of mathematics and the ability to equate one thing to another. It is the Pythagorean origin of harmony () (Fideler, 1988, p. 22).

The fourth Pythagorean number, the Tetrads, has special significance because of its relation to the rest of the Decad. The most famous Pythagorean figure is the Tetraktys, a triangle with four levels.

Figure 1: The Tetraktys



A triangle made from ten elements.

This triangle can be seen as a combination of the numbers 1, 2, 3, and 4 which added together give 10, the Pythagorean Decad. That a perfect triangle is naturally formed by ten numbers was evidence to the Pythagoreans that the Decad is a significant quantity. The tetraktys was regarded as a sacred figure. It was said that Pythagoreans would not violate the names of the Gods or of Pythagoras in an oath and instead say:

I swear by the discoverer of the Tetraktys,
Which is the spring of all our wisdom,
The perennial root of Nature's fount. (Iam., *VP*, 29.162)

The first four numbers also have significance when applied to geometry. The number one signifies a point in space. The number two is a line, which is drawn between two points. Number three is a two-dimensional figure, such as a drawing of a triangle. With the number four, the realm of physical bodies has been reached: a three dimensional figure (a pyramid) can be constructed from four points.²⁰

Figure 2: Progression from One Point to a Three-Dimensional Pyramid

			
Figure 2a One point.	Figure 2b Two points form a line.	Figure 2c Three points form a triangle.	Figure 2d Four points form a three-dimensional pyramid.

For the Pythagoreans, the Un-limited component of numbers was subservient to the

Limited. The Un-limited, even numbers are not insignificant, but they are less perfect than the Limited, odd numbers. An example of this imperfection can be seen when the method of placing carpenter's squares, *gnomon* () in Greek, around numbers is replicated. A gnomon is a right-angle L shape marked with equal units. Using dots to signify numbers, a single dot represents a one, and two dots next to each other represents the number two. The single dot has the same height and width, and when a gnomon is placed adjacent to this square, it forms a larger square. The added gnomon is three units long. When another gnomon is added, it will be five units long and a larger square will be formed. Each successive square has the same height and width and is an odd number of units long.

Figure 3: The Gnomon Method²¹

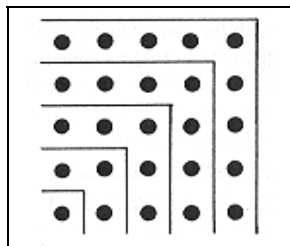


Figure 3a

Carpenter's squares placed around an odd number.
Each new gnomon forms a square with the same height and width ratio.

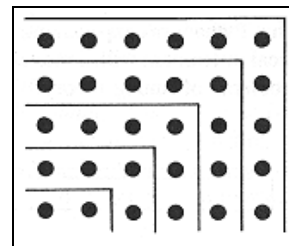


Figure 3b

Carpenter's squares placed around an even number.
Each new gnomon forms a rectangle with a different height and width ratio.

In the case of even numbers, a rectangle is formed by two dots placed side by side. This object has a height of one and a length of two. When a gnomon is placed around this rectangle, a larger rectangle is formed with height two and length three. The new gnomon is four units long. Each additional gnomon will be an even number. The imperfect nature of even numbers appears when comparing each new rectangle. The first rectangle formed from the Dyad has a height to

width ration of 1:2. The next rectangle has a ratio of 2:3. Adding another gnomon makes a rectangle with proportions 3:4 and so on. Each new rectangle has a different shape and proportion, versus a square which maintains the same proportion as it grows.

The contrast between even and odd carried into many subjects in Pythagorean philosophy. The best example of the differences appears in Aristotle's *Metaphysics* where he includes the Pythagorean table of opposites²²:

1)	Limited	Un-limited
2)	Odd	Even
3)	One	Plurality
4)	Right	Left
5)	Male	Female
6)	At rest	In motion
7)	Straight	Crooked
8)	Light	Darkness
9)	Good	Evil
10)	Square	Oblong

This chart consists of ten sets of opposites, which is a reference to the Decad as the ultimate source of everything. This table demonstrates how the principle of the Limited and Un-limited can apply to many subjects. The Pythagoreans believed that numbers dictated what was good or evil, straight or crooked. Pythagorean philosophy applied numerology to many different aspects of the world.

Because the universe is built out of numbers, each number has a special property and attribute that it displays when it is part of something. As described above, the Monad represents unity, the Dyad represents duality, and the Triad represents harmony and relation. The Tetrad, in its capacity as the Tetraktys, stands for foundation and stability. As Iamblichus says, it is the fount, the source of all numbers. It is therefore the foundation for all Pythagorean numerology

(Iam., *Theology*, 23).

The Pentad was called marriage, since it consists of the first even number, two, combined with the first fully odd number, three. From the table of opposites, male belongs to the odd column and female belongs to the even column. The Pentad can be formed by combining male and female numbers. The Hexad was also called marriage because it can be formed by the multiplication of the numbers two and three. The Heptad is a prime number; it has no factors other than one and itself. Because of this it was labeled a virgin, not born of any mother or father. It was associated with Athena, a goddess who was born from Zeus's head, not the product of sexual intercourse (Ibid, 71). The Octad is described as the first actual cube, because it is the product of $2 \times 2 \times 2$. The Ennead was labeled the horizon because it is the last number within the Decad. The Decad, which contains all the Pythagorean numbers, is known as wholeness and as the universe (Ibid, 1 - 80). This is an abridged list of the attributes of the Pythagorean numbers. As Pythagorean philosophy developed over time, numerous associations and attributes were given to these ten numbers.

Pythagorean philosophy is based on the belief that numbers and mathematics are fundamental aspects of the universe. A powerful example of the importance of numbers is the discovery, attributed to Pythagoras,²³ of the use of whole numbers in the musical intervals. Ancient Greeks knew that the relationships between pleasant-sounding notes on the musical scale could be expressed numerically. On a stringed instrument, if one string is twice as long as another string, the notes played when the two strings are simultaneously plucked will be exactly one octave apart. The shorter string will produce the higher note. If the two strings have the ratio of 2:3, when played together the notes will be the perfect fifth, the most powerful musical

relationship. If the string lengths have the ratio 3:4, the corresponding notes will be the perfect fourth. These ratios, along with more complicated whole number ratios, can be used to construct the entire musical scale (Fideler, 1988, p. 25). The musical scale is a naturally existing phenomenon; certain frequencies of sound, by their nature, are pleasing to the human ear. The fact that the relationship between pleasing notes can be expressed by ratios of one whole number to another offers easily replicated evidence that numbers are a significant part of the world. As one scholar puts it: If musical sounds can be reduced to numbers, why not everything else? ²⁴

Pythagoras himself must have used mathematics in his teachings. Arithmetic, geometry, music theory, and astronomy are featured heavily as subjects that members of his cult studied.²⁵ The cult that arose around the figure of Pythagoras was instrumental in preserving his teachings and discoveries. It also makes the picture complicated because there are no written records for the earliest years of the cult. Any discoveries made by cult members were kept anonymous or attributed to Pythagoras, the master .

The Pythagorean cult's center of activity was Croton, a Greek colony in Italy to which Pythagoras is thought to have migrated from his native island of Samos. The date of his migration coincides with the domination of Polycrates who was tyrant of Samos and master of the sea in the year 533 B. C. E.²⁶ The story of Pythagoras's arrival in Croton appears in the neo-Pythagorean biographies. In this story, Pythagoras convinces the town of his success as a philosopher and gives lectures on moral conduct to different social groups: youths in the gymnasium, young men, the town women, and the adults in the senate (Iam., *VP*, 35 - 57). The converts from these lectures join Pythagoras and begin a communal way of life that includes studying philosophy.

The specifics of this story may be exaggerated, but the underlying theme is thought to be correct. A Pythagorean society did exist in Magna Graecia, the land of Southern Italy and Sicily that was colonized by Greeks. The society had political ties to the towns of Croton and Metapontum.²⁷ Other towns that appear with reference to cult activities are: Tarentum, Sybaris, Caulonia, and Locri. After the death of Pythagoras the cult became the vehicle for the transmission of his teachings and philosophy. Many of the cult practices were kept secret or transmitted as encoded symbols, and the penalty for revealing them was excommunication and divine retribution (Iam., *VP*, 88). For the early years of the cult there are no written records; the teaching was done orally. Near the time of Pythagoras's death, there was political upheaval in Italy, and it appears that the Pythagorean society was dispersed. Two different versions of this ending are recorded by writers of the Peripatetic school. Aristoxenus says that Pythagoras withdrew to Metapontum to avoid the upheaval and died peacefully. Dicearchus says Pythagoras was in Croton at the time of the political trouble. These discrepancies arise when years of oral tradition precede written documentation (Burkert, 1972, p. 117). The continuing existence of this cult affects Pythagorean research; it is impossible to separate the historical Pythagoras from the legends told by members of his cult.

Most depictions of the Pythagorean cult include gradations in the level of initiation. Iamblichus and other neo-Pythagoreans describe two major divisions: the *acusmatici* (, the hearers) and the *mathematici* (, the learners). Sometimes a political division is also mentioned. According to Iamblichus, the *acusmatici* were the exoteric disciples who listened to lectures that Pythagoras gave out loud from behind a veil. The *acusmatici* were not allowed to see Pythagoras and they were not taught the inner secrets of the

cult. Instead they were taught laws of behavior and morality in the form of cryptic, brief sayings that had hidden meanings. These maxims are known as *acusmata* and also *symbola*. They were first transmitted orally and can be dated back to about 400 B.C.E. (Burkert, 1972, p. 166).

Iamblichus includes sayings such as: Do not help to unload a burden (because it is wrong to encourage lack of effort) but help to load it up. ; Pour a libation to the gods over the handle of the cup, as an omen, and so that no-one drinks from the same place. Other sayings are not accompanied by such explicit interpretations. For example: One must put the right shoe on first. ; Do not speak without a light. ; One should make sacrifice, and go to holy places, barefoot (Iam., *VP*, 18.82-83). By following the instructions in these maxims, the *acusmatici* would replicate the ascetic lifestyle that Pythagoras introduced and theoretically would improve the quality of their lives.

The *mathematici* were the esoteric members of the cult who studied the teachings of Pythagoras. They went through rigorous initiations and a highly structured educational process including years of study under a vow of silence. If a student was not able to maintain his/her discipline over the years, he/she was rejected and regarded as dead (Ibid, 117). As the name implies, they were concerned with the mathematics and numerology of Pythagoras's teachings. They studied the Pythagorean quadrivium of four mathematical subjects: arithmetic, geometry, astronomy, and music.

It is uncertain whether these divisions were formal sects and not the invention of later authors. What is clear is that in the 5th and 4th century sharp contrasts were seen among different groups of people calling themselves Pythagoreans. On the one hand, the term Pythagorists was used for wandering ascetics and unintelligible mystics in plays of Old and Middle

Comedy.²⁸ These characters are portrayed as poor, dirty, unshod vegetarians who expounded hypocritical beliefs. Drama is by no means historical evidence, but in order for the stereotypes to have a humorous effect Pythagorean cult members must have existed who could be thought of this way (Burkert, 1972, p. 200).

On the other hand, there were intellectuals who called themselves Pythagoreans and pursued mathematics and philosophy. Archytas was a well-respected politician in Tarentum²⁹ during the early fourth century who engaged in Pythagorean studies. Aristoxenus was a scholar in Aristotle's Peripatetic school and he pursued musical theory as a Pythagorean (Ibid, p. 198). These are only a few of the many Greek thinkers who saw Pythagoras as their intellectual predecessor.

Somewhere in its development, Pythagoreanism grew into two different styles: the mystical and the mathematical. Evidence of this split has been suggested by the scholar F.M. Cornford. By examining contemporary writers he deduces that Pythagorean numerology was understood two different ways. Initially the philosophy of numbers meant that everything was made by numbers, and different numbers had different attributes. Later Greek thinkers then modified this into the theory that numbers measure the quantity of a material thing. Aristotle notices these differences in Pythagorean number theory and asks the question in his

Metaphysics:

It has yet to be explained [by the Pythagoreans] *how* numbers are the causes of substances and of being: whether (1) as boundaries, as points are of spatial magnitudes, as Eurytus determined the number of each living thing (e.g. man or horse) by counting the number of pebbles he used in tracing its outline; . . . or (2) because harmony, man, and everything else is a ratio of numbers. (Aristotle, *Metaphysics*, Book N, V 1092b8.)

Cornford offers his explanation:

I believe that this second view is the original Pythagorean doctrine, according to which things *embody* or *represent* numbers, not *are* numbers; and the soul, as the essential reality, is a ratio or harmony, not a mere collection of monads. The other is the crude materialistic view of Number-atomism that things *are* numbers, and numbers consist of monads.

It was at this point, I believe, that the two schools of Pythagoreans the original sixth-century mystics and the fifth-century mathematicians parted company. They took very different views of the nature of the Monad, and consequently of the generation of numbers and things. (Cornford, 1923, p. 11, 5)

Cornford's analysis sheds light on the divergent sects of Pythagoreanism. The original philosophy of numbers was both mystical and mathematical. It introduced the idea that numbers are fundamental principles in the universe. Arithmetic proofs, geometrical figures, and music theory were all examples of the important position that numbers have in understanding the way the world works.

Over time, the nature of Greek mathematical inquiry changed, as Greeks from Ionia put forth more scientific views of the world based on experiment and observation. Atomism, the belief that the universe is made up of an infinite number of unbreakable particles, began to take hold (Burnet, 1963, p. 10,26,336). But Greeks continued to look back on Pythagoras as a pioneer in mathematics and geometry. Proclus, one of the last Greek philosophical writers, wrote his *Commentary on Euclid* in the fifth century C.E. as a review of the development of Greek mathematics. Pythagoras appears early in his sequence of important figures. He wrote:

Pythagoras transformed the study of geometry into the form of a liberal education, examining the principles of the science from the beginning.³⁰ Pythagoras is seen in a heroic light as someone who spread interest in numbers and mathematics to the Greeks of his time. He is remembered as an important influence on the development of Greek science.

The Mystical Pythagoras

The mathematics and theories of number that Pythagoras is associated with have implications that reach far beyond the realms of science and logic. The Pythagorean philosophy that can be traced to Pythagoras's time promoted a mystical knowledge whereby the truly initiated would be in complete harmony with the inner workings of the universe. In the years after Pythagoras's death, there were legends in circulation that described him as a miracle worker. These legends depict Pythagoras with supernatural abilities. They describe a Pythagoras who is more than mortal. In these legends, he is elevated to the status of a demi-god, a being who is part human, part divine.

These stories may have originated within the cult and been passed down orally. Eventually they became publicly known. Aristotle collected these stories and published them in the first of two monographs concerning the Pythagoreans.³¹ The two monographs were later combined into one. The titles of the original two monographs cannot be specifically stated, but collectively the work was referred to as *On the Pythagoreans* (Ibid, p. 186). This collection of legends, gathered some 200 years after the death of Pythagoras, played a major role in shaping the subsequent tradition. Aristotle's work is frequently referred to in most Pythagorean biographies. The monograph is no longer extant, but the legends survive because they were so frequently quoted. The following is a list of some of the legendary details from Aristotle's lost monograph which became important to later Neo-Pythagorean authors:

Fragment I³²:

Pythagoras predicted that an approaching ship would carry a dead body. (Apollonius. *Historia Mirabilium* 6.)

He predicted that a she-bear would appear in Caulonia. (Apoll. 6.)

In Tuscany Pythagoras bit a serpent to death. (Apoll. 6.)
He foretold of political strife against the Pythagoreans; then he secretly went to Metapontum. (Apoll. 6.)
He addressed the river Cosas and it replied Hail Pythagoras (Apoll. 6.) (Aelian. *Varia Historia*, 2.26.)
He appeared in both Croton and Metapontum on the same day in the same hour (Apoll. 6.)
He displayed his golden thigh while sitting in the theater (Apoll. 6.) (Aelian. 2.26.)
He was called the Hyperborean Apollo by people in Croton (Aelian. 2.26.)

Fragment II (Ibid, p. 136):

The following division was preserved by the Pythagoreans as one of their greatest secrets that there are three kinds of rational living creatures gods, men, and beings like Pythagoras. (Iam., *VP*, 6.31.)

This material becomes very important when Pythagorean and Platonic philosophy experience a rise in popularity after they had gone out of style for hundreds of years.

The earliest efforts to reintroduce the mystical aspects of these philosophies are the product of a Roman governor named Nigidius Figulus who lived from 98 to 45 B.C.E. In the first century C.E. Apollonius of Tyana, who wrote a biography of Pythagoras, claimed to be a reincarnation of Pythagoras and lived as an ascetic mystic. Nicomachus of Gerasa, a mathematician active 140-150 C.E., wrote about the mystical Pythagorean numbers in his book *Theology of Arithmetic* and about Pythagoras in his *Life of Pythagoras*. The majority of the information about Pythagoras that has survived to this day and influenced subsequent people comes from this time, which is known as the Neo-Pythagorean and Neoplatonic period. The largest amount of material is found in the work of Porphyry (c. 230 - c. 305 C.E.) and his student Iamblichus (c. 240 - c. 325 C.E.) (Fideler, 1987, p. 40-42.).

The material that is found in the Neo-Pythagorean authors has come under scholarly scrutiny. The trend that this material follows is indeed strange to observe: as the length of time

increases since Pythagoras was active, authors have more to say about his philosophy and more details of his life to relate. Eduard Zeller, writing in the late 19th century, feels that the miraculous tales and improbable combinations (Zeller, 1881, p. 310) found in late Pythagorean history are not historical. He says that the details that are not supported by other testimony have been inserted by Neo-Pythagoreans and are based on dogmatic presuppositions, party interests, uncertain legends, arbitrary inventions, or falsified writings (Ibid). Zeller's solution is to disregard any suspicious late source. But more recent scholarship has argued for the validity of these later works. Walter Burkert begins his extensive book *Lore and Science in Ancient Pythagoreanism* with an explanation of how Pythagorean scholarship has changed since Zeller's time. He points to scholarly evidence which suggests that Neo-Pythagoreans of the 3rd and 4th century C.E. used 4th century B.C.E. sources in their biographies.³³ He also sees value in what later authors have to say about Pythagoras. He writes:

Though many sources may be late and not very reliable, more must lie behind them all than a simple zero. Pythagoreanism without Pythagoras, without chronological position or a place in the history of thought, is not only unsatisfying to the scholar, but impossible in itself. A minimalism that eliminates every aspect of tradition which seems in any respect questionable cannot help giving a false picture. (Ibid, p. 10)

With the knowledge that later Neo-Pythagoreans used fourth-century sources, Burkert is able to use later testimony to shed light on the earlier picture. There is still the problem of mistaking new interpretation for an authentic older source:

Just as a city which was continuously inhabited over a period of time, by changing populations, presents to the archaeological investigator far more complicated problems than a site destroyed by a single catastrophe and then abandoned, the special difficulty in the study of Pythagoreanism comes from the fact that it was never so dead as, for example, the system of Anaxagoras or even that of Parmenides. When their systems had been superseded and lost all but their philological and historical interest, there still seemed to be in the spell of Pythagoras' name an invitation to further adaption,

reinterpretation, and extension. And at the source of this continuously changing stream lay not a book, an authoritative text which might be reconstructed and interpreted, nor authenticated acts of a historical person which might be put down as historical facts. There is less, and there is more: a name, which somehow responds to the persistent human longing for something which will serve to combine the hypnotic spell of the religious with the certainty of exact knowledge an ideal which appeals, in ever changing forms, to each successive generation. (Ibid)

Because Pythagoras is such an important symbol of the connection between science and religion, it is still valuable to look at what other people have to say about him, even if they include material that cannot be linked to original sources. The new material should not be taken as historical fact, but it should be analyzed to explain how Pythagoras was understood by subsequent admirers.

Iamblichus, in the 3rd and 4th century C.E., was approaching Pythagoreanism from a very different position than 5th and 4th century B.C.E. followers. He believed in the concept of theurgy (*theia erga* or *theon erga*), divine works.³⁴ By doing divine work such as praying and performing rituals, mortals could gain assistance from the gods. Iamblichus believed that philosophy was a tool for spiritual enlightenment sent from heaven. His belief in the Greek gods stands in opposition to Christian doctrine, which was becoming the dominant religion during his lifetime.³⁵ He also stands in opposition to trends in Platonic philosophy which sought to minimize the importance of the gods.

Iamblichus believed that the world described by Plato in the *Timaeus* was being torn apart by a new kind of Platonism that denied the sanctity of the world and elevated the human mind beyond its natural limits. According to Iamblichus such rationalistic hubris threatened to separate man from the activity of the gods.³⁶

For Iamblichus, Pythagoras was an example of the perfect life. Here was a figure from a past age for whom the relationship between gods and mortals was better than it was in Iamblichus's

time. Iamblichus portrays Pythagoras as a man of incredible wisdom. Part of the proof that Iamblichus gives of Pythagoras's talents are his reverence for the gods and his desire to teach others to worship them properly. In Pythagoras Iamblichus had the perfect example of how wisdom should be used: to strengthen the relationship between humans and gods, not to dissolve it.

Iamblichus's surviving text has the title *On the Pythagorean Life* () and was the first part of his overall description of Pythagorean philosophy. The exact title is uncertain, but scholars refer to the entire work as *On Pythagoreanism* because it covered the biography of Pythagoras as well as the mathematics and philosophy of the cult.³⁷ *On the Pythagorean Life* is meant as the first stepping stone on the path to comprehension of Pythagorean philosophy. Iamblichus begins:

All right-minded people, embarking on any study of philosophy, invoke a god. This is especially fitting for the philosophy which takes its name from the divine Pythagoras (a title well-deserved) since it was originally handed down from the gods and can be understood only with the gods' help. . . . And after the gods we shall take as our guide the founder and father of the divine philosophy. (Iam., *VP*, 1.1-2)

As Iamblichus says in the first line, it is customary to invoke a god. Then, after mentioning the gods, Iamblichus praises Pythagoras as the divine founder of this amazing system of thought. In Iamblichus's mind, Pythagorean philosophy came to humans from the realm of the gods via Pythagoras. Iamblichus casts Pythagoras in a special position in the relationship between god and man because of his piety and the philosophy that he introduced to the Greek civilization. Because of this special position, Iamblichus feels it necessary to invoke Pythagoras at the very outset. Iamblichus does so only after invoking the gods, reinforcing the standard hierarchy between divinities: demi-gods are worshiped after the gods. This hierarchy was important to the

Pythagoreans. Later in the text Iamblichus includes a quotation from Aristotle's monograph:

the Pythagoreans make a distinction as follows, guarding it among their most secret teachings: among rational beings there are gods, and humans, and beings like Pythagoras. (Ibid, 6.31) This fragment from the 4th century displays the reasoning behind the hero-worship of Pythagoras. He was accepted as being more intelligent than any other person, so his intelligence must be due to powers beyond the human scope. Pythagoras is seen as belonging to a category of beings superior to regular humans but inferior to the eternal gods. This category is known as demi-god, a half-god.

In the traditional Greek mythology of Hesiod and Homer there are stories about men who displayed extraordinary talents and performed legendary feats. Through their strength and bravery, these men performed tasks which generally improved the quality of life for the common people involved. Most of these heroes had divine origins; they were the product of a union between a god and a mortal. Once a man had proven his divine origin and achieved fame by completing tasks, he became a hero, an object of worship for the people whose lives he has affected. There is a strong opposition between the worship paid to a god and that paid to a hero. The gods reside in the sky, in Olympus, and are worshiped in temples. Heroes reside under the earth (*chthonioi*) and are worshiped at grave sites (Burkert, 1985, p. 199). Often heroes were closely associated with the region of Greece in which they performed their feats, but other heroes were worshiped in many Greek city-states. There are tales of many heroes throughout Ancient Greece, but the figure of Heracles stands out as being the most universally worshiped. He is the prototypical Greek hero. Heracles (Hercules in Latin) was renowned for killing monsters, traveling to the underworld, and performing legendary feats that took place in many

different parts of the ancient world.

In the biographies of Pythagoras's life, there are many details which compare to the worship of the mythological heroes. Common to all heroes is the notion of divine origin. Often it is Zeus, the ruler of the gods, who disguises himself in order to mate with a mortal woman. The child is then raised by its mortal parent or parents. Heracles was conceived when Zeus, in the form of the mortal Amphitryon, slept with Amphitryon's wife, Alcmena. Perseus is the offspring of the woman Danaë who was impregnated by Zeus when he took the form of a shower of gold and came to her in prison. Achilles, the epic hero of the Greeks in the *Iliad*, was the child of a mortal man and the goddess Thetis.³⁸

Some of the ancient Greeks understood Pythagoras as being similar to these mythical demi-gods. One similarity is the notion that Pythagoras was the offspring of a god. Iamblichus begins Pythagoras's genealogy by saying that his parents were Mnesarchos and Pythais, two mortals who were related to Ankaïos, the founder of Samos. He then describes the story that was circulating about Pythagoras's divine origins and offers his explanation:

One of the Samian poets says he was the son of Apollo:

Pythagoras, born to Zeus-beloved Apollo

By Pythais, the fairest of the Samians.³⁹

I must explain how this story came to prevail. Mnesarchos the Samian was in Delphi on a business trip, with his wife, who was already pregnant but did not know it. He consulted the Pythia about his voyage to Syria. The oracle replied that his voyage would be most satisfying and profitable, and that his wife was already pregnant and would give birth to a child surpassing all others in beauty and wisdom, who would be of the greatest benefit to the human race in all aspects of life. Mnesarchos reckoned that the god would not have told him, unasked, about a child, unless there was indeed to be some exceptional and god-given superiority in him. So he promptly changed his wife's name from Parthenis to Pythais, because of the birth and the prophetess. When she gave birth, at Sidon in Phoenicia, he called his son Pythagoras, because the child had been foretold by the Pythia. So we must reject the theory of Epimenides, Eudoxos and Xenokrates that Apollo had intercourse at that time with Parthenis, made her pregnant (which she was not

before) and told her of it through the prophetess. But no one who takes account of this birth, and of the range of Pythagoras' wisdom, could doubt that the soul of Pythagoras was sent to humankind from Apollo's retinue, and was Apollo's companion or still more intimately linked with him. So much, then, for the birth of Pythagoras. (Iam., *VP*, 2.5-8)

Iamblichus discards the story that Apollo had sexual relations with Pythagoras's mother by stating that she was already pregnant when her husband visited the Pythia, the oracle of Apollo at Delphi. Iamblichus does not want to lend support to the theory that Pythagoras is the result of a sexual liaison with Apollo, but he cannot dispel the connection. The idea that Pythagoras was the son of Apollo is older than Nichomachus, who was active in the 2nd century C.E. (Burkert, 1972, p. 146). By Iamblichus's time, the report of the Samian poet was well established. So at the end of this passage he offers his solution: Pythagoras's soul comes from Apollo, and was sent to mortals to improve their existence. This concept of the soul as a companion of the gods comes from Plato's *Phaedrus* (246 e - 248 c).⁴⁰ Iamblichus's solution explains Pythagoras's divine origins in more intellectual, philosophical terms. Pythagoras was not formed like the heroes of mythology, but he is still thought of as connected to the gods, specifically Apollo.

Pythagoras is associated with the god Apollo in every biographical account. When he was first received in Croton, it is said that his disciples named him the Hyperborean Apollo.⁴¹ This association goes back to Aristotle (Aristotle, *On the Pythagoreans*, fr. 1). The Hyperboreans were mythical people thought to inhabit the regions north of Greece. The word Hyperborea literally means the land beyond the north wind. Hyperborea was thought of as a utopia where the climate was mild, the sun produced two crops a year, and old people happily threw themselves into the sea after they had decided that they had lived a good life. Hyperborea was considered a favorite place of Apollo. The god lived there before he made his ceremonial

entrance into Delphi, and for 19 years he returned every time the stars made one complete revolution in the sky (Grimal, 1996, p. 221).

There is also the legend of Apollo's arrow which appears in stories about Pythagoras. Apollo's son Asclepius learned the art of medicine and became so skilled that he was able to revive a dying person. Asclepius revived many people. Zeus noticed this and, fearing an upset to natural order, struck him down with a thunderbolt. Apollo sought revenge for the death of his son and killed the Cyclopes who forged Zeus's thunderbolt. Apollo hid the arrow he used for revenge in one of his temples in Hyperborea. Some accounts state that the arrow flew into the temple of its own accord. This arrow was used by Abaris, a Hyperborean priest of Apollo, to fly around the world and it provided him with nourishment (Grimal, 1996, p. 221,63). The arrow was also able to prevent plagues (Iam., *VP*, 19.92).

This arrow, or one similar to it, appears in stories which depict Abaris meeting Pythagoras in Croton. Iamblichus writes:

Now Abaris had come from the Hyperboreans, and was a priest of their Apollo: an old man, very wise in sacred matters. He was returning from Greece to his own country, to deposit the gold collected for the god in the temple in the land of the Hyperboreans. On his journey he passed through Italy, saw Pythagoras and thought him very like the god whose priest he was. He was convinced, by most sacred tokens which he saw in Pythagoras and which he had, as a priest, foreseen, that this was no other: not a human being resembling the god, but really Apollo. He returned to Pythagoras an arrow, which he had brought when he left the temple as a help against difficulties he might meet on his lengthy wanderings. (Ibid, 19.91)

Iamblichus also says that Abaris became a member of the cult in Croton, and he was allowed advanced initiation because of his piety. In Iamblichus's description, Abaris was already a skilled priest and a wise man when he encountered Pythagoras. Abaris was able to recognize the divinity of Pythagoras. Later in this section Pythagoras proves his divine nature:

When Pythagoras received the arrow, he did not think it strange, or ask why Abaris gave it to him, but like one who is truly a god privately took Abaris aside and showed him his golden thigh, as a token that he was not deceived. He also told him exactly what was deposited in the temple, giving him sufficient proof that he had not guessed wrong, and added that he had come for the welfare and benefit of humanity. For that reason he was in human form, so that people should not think the presence of a superior being strange and disturbing, and run away from his teaching. He told Abaris to stay there and help in the amendment of those who came. . . . Abaris remained, and, as I said, Pythagoras taught him natural science and theology in summary form. Instead of divination by inspection of sacrifices he taught him divination by numbers, which he thought purer, more divine, and more closely connected with the heavenly numbers of the gods. He also taught Abaris other practices suited to him. (Ibid, 19.92-93)

Pythagoras revealed his true divine nature only to Abaris. He needed to maintain his appearance as a human so that the other humans would not react negatively.

The tradition concerning the golden thigh as proof of Pythagoras's divinity goes back to a fragment from Aristotle (Aristotle, *On the Pythagoreans*, fr. I). According to Iamblichus the untrained members of the Pythagorean community could not learn the true nature of their master. The divinity of Pythagoras is a secret that only the truly wise could learn and comprehend. Also in Iamblichus's passage Pythagoras teaches Abaris the technique of divination by numbers, to replace the older, less accurate method of inspecting the insides of sacrificed animals. This implies that there is a connection between the philosophy of Pythagoras and the system of prophecy practiced by priests of the Hyperborean Apollo.

Abaris was a priest of the Hyperborean Apollo. Because of his piety and priestly skills he gained advanced entrance into Pythagoras's school and was taught Pythagoras's method of divination by numbers. In Ancient Greece the god Apollo was associated with the art of prophecy, and it may be because of this association that Pythagoras and Apollo are connected. In the later biographies Pythagoras was said to have spent time in Egypt and Babylonia traveling

to oracles and temples to talk with priest and prophets. By doing this he obtains their knowledge (Iam. VP 13-19). According to Iamblichus, when Pythagoras returned to Greece he visited Delos, the island sacred to Apollo and home to the most famous oracle. At Delos Pythagoras sought out the bloodless altar of Apollo. He then traveled to all the oracles (Ibid, 25). Pythagoras is able to absorb and amalgamate knowledge by visiting every sacred place that he can.

In the Greek world oracles were special places where mortals had the opportunity to learn something about their future by soliciting divine forces. Iamblichus's Pythagoras, by virtue of his intelligence and piety, was able to obtain information from these divine sources and transform it into his philosophy and teachings. Many of the legendary acts that Pythagoras is said to have performed are acts of prophecy and prediction.⁴² While the god Apollo has many other attributes such as medicine, music, archery, and beauty, it is prophecy that most logically connects Pythagoras to the god. Prophecy is the means by which divine information is communicated to mortals. Pythagoras can be seen as a prophet disseminating his philosophy which he created with divine knowledge.

Pythagoras is also depicted as being able to communicate with animals and travel to the underworld. These abilities arise from Pythagoras's connection to the theory of metempsychosis. In addition to the concept that numbers are the principles of the world, Pythagoras was thought to have expounded the belief that the human soul can exist after death outside the physical body and enter another living creature, either a human or an animal. This theory about the human soul, known as metempsychosis, is a unique aspect of Pythagorean philosophy. It has some similarities to Orphic beliefs. It is hard to state conclusively any

doctrine of Orphism, but it is thought to include the concept that the human soul comes from heaven but is trapped in the physical body. The Orphic hymn *To Death* describes the separation that is death: Your sleep tears the soul free from the body's hold.⁴³ This theory assumes that the human soul is something qualitatively different from the physical body, and death releases the heavenly soul from its earthly prison. These Orphic beliefs assume that the human soul existed before entering the body, but there is no evidence of a belief in metempsychosis (Burkert, 1972, p.126). These two beliefs are similar in that they both postulate that the human soul is something substantially different from physical matter, and it can exist outside the human body.

The connection between Pythagoras and metempsychosis dates back to the earliest surviving records. Xenophanes of Colophon was in his prime around 530 B.C.E. Among his fragments is the following:

Now I shall pass to another theme, and shall show the way . . .
. . . And once, they say, passing by when a puppy was being beaten, he pitied it, and spoke as follows: Stop! Cease your beating, because this is really the soul of a man who was my friend: I recognized it as I heard it cry aloud.⁴⁴

The subject of this fragment is lost, but it is thought to be Pythagoras by ancient and modern scholars.⁴⁵ The belief that animals and humans' souls are similar is the reason that Pythagoras was a vegetarian and taught his followers not to eat meat. Sometimes the Pythagorean cult is described as partially vegetarian, with only certain parts of the animal being forbidden, so that eating sacrificial meat was sometimes tolerated. Dietary restrictions were a distinctive feature of the cult.

In addition to the ability to converse with animals, Pythagoras was said to have been able

to recollect the former incarnations of his soul before it entered his body. Most of the accounts of Pythagoras's previous lives mention the character of Euphorbus. Euphorbus was a relatively minor Trojan warrior in Homer's *Iliad* who fatally wounded the Greek hero Patroclus with a spear, and then died in battle with Menelaus over possession of Patroclus's body.⁴⁶ Pythagoras was able to prove that he had been Euphorbus by identifying his shield, which Menelaus had dedicated in a temple after the Trojan War. The shield was so old that only the ivory facing remained.⁴⁷

Iamblichus and Porphyry do not go into detail with the shield story; they omit it as being of too generally known a nature. (Porphyry, *VP*, Section 27) If Pythagoras was to convince his Greek audience that he was able to recall his past lives, it was essential that he could refer to a character in Homer's epic. The *Iliad* and the *Odyssey* were traditional texts and the most widely told stories in the Greek world; they defined the culture. The question of why Pythagoras used Euphorbus as his previous incarnation has received much attention from the scholarly community. One recent article traces the genealogy of Euphorbus to his mother Phrontis () who represents thought and philosophy in Homer. Therefore: by making Euphorbus his previous self, Pythagoras makes himself a (second-hand) son of Thought, and that would not be possible with any other Homeric hero.⁴⁸ Walter Burkert favors the interpretation of Karl Kerényi who finds a solution within the lines of Homer. As Patroclus is dying he says to Hector: it was hateful Destiny and Leto's Son [Apollo] that killed me. Then came a man, Euphorbus; you were only the third. (*Iliad*, 16.849) When the number of people in Patroclus's speech are counted, four entities (Destiny, Apollo, Euphorbus, Hector) register as only three antagonists, suggesting that there may be some connection between Apollo and Euphorbus. If

someone wanted to say, I am perhaps Apollo, he could, in Homeric terms, call himself Euphorbus, stipulates Kerényi.⁴⁹

In the legends, Pythagoras displayed many amazing abilities, reflecting the concept that the human soul is immortal and can exist in humans and animals. The legends function as proof of his doctrine. As Walter Burkert puts it:

If the historical Pythagoras taught metempsychosis, this same historical Pythagoras must have claimed superhuman wisdom, he had to use his own life as an example and find himself in the Trojan War. And if he wanted to make this credible, he had to -- perform miracles. (Burkert, 1972, p. 147)

In order for the Pythagoreans to successfully believe in the doctrine of metempsychosis, examples of the connection between the souls of humans and animals must be given. The stories that depict Pythagoras interacting and communicating with animals serve as proof that the theory of metempsychosis is true (Ibid, p. 136). Pythagoras is so in tune with the inner workings of his soul and is such a wise man that he can communicate with the souls of animals. Metempsychosis posits that humans and animals have similar souls, and since Pythagoras has such a powerful soul, he is able to provide proof by interacting with them. There are many examples of Pythagoras's connection to animals:

- " Pythagoras predicted that a she-bear would appear in Caulonia (Apollon. *Mirab* 6; Aristotle, *On the Pythagoreans*, fr. I) Iamblichus says the she bear was white. (Iam., *VP*, 142)
- " Pythagoras stroked a white eagle, which made no resistance (Aelian, *Varia Historia*, 4.17; Aristotle, fr. I)
- " Pythagoras killed a deadly biting serpent in Tuscany by biting it to death (Apollon., 6; Aristotle, fr. I)
- " Pythagoras caught and sent away a serpent in Sybaris and a little serpent in Eturia whose bite is fatal (Iam., *VP*, 142; Aristotle, fr. I)
- " The white cock is sacred to the Pythagoreans. (D.L., *Lives*, 8.33; Aristotle, fr. 5)
- " Pythagoras pacified the Daunian bear which was ravaging the countryside (Porphyry, *VP*, Section 23; Iam., *VP*, 13.60)

- " Pythagoras told an ox to stop eating beans; the animal ceased to eat beans and lived to an old age in the temple of Hera, being called sacred (Porphyry, *VP*, Section 24; Iam., *VP*, 13.61)
- " Pythagoras predicted the exact number of fish caught in fishermen's nets. All the fish were thrown back into the water and survived. (Porphyry, *VP*, Section 25; Iam., *VP*, 8.36)

With the exception of the serpents, these tales end positively for the animals involved. The ox became a sacred animal, the fish survived out of water, and the Daunian bear was placated.

Some of these stories have similarities to the deeds of mythological heroes. In the deeds of heroes like Heracles, Theseus, and Perseus there are many wild animals and monsters terrorizing the civilized world, which cannot be destroyed by regular men. Theseus killed the Minotaur who was devouring Athenian men and women. Perseus destroyed the Gorgon Medusa. The labors of Heracles are filled with creatures that he must conquer. These monsters are challengers to the progress of the human world. The brave men who conquer these creatures and restore order to the afflicted regions become national heroes and founders of civilizations. Their actions extend the borders of the known world. In the case of Pythagoras, he too expands the known world, but by teaching. His methods differ from the heroes of strength. Porphyry and Iamblichus include the story of the Daunian bear:

If we may believe the many ancient and valuable sources who report it, Pythagoras had a power of relaxing tension and giving instruction in what he said which reached even non-rational animals. He inferred that, as everything comes to rational creatures by teaching, it must be so also for wild creatures which are believed not to be rational. They say he laid hands on the Daunian she-bear, which had done most serious damage to the people there. He stroked her for a long time, feeding her bits of bread and fruit, administered an oath that she would no longer catch any living creature, and let her go. She made straight for the hills and the woods, and was never again seen to attack even a non-rational animal. (Iam., *VP*, 13.60; c.f. Porphyry, *VP*, Section 23)

Pythagoras is able to manipulate the initially destructive bear by his command of rational thought and his ability to communicate with animals. The bear sees the error of her ways and

accepts an oath not to harm living things. Pythagoras conquers this force of nature using peaceful methods and by promoting the power of rational thought. The very nature of an oath belongs to the realm of humans and gods, not animals. This separation is spelled out in Hesiod's *Works and Days*, one of the earliest Greek texts:

For the son of Cronos (Zeus) has ordained this law for men, that fishes and beasts and winged fowls should devour one another, for right is not in them; but to mankind he gave right which proves far the best.⁵⁰

In Hesiod's division of the world, the concept of Justice was given to humans from the gods. It is a concept that separates humans from animals. Pythagoras challenged this traditional view and believed that animals were like humans. He was so skilled in rational thinking that he could transmit human concepts to an animal.

Should this story be taken at face value, the people of Daunia would have seen Pythagoras in a fashion similar to the hero of mythology who saves civilization when no one else can. This event and the other similar tales can be seen as specific proof of Pythagoras's power to improve the quality of human life. Iamblichus writes that Pythagoras was sent to mankind for the purpose of improving the human condition (Iam., *VP*, 12.59). Just as the mythological heroes use strength to overcome threats to civilization, the genius Pythagoras can prevent disasters with his wisdom and improve humanity by his teachings.

Particularly specific to the worship and myths of Greek heroes is the ability to descend into the underworld and successfully return. The afterlife is the ultimate boundary of normal, mortal life; among mortals only a hero is able to cross that boundary. The descent to the underworld is a crucial event in the legends of mythological heroes like Orpheus, Theseus, and Heracles and in the epic tales of Odysseus and Aeneas. Heracles is able to exert control over the

underworld with his strength. He captures Cerberus, the canine guardian of Hell, and also rescues a hero from eternal imprisonment in Hell. In the epic poems, Odysseus and Aeneas both obtain information necessary to their quest from the underworld, although Odysseus does not travel beyond the entrance.

The legends of Pythagoras are not lacking in tales of communication with the dead. The theory of metempsychosis and the ability to recollect previous lives gave Pythagoras great power over death. Like the heroes, Pythagoras is said to have made a descent into Hades and returned with new wisdom. Diogenes Laertius includes this fragment:

Hieronymus, however, says that, when he [Pythagoras] had descended into Hades, he saw the soul of Hesiod bound fast to a brazen pillar and gibbering, and the soul of Homer hung on a tree with serpents writhing about it, this being their punishment for what they had said about the gods; he also saw under torture those who would not remain faithful to their wives. This, says our authority, is why he was honored by the people of Croton. (D.L. *Lives*, 8.21)

This fragment is a late addition from Hieronymus of Rhodes (Burkert, 1972, p. 155). One of Pythagoras's first messages to the people of Croton was to abandon their concubines; he stressed the importance and benefit of marital copulation. According to Hieronymus, Pythagoras learned this lesson from his descent into Hades.

Often this power over death was ridiculed by Pythagoras's critics. Iamblichus relates one such story based in Croton when Sybarite ambassadors were defending themselves for having murdered some Pythagoreans:

Another one of the ambassadors derided his school, wherein he taught the return of souls to this world, saying that as Pythagoras was about to descend into Hades, the ambassador would give Pythagoras an epistle to his father, and begged him to bring back an answer when he returned. Pythagoras responded that he was not about to descend into the abode of the impious, where he clearly knew that murderers were punished. (Iam., *VP*, 30.178)

Another comment directed against Pythagoras's ability to descend into Hades appears in Diogenes Laertius, who preserves this fragment:

Hermippus gives another anecdote. Pythagoras, on coming to Italy, made a subterranean dwelling and enjoined on his mother to mark and record all that passed, and at what hour, and to send her notes down to him until he should ascend. She did so. Pythagoras some time afterwards came up withered and looking like a skeleton, then went into the assembly and declared he had been down to Hades, and even read out his experiences to them. They were so affected that they wept and wailed and looked upon him as divine, going so far as to send their wives to him in hopes that they would learn some of his doctrines; and so they were called Pythagorean women. Thus far Hermippus. (D.L., *Lives*, VIII. 41).

This fragment is curious because it refers to Pythagoras's mother. She is never mentioned elsewhere and it is questionable whether Pythagoras would have brought his mother with him when he fled Samos. Burkert interprets the mother in the story as a reference to the divine mother (), the Greek goddess Demeter. Pythagoras has another connection with Demeter. The historian Timeas says that Pythagoras's house was made into a temple to Demeter which cursed the uninitiated who entered it.⁵¹ Burkert says these stories show Pythagoras in the role of a hierophant in the cult of Demeter (Burkert, 1972, p. 159) and are examples of how Pythagoras is similar to a shaman, the word for a spiritual leader in the language of the Siberian tribe of Tunguses. Burkert writes:

The shaman has the ability, in an ecstatic state which is voluntarily induced by means of a definite technique, to make contact with gods and spirits, and in particular to travel to the Beyond, to heaven or to the underworld. (Ibid, p. 162)

Pythagoras is associated with descent into the underworld. Because of his abilities he can cross the boundaries of mortal life and return with information that is beneficial to mortal life. Pythagoras shares this ability with other Greek heroes who are also able to go beyond the boundaries of ordinary, mortal life.

Along with these commonalities, there are times when Pythagoras is mentioned in connection to Heracles, the prototypical hero of Greek mythology. Iamblichus writes:

Then he [Pythagoras] told the Crotoniates that, as their founders were kin to Heracles, they must willingly obey their parents' commands. They had heard how he, a god, underwent his labors in obedience to a senior god, and had founded the Olympics in honor of his father, as a victory-celebration of his achievements. (Iam., *VP*, 8.40)

And later:

Pythagoras concluded by saying that, according to tradition, their city was founded by Heracles when he drove the cattle through Italy. He was injured by Lacinius, and unwittingly killed Croton, who had come at night to help him, thinking he was one of the enemy. Heracles then promised to found a city named Croton at his tomb, if he himself achieved immortality. So they were bound to administer it justly, in gratitude for the kindness Heracles had returned. (Ibid, 9.50)

Iamblichus relates that the city of Croton, the epicenter for the Pythagorean cult, had ties to Heracles. Heracles was said to have founded many Greek cities, so it is not unusual that Croton has this legend of its past. But it does allow Iamblichus to emphasize similarities between Heracles and Pythagoras. In this way, Iamblichus is able to elevate Pythagoras to Heracles' status as a divine hero. It is a way for Iamblichus to stress Pythagoras' connection to the gods. In Iamblichus's text, Pythagoras teaches the Crotoniates about the virtuous example that their city's divine founder set. This could be read as a mirroring of the example that Iamblichus wants Pythagoras to set. Pythagoras uses Heracles as an example of the proper way to act, just as Iamblichus uses Pythagoras as an example of the proper way to live.

Iamblichus also records that the Tetraktys was called Heracles (Iam., *Theology*, 28).

Pythagoras and Heracles are explicitly equated once in Iamblichus:

Pythagoras, defending humanity with the justice and courage of Heracles, for the benefit of humanity punished and sent to his death the man who had treated people with violence and injustice: this was in accordance with the very oracles of Apollo. (Iam., *VP*, 32.222)

Porphyry mentions an unusual connections between the two demigods: Pythagoras claimed that his diet had, by Demeter, been taught to Heracles. (Porphyry, *VP*, Section 35) Here Porphyry is using Heracles to emphasize Pythagoras s connection to the gods. Porphyry is saying that Pythagoras s diet came from divine sources: it was passed from the goddess Demeter, to the demi-god Heracles, and then to Pythagoras.

Pythagoras has many aspects in common with the heroes. They are all types of demi-gods, who occupy the position between mortals and gods in the hierarchy of Greek religion. The Greeks worshiped heroes as *chthonic* powers, which were treated very differently than the gods of Olympus. Chthonic deities live in the ground and are respected because of their connection to the land of the afterlife, Hades, which was located under the ground by most mythological accounts. Like the cult of the dead, hero cult practices were centered around a grave associated with a particular hero, which became a sacred place. Libations and offerings would be made at the grave and a feast would be held in the company of, and in honor of, the hero (Burkert, 1985, p. 205). In return for these acts of reverence, the hero provided protection and good things for the local people. This form of worship, centered on a particular individual, became popular in the seventh century B.C.E. as the *polis* and its *hoplite* army became dominant (Ibid, p.199-208).

The localized worship of a hero who exerts his influence over an area determined by the location of his grave is different from the way that Pythagoras is treated. While the collection of Pythagoras s miracles are geographically concentrated in Southern Italy, his influence covers many regions in Greece. One reason for this difference comes from the contrast between Pythagoras s power over death and a hero s power. A hero s spirit existed after death because

the Greeks believed that a famous mortal was worthy of worship. By honoring the hero it was possible to prosper from his favor. An example of this from Homeric epic is when Odysseus meets the spirits of the fallen heroes of Troy in the underworld. He offers them blood which gives them strength. Then they are able to assist him in his quest (Ibid, p. 196).

Pythagoras's power over death comes from an altogether different source. He does not require blood sacrifice and does not remain localized around the area of his death, which is not known definitively.⁵² Pythagoras has power over death because of: a) his theory of metempsychosis, and b) the strength and suggested divinity of his soul. Since metempsychosis stresses the equivalence of all living creatures, Pythagoras can return as a human being or as an animal. Pythagoras appears as various creatures throughout drama. In Lucian's *Gallus*, Pythagoras appears in a dream in the form of a rooster.⁵³ Pythagoras's soul can return from the afterlife, but its powers are different than those of the soul of a mythological hero.

Conclusion

Pythagoras was seen by ancient Greeks and Romans as both a man of science and a religious leader. It is the synthesis of these two characteristics that is essential to Pythagoras's fame. Pythagoras dates back to a very influential period in the history of Western civilization. The Greeks invented Philosophy, History, Medicine, Mathematics, and the Natural Sciences. In sharp contrast to today, these intellectual inroads were forged under a polytheistic religion. Mythology played an important role as a way of explaining the world. While some thinkers questioned the existence of the gods, others sought to understand what constitutes the divine. Philosophy and science could offer rational explanations of the world, but religion still held the answers for many. It is where these interrelated systems of thought overlap that the figure of Pythagoras rises to heroic status. Pythagoras is one figure who can unite the irrefutable logic of science with the promise of religious salvation. The undeniable truths that science uncovers become religious doctrine to those who worship Pythagoras.

The philosophy of number that Pythagoras is associated with is both mystical and mathematical. It incorporates mathematical laws and geometric figures as proof that numbers are fundamental elements of the universe. To Pythagoreans, numbers are more than abstract figures. They are the first principles from which the universe is formed. The Pythagoreans saw mathematics and geometry as sacred tools for uncovering the true nature of the universe.

For centuries Pythagoras was revered as a divine being. His mythical abilities stemmed from the legendary power of his intelligence. He was associated with the god Apollo, the god of prophecy, and like a prophet or seer Pythagoras was depicted as a conduit for divine information. His followers felt that his teachings were so beneficial to humanity that they must

have come from the gods. The power over death that Pythagoras was said to have can be traced to his theories regarding the human soul. Like mythological heroes, Pythagoras was thought of as a combination of mortal and divine. His followers elevated him to a mythical status because his intelligence was so great and his teachings so influential.

Pythagoras is seen as a bridge between two worlds which usually do not meet: the scientific and the religious. As this bridge, he symbolizes the idea that scientific knowledge can have religious implications. According to this belief, science is the means by which humans comprehend the divine. If the universe was created by some divine force, it is with scientific inquiry and controlled experiments that humans are able to detect the natural order which comes from this divine force. Pythagoras is thought of as the chief scientific investigator of the divine secrets of the universe.

The legend of Pythagoras is still present today. His name appears in many diverse locations. The critically-acclaimed independent film *(pi)* (1998) dealt with the overlap of science and religion. The protagonist of the movie was a young number theorist who stumbled onto a mathematical formula that contained the answers to many of life's secrets. This formula was sought after by many different antagonists: stockbrokers, scientists, even Kabalistic Jews who had been searching their holy books for the same formula. This movie portrayed science and mathematics as tools for understanding the secrets that a divine presence had imbedded into the universe. Pythagoras was mentioned in this movie as an example of a person attempting to understand the mind of god with mathematics. The movie's Web site, with extreme artistic license, describes Pythagoras as a failed Greek messiah.⁵⁴

People using public transportation at the Massachusetts Institute of Technology in

Kendall Square, Cambridge, Massachusetts may come into contact with the name Pythagoras. In the subway station there is a sculpture entitled The Kendall Band.⁵⁵ One of the pieces is an interactive sculpture called Pythagoras that makes use of the whole number ratio of the musical notes to create sound. Passengers waiting for a train can move a lever to make hammers hit pipes of different lengths. This is an example of how the name Pythagoras remains attached to the discovery of the musical intervals.

The book *A Mathematical Mystery Tour: Discovering the Truth and Beauty of the Cosmos* depicts a theoretical odyssey through the world of mathematics. This book questions whether mathematics is part of the natural world or a tool created by humans. The main character begins his journey in Greece, and attempts to replicate some of the geometrical problems associated with the Pythagoreans. The book's author, A.K. Dewdney, is also familiar with the mystical side of Pythagorean philosophy. Pythagoras and his philosophy of numbers are cited as the first example of the human mind perceiving an inherent connection between mathematics and reality. Dewdney writes in his introduction:

Today, many scientists believe that math has a striking relationship with reality. A few scientists even believe that mathematics in some sense governs or controls reality. But who could possibly believe that mathematics makes reality? Pythagoras did.⁵⁶

Here Pythagoras is remembered as the first human being to recognize the overall significance of mathematics and numbers.

Pythagoras has been admired as a hero from ancient Greek times to the present day. He is a legendary figure who appeals to people for many different reasons. His identification as a bridge between science and religion places him in a unique role within Western culture. He is a hero with a lasting influence.

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Abbreviations:

Iam.	Iamblichus
VP	Vita Pythagora, The Life of Pythagoras
DL	Diogenes Laertius
Lives	Diogenes Laertius, Lives of Ancient Philosophers.
Fr.	Fragment
D-K	Diels-Katz

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1. Diogenes Laertius, *Lives of Eminent Philosophers*, Trans. R. D. Hicks (New York: G. P. Putnam's Sons, 1931), Vol. II, Book VIII, line 21, p. 339. Henceforth abbreviated as: D.L., *Lives*.
2. Porphyry, *The Life of Pythagoras*, In *The Pythagorean Sourcebook and Library*, Trans. Kenneth Sylvan Guthrie (Grand Rapids Michigan: Phanes Press, 1988), Section 57, p.135. Henceforth abbreviated as: Porphyry, *VP*.
3. Eduard Zeller, *A History of Greek Philosophy From the Earliest Period to the Time of Socrates*, Trans. S. F. Alleyne (London: Longmans, Green, and CO., 1881), Vol. I, p. 313. And also: Kathleen Freeman, *The Pre-Socratic Philosophers: A Companion to Diels, Fragmente der Vorsokratiker*, 2nd ed. (Oxford: Basil Blackwell, 1949), p. 74.
4. Ion of Chios, *Ancilla to the Pre-Socratic Philosophers: A Complete Translation of the Fragments in Diels, Fragmente der Vorsokratiker*, Trans. Kathleen Freeman (Cambridge, Massachusetts: Harvard University Press, 1957), Diels-Kranz (D-K) 36, fr. 2, p. 70. This collection of fragments henceforth abbreviated as: *Ancilla*.
5. Walter Burkert, *Lore and Science in Ancient Pythagoreanism*, Trans. Edwin Minar (Cambridge, Massachusetts: Harvard University Press, 1972), p. 129. Burkert notes that the language used by Ion () is the common way to refer to literature which circulated under the name of Orpheus or Musaeus. Ion is familiar with Orphic poems, which he is trying to attribute to Pythagoras.
6. Herodotus, *The History*, Trans. David Greene (Chicago: The University of Chicago Press, 1988), Bk. 2.81, p. 164. This occurs when Herodotus is comparing Greek and Egyptian customs. He writes that the Egyptians do not bring anything made of wool into their temples. In this they agree with those rites that are called Orphic and Bacchic but are in fact Egyptian and Pythagorean.
7. Heraclitus, *Ancilla*, D-K 22, fr.129, p. 33.
8. Iamblichus, *On the Pythagorean Life*, Trans. Gillian Clark (Liverpool, England: Liverpool University Press, 1989), Section 31, line 197, p. 85. Henceforth abbreviated as: Iam., *VP*.
9. D. L., *Lives* 8.36 quotes a fragment of Xenophon that does not contain the name Pythagoras. See also Burkert, (1972) p. 121.
10. All classical scholars agree that Pythagoras did exist, e.g. Walter Burkert, *Greek Religion*, Trans. John Raffan (Cambridge, Massachusetts: Harvard University Press 1985), p. 299.
11. Euclid, *The Elements*. In *Greek Mathematical Works I*, Trans. Friedlein. (Cambridge, Massachusetts: Harvard University Press, 1967) p. 179. Book I, Section 47.

12. Sir Thomas L. Heath, *A Manual of Greek Mathematics* (Oxford: Clarendon Press 1931), p. 95. Heath cites Callimachus (285 B.C.E.); Burkert, (1972) p. 428 cites Apollodorus, and Democritus (fourth century B.C.E.)

13. K.O. Friedrichs, *From Pythagoras to Einstein* (Mathematical Association of America 1965), p. 88. This book is aimed at teachers. It traces the Pythagorean theorem through modern physics, culminating with the calculation of nuclear energy, expressed as $E = mc^2$.

14. Aristotle, *Metaphysics*, trans. Hugh Tredennick, (Cambridge, Massachusetts: Harvard University Press, 1947) Line 987a29: The philosophies described above were succeeded by the system of Plato, which in most respects accorded with them, but contained also certain peculiar features distinct from the philosophy of the Italians [Pythagoreans]. And later, 987b: . . . whereas the Pythagoreans say that things exist by imitation of numbers, Plato says that they exist by participation merely a change of term. See also Burkert, (1972) p. 15.

15. Philolaus, *Ancilla*, D-K 44, fr. 4, p. 74.

16. David Fideler, Introduction, In *The Pythagorean Sourcebook and Library* (Grand Rapids, Michigan: Phanes Press 1988) p. 23.

17. F. M. Cornford, Mysticism and Science in the Pythagorean Tradition, *The Classical Quarterly* Vol. XVII (1923): p. 3.

18. Archytas, *Ancilla*, D-K 47, fr. 1, p. 78.

19. Iamblichus, *The Theology of Arithmetic : On the Mystical, Mathematical and Cosmological Symbolism of the First Ten Numbers*, Trans. Robin Waterfield, (Grand Rapids, Michigan: Phanes Press, 1988), p. 35. Henceforth abbreviated as: Iam., *Theology*.

20. Iamblichus quoting Speusippus (Heath, 1931, p. 81).

21. These images appear in Fideler, 1988, p. 23. The ultimate source is: Aristotle, *Physics*. Trans. Philip H. Wicksteed and Francis M. Cornford. (Cambridge, Massachusetts: Harvard University Press, 1957) Line 203 a 10.

22. Aristotle, *Metaphysics*, Line A.5.986 a23.

23. Pythagoras was said to have discovered the musical intervals by stumbling upon a blacksmith banging on metal with different sized hammers. The different hammers produced harmonious notes. Pythagoras then measured the ratios of the weights of the hammers and applied the same ratios to weights which he hung on string from a rod. (Iam., *VP*, 26.115) The tale is physically impossible: it is the length of the string, not the amount of mass, that creates a whole number ratio. (Burkert, 1972, p. 376n24) For a hands-on demonstration using images and sound see: J. Boyd-Brent, *Pythagoras: Music and Space*, <<http://www.aboutscotland.com/harmony/prop.html>> Accessed 21 April, 1999.

24. John Burnet, *Early Greek Philosophy*, 4th ed. (London: Adam and Charles Black, 1963), p. 107.
25. These subjects are listed by Archytas, *Ancilla*, D-K 47, fr. 1.; Introduced as the Pythagorean Quadrivium in Ivor Thomas, *Greek Mathematical Works* (Cambridge, Massachusetts: Harvard University Press, 1967), Vol I, p. 5.
26. Whibley, Leonard, *A Companion to Greek Studies* (New York: Cambridge University Press, 1931), p. 88-89.
27. Zeller, 1881, p. 354-360; Burkert, 1972, p. 115-120.
28. For example: Cratinus (c. 490-20) *The She-Pythagorean*, Aristophon (4th century) *The Pythagorist*. Freeman, *The Pre-Socratic Philosophers* (1949), p. 260, D-K 58E.
29. He was for many years elected general of Tarentum, under the democratic constitution which ordinarily allowed this office to be held for one year only; and during his term of office he was never defeated. Archytas, *Ancilla*, p. 234, D-K 58 A1.
30. Proclus, *Commentary on Euclid, Book I*, In *Greek Mathematical Works*, ed. Friedlein (1967), Vol. II, p. 149. See also: Heath, 1931, p. 37.
31. J. A. Philip, Aristotle's Monograph On the Pythagoreans, *Transactions of the American Philological Association* 94 (1963): 185-198.
32. Aristotle, *On the Pythagoreans*, In *The Works of Aristotle Translated into English: Volume XII Select Fragments*, Trans. Sir David Ross (Oxford: Clarendon Press, 1952) Vol XII p. 134.
33. Burkert, 1972, p. 4. refers to the work of Erwin Rohde (*Die Quellen des Iamblichus in seiner Biographie des Pythagoras* *Rheinisches Museum* 26 [1871] 554-576, 27 [1872] 23-61). This work argues that Porphyry and Iamblichus used 4th century authors Aristoxenus, Dicaerchus, Heraclides Ponticus, and Timaeus as sources.
34. Gillian Clark, Introduction, In *Iamblichus: On the Pythagorean Life*, (Liverpool, England, Liverpool University Press, 1989), p. xiv.
35. Constantine, the first Christian Emperor of Rome, ruled from 312 - 336 C.E. Iamblichus died c. 325 C.E.
36. Gregory Shaw, *Theurgy and the Soul: The Neoplatonism of Iamblichus* (University Park, PA: The Pennsylvania State University, 1995), p. 4.
37. Dominic J. O Meara, *Pythagoras Revived: Mathematics and Philosophy in Late Antiquity* (Oxford: Clarendon Press, 1989), p. 33.

38. Pierre Grimal, *The Dictionary of Classical Mythology*, Trans. A. R. Maxwell-Hyslop, (Cambridge, Massachusetts: Blackwell Publishers Inc., 1996), s.v. Heracles , Perseus , Achilles .
39. This poem also appears in Porphyry *VP*, Section 2. The poem is attributed to a Samian poet but is not treated critically.
40. Plato. *Phaedrus*. Trans. C.J. Rowe. (Atlantic Highlands, N.J., Humanities Press, 1986), lines 246e - 248c; See also: O Meara, 1989, p. 37.
41. Iam., *VP*, 30; Porphyry, *VP*, Section 28; D.L., *Lives*, 8.9.
42. See infra, p. 22; Burkert, 1972 lists a collection of other legends that were attributed to either Pythagoras or Pherecydes at different times. He writes: These miracles all belong to the realm of prophecy. p. 145.
43. Orphic Hymn #87 *To Death*, In *Ancient Mysteries Sourcebook*, ed. Marvin W. Meyer (New York: HarperCollins Publishers, 1987), p.109. line 3.
44. Xenophanes, *Ancilla*, D-K 21, fr. 7.
45. Burkert, 1972, p.120; D.L., *Lives*, 8.36.
46. Homer, *Iliad*, trans. E.V. Rieu (Baltimore: Penguin Books, 1975) Books XVI, XVII, p. 315-317.
47. D.L., *Lives*, 8.5 says the shield was in the temple to Apollo at Branchidae. Iam., *VP*, 14.63 and Porphyry, *VP*, Section 27 locate the shield in a temple to Argive Hera at Mycenae
48. Hendry, M. Pythagoras s Previous Parents: Why Euphorbus?, *Mnemosyne* 48:2 (1995) p. 210.
49. Burkert, 1972, p. 141 points to: Kerényi, Karl *Pythagoras und Orpheus* (Zurich: Rhein-Verl., 1950) p. 19.
50. Hesiod, *Works & Days*, Trans. Hugh G. Evelyn-White (Cambridge, Massachusetts: Harvard University Press, 1950) lines 274 - 279, p. 23.
51. Burkert, 1971, p. 155; Iam *VP* 143.
52. Either Croton, Metapontum, or Tarentum.
53. Noting that the rooster functions as a reincarnation of both Pythagoras and Apollo: Miroslav Marcovich, Pythagoras as Cock, *American Journal of Philology* 97 (1976), p. 331-335.

54. Pi: The Golden Spiral, *Pi The Movie*, Artisan Entertainment
<<http://www.pithemovie.com/gold.html>> Accessed 1 May 1999.

55. Arts on the T, *Massachusetts Bay Transit Authority Web Site*, Massachusetts Bay Transit Authority <<http://www.mbtta.com/boston/arts/body/artcollection.html>> Accessed 1 May 1999.

56.A. K. Dewdney, *A Mathematical Mystery Tour : Discovering the Truth and Beauty of the Cosmos* (New York: John Wiley & Sons, 1999), p. v.