Emory Resources on the Middle East

Great Books of the Islamic World III:

The Book of the Categories of Peoples
by Sa`id al-Andalusi (1029-1070 C.E.)

The Book of the Categories of Peoples, written in the eleventh century in what is now Spain focuses on the contributions various "nations" or peoples have made to human knowledge, particularly mathematics and the sciences. It is an important source for several reasons. It gives us a vivid picture of what one Arab, Muslim author from this time period understood about the inhabited world and the development of the sciences by various historical and contemporary peoples. It also provides crucial information about the transmission of this knowledge from one culture to another, about the translation of books from Sanskrit, Persian, and Greek into Arabic, about the usage and influence of works which are now lost, supplementing information available from extant translations, other scientific works, and other descriptive works like the *Catalogue* of Ibn al-Nadim (987 C.E.). In addition, the work is interesting for providing a snapshot of the intellectual environment in Muslim Spain just before the great period of translation from Arabic into Latin and Spanish, the center of which would be Toledo in the twelfth century C.E.

Sa`id al-Andalusi:

The author of this work was Abu al-Qasim Sa`id b. Ahmad b. `Abd al-Rahman al-Qurtubi, also known as al-Qadi Sa`id [that is, the Judge, Sa`id] or Sa`id al-Andalusi [that is, Sa`id from the Andalus, the Muslim territories in what is now Spain]. He was born in Almería in southern Spain in 1029 C.E. to a learned family, his grandfather having served as judge in the town of Sidonia. When he was very young, his family moved to Cordoba, where his father held an important position. In 1046, when Sa`id was seventeen years old, he moved to Toledo, probably to further his education.

The Umayyad state, with its capital at Cordoba, had united all of the Muslim territory in the Iberian Peninsula for over a century. In1035 it collapsed because into a civil war and split up into several smaller principalities. This period in the history of Spain is known as that of the "Party Kings" or "Kings of Factions," because of the many small kingdoms or principalities which divided the territory. Toledo was the capital of one of these principalities, that of the Banu al-Nun. The other principalities had their capitals at Cordoba, Seville, Granada, and elsewhere. The principality of the Banu al-Nun was the northernmost of the Muslim principalities; to the north was Christian territory, it too divided into several small kingdoms. Toledo became an important political and intellectual link between Christian Spanish kingdoms in the north and Muslim territories in the south. The prince of the Banu al-Nun when Sa`id arrived in Toledo, Yahya Ibn Dhi al-Nun (1037-1074 C.E.), was a capable ruler who attracted people of talent in many fields to the new capital, including scholars of mathematics and astronomy as well as teachers of Arabic grammar and the Islamic religious sciences, including study of the Qur'an, hadith (the sayings of the Prophet Muhammad), Islamic law, and theology. When Toledo was captured by King Alfonso VI in 1085, it remained an important intellectual center and a link between Latin, Christian culture and Arab,

Muslim culture. For this reason, it became a major center for translation from Arabic into Latin and Spanish, and historians speak of the Toledo School of Translation--not an actual school or building, but rather a conglomeration of resources and activity--from the late eleventh through the thirteenth century.

In Toledo, Sa`id primarily with Abu al-Walid Hisham al-Kinani, known as al-Waqashi, meaning from Huecas, a town just outside Toledo. He was a well-known scholar and poet, and Sa`id probably studied poetry, other literature, and the Islamic religious sciences with him. He also served as a judge in Toledo and was very influential at the court of Yahya Ibn Dhi al-Nun. Sa`id also studied with mathematics and astronomy with Abu Ishaq Ibrahim ibn Idris al-Tujibi. He soon became accomplished both in Islamic law and in mathematics and astronomy. His teacher al-Waqashi introduced him to the ruler, Yahya, and he received a position at court. He would later serve as judge, like al-Waqashi, and became known as al-Qadi ["the Judge"] Sa`id, in recognition of his attainment of that powerful and influential position.

Sa`id spent the rest of his days in Toledo, teaching, writing, and serving as judge and in several other positions. He died in 1070 C.E., and his funeral was attended by many of the prominent figures at court.

Sa`id al-Andalusi's Works:

Unfortunately, only one of Sa`id's works has survived, *The Book of the Categories of Peoples*., which we will discuss in greater detail below. From remarks in that and other books, we know that he wrote several other works, including the following:

Articles on the Doctrines and Religions of Peoples. This is a work on religious sects and views (called a doxography), including non-Muslim religious sects and views such as those of the Hindus. (p. 12)

Rectification of the Movements of the Planets, an astronomical work correcting the calculations of earlier astronomers. (p. 13) In another passage, he gives the title as *Rectification of the Movements of the Planets and the Errors Committed in Observational Astronomy*. (p. 64). From Sa`id's remarks, it is clear that he set out in this work to correct the work of an Andalusian mathematician and astronomer, Maslamah ibn Ahmad al-Majriti (d. 1008 C.E.), who wrote a new edition of the astronomical tables done by Muhammad ibn Musa al-Khwarizmi, most famous for his invention of algebra. (The word algorithm actually derives from his name, al-Khwarizmi.)

Comprehensive Annals of the Arab and Non-Arab Peoples. This must have been a survey of world history until al-Andalusi's time. We know from his mention of this work that it discussed the ancient history of Persia (p. 15) and the pre-Islamic migrations of Arabs from Arabia to various areas in Syria (p. 43).

Exercise I: Answer the following questions.

1. From the descriptions of his works above, what can you tell about Sa`id al-Andalusi's interests?
2. Are the three works described above are related to each other? How so?
3. How are these three works related to the topic of *The Book of Categories of Peoples*, that is, the history of science in the various nations of the world?

Chronology of Islamic Spain:

632 death of the Prophet Muhammad
640 conquest of Egypt by Arab/Muslim forces
690 by this date, all of North Africa had been conquered
712 Berber and Arab Muslim army crosses over from Morocco into Spain.
Gothic kingdom with its capital at Toledo collapses.
Cordova becomes the capital of Muslim territory in Spain.
732 Arab/Muslim army defeated by Charles Martel between Tours and Poitiers in France.
This marked the furthest reach of their invasion.
747-50 The Abbasid revolution. The Umayyad Caliphate in Damascus overthrown.
756 Umayyad survivor, Abd al-Rahman, escapes to Spain and named Prince of Cordova.
Umayyad dynasty established in Spain
759 Muslim armies expelled from southern France.
929 Umayyad Caliphate in Spain declared by Abd al-Rahman III (912-961 C.E.)
1029 Sa`id al-Andalus born in Almería.
1031 The last Umayyad Caliph, Hisham III, is deposed and replaced by a council of state.
Ibn Jahwar is the first consul.
1031-36 civil war; beginning of the "petty kingdom" period, in which there were as many as twenty-three independent city states at one time
1068 Sa`id al-Andalusi writes*The Book of the Categories of Peoples*.
1070 Sa`id al-Andalusi dies, in Toledo.
1085 fall of Toledo to Alfonso VI
1118 Saragossa taken by Christian powers
1212 Battle of Las Naves de Tolosa
This decisive battle allows the conquest of a large territory in southern Spain by Christian powers.
1236 Cordova conquered by Christian powers
1238 Valencia conquered by Christian powers
1248 Seville conquered by Christian powers
1250 Cadiz conquered by Christian powers
After this point, the only remaining Muslim territory is the Kingdom of Granada.
1492 Granada falls to the Catholic Monarchs, Ferdinand and Isabel.
1492 Expulsion of the Jews from Spain.
1609-13 Last expulsions of Muslims from Spain.

***The Book of the Categories of Peoples*:**

Al-Andalusi completed *The Book of the Categories of Peoples* in 1068 C.E., just two years before he died. The book is organized as follows:

Chapter One: *The Seven Ancient Peoples.*
Chapter Two: *The Two Types of Peoples.*
Chapter Three: *Peoples Having No Interest in Science.*
Chapter Four: *Peoples That Cultivated the Sciences.*
Chapter Five: *Science in India.*

Chapter Six: *Science in Persia.*
Chapter Seven: *Science of the Babylonians.*
Chapter Eight: *Science in Greece.*
Chapter Nine: *Science of the Romans.*
Chapter Ten: *Science in Egypt.*
Chapter Eleven: *The Arabs.*
Chapter Twelve: *Science in the Arab East.*
Chapter Thirteen: *Science in the Arab Andalus.*
Chapter Fourteen: *Science of the Jews.*

Exercises: Answer the following questions based on the outline above.

1. What does al-Andalusi mean by the seven ancient peoples of the world mentioned in Chapter One? (Guess)

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2. What do you think are the two types of peoples mentioned in Chapter Two?

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3. Three of the fourteen chapters are devoted to the Arabs (Chapters Eleven-Thirteen). Why is this unusual? Why do you think al-Andalusi arranged his book in this way?

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Passage I: Chapter One

The Judge Abu al-Qasim Sa`id ibn Ahmad ibn Sa`id wrote: It is known that all people on earth, from East to West and North to South, though they constitute a single group, differ in three distinct aspects: customary behavior, physical appearance, and language. Those interested in the history of people and the study of the records of human events, who have researched the succession of past generations, claim that all the people of the distant past, before the branching off of various tribes and the division of multiple languages, formed seven peoples.

The first people was the Persians, who inhabited the center of the populated world. Their territory bordered on the mountains in northern Iraq and reached as far as the Pass of Hulwan, including Mahan, Karaj, Dinavar, Hamadhan, Qum, Kashan, and other cities. Their borders extended to the lands of Armenia and Darband, which is situated on the Caspian Sea, and to Azerbaijan, Tabaristan, Muqan (?), Baylaqan (?), Van, Shirvan, Taliqan, and Jurjan, and to the land of Khurasan, including the cities Nishapur, the two Marv's [Marv and Marvarrud], Sarakhs, Herat, Khwarizm, Balkh, Bukhara, Samarkand, Farghana, Shash, and other cities in the land of Khurasan, also Sijistan, Kerman, Fars, Ahwaz, Isfahan, and other neighboring regions. They had one

kingdom, one king, and one language: Persian. Although they spoke slightly different dialects, they were in agreement on the shape and number of the letters in their alphabet, and their differences did not affect the various aspects of those languages, such as Pahlavi, Dari, and the other languages of the Persians.

The second people was the Chaldeans, that is, the Syrians and Babylonians, who were comprised of the Canaanites, the Assyrians, the Aramaeans, the Jaramiqah (?), who inhabited Mosul, and the Nabataeans (Aramaic-speaking Semites), who inhabited most of Iraq. Their territory, also at the center of the populated world, included Iraq, "the Island" meaning the area between the rivers Tigris and Euphrates (in northern Iraq and Syria) and known as Diyar Rabi`a ["territories of the Rabi`a tribe"] and Diyar Mudar ["territories of the Mudar tribe"], greater Syria, and the Arabian Peninsula, in which are the Hijaz, Najd, the Tihama, Ghawr, and Yemen, including Zabid, San`a', Aden, `Urud (?), Shahr, Hadramawt, Oman, and the other parts of the Arabian Peninsula. All this was one kingdom having one king and one language, Syriac. This is the ancient language spoken by Adam, Idris, Noah, Abraham, Lot, and others. Later on, Syriac branched out into Arabic and Hebrew. The Hebrews, also known as the Israelites, conquered greater Syria and inhabited it. The Arabs took over northern Iraq, also known as the territories of the Rabi`a tribes and the territories of the Mudar tribes, and inhabited all of it. The rest of the Syrians retreated into [southern] Iraq, where the capital of their kingdom was at Kalwadha.

The third people comprised the Greeks, the Romans, the Franks, the Gallicians, the Burjans (?), the Slavonians, the Russians, the Burghuz, the Llan, as well as other peoples living around the Black Sea, the Lake of Maytus [probably the Sea of Azov], and other areas in the northwest quadrant of the populated earth. They had one kingdom and spoke the same language.

The fourth people was the Copts. They comprise the people of Egypt and the people of the South, including the black peoples of the Ethiopians, Nubians, East Africans, and others. They also include the people of the West [Maghrib = western North Africa], that is to say the Berbers and neighboring peoples to the west, bordering on the [Atlantic] Ocean. They spoke the same language and had one kingdom.

The fifth people was the races of Turks, which include the Karluks, the Kimaks [Qipchaqs?], the Taghuzghuz, the Khazars, the Sarirs, the Jilans, the Khuzans, the Tilsans, the Kazakhs, and the Burtas. They spoke one language and had one kingdom.

The sixth people was India and Sind and the neighboring peoples. They had one language and one king.

The seventh nation was China and the neighboring country of `Amur [between Manchuria and Russia], named after `Amur, the sone of Noah's son Japheth. They had one kingdom and one language.

These seven peoples made up the entire human race, and they were all Sabians, that is, they worshiped idols representing celestial bodies, including the seven planets and other stars. Later on, these seven peoples were dispersed, their languages branched out, and their religions became different.

Exercise III: Answer the following questions.

1. List the seven ancient peoples of the world mentioned here. How does this list compare with your answer to question #1 in Exercise II above? Why do you think it is different?

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2. What ancient peoples are not mentioned by al-Andalusi?

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3. What language did Noah and Abraham speak, according to al-Andalusi?

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4. How are Hebrew and Arabic related, in al-Andalusi's view?

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5. What was the original religion of all of the seven ancient peoples, in al-Andalusi's view?

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6. What are some of the ways in which the original seven peoples changed over time?

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Activity I:
Using a world atlas, maps of Europe, Africa, the Middle East, and Asia, or the internet, complete one or all of the following:

1. Draw a map of the territory controled by the ancient Persians, as described by al-Andalusi.

2. Draw a map of the territory controled by any of the other peoples mentioned by al-Andalusi.

3. Draw a map of the world as al-Andalusi knew it.

Activity II:

1. Using reference works in the library or on the internet. Draw a chart of time lines showing the following historical dynasties/civilizations in parallel:

A. The Old, Middle, and New Kingdoms of Egypt.
B. The Sumerians.
C. The Babylonians.
D. The Assyrians.
E. The Achaemenid, Ashkanid (Parthian), and Sasanian dynasties of Persia (Iran).
F. The Roman Empire.
G. The Abbasid dynasty

Passage II: Chapter Five: Science of the Indians (Selections)

The first people who cultivated the sciences is India. They are a powerful people having a large population and a rich territory. India is know for the wisdom of its people. Over many centuries, all the kings of the past have recognized the ability of the Indians in all the branches of knowledge....

The Indians, as is known to all peoples for many centuries, are the mine of wisdom and the source of fairness and objectivity. They are a people of sublime pensiveness, universal justification, and useful and rare inventions. ...

The Indians have made great strides in the study of arithmetic and geometry. They have acquired immense information and reached the highest point in their knowledge of the movements of the planets and stars and the secrets of the skies [astrology], and other mathematical fields as well. After all these things, they have surpassed all other peoples in their knowledge of medical science,the effects of drugs, the characteristics of compounds, and the properties of substances of various types. ...

Since the Indians are far from our country , and since many kingdoms separate us from them, we have very few of their books. Only a small fraction of their knowledge and a few fragments about their religions have reached us, and we have heard about only a small number of their scholars.

Of the Indians' stronomical systems, the three that are well known are the Sindhind, which means cyclical time, the Arjabhar, and the Arkand. We only have correct information about the Sindhind systen, which was adopted and further developed by a number of Muslim scholars, including Muhammad ibn Ibrahim al-Fazari [ca. 760-790 C.E.]. Hubaysh ibn Abd Allah al-Baghdad [fl. ca. 800 C.E.], Muhammad ibn Musa al-Khwarizmi [800-847 C.E.], al-Husayn ibn Muhammad, also known as Ibn al-Adami [fl. ca. 920 C.E.], and others. The meaning of Sindhind is infinite or cyclical time, according to what Ibn al-Adami reported in his astronomical tables.

Those who believe in the Sindhind say that the seven planets and their apogees and perigees meet at the beginning of Aries once every four billion, three hundred and twenty million solar years. They call this cycle "the period of the universe" because they believe that when all the planets meet at the beginning of Aries, everything on earth will perish, leaving the lower universe in a state of destruction for a very long time, until the planets and their apogees and perigees disperse back to their sections of the zodiac. When this takes place, the world will return to its original state. The cycle repeats indefinitely. ...

What has reached us from the works of the Indians on music is the book known in the Indian language as *Bafir*, which means *The Fruits of Wisdom*. It contains the fundamentals of modes and the bases of the construction of melodies.

What has reached us from their works on the improvement of morals and excellent upbringing is the book *Kalilah and Dimna*, which was brought by the Persian physician Burzuwayh from India to the King of Persia, Anushirvan son of Qubadh, son of Piruz. Burzuwayh translated Kalila and Dimna for the King from Sanskrit to Persian. It was later translated from Persian into Arabic during the Islamic period by Abd Allah Ibn al-Muqaffa`. This is a book of noble purpose and great practical worth.

That which has reached us of their works on arithmetic is *Dust oard Arithmetic*, which was simplified by Abu Ja`far Muhammad ibn Musa al-Khwarizmi. This method of calculation is the simplest, fastest, and easiest method to understand and has a remarkable structure. It is a testimony to the intelligence of the Indians, the clarity of their creativity, and the power oof their inventiveness.

That which has reached us from the discoveries of their perceptive thinking and the marvels of their inventions is the game of chess. The Indians have, in the constuction of its quares, its double numbers, its symbols and secrets, reached the forefront of knowledge. They have extracted its mysteries from supernatural forces. While the game is being played and its pieces are being manoeuvred, the beauty of structure and the greatness of harmony appear. It demonstrates the manifestation of high intentions and noble deeds, as it provides various form of warnings from enemies and points out ruses as well as ways to avoid dangers. In this there is considerable gain and useful profit.

Among the Indian scholars who have knowledge of the shape of the physical universe and the composition of the celestian spheres and the movements of the planets and stars, we have heard of Kanka the Indian. In his book *The Thousands*, Abu Ma`shar Ja`far ibn Muhammad ibn `Umar al-Balkhi [787-886 C.E.] stated that this scholar was considered the most prominent in his knowledge of astronomy by all the Indians scholars of the past. I have no information as to when or where he lived or anything about his life or work except what I have just mentioned.

Exercise IV: Answer the following questions.

1. Did al-Andalusi know Sanskrit or any other Indian language? Why do you think so?

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2. What are some of the fields of knowledge in which the Indians excelled?

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3. In which of these fields did the Indians influence Arab and/or Muslim scholars the most?

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4. How does al-Andalusi know about the Indian astronomer, Kanka?

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5. What can one learn from playing chess, in al-Andalusi's view?

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6. Is music a science? Why do you think al-Andalusi includes it here?

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Passage III: Chapter Eight: Science of the Greeks (Selections)

The fourth people who cultivated the sciences were the Greeks. Among the various peoples, they have been considered the ones with the greatest power and the most widely revered reputation. Their great kings earned the respect of all the peoples of neighboring countries. Among them was Alexander, son of Philip of Macedon, known as Alexander of the Two Horns, who conquered the King of Persia, Darius son of Darius, in his own territory, brought down his throne, broke up his kingdom, and dispersed his people. Then he traveld beyond, intending to meet the kings of the East, such as those of India, Turkey, and China. He defeated some of them, and all of them accepted his authority. They met him with precious gifts and held him off by paying enormous sums in tribute. He continued advancing in the farthest provinces of India and along the borders of China and the rest of the East, until all the kings of the earth without exception submitted to his authority and were humiliated by his glory. They accepted him as king of the world and master of the earth. ...

The scholars of the Greeks were called falasifa, the singular of which is faylasuph [philosopher]. This word means "lover of wisdom" in Greek. The Greek philosophers are the highest and most revered category of people among the people of knowledge; this is because of the true care that they have demonstrated in cultivating all the ranches of knowlege, including mathematics, logic, natural philosophy, and theology, as well as the political sciences that deal with the home, family, and society as a whole. The greatest of the Greek philosophers are five. The first, historically, is Empedocless [c. 490-430 B.C.E.], then Pythogoras [c. 582-500 B.C.E.], then Socrates [c. 469-399 B.C.E.], then Plato [c. 427-347 B.C.E.], and then Aristotle son of Nicomachus [c. 384-322 B.C.E.]. There is general agreement that these five are the ones who deserve to be called the Philosophers of the Greeks.

... Aristotle is the son of Nicomachus of Gerasha, the Pythagorean. Abu al-Hasan `Ali ibn al-Husayn al-Mas`udi [the famous Arab historian and geographer] states that Nichomachus means "conqueror of the enemy" and that Aristotle means "of complete virtue." Nichomachus adopted the Pythagorean doctrine and wrote weveral mathematical treatises. His son Aristotle was a student of Plato, and it is said that he stayed with him,

studying, for some twenty years. Plato preferred him over all other students annd called him "the Wise" or "the Mind".

Aristotle is that last and best known of the Greek philosophers. He was the last of their sages and the most eminent among their scholars. He was the first to separate the art of proof from other forms of dialogue and to provide it with it syllogistic type of argument, turning it into an instrucment of theoretical investigation. For that reason, he was given the title "the Logician."

Aristotle wrote on all the subjects pertaining to sciences and philosophy. He wrote great books of a general nature as well as specialized treatises. Each one of his short treatises dealt with a single subject. On the other hand, his general books are mnemonic in nature; they present records of his teachings and philosophies. He wrote over seventy such books. Most of his writings were didactic treatises, written for Ofarus and designed to teach three forms of knowledge. The first is the science of philosophy, the second is the application of philosophy, and the third is the tools used in the science of philosophy as well as other sciences. Some of his books that deal with the science of philosophy trreat matehmetical sciences; others treat the physical sciences; and those of the third group discuss theology.

Among his books on the physical sciences are a book on optics, a second book on lines, and a third book on mechanics. ...

...

The Greek scholars who specialized in particular fields of philosophy and studied only one of its subjects are many. One of those who specialized in the physical sciences and medicine was Hippocrates, the leading physical scientist of his time. He live about one hundred years abbefore the time of Alexander. He wrote concise and noble books on medicine, of which we mention here [the following]: *The Chapters*, The Prognosis, Barley Water, The Fetus, and so on.

Also in this group, we mention Galen [c. 130-200 C.E.], who lived in the city of Pergamum in the land of the Greeks [Anatolia]. He was the leader of the physicians adnd the most prominent physical scientists of his tim. He was the author of great books on the practice of medicine, the physical sciences, and the science of proof. Galen recorded the titles of his books in a large index in which he discussed the order in which they should be read and the method by which they should be studied. His books were over one hundred in number. ...

Among the Greek mathematicians, we have [the following]: Apollonius the Carpenter [Apollonius of Perga, fl. c. 200 B.C.E.], who wrote the book On Conics, which discusses bent lines that are neither straight lines nor segments of the arc of a circle. Euclid of Tyre [fl. c. 300 B.C.E.], author of the most famous introduction to geometry, known by the title The Elements. He is also the author of *The Book of Prisms*, *The Book of Optics*, *The Book of the Composition of Harmonies*, and other works. Abu Yusuf Ya`qub ibn Ishaq al-Kindi mentioned in one of his books that a Greek king found in his library two books by Apollonius the Carpenter in which he discussed the characteristics of five solds whose volume cannot be exceeded by that of a sphere. The king serached for someon to help him understand the two books, but Euclid was the only one who could, for he was the best geometer of his time. He simplified the two books and explained to the king what Apollonius meant, then added some diagrams to help him understand these five solids. The resulted in the Thirteen Articles of Euclid's *Elements*. Euclid later added to the work two articles on the ratios of solids and their mutual relations, which had not been discussed by Apollonius.

Among the Greek scholars is also Archimedes [c. 287-212 B.C.E.], who authored the book *The Heptagon Inscribed in a Circle, The Area of a Circle, The Sphere, the Cylinder, and the Cone*.

...

There is also Claudius Ptolemy [85-165 C.E.], author of the Almagest [on astronomy], Optics, and The Four Articles [Tetrabiblios] on the study of astronomy. He also authoed The Book of Music, The Book of the Phases of the Moon or The Book of Lights, and the Canon, which he esxtracted from the Almagest. He was a contemporary of the Roman Emperors Hadrian and Antoninus; that is, he lived some 280 years after Hipparchus. Many people who claim knowledge of the hsitory of peoples include Claudius Ptolemy with the Greek Ptolemies who reigned after Alexander [in Egypt; Cleopatra belonged to their dynasty]. This is clearly an error, because Ptolemy mentions in his book the Almagest, specifically in the third section of the third book, where he discusses the motion of the sun, its observations, and all its variations, that he observed the fall equinox during the nineteenth year of the reign of Hadrian. This means that from the first year of the rieng of Nebuchadnezze [c. 604-561 B.C.E.] to the time of this fall equinox, there were 879 years, 36 days, and 6 hours. Subdividing this period, he stated that from the first year of the reign of Nebuchadnezzar until the death of Alexander of Macedon, the grandfather of Alexander of the Two Horns, there are 424 Egyptian years; and from the death of Alexander to the time of the King Augustus, the first of the Roman emperors, there are294 years, adnd fom the first year in the reign of Augustus to the observation of the fall equinox, there are 161 years, 66 days, and 2 hours. Thus, Ptolemy demonstrated in a clear and concise fashion that from the time of Augustus to his own time there were 161 years. Those knowledgeable of the history of peoples and the annals of past generations have agreed that this Augustus is the Roman Emperor who defeated Cleopatra, the last of the Ptolemaic Greek rulers, and usurped her kingdom. With this defeat, the Greek kingdom disappeared from the face of the earth. This is enough to clarify the error of those who say that Claudius Ptolemy was one of the Ptolemaic kings, God willing.

With this Ptolemy, the science of astronomy and the knowledge of the secrets of the skies reached perfection. He collected all the fragments of this science that had been obtained by the Greeks, the Romans, and the rest of the people who lived in the western region of the earth. He organized its parts ad clarified its obscurities. I do not know of anyone after him who attempted to write a book that resembles his book the Almagest, or anybody who tried to criticize it, though some scholars wrote commentaries on some of its parts and clarified some of its contents, such as al-Fadl ibn Hatim and Nayrizi [d. 922 C.E.], while others abridged it and rendered it more accessible, including Muhammad ibn Jabir al-Battani [d. 900 C.E.]. The goal of the scholars who came after him was to understand this book and the arrangement o its parts; they struggled and competed to attain this goal. I do not know of any book dedicated to a given scientific field, whether ancient or recent, that is more complete in its treatment of the field than the following three books. The first is the Almagest, on the science of astronomy and the motions of the planets and stars; the second is Aristotle's book on the science of logic; and this third is the book of Sibawayh al-Basri on the study of Arabic grammar. Each of these three books contains all the fundamental and subsidiary points of the subjects they treat, and what they omit is insignificant. ...

Exercise V: Answer the following questions:

1. Who were the five most important philosophers of the Greeks, in al-Andalusi's view?

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2. What were some of the fields in which the Greeks excelled?

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3. How does this section compare with the section on Science in India?

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4. What were some of the books written by Greek authors that al-Andalusi considered important?

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5. How did he know about these books? Could he read Greek? Is there any specific evidence about his sources of information in the passage? Can you deduce anything about them from the passage?

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6. Make a general statement about what we learn from this passage about the history of the sciences.

Passage IV: Chapter Twelve: Science in the Eastern Arab World

The first fields of science cultivated during the Abbasid dynasty [750-1258 C.E.; capital at Baghdad in Iraq] were logic and astronomy. The first scholar of this dynasty to become known for his study of logic was `Abd Allah ibn al-Muqaffa`, the Persian orator and secretary of Abu Ja`far al-Mansur [the ]. He translated Aristotle's three books on logic, which are the precise foundations of that science. They are the books *The Categories, Of Interpretation,* and *The Analytics*. Ibn al-Muqaffa` stated that until that time, only the first of these three books had been translated. He also translated the introduction to the book of logic known as the Eisagoge ["Introduction"], by Porphyry, Marcus of Tyre, and others. His translation was in simple and accessible style. He also translated the Indian book *Kalila and Dimna*; he was the first to translate from Persian into Arabic. In addition, he wrote several excellent works, among the best known of

them is is work on proper comportment and politics, and another known as the *Solitary Pearl*, on submission to the ruler's authority.

The first scholar to devote himself to astronomy during [the Abbasid dynasty] was Muhammad ibn Ibrahim al-Fazari. Al-Husayn ibn Muhammad ibn Hamid, better known as Ibn al-Adami, stated in his astronomical calendar entitled the String of the Necklace, that a man from India came to the Caliph al-Mansur in the year 773 C.E. and presented him with the arithmetic known as the Sindhind for calculating the motions of the planets. It contains equations that give the positions of the planets with an accuracy of one-fourth of a degree. It also contains examples of celestial events such as eclipses and the rises of the zodiac signs, and other information. All this was in a book containing twelve chapters. Ibn al-Adami reported that it was the summary of a work by an Indian king named Qabghar. In that work, calculations of the positions of planets were carried out to an accuracy of one minute [= one sixtieth of a degree]. Al-Mansur ordered that the book be translated into Arabic so that it could be used by Arab astronomers as the foundation for understanding celestial motions. Muhammad ibn Ibrahim al-Fazari accepted the charge and extracted from it the book that astronomers called the Sindhind. In the Indian language [i.e., Sanskrit], this word means "infinite time."

This book was used by astronomers until the reign of the Caliph al-Ma'mun, when it was abridged for him by Abu Ja`far Muhammad ibn Musa al-Khwarizmi, who extracted it from his famous astronomical tables, which were commonly used in the Islamic world. Al-Khwarizmi also made some modifications of the Sindhind system, and he deviated from its relations and declinations. He adopted the Persian system in formulating his equations, and he adopted the method of Ptolemy for determining the declination of the sun. He invented ingenious methods of approximation, but these were not enough to make up for the obvious errors in his work, which demonstrate his weakness in geometry and astronomy both. Nevertheless, his work was well received and was highly praised by proponents of the Sindhind. His book is in use at the present time by those concerned with figuring out equations of motion of this type.

When `Abd Allah al-Ma'mun, son of Harun al-Rashid, such of Muhammad al-Mahdi, suon of Abu Ja`far al-Mansur became caliph, his noble soul craved the understanding of wisdom and the apprehension of philosophy. When the scholars of his time learned of [Ptolemy's] Almagest and understood the construction of observational instruments described in it, he took action. Guided by his nobility and his love for knowledge, he assembled all the scientists of his kingdom and chared them with the construction of such equipment and with its use in the study of the plaents and their motions, as had been done long before by Ptolemy and his predecessors. Al-Ma'mun's orders were carried out, and observations beganin in the city of Shamasiyah in the region of Syria in the year 214 A.H./829 C.E. They determined the length of the solar year, the magnitude of the sun's declination, the eccentriity of its orbit, and the position of its apogee. They further studied the behavior of stars and planets until their work was interrupted by the death of Caliph al-Ma'mun in 833 C.E. They recorded all their observations in a book which they named *The Ma'munid Observations*. Those who worked on the project were Yahya ibn Abu Mansur, the chief astronomer of the time, Khalid ibn `Abd al-Malik al-Marwarrudhi, Sanad ibn `Ali, and al-`Abbas ibn Sa`id al-Jawhari. Each one of them compiled astronomical tables that bear his name and are still in use at the present time. The observations of these scholars were the first ever performed in the Islamic era.

From that period until the present time [1068 C.E.], there has always been a select number of scholars, Muslims and non-Muslims, attached to the Abbasid Caliphs and other Muslim rulers, working on astronomy, geometry, medicine, and other ancient sciences. They have written important books in these fields and attained fascinating results. ...

There was also Muhammad ibn Zakariya al-Razi, the unmatched physician of the Muslims and one of the most skilled in the sciences of logic, geometry, and other branches of philosophy. He began his career as a lute player, but soon abondoned that to study philosophy. He succeeded in assimilating it well, and wrote more than one hundred books, mostly on practical medicine, and some on the physical sciences and theology. ...

There was also Abu Ja`far Muhammad ibn Sinan al-Harrani, known as al-Battani [d. 929 C.E.]. He was very skillful in observational astronomy, a leader in the science of geometry, celestial events, and astronomical calculations. Al-Battani produced remarkable astronomical tables in which he included the results of his observations of the sun and the moon and corrected their motion from the rror found in the book of Ptolemy known as the Almagest. He also discussed the distinctive motions of the five remaining planets and included the possible corrections needed for his astronomical calculations. Some of the observations included in his table were made in the year 882 C.E., which corresponds to the eighth year in the reign of the Caliph al-Mu`tamid. I do not know of anyone in Islam who excelled as much as al-Battani in rectifying astronomical observations and examining planetary movements. In addition to all this, he was interested in astrology, which led him to write on [that topic]. Among his works is his commentary on Ptolemy's Tetrabiblios [also on astronomy]. ...

Exercise VI: Answer the following questions.

1. What two sciences were developed first during the Abbasid dynasty?

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2. From what languages were scientific works translated during this period? Give several examples.

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3. Judging from this account, which of the Abbasid Caliphs were especially interested in the sciences?

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4. In al-Andalusi's view, which works seem particularly important in the history of science? Why?

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5. Give several examples of the contributions made during the early Abbasid period to the advancement of science. How did Arab or Muslim scholars (and Jewish and

Christian scholars living in the Abbasid Empire) add to and/or improve on the works of the Greeks, Persians, and Indians?

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Bibliography and Further Reading:

Sa`id al-Andalusi's work has been translated into English by Sema`an I Salem and Alok Kumar under the title *Science in the Medieval World:"Book of the Categories of Nations"*. Austin, Texas: University of Austin Press, 1991. Unfortunately, this translation contains many errors of transcription, translation, and spelling; it is nevertheless useful for a general overview.

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