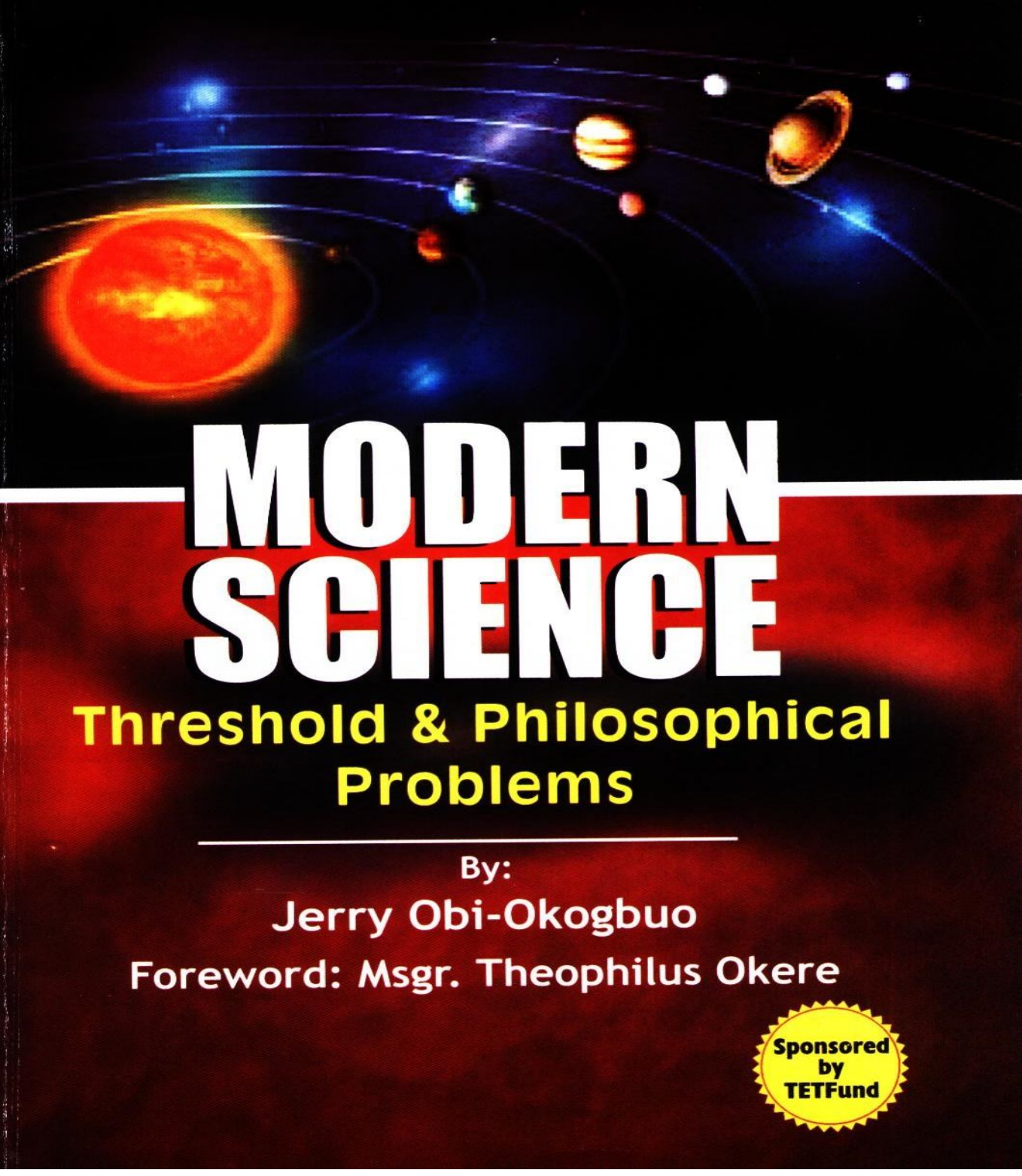

CHAPTER 4
SCIENCE IN ANCIENT EGYPT

Prehistory Science: The Modern Scientific Revolution did not happen phoenix–like. It was not a sudden bolt from the sky. It did not all on a sudden spring from the works of those sixteenth and seventeenth centuries progenitors of the modern scientific revolution such as Bacon, Descartes, Kepler, Galileo and Newton Modern science was the result of a long drawn developmental process extending back time immemorial. The point that is being made is that science the way we know it today has its root laid in prehistory – far back before the appearance of the first civilization. Since inception, humanity has had the primary concerns to survive, understand his environment, and to explain it. Science defined in these general terms has always been with man. From the very beginning man saw himself as unique, not divine and not just one other thing in nature but involved with these. He saw himself as having power to control nature through mastery exhibited by the *techne* of his hands. Yet there are other things beyond his control. The mystery of nature and the need to control it are part of the sources of science. The primacy of utility meant that *techne* preceded science.

The point at issue is the origin of science. The suggestion is that the origin of science could not have been historical in the sense of starting at a particular time and place, for instance, with the classical Greeks as most western writers are wont to assert. The origin of science is a-historical and ontological. S. F. Mason pictures appropriately the ontological origin of science when he states:

> The roots of science, however, ran deep, back to the period before the appearance of civilization. No matter how far back in history we go there were always some techniques, facts and conceptions, known to craftsman or scholars, which were scientific in character.[1]

Truly there is no human group without the rudiments of science, no human society without a way of surviving and mastering their environment. This is the principal root of science; the magical art, skill, technic, practical impulse, learning by trail

and error, and insightful imagination, brought about the technological innovations of prehistory.

However, science understood as an "orderly and systematic comprehension, description and/or explanation of natural phenomena, and secondly, the tools necessary for that undertaking including especially, logic and mathematics"[2] has not always been with man, this must have evolved at a later particular time and place.

These two primary historical roots of science: 'the technical tradition' and the 'spiritual traditional' seemed to have remained apart till a much later period in the development of science and till then science could not really become itself. Since prehistoric science is deeply heuristic, utilitarian, practical, trial and error, guesswork, luck, not involving conscious theorizing; it is not science strictly speaking, it is science nontheless but science subordinated either to the craft tradition, religion, or the tradition of philosophy. The essence of this part is to account for the gradual but increasing emergence of science, which culminated in the modern scientific revolution.

Science is not an entirely autonomous self-moving historical phenomenon. Even though science is distinctive and has its own evolutionary logic, it is still an element in the general interconnected matrix called civilization. Thus our account will analyze the cross-flow of influences between science and some of these other elements of civilization some of which are geo-cultural and sociopolitical.

It follows that before the appearance of the first urban civilizations, humanity had gone beyond the simple life of the Old Stone Age: wandering from place to place with 'crude tools of stone and bone, hunting, shepherding and gathering ready raw food from nature to a more relatively sophisticated Neolithic settled and subsistence community life of a farmer and breeder of animals with an assortment of relatively improved techniques, instruments, and skills; this is the new stone age of about the sixth millennium B.C. This settled agricultural (urban) life could be observed in the seminal areas of civilization in different degrees in the valleys of the Indus, the Tigris-Euphrates, and the Nile Rivers where the natural flooding of the rivers deposited a fresh layer of fertile silt annually.

The point we emphasize is that the endeavor to understand events in nature is as old as civilization; that since his appearance, man's mental capacities have been unfolding; that before the triumphant age of modern science in the west, its budding light had shown in the East; its foundation was already laid in the seminal areas of civilization like Egypt and Mesopotamia; that it is impossible to

understand the modern scientific revolution without the consideration of its threshold in ancient Egypt and development in Greece and incubation in the Middle Ages; that material and intellectual advancements are not novel with modern people; and that as Eisley Loren says "...in science there is no such thing as total independence from one's forerunners."[3] Let us now scan through history and note the changing modes of thought which finally exploded as the modern scientific revolution.

Science in Ancient Egypt: Today the trail-blazing pioneering role played by ancient Egypt in the overall civilization of the human mind in general and the development of philosophy and science in particular, including the experimental method and mathematics, is increasingly being researched, discovered, re-constructed, and documented. This is a credit to the current deconstruction and reconstruction approaches in *African philosophy*. Initially, due to the West's advantage in literacy, dominance in the authorship of philosophies, commentaries, and histories, arrogant pride, outright mischief to distort history; and perhaps the absence in contemporary Africa of sages, artifacts and monumental evidences indicative of a people who had witnessed high civilization in the past; Africa's seminal contribution to the development of science was denied and overwhelmingly credited to the Greeks. For instance, Martin Faber, a western historian of philosophy writes: "...the known history of philosophy in the western world begings with the philosopher Thales who is credited with first formulating the problem of the unity of the cosmic process."[4]

Neglect and at times outright denial of Africa's contribution to the origin and development of philosophy and science such as the above derive from biased and uncritical reports of European bourgeois anthropologist and missionaries such as the following:

> An African whether Negro or Bantu, does not think, reflect, or reason, if he can help it. He has a wonderful memory, has great powers of observation and initiation, much freedom of speech and very many good qualities; he can be kind, generous, affectionate, unselfish, devoted, faithful, brave, patient, and persevering; but reasoning and inventive faculties remain dormant. He readily grasps the present circumstances, adapts himself to them and provides for them; but a careful thought-out plan or a clear piece of induction is beyond him.[5]

This way the African is granted everything but the rational potentiality which is the foundation of science. But contrary to these uncomplimentary reports, there are now emerging preponderant evidences that Egypt is the cradle of civilization; that wandering peoples coming from different African tribes started settling in the Nile valley and before 10,000 B.C there was already a settled life there. Rudimentary ideas of science started developing with the people as they involved in the practical consideration of every day living. The Egyptians watched with awe the annual flooding of the Nile valley at particular periods, they needed to compute its rise and fall, mark boundary lines, construct pyramids for the burial of their kings; and their priests developed the study of the heavens. About 5,000 B.C., the two kingdoms of upper and Lower Egypt were already founded. And about 3500 B.C., Menes, the King of Upper Egypt conquered and brought the whole of Egypt under one government. He is generally regarded as the first of the pharaohs, a title given to subsequent kings of Egypt till the time of Alexander the Great.

Ancient Egypt also developed commerce with neighboring countries by means of sea-going trade. By about 2500, there was devised a calendar; there was decimal notation by about 2000 B.C. Industrial method of smelting iron was devised by about 1400 B.C, and by 1300 there existed a truly alphabetic script. Theoretical and speculative thinking were also pursued by the priests of the Mystery Systems of Egypt. The first known philosopher in history was Ptah-Hotep of Egypt who flourished about 2800 B.C.; while the first known physician was Imhotep of Egypt who flourished about 2000 B.C. It follows that the scientific attitude of which the modern world so much prides itself had its foundations laid in the golden age of Egyptian science more them a thousand years before the golden age of Greek science. So George Sarton concludes:

> ...that the seeds of science, including the experimental method and mathematics, in fact the seeds of all the forms of science, came from the East; and during the Middle Ages they were largely developed by the Eastern people. Thus, in a large sense, experimental science is a child not only of the West, but also of the East; the East was its mother, the West was its father.[6]

Aristotle, one of the greatest of the Greek philosopher-scientists credited with originating philosophy and science conceded the credit to ancient Egypt when he acknowledged:

> Hence when all such inventions were already established, the sciences which do not aim at giving pleasure or at the necessities of life were discovered, and first in the places were men first began to have leisure. This is why the mathematical arts were founded in Egypt; for the priestly caste was allowed to be at leisure.[7]

Aristotle's acknowledgement of Egyptian origin of science easily proves the thesis that there is an evolutionary trend in the scientific revolution; that in science there is no such thing as complete independence from one's forerunners. It also easily accounts for the wonders of the Greek achievement. Homer, the mythopoeic writer, believed to be one of the local backgrounds of Greek civilization visited Egypt. Also Thales, the Greek, universally acclaimed first recorded Western philosopher-scientist and one of the seven sages, visited Egypt. Both were students at the feet of the Egyptian intellectual class,[8] the priest-philosophers, learning Menphite Theology, the Corpus Hermeticum and works like the Rand Papyrus, the Edwin Papyrus and the Mystery System, the strands of philosophy that existed in Egypt then. Greek achievement regarded as the beginning of western science could also be regarded as the climax of Egyptian science. Every beginning in an evolutionary line is the climax of another. Thus we now begin to understand in a new light the feat achieved by the Greeks in mathematics, astronomy, medicine, and general speculative thought.

More or less contemporaneous with ancient Egyptian civilization was the Mesopotamian and may be the Hindus and Chinese ones. The Sumerians invented writing and it spread to Egypt and even to China. It was in the tenth century that the Phoenicians developed the alphabet by breaking down the Sumerian script. Their diviners were remarkable planetary observers. The Chaldean magi were reputable astronomers combining their knowledge with astrology. In Mesopotamia, the science of the classification table (taxonomy) developed. These tables contained the classification of animals, plants, minerals, rivers, mountains, and trades. This is the root of the classification by species or by family. This is the foundation of natural science. The Babylonians were skilled in manipulating arithmetical numbers. They laid the foundation for the development of mathematics and quantified astronomy. They also had myths about the beginning of the world. Both the Egyptians and the Mesopotamians speculated about the origin of the world. Both believed the world emerged from the waters of chaos. It is thus crystal clear that the efflorescence of science in Egypt and Mesopotamia is

anterior to Greek science and that the latter borrowed from Egypt and Mesopotamia even though the details of time and manner of borrowing are not clear. As for borrowing from India and china there is no clear indication.

Who are the Ancient Egyptians?

That the light of civilization came from the East seems now indubitable. That Egypt and Mesopotamia laid the foundation of the natural sciences, the credit of which was ascribed to the Greeks, has been proved reasonably. The next questions to be considered are: Was ancient Egypt African, Oriental or Occidental? Or were the original inhabitants of ancient Egypt a part of the old world – the Mediterranean world? Which, as the argument went, was neither Africa, Europe nor Asia but the East, the Middle East (Medius Terra), middle of the land or earth; the landlocked midland, the nominal meaning of Mediterranean – the inhabitants of South Europe and North Africa, with its own distinctive culture different from those of the continents enclosing it, the so-called Mediterranean civilization. Some Western historians of philosophy regard Egypt in this light. Marie Boas refers to the seminal areas of civilization as "the Chinese, the Indian and the Western Asian-European". He also says for modern science "Europe owed much to the Oriental world." He also says "Europe drew likewise on the East for its first knowledge of some phenomena." But he will not bring himself to explicitly acknowledge any indebtedness to African-Egypt. G.W.F. Hegel was so direct in denying that ancient Egypt was African. He divided Africa into three and confusedly placed Egypt under Europe or Asia. He writes of his tripartite division of Africa:

> One is that which lies south of the desert of Sahara ...Africa proper... the Upland almost entirely unknown to us, with narrow coast-track along the sea; the second is that to the north of the desert – European Africa (if we may so call it) – a coastland; the third is the river region of the Nile, the only valley-land of Africa, and which is in connection with Asia.
>
> Africa proper, as far back as history goes, has remained for all purposes of connection with the rest of the world – shut up; it is the gold-land compressed within itself the land of childhood, which lying beyond the day of self-conscious history, is enveloped in the dark mantle of night.... The third portion of Africa is the river district of the Nile – which was adapted to become a mighty center of independent civilization and therefore

> is as isolated and singular in Africa as Africa itself appears in relation to the parts of the world. The Northern part of Africa, which may be specially called that of the coast-territory... lies on the Mediterranean and the Atlantic; a magnificent territory on which Cartage once lay – the site of modern Morocco, Algiers, Tunis, and Tripoli. This part was to be – must be attached to Europe... it looks Europe-wards....[9]

In this way, Hegel mischievously denies that ancient Egypt was Africa; all in the attempt to deny the contributions of Africa to the march of civilization generally and the development of science particularly. But the inhabitants of ancient Egypt were Africans. And By "African" is understood the geo-political and socio-cultural entity englobed by the continent of Africa. And the aborigines of Egypt were of African stock; settlers of the Nubians, the Ethiopians, the Maghreb, the Western Sudan and other African tribes. Having established Egypt's pioneering contribution to the development of science and also that Egypt has always been African; let us discuss in specific terms the areas of science that this seminal contribution was made.

Agriculture: The River Nile was central in the lives of the Egyptians. The River flooded its valley from July to November. Ordinarily, ancient Egypt was a dry arid land. The people depended largely on the Nile flood and the silts that came with it for the fertilization and watering of their parched land. At other times the Nile could be destructive as it overflowed its banks, eroded top soil and washed away crops. Consequently, the people constructed dykes, dug trenches, and sunk wells. In this way, a definite system of irrigating the land was established such that watering parts of the land was made possible for increased and improved yield.

Some of the staple food crops that were cultivated include Barley, wheat, millet, and lentils. The vegetables included broad beans, peas, onions, cabbage and lettuce. The fruits included grapes, figs, and pomegranates. Some wild plants were also domesticated, for instance, flax and papyrus. From the former, linen for making clothes was derived, while from the dried stalk of the papyrus reed the earliest writing material known in history was produced. The modern English word 'paper' is derived from the Egyptian word 'papyrus'. Animals, such as pigs, goats, horses, and cows were domesticated and reared.

In this way, Egypt gave to the world the rudiments in agricultural science; ideas like irrigation, crop rotation, shifting cultivation, crop science, fertilization and animal husbandry.

Geometry (Mathematics): Nominally defined, Geometry is the measurement of the earth, the ground or land. It is the science of space measurement. It is that part of mathematics which is concerned with the properties of points, lines, surfaces and solids.

Like most scientific contributions, the Egyptians invented geometry through practical considerations. Provisionally they searched for solutions to concrete problems of parceling out land or surveying; in so doing they discovered methods of calculating figures like rectangles, triangles and circles.

Egyptian contribution in this field is contained in the Ahmôse Papyrus (c. 2200 B.C) and the Rhind Papyrus (1800 B.C). These are the oldest known mathematical treatises. The Rhind Papyrus is most probably a copy of the Ahmôse Papyrus. Translations of the Rhind Papyrus are kept in London and New York. The mathematical treatise, the Rhind Papyrus, was written more than thirteen centuries before the famed first mathematical treatise – the *Elements* of Euclid, though the latter is incomparably more advanced.

The Egyptian mathematical treatise shows that the Egyptians had already mastered rudimentary arithmetical computations: they reckoned numbers in terms of units of ten; they had knowledge of whole numbers and fractions. They could add, subtract, and divide. But direct multiplication was not possible to them till the Hellenistic period. Multiplication was achieved by repeated additions. They had the knowledge of the principles of mensuration and plane surveying. They also had algebraic solutions of the problems involving determinate and indeterminate equations. They could find the areas of circles and spheres with remarkable approximation. They could measure the volume of a cylinder and of the frustrum of a square pyramid. These were in use for practical purposes till the Muslims introduced Arabic numerals during the Christian era.

The ancient Egyptians knew the theory of the right-angled triangle and could compute approximately the circumference of a circle giving π the value of 3.6. They knew something about algebra-solving equations. Consequently the ancient Egyptians' invention of mathematics was acknowledged by no less a personality than Plato himself. In a dialogue between Clinias and Athenian, Plato praises

Egyptian invention and genius in mathematics while regretting Greek ignorance. He writes:

> *Athenian:* 'Well, then, I maintain that free-born man should learn of these various subjects as much as in Egypt is taught to vast numbers of children along with their letters. To begin with, lessons have been devised there in ciphering for the veriest children which they can learn with a good deal of fun and amusement, problems about the distribution of a fixed total number of apples and garlands among larger and smaller groups, and the arranging of a successive series of 'byes' and pairs between boxers and wrestlers as the nature of such contests require.... In this way, they, as I was saying, incorporate the elementary application of arithmetic in the children's play, give the pupils a useful preparation for the dispositions, formations and movements of military life as well as for domestic management....They then go on to exercise in measurement of length, surface, and cubical content, by which they dispel the native and general, but ludicrous and shameful, ignorance of mankind about the whole subject.
>
> Clinias: 'And in what may this native ignorance consist?'
>
> Athenian: 'My dear clinias, when I was told, rather belatedly of our condition in this matter, like you, I was utterly astounded. Such ignorance seemed to me more worthy of a stupid beast like the hog than of a human being, and I blushed not for myself alone, but for our whole Hellenic world.[10]

By the time Plato was feeling ashamed of Greek ignorance of mathematics, it was already adapted into children's game to prepare them for military and domestic life. In this way, Plato credits Egypt with originating the science of numbers – mathematics.

Architecture: Ancient Egyptian primogenital contribution to the origin and development of architecture is again a fall-out from their practical daily living, this time their religious life. The Egyptians were, like other African people, a deeply religious people. They were polytheists and believed in life after death. They believed that one-day the spirit of the dead would come back and re-possess the body; hence, the body was embalmed for preservation in what became popular as the Egyptian mummies. Some of these mummies can still be discovered in Egypt

or seen at the British museum in London. The ancient Egyptians also worshipped their Kings because they believed that they were gods in human flesh. Sacrifices were offered to them while alife and Temples built in their honour while dead. *Pharaoh* the title of their kings means *Great House*.

The construction of Pyramids, Rock-Hewn Tombs, Temples and Sphinxes are the direct outcomes of this religious belief and practice. Pyramids are gigantic stonework burial-chambers where the bodies of Egyptian pharaohs are mummified; and with the bodies are buried everything (treasures) they needed to journey to future life. Thus the pyramids, the burial-chambers, were fortified or cleverly concealed against thieves and treasure-seekers.

It was then a common practice that pharaohs and nobles built their burial-chambers in their lifetimes. Between 3000 - 2500 B.C., the rulers of Egypt were known as the 'pyramid kings' because they built pyramids for their burial. The first pharaoh to do this was Zoser (c.3000 B.C). He built the first known pyramid in history at Sakkara towards the south of Memphis. The best known, the 'Great Pyramid', however, was among those built at Gizeh on the edge of the desert near Cairo, five miles from the left bank of the Nile, by king Khufu or Cheops, as the Greeks later called him, one of Zoser's successors.

The Great pyramid at Gizeh has been described as "the greatest stone structure ever erected". Its height is 450 feet and was thirteen feet higher when the outer casing was present. At its base, each of its four sides is over 250 yards. Over two million huge blocks of limestone, each weighing about two and a half tons, were used in its construction. It took about 100,000 men about twenty years to construct. Referring to the pyramids, George Sarton writes:

> Pyramids?.... Do not these gigantic witnesses of the Egyptian genius speak loudly enough?.... In our age of mechanical wonders, its mass is still as imposing as when it was built almost five thousand years ago; it seems as permanent as the hills and in all probability will outlast most of the skyscrapers of which we are so proud. However startling our first vision of it, our admiration increases as we analyze the achievement and measure the amount of mathematical and engineering skill, of experience and discipline, which were needed to bring it to a successful conclusion.[11]

Astronomy: The inundation of the Nile affects the life of the Egyptian. There was therefore the need to understand and predict its rise and fall and if possible regulate it. Hence the interest of the ancient Egyptians in astronomy is to be explained not only on ritual or liturgical grounds but also by the need to understand, predict, and perhaps regulate the Nile inundation. The ancient Egyptians as well as the Babylonians and the Greeks believed that an occult relationship exists between the movements of the heavenly bodies and the destinies of nations and of individuals, and thus developed the pseudo-science of astrology. But while the Babylonians believed in collective destiny, the Greeks believed in individualized astrology.

Apparently the Babylonians were more advanced and influenced the Greeks more than the Egyptians in the field of astronomy. No Egyptian record in observational astronomy survives while the Babylonians left numerous records behind. The information on Egyptian astronomy is got from the inscriptions and pictures of the heavens painted on coffin lids.

The main achievement of the ancient Egyptians in this field is the application of mathematics to astronomy by which they computed the "only intelligent calendar in human history". By 4241 B.C; they had already worked out the first calendar. They grouped the stars of the equatorial belt of the skies into thirty-six. Each star group, when it rose above the horizon just before dawn indicated the beginning of one of the ten-day periods into which the year was divided. Thus by 2781 B.C. the Egyptians already had the knowledge that the year was comprised of 365 days, extra five days were added to the thirty-six ten-day periods. That is, the year was composed of twelve months of thirty days each, plus five additional days.

Such an idea to regulate endless succession of time must have come from averaging out every several years the number of days separating the regular annual flood of the Nile, with which the Egyptian New Year started. About 2700 B.C., the rising of the dog star Sotkis or (Sirius) on July 19th, was used to begin their calendar.

Egyptian arrangement was far better than the lunar or more appropriately the luni-solar calendars of the Babylonians and the Greek city-states' various chaotic civil calendars. The Babylonians and the Greeks aimed to keep the months in harmony with the seasonal agricultural festivals or observed phases of the moon. But since the interval between one new moon and the next does not correspond to a whole number of days, the months were either twenty-nine or thirty days long.

Also more serious confusion arose from the fact that the year cannot be divided into an exact number of complete lunar months. Whereas the ordinary year consisted of twelve such months, with individual days added to some of these. In some years a whole month was intercalated to keep the calendar approximately in agreement with the seasons. Thus the Babylonians did not have an official year.

The most accurate astronomical knowledge in Mesopotamia concerned the motions of the Planets. By 2000 B.C. it was already known that Venus returned to the same position five times in eight years. By 1000 B.C. the observations in Mesopotamia were accurate and by 700 B.C. they were systematically recorded.

By 600 B.C, however, the Babylonians could calculate the relative positions of the sun and moon and predict eclipses with accuracy. They advanced the Sumerian lunar calendar of twenty-nine and one-half days to the month. They put an extra month when needed. Each year had twelve months. From the Sumerians, also, we obtained our twenty-four-hour day and our seven-day week. The Babylonians later divided the day into hours, minutes, and seconds, which was not done in medieval Europe until the fourteenth century A.D.

Both the Egyptians and Babylonians, however, thought of the cosmos as a great rectangular box with the earth as its floor, a vaulted roof, and held by four great cover pillars hence the expression 'the four corners of the earth'. But due to the chaotic and unsystematic nature of their calendars, (the intercalation of days and months was controlled by the decisions of the magistrates) and in spite of their advance in astronomy, the Greek astronomers used the Egyptian-style calendars for their calculations. Acknowledging Egyptian seminal contribution and advance in the science of astronomy Herodotus writes:

> ...the Egyptians were the first to discover the solar year and to portion out its course into twelve parts. They obtained this knowledge from the stars. To my mind they contrive their year much more cleverly than the Greeks, for these last every other year intercalate a whole month, but the Egyptians, dividing the year into twelve months of thirty days each, add every year a space of five days besides, whereby the circuit of the seasons is made to return with uniformity.[12]

Medicine: If there is a field of knowledge which the Egyptians have a claim to have originated and advanced much more than their Mesopotamian contemporaries, it is the field of medicine. Indeed, the Egyptians founded the

science of medicine. The Egyptian Mystery System produced not only philosophers and natural scientists but also medical doctors. The founder of Egyptian medicine, the first physician known to history is Imhotep; a black Egyptians who flourished in the third dynasty for he was also vizier to king Zoser (3000 B.C.) and had his temple at Memphis where he taught. His knowledge of medicine was so immense that he was apotheosized and in later time accorded the status of patron deity of medicine. He flourished more than 2000 years before the Greek Hippocrates (c.460-c.377 B.C.) today regarded as the father of medicine and whose oath doctors swear to before practicing. And the Greek god of healing is a descendant of the Egyptian deified Imhotep. In later times people went to sleep in his temple and dream about him to get cured.

The record of ancient Egyptian medicine is contained in a number of medical texts or papyri dated as far back as 2000 B.C and contain materials of the time of Imhotep. But there is no Mesopotamian cuneiform medical text earlier than the seventh century B.C. The Egyptian medical texts include the Ebers Medical Papyrus (c.1600 B.C) and the Edwin Smith Papyrus (c.1700), a copy of a text about two centuries earlier.

Egyptian medicine might have been rudimentary but the medical treatises show that it had gone beyond folk medicine. The Edwin Smith Papyrus is not just like other papyri, a collection of recipes and charms, but a systematic treatise. It contains forty-eight cases each case reported in the order: "name, examination, diagnosis, judgment, treatment, gloss". The prescriptions are simple and cases are described and recorded as favourable, uncertain or unfavorable, and incurable. Much attention was given to the treatment of fractured bones so that the injured in war can quickly return back to fighting. This shows that Egyptian doctors started recording empirical data earlier, a tradition which Hippocratic doctors were to follow. Yet despite its remarkable distance from magic and superstition, the papyrus still contains supernatural aids; example is case nine, which contains nearly no examination and no diagnosis, yet it contains the charm to be recited to effect a cure.

The Ebers medical papyrus contains recipe for fertility control; this consist of "a mixture of the tips of the shrub of Acacia and honey made into a tampon and inserted into the vagina as a suppository. Through fermentation the Acacia breaks down into lactic acid, one of the active spermicidal agents used in contraceptive jellies today".[13]

Another Egyptian medical treatise, the Carlsberg Papyrus 4, contains a case of the diagnosis of sterility in a woman, and this was copied verbatim by Hippocrates. According to this diagnosis; "insert a clove of garlic in the vagina for one night, if the odor comes out of her mouth, she will bear children."[14]

There is no Egyptian papyrus on anatomy or physiology, yet they had the knowledge. This must have come from the practice of mummification. But in actual fact, the Egyptian knowledge of anatomy and physiology is largely acquired from animal not from human anatomy. This implicates that there was little contact between embalmers and physicians. The Egyptians were also prone to eye trouble, but they had oculists to treat the ailment.

Another important element of medical practice in ancient Egypt was specialization: each Physician concerned himself with a particular disease. This became the model even today. Herodotus visited Egypt and gave an eye-witness account:

> ...medicine is practiced among them on a plan of separation; each physician treats a single disorder and no more: thus the country swarms with medical practitioners, some undertaken to cure diseases of the eye, others of the head, others again of the teeth, others of the intestine, and some of those which are not local.... There are a set of men who practice the art of embalming and make it their proper business.[15]

The Mesopotamians trail behind the Egyptians in the field of medicine. Their medical text was not earlier than seventh century B.C; and even at that it was filled with the 'demon' theory of disease. Illness was personified as an evil spirit that needed to be expelled from the sick by the physician through the use of emetics, purges or revolting medicament, magic and incantations. The Babylonian medical practice was astrological. So Greek medicine was largely derived from Egypt, but both Egyptian medicine and the astrological medicine of the Babylonians were both greatly elaborate before they reached Christian Europe.

Alchemy (Chemistry): It appears that the ancient Egyptians, and indeed the rest of the ancient world, contributed little or nothing elaborate and substantial in this field. There was no Egyptian or Babylonian chemical text. Alchemy developed about the third and fourth centuries A.D in Alexandria. But Egypt still laid the foundation in this field because mineral compounds were mentioned as drugs.

There was also dyeing and metallurgy. These led to the development of alchemy, the esoteric art that ultimately developed into chemistry.

Writing: The solvency and catalytic force of writing (recording) in the general march of civilization and the development of science cannot be overemphasized. The ancient Egyptians are, without reservations, credited with originating writing. Long before modern paper was developed; the Egyptians had started recording their ideas, products, discoveries and inventions. In the very beginning, this was done by means of the hieroglyphics, a picturesque depiction of the object indicated. This was also followed by the depiction of ideas with picture; for instance, a musical instrument would mean "happiness or pleasure". This was succeeded by signs which represented letters or words; and finally a cursive or running-hand writing came into use.

The earliest Egyptian writing (recording) materials were solid rocks and walls on which inscriptions were etched by means of sharp pointed instruments. Writing could also be made on soft clay, which was afterwards baked, and on sheets of wax or lead. Eventually papyrus (from which we derived paper), ink and reed were introduced. Sheets of papyrus were pasted together to give the required length. An example lies today at the British museum. It measures 135 feet by 1 foot 5 inches.

The development of writing is credited to the Egyptian priestly scribes. They used to record those disciplines they developed in the course of doing their duties, namely: mathematics for keeping account; surveying for parceling and keeping account of the land; astronomy for astrological prognostication and calendaring; and medicine for curing the sick and putting evil spirit to flight. But they did not, for the duration of the ancient period, record the affairs of the craftsmen: chemical arts, metallurgy, dyeing, etc. A father's advice to his son contained in an Egyptian papyrus of about 1100 B.C underscores the value of writing as it stresses the distance between the affairs of the clerical scribes and those of the craftsmen:

> Put writing in your heart that you may protect yourself from hard labour of any kind, and be a magistrate of high repute. The scribe is released from all manual tasks; it is he who commands. I have seen the metal worker at his tasks at the mouth of his furnace with fingers like a crocodile. He stank worse than fish-pawn. I have not seen a blacksmith on a commission, a founder who goes on an embassy.[16]

This lack of contact between the priestly scribes and the craftsmen was a major reason science could not fully develop in the ancient world. This was also the reason the revolution in science had to be delayed till the 17th century A.D.

Literature and Arts: Egyptian contribution in this field is great. Much of what is known about the Egyptians is got from the reconstruction and analysis of their arts. Beautiful paintings adorn the sides of monuments and there are many of these. The walls of temples, palaces and tombs are covered with mural paintings. Through these paintings we come to know a lot about Egyptian religions, industries, sports and amusement. The Cleopatra's Needle, the tapering granite Obelisk and the great Sphinx are all testimonies of Egyptian legacy in literature and arts.

Administration: The Egyptians gave the world the idea of administration, the art and science of managing resources: human and material. This idea has blossomed into modern sophisticated systems of government in different countries of the world.

Before 5000 B.C; there was already established in ancient Egypt two separate kingdoms: the Upper and Lower Egypt. Lower Egypt embraced the whole of the Nile delta, while the kingdom of Upper Egypt was southward from the tip of the delta. By about 3500 B.C. the whole of Egypt was brought under one government when Menes king of Upper Egypt conquered the Lower Kingdom of the delta area with capital at Memphis and it remained so for about a thousand years before it was moved to Thebes about 2200 B.C. Menes thus became the first "pharaoh" of Egypt; a term given to all subsequent kings of Egypt until the time of Alexander the Great (c.325 B.C.) and Ptolemy one of his generals who founded a new dynasty of Greek kings on Egyptian throne.

The word 'pharaoh' means 'Great House' the Egyptians believed their kings were gods in human flesh. Thus they were so hallowed to be called ordinary names. Even sacrifices were made to them while still alive; and temples erected in their honor after death.

The early pharaohs ruled wisely. Their main concern was to maintain the worship of the numerous deities in Egypt. Civil matters were handled by appointed officers. The principal officer was the prime minister or vizier. He was also responsible for the administration of justice. Initially the crown prince always held this office, this afforded him the opportunity to gain experience in the art of governance. Latter the office fell into the hands of the noble.

The entire country was divided into districts called 'nomes' and each nome was administered by an officer called 'nomarch'. Their main function was to collect taxes and account to the national treasure. Taxes were paid in kind till about 400 B.C. Initially, all the land belonged to the king and the nobility. The masses were treated well.

About 500 B.C., during the twenty-seventh Dynasty, Egypt started showing serious signs of decline. The Persians invaded it again and formed the thirty and thirty-first Dynasties (c.360-332 B.C). At this point Alexander the great invaded Egypt and established his kingdom changing the name of the capital to Alexandria (c.332 B.C). He ruled for ten years and the era of the Ptolemies – Alexanders generals started. Black Cleopatra ascended the throne about 57 B.C. she was involved with Julius Caesar and Mark Anthony, and allegedly committed suicide after Mark Anthony's defeat at the battle of Actium in 31 B.C after which Egypt became a Roman province.

Religion: The Egyptian contribution to the development of religion is outstanding. But one may ask why a slot in religion while we are here concerned with the origin of science? The analysis of the importance of religion in the development of science will be put off till the chapter on science in the medieval period. For now we are concerned to examine the leading role of Egypt in the development of religion. Egypt reached the apogee of its religious development in the fifth Dynasty (2450B.C.); and the Memphite Theology Text was written about this time.

Like all ancient Africans; the Egyptians were a very religious people. They worshipped many gods. Every village, town and district had at least one recognized god. The total number of gods in Egypt during this time was more than two thousand. Of these, only a couple was outstanding and eminent. Some of these are Ra, Shu, Horus, Osiris and Isis, Ptah and Ammon.

Apparently, the prominent god of a city becomes more powerful than the others as the city becomes more politically powerful and strategic. Example is the Ptah, the god of Memphis, which became general overseer of the universe created by Ra. Ra is the sun god, Osiris is the god of the Nile and the judge of the dead; and Isis is his wife. Ra the sun god was regarded as the lord of heaven and earth, the creator of everything: man, woman, beast, the Nile, the mountain and everything in the water and on land. Osiris was the king of eternity. He judges

every soul by weighing them in the Great Balance. The Egyptians believed in life after death, thus the practice of mummification.

An essential feature of Egyptian religion is the existence of Egyptian priests. They held high social positions and were respected accordingly. Large acres of land were dedicated for the maintenance of tempel services. These lands were the property of the gods as such they were not taxed. The priests controlled the tempel land and slaves attached to them.

Ancient Egypt Ideal of Science:

Let us conclude this section by outlining the ancient African-Egypt Ideal of Science. The African-Egypt science was basically rudimentary. It was deeply heuristic, operating at the level of trial and error, guesswork and luck. It used the method of the simple rule of the thumb learning-process. Science in the hands of the ancient Egyptians could not transcend the temporal and the particular. Hence deliberate abstraction or theorizing was apparently lacking in it. Ancient science was intimately interwined with ancient religion and could not distinguish between the objective and the subjective. But nonetheless the seeds of the developments in modern science were already sown in ancient Egyptian science.

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