

HUMANITIES INSTITUTE

## AFRICAN SCIENCE

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**Overview** Africa is the earliest home of human beings. *Homo sapiens*, the human like ancestor with whom we feel most at home, clocks in at 90,000 years ago in Africa, but on the African continent we find worked stone tools dating from well over three million years ago, while from then on we encounter creative vestiges of early African humanity, down through the millennia; multiple proofs of the adaptability, ingenuity, and scientific capacity of the ‘African mind.’ From the following survey we will pick up at least the names of some of the highest points of African scientific achievement. What you will not find is any adequate accounting for the poor press African scientific achievement has received, in the view of the outside world. Concern with African scientific achievement inevitably involves the query why African science has been slow to reach the cultural mainstream. We allude to this issue at the end. Otherwise we limit ourselves to remarks on some of the pre eminent African achievements in astronomy, math, architecture, metallurgy, medicine, and navigation.

**Astronomy** The Egyptians were from their earliest dynasties, five millennia B.C.E., conscious of the basic movements of the sun and of the planets in the solar system. From the experience of the annual rhythms of the river Nile, which governed their all-important agricultural growing seasons, the Egyptians were deeply aware of the regularity of the cosmos, which they early on invented mathematical tools to analyze, and to extrapolate from, for instance by aligning their eighty great pyramids to the position of the stars. (Astronomers by setting, the ancient Egyptians shared and borrowed with their nearby River-driven cousins, the Sumerians, whose analyses of nature were prompted by the annual flooding of the Tigris and Euphrates.) What more need be added, to this account of original African skill in astronomy, than to mention the two extraordinary ‘medieval’ African sites of Mali’s Dogon country and Mali’s Timbuktu. In the former culture, florid still today in the cliffs around Bandiagara, traditional lore recounts the Dogon people’s (then millennial) understanding of star movements, the orbits of the moon and stars, of Saturn’s rings and Jupiter’s moon, and particularly the movements of Sirius B, the to modern astronomers still virtually invisible twin shadow star to Sirius A. The ancient manuscripts of Timbuktu, many dating from the 12th to the 17th centuries C.E., are being translated as we speak, and disclose accurate stellar measurements rivalled only by the latest telescopes of our day.

**Mathematics** For their astronomical calculations, the pyramid-building Egyptians made notable advances in fractal geometry, while many centuries later Yoruba mathematicians, in today’s Nigeria, developed elaborate computational systems, in which, for example, figuring by units of twenty, or highly sophisticated uses of subtraction are prominent.

**Architecture** The skills required for major architectural projects inevitably involve both math and astronomical skills, both of which are pressed to their highest level in, say, the precise alignments of the great pyramids in Egypt, in which monumentality and delicacy blend. The subsequent history of African architecture is a mosaic tribute to the talent and flexibility of African architects, dealing as they often did in friable or hard to extract materials, and with challenging means of construction. For careful hewn power, cf. the great mosques of Djenne and Mopti, in Mali (12-13 centuries), the Sankore mosque at Timbuktu, or the Walled City of Great Zimbabwe, the largest ancient structure south of the Sahara.

**Metallurgy** Metallurgy was the driving power behind the technical skills of African construction. Iron smelting was known on the continent from 2500 B..C.E., and iron tools played from the earliest period an abundant role in African construction: chisels, saws, copper tools, nails, glue. Tanzanian blast furnaces, it seems, outeated (1800 degrees centigrade) their contemporary counterparts in ancient Rome. The prevalent use of iron products, from the earliest period of African history, fostered the revolutions in agricultural technique, which write the largest story of the growth of food stuffs on the African continent.

**Medicine** It is no surprise that Egyptian culture, in its five millennia, generated some of humanity’s first systematic efforts at medical treatment. The Egyptians established medical schools, promoted the practices of surgery and sterilization, and made important steps toward understanding mental health. There was a bevy of post-Egyptian medical discoveries, many of them derived from close observation of the properties of native plants. Long

prior to the European incursions, concoctions for treating malaria or diarrhea (kaolin) joined pain killing (salicylic acid) and abortion causing plants, in the quest for the improvement of daily life. Medical interventions were, however, taken much farther than this. Bone setting and traction were refined; everything from (limited) brain surgery, to Caesarean sectioning was made possible; antiseptic conditions were assured and refined.

**Navigation** Africa has abundant and vast inland waterways, which were from the earliest times both a challenge and a stimulus to transportation on the continent. The pronounced advancement of waterway vessels yielded, from what we know, to considerable ocean-going vessel traffic in the African middle ages. Unverifiable legend indicates that African trans-oceanic shipping reached both South America and Asia, in the mediaeval period.

**The African achievement in science: some comparative thoughts** Perceived opinion supports the assumption that the scientific mind--at least west of Asia--came to birth in the Greco Roman quests to discover the nature of man and his place in his world. Pythagoras, Euclid, and Aristotle laid down developmental principles which by the Renaissance, and soon the eighteenth century, had generated an Enlightenment mentality, which observed the world and used it. This narrative was established and supported by Western thinkers--from Aristotle to Diderot--for whom other traditions, like the African (or Chinese) were almost unknown. African achievements in science, which were considerable, were not written into the larger account of human development, though African achievements were significant, greatly enriching life for Africans. In a global age such as ours hopes toward, much can be gained by recognizing the commonality of our human effort to make life on the planet beautiful and meaningful. One gain could be the commitment to inter-continental--African and Western--collaboration, at every level of scientific inquiry.

### Reading

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Govindarajan, Vijay; Trimble, Chris, *The Other Side of Innovation: Solving the Executive Challenge*, Hanover, 2010.

Katz, Victor; Imhausen, Annette, *The Mathematics of Egypt, China, India and Islam: A Sourcebook*, Princeton, 2007.

Strouhal, Eugen, *Life in Ancient Egypt*, Norman, 1989.

### Discussion questions

Were there specially creative centers of scientific development in Africa? Egypt? Timbuktu? Bandiagara? Zimbabwe? Are there modern African centers that belong in this list?

What is the present state of scientific achievement on the African continent? Is there anything significant going on, in the way of an indigenous African science today?

Metallurgy assured the abundance of tools in many parts of ancient Africa, and at various times. Were there factories? Where were tools made? How were they distributed?

South Africa is today home to the one of the world's most powerful telescopes. Did the great astronomers of earlier Africa have telescopes? Or did they do their work with visual observation and mathematics?

Did African scientists have contact with European or other 'foreign' scientists, during the long centuries when indigenous African scientific knowledge was assuming mature form?

Diverse methods of time telling led to a wide range of different calendars throughout the history of African societies. What principle differences separated those calendars? What role did higher mathematics play, in the establishment of those calendars?