

SCIENCE IN AFRICA

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1. INTRODUCTION

Science has been used for coping with basic human needs in food, water, energy, healthcare, environment protection and in the alleviation of poverty. This has been true at all times and in all places. This is true of Africa as it is of other places. However in the case of Africa the intervention of colonialism masked indigenous knowledge that had served African communities for millennia. In modern post colonial times several African countries have adopted, formally and informally, Science and Technology policies for national socio-economic development goals at all levels of society. The greatest challenge facing advocates of science-led development in Africa today is devising mechanisms to fuse science and African cultures in such a way that science becomes a driving force for the improvement of the overall quality of life for all people. This paper attempts to present a panoramic state of scientific bibliographies and archival sources on Africa's past and present contributions to the world science.

2. SOME BIBLIOGRAPHIES AND ARCHIVAL SOURCES

2.1 SOME MAJOR WEBSITES

A most comprehensive website on African history is <http://www.africahistory.net> managed by Professor Gloria T. Emeagwali <http://www.africahistory.net/cv2004.htm> who is a Professor of History and African Studies at the Central Connecticut State University, New Britain, CT06050 USA. Email: emeagwali@mail.ccsu.edu

Also: <http://www.members.aol.com/afsci/africana.htm>

AFRICA'S HISTORY <http://www.africahistory.net/afrihist.htm>

“African Indigenous Knowledge Systems: implication for the Curriculum” This is an outline of links to other sites (including selected books available from Amazon.Com) and brief historical summaries on African history, science and technology. The site presents various perspectives on African Indigenous Knowledge Systems (AIK) from a wide range of scholars Brief extracts from scholarly works on the subject are published and there is focus on several areas. <http://www.africahistory.net/AIK.htm>

African Timeline: <http://www.africahistory.net/africantimeline.htm>

Colonialism and Africa's Technology
<http://www.africahistory.net/colonial.htm>

Research on the historical development of the African continent and its people during the last 12,000 years in light of the complex interrelation between Man and changing environmental conditions. [Arid Climate, Adaptation and Cultural Innovation in Africa](#)

2.1.1 Derivative websites

Internet African History Sourcebook

<http://www.fordham.edu/halsall/africa/africasbook.html>

Microbiological perspectives on Nigerian Food Processing (R N Okagbue)

<http://www.africahistory.net/okagbue.htm>

TEXTILES IN NIGERIA (Philip J Shea) <http://www.africahistory.net/shear.htm>

AFRICAN MATHEMATICS Pre-colonial Northern Nigeria (AHMAD KANI)

<http://www.africahistory.net/kani.htm>

Ancient Egyptian Astronomy (Dr Theophile Obenga)

<http://www.africahistory.net/obenga.htm>

AFRICAN FRACTALS (Ron Eglash)

<http://www.africahistory.net/roneglash.htm>

<http://members.aol.com/africahist/gerdes.htm>

<http://members.aol.com/afriforum/colonial.htm>

METALLURGY IN PRE-COLONIAL BORGU, WEST AFRICA (Dr Olayemi Akinwumi) <http://www.africahistory.net/metal.htm>

The Faces of Science: African Americans in the Sciences

<http://www.princeton.edu/~mcbrown/display/faces.html>

Index of African American Inventors: Historical

The Faces of Science: African Americans in the Sciences

http://www.princeton.edu/~mcbrown/display/inventor_list.html

Source: Charles Isbell. Partial Lists of African American Inventors.

Inventions and Patent dates

http://www.ai.mit.edu/~isbell/HFh/black/events_and_people/009.aa.inventions

The Past: "What Has Happened Before?". Profiled here are African Americans and women who have contributed to the advancement of science and engineering. The accomplishments of the past and present can serve as pathfinders to present and future engineers and scientists. African American chemists, biologists, inventors, engineers, and mathematicians have contributed in both large and small ways that can be overlooked when chronicling the history of science. By describing the scientific history of selected African American men and women we can see how the efforts of individuals have advanced human understanding in the world around us.

Index of African American Inventors: Historical

AFRICAN MATHEMATICAL UNION COMMISSION ON THE HISTORY OF MATHEMATICS IN AFRICA

http://www.math.buffalo.edu/mad/AMU/amu_chma_03.html

US Black Engineer Magazine

The Black Community's Technology News and Information reaching 120,000 readers in the US, UK, Caribbean, and Africa (last update 11 June 2005)

<http://www.blackengineer.com/artman/publish/index.shtml>

AfroCubaWeb: the African cultures in Cuba- Yoruba – Congo – Dahomey – Abakwa ... <http://www.afrocubaweb.com>

Amazon.com: Books: The Culture and Technology of African Iron Production

<http://www.amazon.com/exec/obidos/ASIN/0813013844/gloriaemeagwaofA/103-853...>

Amazon.com: Books: Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures

<http://www.amazon.com/exec/obidos/ISBN%3D0792340663/gloriaemeagwaofA/103-...>

Mathematics (Beatrice Lumpkin) <http://www.africahistory.net/lumpkin.htm>

AFRICA UPDATE: is the quarterly newsletter of the African Studies Central Connecticut State University.

http://www.ccsu.edu/afstudy/africaupdate_archives.html

<http://www.ccsu.edu/afstudy/archives.html>

Conversations on AIDS (Part 2) <http://www.ccsu.edu/afstudy/upd9-1.htm>

Great Zimbabwe

<http://www.scholars.nus.edu.sg/landow/post/zimbabwe/art/greatzim/gzl.html>

Amazon.com: Books: Science and Technology in African History with case studies from Nigeria, Sierra Leone, Zimbabwe, and Zambia

<http://www.amazon.com/exec/obidos/ISBN%3D0773495576/gloriameagwaofA/103-...>

2.2 SCIENCE AND TECHNOLOGY WEBSITES

- **African Indigenous Science and Knowledge Systems Page** (Dr. Gloria Emeagwali, Department of History, Central Connecticut State University) An outline of links to other sites (including selected books available from Amazon.Com) and brief historical summaries on African history, science, and technology.
- **African Technology Forum Consulting Office (2004)** *Excerpts from Sample Issues.* (Cambridge, Massachusetts) *Note:* This site includes electronic versions of "feature articles" only from selected back issues of ATF's journal, "Forum". The printed version of this journal has been suspended. "African Technology Forum is the premier source of information on science and technology in Africa. We provide practical

information to corporations, individuals and institutions in the US, Africa and the rest of the world."

- **AllAfrica.Com--Business & Technology Center** (AllAfrica Global Media, Washington, DC) Current and recent news from all over the African continent on business news. The principal sources of news reporting are African newspapers and news services, and UN agencies. *Warning:* the searchable archive for articles older than 30 days is only available through subscription.
- **Bioline International Publications: Abstracts, Full Texts for Selected Journals, and Subscriptions** (Centro Referência Informação Ambiental, Brazil; Electronic Publishing Trust for Development, UK.)
 - A selection of African science journals, plus numerous others from outside of Africa, can be accessed online. There are also links to technical reports and newsletters. This is a program that allows the reader to view the abstracts and full-text of a small number of science journals without charge. However, to view online or receive full texts of other titles in this collection, *paid* registration is required. There are journals from Nigeria, Senegal, Kenya, Uganda, Zimbabwe, South Africa....including:
 - [African crop science journal. \(Online\)](#) -- Kampala, Uganda: Makerere University, Faculty of Agriculture and Forestry ; African Crop Science Society, 1995-
 - [African journal of biotechnology. \(Online\)](#) -- Nairobi, Kenya: Academic Journals, Inc, 2002-
 - [African journal of food and nutritional security. \(Online\)](#) -- Nairobi, Kenya: Quest and Insight Publishers ; Friends-of-the Book Foundation, 2001-
 - [African journal of neurological sciences. \(Online\)](#) -- Nairobi, Kenya: Pan African Association of Neurological Sciences, 1995--
 - [African population studies. \(Online\)](#) -- Dakar, Senegal: Union for African Population Studies, 2002-
 - [Ichthyological bulletin. \(Online\)](#) -- Grahamstown, South Africa: J.L.B. Smith Institute of Ichthyology, 1995-
 - [Journal of food technology in Africa. \(Online\)](#) -- Nairobi, Kenya: Innovative Institutional Communications, 2001-
- **Birds of Africa on the Internet** (Karen Fung, Stanford University Libraries, Stanford, California)
- **African Frogs** (Robert C. Drewes, Department of Herpetology, California Academy of Sciences, San Francisco, California) This illustrated site summarizes research carried out by the author since 1986...in *East Africa*: Uganda, Kenya, and Tanzania.
- **Chemistry in Africa WebAnalytes: Analytical Chemistry Web Directory.** (Ghirma Moges, USA) An extensive list of links to Africa-specific and general chemistry and other science-related resources,

including Chemistry departments at African universities and African scientific associations.

- **Climate and Environment in Africa** (via Columbia University Libraries)
- **Health Information and Health Organizations on Africa** (via Columbia University Libraries)
- **International Network for the Availability of Scientific Publications: [African Journals On-Line](#)** (Oxford, UK) A tables-of-contents service, with an option for full text services through paid subscription. There is also a *photocopy or document delivery service* for individual journal articles of some titles. The following journals are covered: *Afrique et développement*=Africa Development; African Crop Science Journal; African Journal of Political Science; Bulletin of the Chemical Society of Ethiopia; CODESRIA Bulletin, Discovery and Innovation; Ghana Journal of Agricultural Sciences; Insect Science and its Applications; SINET:Ethiopian Journal of Science; and, Zimbabwe Veterinary Journal; and others.
- **The Internet in Africa** (via Columbia University Libraries)
- **Maps of Africa** (via Columbia University Libraries)
- **Science in Africa. (Online)** -- Grahamstown, South Africa : Science in Africa, 2001- Current issue and back issues since January 2001. A *popular* monthly news magazine about scientific research and development on the African continent, plus information about funding and job opportunities and links to organizations.

Scientific Societies and Institutions in and on Africa

- See also: [Scholarly Associations and Other Directories \(General\)](#), via Columbia University Libraries.
- **The Working Group on Space Sciences in Africa**
- ([South African Astronomical Observatory](#), Foundation for Research Development, Cape Town, South Africa)
 - "[Since September 1996] The Working Group seeks to promote the development of the space sciences in Africa by initiating and coordinating various capacity-building programmes throughout the region. These programmes fall into a broad spectrum ranging from the promotion of basic scientific literacy in the space sciences to the support of international research projects."
 - [WGSSA Home Page](#)
 - *African Skies. (Online)* -- Cape Town, South Africa: Working Group on Space Sciences in Africa; via South African Astronomical Observatory, 1997- [ISSN 1027-8389] Back issues

available (some in HTML, PDF, or Word): [1 \(May 1997\)](#) | [2 \(Apr. 1998\)](#) | [3 \(Jan. 1999\)](#)
[4 \(Dec. 1999\)](#) | [5 \(Jan. 2001\)](#) | [6 \(Dec. 2001\)](#)
[7 \(May 2002\)--PDF](#) | [8 \(Oct. 2003\)--PDF](#)

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- **World Data on Education = Données mondiales de l'éducation (2004)** (UNESCO International Bureau of Education, Geneva, Switzerland) A library of profiles and reports on national education systems worldwide -- searchable by country. The information is based on UNESCO and government reports ; plus related links. See especially: [National reports for 2004](#) presented at the 47th International Conference on Education, 8-11 September 2004, Geneva, Switzerland.
- [AAAS Africa Program](#) - American Association for the Advancement of Science capacity-building effort, promoting access to scientific and technical information, R&D in support of development, and improved links with the international community.
- [Africa - Forestry, Agroforestry and Environment](#) - Promotes the protection, health and sustainability of African forests and forest environments.
- [Africa: Environment](#) - African studies links page.
- [Africa Journals On Line \(AJOL\)](#) - Offers the contents and abstracts from journals published in Africa in order to promote the awareness and use of African journals in the fields of agricultural sciences, arts, culture and literature, health, science and technology, and social sciences.
- [Africa Resources Trust](#) - Campaigns for the right of rural communities to benefit from sustainable use of their natural resources -- newsletter, projects, publications.
- [Africa Volcanoes and Volcanics](#) - Descriptions and maps.
- [AfricaLink](#) - A division of USAID that supports regional networks of African policy makers and scientists in agriculture, natural resource management, and the environment.
- [African Centre for Technology Studies](#) - An international inter-governmental policy research and training organization located in Nairobi, Kenya. The Centre's activities focus on the implementation of Agenda 21 and related conventions on biological diversity, climate change and desertification.
- [African Forestry Policy Forum](#) - Proceedings, summaries and case studies: August, 1996.
- [African Journals Online](#) - Tables of contents and abstracts of articles from journals in agricultural sciences, science and technology, health and social sciences, published in Africa.
- [African Scientific Societies and Associations](#) - List and links, compiled by the AAAS in 1998.

- [African Technology Forum](#) - Practical information on science and technology in Africa to corporations, individuals and institutions in the US, Africa and the rest of the world.
- [Africa's Natural Resources Conservation and Management Surveys](#) - Summary Proceedings of the UNU/INRA Regional Workshop. Accra, Ghana - March 1998.
- [AfriCover](#) - FAO project dealing with land cover assessment for the African continent, based on remote sensing and GIS techniques.
- [AllAfrica.com: Environment](#) - Links to current news stories from around the continent.
- [AllAfrica.com: Science and Technology](#) - Links to current news from around the continent.
- [Arid Climate, Adaptation and Cultural Innovation in Africa](#) - Research on the historical development of the African continent and its people during the last 12,000 years in light of the complex interrelation between Man and changing environmental conditions.
- [Arid Lands Information Network](#) - A network of Community Development Workers involved in drylands development. Information about activities, partners, publications, technologies.
- [Basel Convention Regional Centre Pretoria](#) - Aims to assist in building the legal, institutional and technological capacity of English-speaking African countries, enabling the management of hazardous waste in an environmentally sound manner as provided in the Basel Convention.
- [Biosafety News](#) - Monthly publication on agriculture, health, environment, biotechnology, and related matters throughout Africa, especially Kenya. Full contents and archives online.
- [Centre for Environment Information and Knowledge in Africa](#) - CEIKA's objective is to build African capacity for environmental management through the provision of relevant training and multi-media information and knowledge products.
- [Chemistry in Africa](#) - A resource for African Chemistry Departments, research and other organizations, plus databases for retrieval of the continent's scientific information.
- [Climate & Environment in Africa](#) - Columbia University - Area Studies
- [Congo Basin Forest Partnership](#) - Free association of public and private partners, working to reduce poverty and improve the lives of the Congo Basin's people through biodiversity, good governance and sustainable use and management.
- [Council for the Development of Social Science Research in Africa](#) - Offers information on activities, research, workshops and awards.
- [Down to Earth: Geographical Information for Sustainable Development in Africa](#) - Complete text of the 2002 book published by the Board on Earth Sciences and Resources. Covers Agenda 21 implementation, the use of geographic data, and GIS-based decision support systems.
- [Empowerment for African Sustainable Development](#) - A private non-profit corporation focussing on the empowerment of African people and

institutions operating in the area of environmental management and sustainable development.

- [Environment and Ecology](#) - Stanford University Libraries/Academic Information Resources
- [Environmental Information System on the Internet](#) - Environmental information management tools for implementing legal instruments related to the environment in Africa. Includes text of environmental legal instruments, training modules (in PDF format), portals for West Africa, Benin, Mali, Senegal, Uganda, North Africa, Morocco.
- [Famine Early Warning System \(FEWS\)](#) - Meteorological Analyses, Cold Cloud Top Graphics and Animations, Precipitation Estimates, CPC Global Monitoring and Analysis Products.
- [Food Supply Situation & Crop Prospects in Sub-Saharan Africa](#) - Report of the Global Information and Early Warning System (GIEWS) that provides an assessment of the current food supply situation in sub-Saharan Africa. Articles in PDF format.
- [GeoAfrica Earth Science Resource Directory](#) - Directory of earth science companies who have offices in Africa and who are geared to working in Africa.
- [Medicinal Plant Use in Africa](#) - People and Plants Online - Working Paper 1.
- [Natural Resources Development in the Sahel: The Role of the United Nations System](#) - UNU Press online book. Focuses on the problems of socio-economic development, environmental conservation, and the application of scientific knowledge and technological resources in the Sahel.
- [Participatory Development Communication: A West African Agenda](#) - CIME is a development communication program that reflects the interrelations between Communication at the grassroots level, the exchange of Information, two-way Media, and nonformal Education. This online book presents the conceptual framework that led to the articulation of the CIME program.
- [Resource Africa](#) - Information on natural resource management in Africa, targeting academics and practitioners based in the region.
- [Science in Africa](#) - A monthly magazine containing popular articles, research findings, events, scientific developments, and resources about science in Africa.
- [Scientific African](#) - An African-located institute hoping to enhance the worldwide accessibility to scientific publications from Africa.
- [Searching for a Cure: Conservation of Medicinal Wildlife resources in East and Southern Africa](#) - Identifies 102 medicinal plant species and 29 animal species as priorities for conservation and management action. September 1998.
- [Sustainable Africa](#) - Offers resources and links on water, energy, health, agriculture and biodiversity.

- [Sustaining the Future: Economic, Social, and Environmental Change in Sub-Saharan Africa](#) - UNU Press online book. The authors were given the objectives of analysing the trends and processes of environmental change in Sub-Saharan Africa, and of identifying key issues for reaching sustainable environmental and resource management in the region within the medium-term future until around the year 2005.
- [UNEP - The Eastern African Coastal Database](#) - Database provides access to environmental information in the region including documents, contacts, pictures, and maps. Comprehensive search functions.
- [UNESCO Nairobi Office](#) - United Nations Educational Scientific and Cultural Organization's Regional Office for sub-Saharan Africa. Information about programs, staff, online journals.
- [United Nations Environment Programme - Regional Office for Africa](#) - Acts as the link between the various units and centres of UNEP and the countries in the region, and promotes collaboration and partnerships with organizations active in sustainable development in Africa.
- [United Nations University Institute for Natural Resources in Africa](#) - Established in 1986 to catalyze the formation of human capital in science and technology for the effective conservation, management and utilization of Africa's natural resources.
- [Academy of Science of South Africa](#) (Pretoria, South Africa)
 - "The Academy of Science of South Africa was established in 1996. It is a member of the InterAcademy Panel (IAP) on which over 80 countries are represented ...ASSAf is a member of the InterAcademy Council (IAC)... The ASSAf has over 200 members who have been elected on the basis of significant achievement in the advancement or the application of Science."
 - [South African journal of science. \(Online\)](#) -- Pretoria, South Africa: ASSAf, 1996--
Table of contents for current issue and subscription information only.
- [African Academy of Sciences](#) (Nairobi, Kenya)

'The African Academy of Sciences was conceived on the 6th day of July 1985 when 22 prominent scientists met in Trieste, Italy, at the inauguration of the Third World Academy of Sciences (TWAS) and devised the concept of the African Academy of Sciences (AAS). Under the leadership of Prof. Thomas R. Odhiambo as the first elected President of the AAS, membership has grown rapidly from the initial 33 members in 1985 to 107 in 1995, representing 24 African countries and 5 countries overseas.'

[African Association of Pure & Applied Chemistry](#) (via University of Natal, Durban) This website contains an extensive directory of scholars based at universities all over Africa.

- [African Centre for Technology Studies \(ACTS\)](#) (Nairobi, Kenya) "The African Centre for Technology Studies (ACTS) is an international inter-governmental policy research and training organization... The Centre's activities focus on the implementation of Agenda 21 and related conventions on biological diversity, climate change and desertification."
- [African Institute for Mathematical Sciences](#) (Cape Town, South Africa) "The Institute is initially focussed on a one-year, postgraduate course covering many of the most exciting areas of modern science, taught by outstanding African and international lecturers. The course aims to develop strong mathematical and computing problem-solving skills and will lead to a Post-graduate Diploma in the Mathematical Sciences..."
- [ARIMA: Revue africaine de la recherche en informatique et mathématiques appliquées. \(Online\)](#) -- Paris, France: Institut national de recherche en informatique et en automatique (INRIA), 2002-- << La revue est née d'une collaboration scientifique Nord/Sud menée depuis plus de dix ans dans le sillage des activités [CARI](#) (Colloque Africain pour la Recherche en Informatique).
- [African Economic Research, Associations, Directories, Banks, & Other Institutions](#) (via "Business and Economic Information on Africa", Columbia University Libraries)
- [African Mathematical Union = Union Mathématique Africaine](#) (via Dr. Scott W. Williams, Department of History, State University of New York, Buffalo)
- General information about AMU, an organization formed in 1986, is offered here. The web site also provides access to the archives of the online newsletter on the history of Mathematics in Africa and links to related collections.
 - [AMUCHMA newsletter. \(Online\)](#) -- Buffalo, New York: African Mathematical Union Commission on the History of Mathematics, 1987-
 - [AMU Commission on Women](#) (est. 1986).
- [African Medical Research Foundation](#) (Nairobi, Kenya). This site offers news and other information about AMREF programmes (including "Flying Doctor Service") -- with offices in 4 countries: Kenya, Uganda, Tanzania, and South Africa. "AMREF is Africa's largest indigenous health charity, and for 44 years in partnership with local communities, governments and donors, has worked to research and alleviate Africa's health problems."
- [African Networks for Health Research and Development \(AFRONETS\)](#) (Sponsored by SATELLIFE, Watertown, Massachusetts). A clearinghouse website for news, announcements, contact information, e-

mail contributions, and online documents from newsletters on malaria, HIV/AIDS, tuberculosis, other diseases and health issues facing African populations. "An electronic conference for the 'African Networks for Health Research & Development'...established in 1997 to facilitate exchange of information..."

- [African Network of Scientific and Technological Institutions](#) (via UNESCO, Nairobi, Kenya)
 - The ANSTI/RAIST website -- in English or French -- provides links to activities at institutions all over Africa and offers access to online versions of articles appearing in the network's main publication:
 - [African journal of science & technology. \(Online\)](#) -- Nairobi, Kenya: African Network of Scientific and Technological Institutions, 2001--
- [African Scientific Network](#) (via Dept. of Physics, North Carolina A&T State University, Greensboro)
 - This website offers links to science-related programs, conferences, institutions, and forum among African scientists in and outside of Africa, including:
 - [Science, Mathematics, Engineering and Technology Programs in Africa](#)
- [African Scientific Societies and Associations: A 1998 Directory](#) (American Association for the Advancement of Science, Sub-Saharan Africa Project, Washington, DC). This directory is based on a survey conducted in 1997 and 1998 and supplemented by the *World guide to Scientific Associations and Learned Societies (1994)*.
- American Association for the Advancement of Science [Africa Program](#) (Washington, DC). "The AAAS Africa Program was inaugurated by AAAS in 1987, representing a concerned response on the part of U.S. scientists and educators to the institutional crisis their African colleagues were facing. Its establishment also represents the commitment on the part of U.S. scientific societies and donors to attempt to work with African institutions in order to address that crisis. Program activities center on improving access for African researchers to scientific and technological information, on encouraging other aspects of capacity building for universities and related organizations within the region, and on promoting productive collaborative ties between U.S. and African scientists and institutions."
- [Association for the Development of Education in Africa = L'association pour le développement de l'éducation en Afrique](#) (Paris, France). "The ADEA was established at the initiative of the World Bank in 1988. Its objective was to foster collaboration and coordination between development agencies in support of education in Africa. ADEA now focuses on developing partnerships between Ministers of Education and funding agencies..."

- [Association of Nigerian Physicians in the Americas](#) This site offers general information about ANPA, its annual conferences, and related events and activities.
- [Conseil Phytosanitaire Interafricain = Inter-African Phytosanitary Council: African Plant Protection Organization](#) (Yaoundé, Cameroun). Le site Web offre les informations les plus générales sur le conseil en français ou *en anglais*; de plus, on peut lire les dernières nouvelles du newsletter du CPI.
- [Education, en Afrique: un annuaire 1996-2004](#) (Association Paideia, France)
 - "Ces pages entendent constituer un annuaire non exhaustif des ressources utiles aux professionnels du développement de l'éducation en Afrique, qu'ils soient pédagogues, administratifs ou chercheurs. A cet effet, un peu plus de sept cents liens y sont regroupés..." Voir surtout:
 - [Les établissements](#)
 - [Enseignement supérieur](#)
- [Forum for African Women Educationalists \(FAWE\)](#) (Nairobi, Kenya)
 - General information about FAWE and its activities, plus contact information for national chapters. "The Forum for African Women [FAWE] ... brings together African women ministers in charge of national education systems, women vice chancellors of universities and other senior women policy makers in education in Africa. Founded in 1992, and registered in Kenya as a pan-African NGO in 1993, FAWE has 56 full members drawn from 30 African countries, 25 associate members comprising male ministers of education and permanent secretaries ... to stimulate broad policy reform and create a conducive environment for increasing parental demand for girls' education."
 - [FEMSA Project: Female Education in Mathematics and Science in Africa](#)
- [Herpetological Society of Africa](#) (via University of the Witwatersrand, Johannesburg, South Africa)
 - "Founded 1965, the HAA is dedicated to the study and conservation of reptiles and amphibians, particularly those of Africa."
 - Sample issue and tables-of-contents for: [African journal of herpetology. \(Online\)](#) -- South Africa: Herpetological Society of Africa, 1998-
- L'Institut royal des Sciences naturelles de Belgique: [Le Bâton d'Ishango...20.000 ans...le plus vieil objet mathématique = The Ishango Bone...20,000 years...oldest mathematical object](#) (Bruxelles)
 - Voir aussi: [Autour d'Ishango](#) (Vrije Universiteit Brussel)
- [International Society of African Scientists](#) (via DCANet, Wilmington, Delaware)

- "The International Society of African Scientists (ISAS) is a tax-exempt, non-profit organization founded in 1982 to promote the advancement of science and technology among peoples of African descent. It provides a medium through which scientists and engineers can channel their skills to solve technical problems facing Africa and the Caribbean."
 - ["Potential Benefits of Biotechnology to Agriculture in Africa and The Caribbean" -- 2001 ISAS Technical Conference, October 5, 2001, Wilmington, Delaware](#)
- [Mathematicians of the African Diaspora](#) (Dr. Scott W. Williams, Department of Mathematics, State University of New York, Buffalo). This directory includes African mathematicians from the African continent.
- Medical Research Council of South Africa (Tygerberg, South Africa)
 - [MRC Home Page](#)
 - [Publications and research news](#)
- MISR: Multi-angle Imaging SpectroRadiometer: Gallery Images for Africa (NASA--Jet Propulsion Laboratory, California Institute of Technology, Pasadena, California)
 - [Central and Southern Africa](#)
 - [Gulf of Guinea, Northeast Africa and the Middle East](#)
 - [West African coast and the western Atlantic](#)
- [National Mathematical Centre, Abuja, Nigeria](#) (via COMSATS--Commission on Science and Technology For Sustainable Development in The South, Islamabad, Pakistan)
- [National Research Foundation of South Africa](#) (Pretoria)
 - [NRF publications](#)
 - Abstracts and tables-of-contents from: [South African journal of science. \(Online\)](#) -- Pretoria: National Research Foundation, 1997--
- [Société d'Entomologie africaine](#) (Chênée, Belgium). Ce site est en français ou en anglais. "S.E.A. est une société entomologique axée sur les Coléoptères et Lépidoptères. La société a été créée en 1994. Depuis 1996, on publiait la revue, *Entomologia Africana*."
- [Society of Africanist Archaeologists \(SAfA\)](#) (via Rice University, Houston, Texas)
 - The SAfA is an international organization of archaeologists, researchers from associated disciplines and others who share an interest in African archaeology and African societies.
 - [Nyame Akuma -- Bulletin](#) (Tables of contents from the bulletin of the SAfA.)
 - [African Archaeological Review, vol 13 and 15 tables of contents; via H-Net Africa, Michigan State University, East Lansing\)](#)
 - [Conferences organized by related organizations, 2004-2005](#)

- [Society of South African Geographers](#) (via University of the Free State, Bloemfontein, South Africa). "The Society of South African Geographers was founded in 1994 when the (then) Society for Geography and South African Geographical Society joined together..."
- [SOMA-Net: Social Science and Medicine Africa Network](#) (Nairobi, Kenya). General information about SOMA-Net, conferences and other activities since 1995, and contact information on council members in different African countries. "To establish long-term holistic and sustainable solutions to health in Africa; by encouraging, facilitating and supporting research..."
- [South African Society for Animal Science](#) (Hatfield, South Africa). The website includes information on events, online issues of the South African Journal of Animal Science, online paper series, contact information of members in the South African Association of Professional Animal Scientists, and related links especially in the field of *livestock production*.
- [South African Society for Atmospheric Sciences \(SASAS\)](#) (via University of Cape Town, South Africa). "[Founded in 1983] ...our main aim is to stimulate interest and support for all branches of the atmospheric sciences, both in South Africa and in the broader context, including the rest of Africa."
 - [SASAS News](#)
- United Nations Division for Sustainable Development: ["Seminar on Artisanal and Small-Scale Mining in Africa = Séminaire sur la mine artisanale et la mine à petite échelle en Afrique"](#), Yaoundé, Cameroon, 19-22 November 2002: Programme and Report. Co-sponsored by the United Nations and the International Center for Training and Exchanges in the Geosciences. (New York)
- United Nations Economic Commission for Africa: [ESTNET: Science & Technology Network](#) (Addis Ababa, Ethiopia). A portal site for organizations, conferences, and projects in Africa; with country level information.
- [West Africa Rice Development Association \(WARDA/ADRAO\)](#) (Abidjan, Côte d'Ivoire). The West Africa Rice Development Association is an intergovernmental research association with a membership of 17 countries. Its mandate is to conduct rice research, training, and communications activities for the benefit of the West African region.
- [Zimbabwe Medical Graduates Worldwide](#) (via BT Internet, British Telecommunications). "This website should help MBChB and B.Pharm (Hons) graduates of the University of Zimbabwe's Godfrey Huggins School of Medicine keep in touch with each other. A standard entry contains name, E-mail address, year of qualification, city of residence, and a non-residential phone or fax number. There are links to sites in

Zimbabwe and to Medical & Other sites, and a Photo Library of Zimbabwean Wildlife and Scenery."

- Zimbabwe Academy of Sciences (zas@zarnet.ac.zw) The youngest academy in Africa founded in 2004 with merit-based membership.
- Research Council of Zimbabwe (rcz@zarnet.ac.zw). A statutory body that advises the government on all matters relating to science and technology and co-ordinate research undertaken in the country. Top of Form

3. AFRICA'S SCIENTIFIC ANCIENT PAST

Northeast Africa is the cradle of African civilization as evidenced by a significant range of newly discovered sites which include: (a) the world's oldest stone tools dated 2.5 million years (<http://exn.ca/hominids/home>), (b) Olduvai, Northern Tanzania – second oldest in the world with tools dated 2.1 millions years, (c) Blombos Cave, South Africa where in 2003 the world's oldest jewellery, in the form of 41 perforated shell beads, were found. Here we have evidence of stylized artwork as well as the kind of symbolism and creativity we associate with modern humans (www.museum.org.za/sam/muse/9904/htm); (d) at Loiyangalani, Tanzania, East Africa, in the Serengeti National Park, decorated ostrich eggshell beads were discovered by archeologists. They point also to early human activity. These were found in March 2004, in layers dated between 280,000 and 40,000 years. More precise dates for the beadwork will emerge in due course. (www.CBC.ca/stories/2004/03/31/sci-tech/beads040331); (e) The Ishango mathematical/calendar artifact of East-Central Africa dated about 25,000 years which is at the Royal Belgian Institute of Natural Sciences, Belgium (www.naturalscience.be/expo/ishango/en/index.html). Another mathematical artifact is the 37,000 year old Lebombo bone of Swaziland. (f) Africa's oldest boat has been found in Ancient Nigeria and this is about 8,000 years old.

West Africa and other parts of the continent provide artifacts not only of iron, tin, gold and bronze metallurgy but also evidence of building technology, ceramics, maths and medicine. The relics of these technological accomplishments include the following monuments: (g) Aksum in Ancient Northeast Africa, (h) one of several temples, Lalibela, Ethiopia, (i) Ethiopian Temple (j) Queen Hatshepsut's Expedition to the Land of Punt (Horn of Africa), (k) the Gwoza Terraces of NE Nigeria, (l) Great Zimbabwe (m) The walled cities of Zazzau and Kano, Northern Nigeria.

Numerous metallurgical and other artifacts include (n) the bronzes of Benin, Ife and Igbo-Ukwu, Nigeria, (o) indigenous glasswork of Bid, Nupeland, Nigeria, (p) metallurgical artifacts of Mapungubwe (University of Pretoria) South Africa, (q) Africa's Oldest Boat of 8,000 years, Nigeria, ® ancient terracotta

figurines of Nok, Nigeria, (s) Ashanti Gold, Ghana, (t)Akan Metal casting (Arthur /Rowe).

The variety of writing material used in some parts of the continent, historically, reflects the complex history of Africa's writing systems which in the past were inscribed on materials such as parchment, papyrus, leather, skin, fabric, sand, clay, and metal more extensively in some parts of the continent than others. Among some of the writing systems are the following (Ayele Bekerie): Geez (Ethiopia), Meroitic (Nubia), Hieroglyphics (Egypt), Bamun (Cameroon), Vai (Liberia), Nsibidi (Nigeria/Cameroon), Ajimi (Nigeria/Niger) and the Adinkra pictographic system (Akan-ghana, Ivory Coast).

3.1 SELECTED SPECIFIC EXAMPLES

Traditional Medical Practitioners in Burkina Faso (Marian Addy)

Herbalists or traditional medical practitioners (TMPs) are the custodian of indigenous knowledge with respect to how African people treat themselves. Most of the time, scientists and clinicians either ignore them at best, or treat them with contempt. Governments also tend to ignore them. The TMPs in Burkina Faso believed that they had an herbal treatment for HIV/AIDS. Fortunately, these TMPs were not ignored, probably because they came together and spoke with one voice. Scientists teamed up with them to provide evidence-based approach to solving a health problem. The government contributed by requesting financial help from developing partners through WHO/AFRO, and now Burkina Faso has effective plant-based anti-retroviral therapy that belongs to the people!

Mapungubwe's contribution to Technology especially mining history (A.E. Duffey)

Africa, especially Mapungubwe and Great Zimbabwe have a long prehistory of mining, metalworking and trading in particular. Mapungubwe dated the 13th century shows ample evidence that mining has been going on in Africa for millennia. The Iron Age miners developed sophisticated techniques and expertise in digging narrow, sloping shafts known as adits, following seams down 30 metres or more until the gold ran out or they hit the water table. Gold ore was retrieved by cracking the rock using fire and water. The ore was brought to the surface, probably in baskets, where the fragments were crushed to yield a coarse gravel. The gold was then melted, smithed and fashioned into ornaments and jewellery. The gold wealth at Mapungubwe created a powerful state that traded through the Indian Ocean trade ports with Arabia, China, South East Asia and India. This technique of sloping shafts (adits) was practiced in southern Africa for 42 000 years or more. This is also based on evidence of mining by the San (of Botswana and Namibia) who extracted red, yellow and black ochres for rock paintings. The first true underground mines

anywhere in the world are at Ngwenya in Swaziland where ochre adits are preserved to this day.

Africa traded with India and the West from a very early date. Already in the ancient Mesopotamian world of the Akkadians sub-Saharan Africa (including India) was referred to as Meluhha. Raw material such as gold, copper and ivory were brought via India from Africa to Mesopotamia and the Mediterranean world. The Monsoon winds took the trading ships across the Indian ocean to India, creating the impression that all the riches of the ancient world came from India, whereas the truth of the matter was that it actually came from Africa. Tests done on wood specimens in ancient Egypt show that they came from Mozambique.

Metallurgy in pre-colonial Borgu, West Africa (Olayemi Akinwumi)

<http://africahistory.net/metal.htm>

As a result of European imperialism and the Anglo-French Convention of 1898, Borgu was divided between the French and the British. Today it falls within Nigeria in the East and the Republic of Benin in the West. The inhabitants are known as Bariba and Borgawa.

Large-scale iron making in Borgu has to do with the large quantity of iron ore deposits in the region. The soil contained limonite, haematite and gothite. Borgu was also rich in vegetal materials. Two important trees classed as *Butyrospermum paradoxum subsp. Parkii* and *prosopis africana* were available in large quantities. These trees were cut down and burnt to provide fuel. Prospecting for the ore was not simple. It involved extensive search. The reserve capacity of the field had to be evaluated.

The miners spent up to three months at the site digging and preparing for the smelting process. Miners usually went in groups with their families and all the necessary equipment. At the camping ground, referred to as (Zango) the miners chose a leader, who in most cases, enforced discipline in the camp and was responsible for all the necessary religious rites. After enough ore had been stockpiled, the next stage was the smelting process. This was done after the construction of the furnace and tuyeres. Termite clay with other mixtures was used in several areas. At Nikki Wenou, Nikki and Parakou, all regions in the Republic of Benin as present, termite clay was also preferred. This was eventually mixed with sand and other materials. This was done to make the furnace strong. The furnace was constructed after certain religious ceremonies and consultations. The tuyeres were then made in final preparation for smelting process. Smithing then ensued.

Ancient Egyptian Astronomy (Theophile Obega)

<http://africahistory.net/obenga.htm>

The oldest Pharaonic astronomical texts date back to the ninth Egyptian dynasty (c.2150BC). They gave the names of thirty-six stars which rise within ten days of each other at the same time as the sun. Regarding comets, astronomers seem to have recorded under Thutmosis III (1504-1450) the apparition of Halley's comet. This is possible for if comets visible to the naked eye are rare, comets which describe elliptic orbits are periodically observable: this is the case of Halley's and Encke's comets. The course of stars and planets was also a preoccupation of the Egyptians. According to Chabas (*Bibliothèque Egyptologique, 1903. vol. XI. Paris*) "Four thousand years ago, the Egyptians know that the earth moved in space and they did not hesitate to attribute the knowledge of this astronomical fact to the generations who had preceded them centuries ago." In antiquity the Egyptian civil calendar was the only calendar to be based on astronomy; this Egyptian calendar is the very foundation of our present calendar. Thales, the Greek sage, received his scientific education in Egypt, where the annual calendar of 365 days had been known as early as 4200BC and where the Great Bear, a constellation of the boreal hemisphere, was well and truly identified by the Egyptians, who called it "Meskhetyou."

Geometry from Africa: Mathematical and Educational Explorations

(Paulus Gerdes): <http://www.africahistory.net/gerdes.htm>

In the first chapter of *Geometry from Africa*, Paulus Gerdes present through some examples an overview of geometrical ideas in African cultures, as manifested in the work of wood and ivory carvers, potters, painters, weavers, mat and basket makers, and of so many other laborious and creative African men and women alike.

In the second chapter of the book he shows using examples from Senegal in the west to Madagascar in the southwest, how diverse African ornaments and artifacts, varying from woven knots to symmetrical designs and to infinite decorative patterns, may be used as a starting point to create an attractive educational context in which students may be let to discover the Pythagorean Theorem and find proofs of it. He explores connections to related geometrical ideas and propositions, such as Pappus' theorem, similar triangles, latin and magic squares.

In chapter three he analyses geometrical ideas inherent in various crafts and explores possibilities for their educational use. The chapter deal with topics such as symmetrical wall decoration in Lesotho and South Africa; house building in Mozambique and Liberia; weaving pyramidal baskets in the Democratic Republic of the Congo (DRC), Mozambique and Tanzania; plaited strip patterns from Guinea, Mozambique, Senegal and Uganda; finite geometrical designs from the Lower Congo region. Exploration of a hexagonal basket weaving technique from Cameroon to Kenya, Congo to Mozambique. The theme of the fourth chapter is the geometry of the Southern-central African sand drawing tradition – the drawings are called SONA in the Chokwe language (Northeast Angola).

Thomas Fuller and his African Mathematical education (AMU CHMA NEWSLETTER #3 (03/02/1989))

http://www.math.buffalo.edu/mad/AMU/amu_chma_03.html

Thomas Fuller, known as the Virginia Calculator, was stolen from his native Africa at the age of fourteen and sold to a planter. When he was about seventy years old, 'two gentlemen, natives of Pennsylvania, viz., William Hartshorne and Samuel Coates, men of probity and respectable characters, having heard, in traveling through the neighbourhood in which the slave lived, of his extraordinary powers in arithmetic, sent for him and had their curiosity sufficiently gratified by the answers which he gave to the following questions: First, Upon being asked how many seconds there were in a year and a half, he answered in about two minutes, 47,304,000. Second: On being asked how many seconds a man has lived who is 70 years, 17 days and 12 hours old, he answered in a minute and a half, 2,210,500,800. One of the gentlemen who employed himself with his pen in making these calculations told him he was wrong, and the sum was not so great as he had said – upon which the old man hastily replied: stop, master, you forgot the leap year. On adding the amount of the seconds on the leap years the amount of the whole in both their sums agreed exactly. [American Meseum, Vol. V, 62, Phila. 1799].

Another question was asked and satisfactorily answered. Before two gentlemen he gave the amount of nine figures multiplied by nine. ...In 1790 he died at the age of 80 years, having never learned to read or write, in spite of his extraordinary power of calculation. Fuller could find also the sum of geometrical progressions [F.D. Mitchell, Mathematical prodigies, American Journal of Psychology, Vol. XVIII, 1907, p.62]. It would be interesting to search for elements of the rich traditional African mathematical education Thomas Fuller had passed through before being sold as a slave to the USA.

African American Rice Technology in the Americas (Judith Carney)

<http://www.africahistory.net/aaricetech.htm>

Long before millions were transported across the Middle Passage West Africans had refined an elaborate food production system that displayed acute knowledge of landscape gradient, soil principles moisture regimes, farming by submersion, hydrology and tidal dynamics, and the mechanisms to impound water and to control its flow. The result was an array of rice production zones with a management portfolio more diverse than those occurring in Asia and more finely nuanced by micro environmental soil and water parameters. This was a system that over millennia minimized subsistence risks, enhanced human survival in drought-prone environments, and contributed to the dense populations of the Upper Guinea coast that were subsequently swept into the Atlantic slave trade. The knowledge and the expertise to adapt cultivation of a preferred dietary staple to New World conditions proved among the scant "possessions" remaining to slaves pressed into slavery from rice-growing regions. For those arriving in frontier South Carolina, a similar geographic

setting of diverse lowland habitats and climatic conditions optimized the transfer of a crucial farming system to North America.

African Fractals (Ron Eglash) <http://www.africahistory.net/roneglash.htm>

Fractals are characterized by the repetition of similar patterns at ever-diminishing scales. Fractal geometry has emerged as one of the most exciting frontiers on the border between mathematics and information technology and can be seen in many of the swirling patterns produced by computer graphics. It has become a new tool for modeling in biology, geology, and other natural sciences. Anthropologists have observed that the patterns produced in different cultures can be characterized by specific design themes. In Europe and America, we often see cities laid out in a grid pattern of straight and right-angle corner.

In contrast, traditional African settlements tend to use fractal structures – circles of circles of circular dwellings, rectangular walls enclosing ever-smaller rectangles, and streets in which broad avenues branch down to tiny footpaths with striking geometric repetition. These indigenous fractals are not limited to architecture; their recursive patterns echo throughout many disparate African designs and knowledge systems.

Great Zimbabwe (George P Landow)

<http://www.scholars.nus.edu.sg/landow/post/zimbabwe/art/greatzim/gzl.html>

This complex of ruins from which the modern nation of Zimbabwe took its name is one of the country's greatest historical and cultural attractions. Great Zimbabwe, the largest ruins in Africa, covers almost 1,800 acres.

Sited on an open wooded plain surrounded by hills, the ruins comprise the vast Great Enclosure complex, and on a nearby kopje the Hill Complex, a veritable castle of interlocking walls and granite boulders, while all around in the valley lie a myriad other walls. The ruins feature any array of chevron, herringbone and many other intricate patterns in its walls, and the astonishing fact is that despite the dry-stone technique used in Great Zimbabwe's construction (no mortar binds the stone blocks), the complex has endured for seven centuries.

The complex, which wealthy Shona-speaking cattlemen built between the thirteenth and fourteenth centuries, may have housed as many as 40,000 people at its height.

Art, Archeology, and Politics

Since Europeans first encountered the ruins of Great Zimbabwe, it has been the focus of ideological concern and conflict. Unwilling to believe that sub-Saharan Africans could have built such a structure, adventurers and ideologues long claimed the ruins a mystery, theorizing that ancient Phoenicians, Arabs, Romans, or Hebrews created the structures. In fact, since archaeologist

Gertrude Caton-Thompson's excavations in 1932, it has been widely known that Great Zimbabwe is truly of Africa and less than 10000 years old. Nonetheless, the White Rhodesians, whose ideology proclaimed the land "empty" of people and culture before they arrived, tried to rewrite history – even asserting that an African genesis for Great Zimbabwe was tantamount to treason. After the war of liberation, the new nation, discarded the name of Cecil Rhodes and, looking to the past for nobler origins, chose the name Zimbabwe.

3.2 OTHER EXAMPLES

In the website: <http://www.africahistory.net/AIK.htm> "African Indigenous Science and Knowledge Systems," Gloria Emeagwali lists the following, *inter alia*, sources which further illustrates Africa's past contribution to science and technology;

1. History of Africa (Gloria Emeagwali)
2. African Food Processing Techniques (Richard Okagbue)
3. African Textile Techniques (Phillip Shea)
4. African Metallurgy (Olayemi Akinwumi)
5. Colonialism and Africa's Technology (Gloria Emeagwali)
6. Mathematics in pre-colonial Hausaland, West Africa (Ahmad Kani)
7. Psychology: African Dimensions (Bruce Bynum)
8. Ancient Egyptian Astronomy (Theophile Obenga)
9. Eurocentrism and the History of Science (Gloria Emeagwali)
10. African Fractals – Modern Computing and Indigenous Design (Ron Eglash)
11. Geometry from Africa (Paulus Gerdes)
12. African Investigations into Space and Time (Astronomy) Charles Finch)
13. Rise of the West
14. Ancient Egyptian Mathematics (Beatrice Lumpkin)
15. Constraints on Africa's Growth: The IMF and Africa – Structural Adjustment (Gloria Emeagwali)
16. African Indigenous Knowledge Systems/Curriculum (Gloria Emeagwali)
17. Rewarding Traditional Knowledge/Benefit Sharing (Anil Gupta)
18. San/Pfizer Benefit Sharing Agreement on Dietary Drug, South Africa
19. African Rice Technologies in the Carolinas, USA
20. African American Quilts
21. African Metallurgy in the Caribbean
22. African Ironmaking Culture among African American Ironmakers.

4. CURRENT AFRICA'S CONTRIBUTION TO WORLD SCIENCE Science in Africa : A bibliometric approach.

N. Narvaez-Berthelemot*, J. M. Russell**, R. Arvanitis***, R. Waast***, J. Gaillard*** . Publié dans [Scientometrics](#) 54 (2) : 229-241, 2002

What is the state of art with respect to science in Africa ? Is scientific research in the continent focussed on issues related to development ? What is the role of basic research ? Is scientific capability in decline or is it taking on new directions ?

Regional scientific activity is a popular subject for bibliometric analysis. Nonetheless, the African region has received little attention from scientometric perspective, perhaps due to the backward nature of science in a continent that encompasses some of the poorest countries in the world. The globalisation of science has resulted, among other things, in a generalised increment in international scientific collaboration making necessary updated information on scientific co-operation, co-authorship and influence. This is important not only for the scientifically advanced countries but, perhaps, more so in the case of the developing world whose contribution to scientific achievement and legacy does not receive the same level of attention and reflection.

The purpose of this paper is to present an overview of the scientific output of the different countries that make up the African continent and to compare their evolution with the rest of the world. Data are also presented and analysed on their affinity with specific fields, institutional participation and production in international collaboration.

Methodology

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- Paulus Gerdes: Geometry from Africa: Mathematical and Educational Explorations. ISBN 0-88385-715-4, Mathematical Association of America, 1999.
- Olayemi Akinwumi: “Metallurgy in pre-colonial Borgu society” in G. Emeagwali (ed), African Civilisation: Technical, Social and Political Dimension, New York, American Heritage, 1997.
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Publié dans [Scientometrics](#) 54 (2) : 229-241, 2002