Pretoria Branch S_2A_3 News

February 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date: **Monday, 3rd March 2003**

Time: **17h15** (to 18h15)

Venue: **Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Dr Paulette Bloomer**
Department of Genetics
University of Pretoria

Topic: Conserving genetic heritage in endemic species of southern Africa

Refreshments will be served after the talk.

Talk Summary

Diversity within species is recognised in the International Convention on Biological Diversity as one of three fundamental levels of biodiversity. In comparison to species or ecosystems, however, patterns of genetic diversity are poorly understood and are inadequately addressed in conservation strategies. We are working towards redressing this by focusing on, amongst others, endemics of the Afrotemperate bioregion and the southwest arid zone. Examples will be discussed to emphasize that South Africa's endemics represent a rich genetic heritage that should be conserved.

The focus of the talk will be on endemic mammals, birds and freshwater fish, but new projects on frogs, lizards and insects will also be discussed.

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The history of man – Did modern man develop South of the African coast, in an area now covered by the sea?

Prof Govert van Drimmelen

First evidence of modern man in Europe

Ancient history often refers to the “change” that occurred in Eastern Europe and Western Asia 40 000 years ago. Around this time, people began to show a new behaviour, with dramatically increased stone tool productivity and versatility. Sustained continuous innovation with new utensils, made from different materials such as antlers, bone, ivory and wood, appeared in greater numbers. Creative art (for beauty, not for utility) became common. Surgical instruments, polished bone articles, gorges for fishing, eyed needles for sewing, spear-throwers and projectile weapons were made.

Most authors ascribe this “change” to newcomers in Europe, an area that was previously inhabited by Neanderthals only. The newcomers were of a modern human type, commonly referred to as the “Cro-Magnon Man.” However, the literature does not explain where the new Europeans that appeared 40 000 years ago, came from.

The period of change is called the “Upper Palaeolithic Stone Age.” The many industries created have been given regional names such as Perigordian, Aurignacian, Gravetian, Solutrean and Madeleinean or Magdalenian. The 200 000 year old Neanderthal people in the northern areas, who were well adapted to cold climate, participated in this Upper Palaeolihic Stone Age, but their hearths and elaborate decorated burials remained inferior to those of the Cro-Magnon-type people, who were named Homo sapiens. The Neanderthals continued maintaining their Mousterian culture throughout the Upper Palaeolithic Stone Age, until they disappeared 27 000 years ago.

Evidence for Aquatic development of man

In 1960, Sir Alister Hardy F.R.S., Professor of Medical Anatomy at the London University School of Medicine, wrote about the “Aquatic Experience in the evolutionary development of Man”. He discussed 15 Human Characteristics indicating that the human body developed in a watery environment. (“Was Man More Aquatic in the Past?” New Scientist 7 (1960), 642 – 645 – *See http://www.riverapes.com/AAH/Hardy/Hardy.htm for an electronic version of the paper. – Ed.*)

Discoveries in Africa

In Africa east of Cape Town, workers have discovered evidence of a Population that was not Neanderthal, but had Cro-Magnon characteristics. In 1967 and 1968 Ronald Singer, a South African anatomist connected to the University of Chicago, and John Wymer, an acheulian researcher from Britain, did intensive excavations in a cave above Klasies River Mouth, on the South Coast near Cape St Francis, where they discovered a human mandible with a prominent chin. Dated at 80 000 years ago (when only Neanderthals roamed in Europe), the mandible was for many years the oldest known Homo sapiens or Cro-Magnon-like specimen known. Singer and Wymer also found Teeth, jaws and cranial pieces from times dated 90 000 to 110 000 years ago. Homo sapiens was also discovered in other finds in Africa, e.g. at Omo in Ethiopia dated 130 000 years ago, in the Levant at Qafseh dated 92 000 years ago, and at Skhul, dated 125 000 years ago.

At the Klasies River Mouth, 80 000 years ago, the coast of Africa was already receding as the Sea level was lowered by the Last Ice Age. This ice age started 20 000 years earlier and the receding sea level began to expose the Agulhas continental shelf stretching 60 kilometres south of Africa. This would mean that a land area of 50 – 60 kilometres wide, with vegetation and animal life, was exposed at the southern tip of Africa for a period of roughly 60 000 years. This is twenty-four times as long as the total history of the Pharaohs in Egypt (2500 years). This stretch of land was similar to other land bridges e.g.

the land bridge between Asia and Alaska in the Behring Straights, the land in the Suna Straights between Borneo and Asia, the lands between Australia and New Guinea, Australia and Tasmania, and the land between The Falkland Islands and South America.

The people who lived in Klasies River Mouth at that time did so with a fully modern human lifestyle as described by Tom Prideaux, editor for Time- Life-International in "Cro-Magnon Man, the Emergence of Man" (Time-Life-Books 1973, Time Inc.). Prideaux outlined the life of people as: "A Home for modern man: The cave overlooked an open grassland, dotted with rivers and riverine bush and trees. The sea lay 50 kilometres away. The women collected seeds and berries and dug up roots and bulbs, the men hunted antelopes, ostriches, baboons, giant buffaloes, bush pigs and warthogs. They built windbreaks between the hearths and the mouth of the cave at Nelson's Bay, just west of Klasies River Mouth."

Latest discoveries

With this evidence in hand, the latest discoveries were made at Blombos Cave, only 300 kilometres east of Cape Town, near Stillbay-West and Riversdale. Here, Christopher Henshillwood of Cape Town and of the New York State University at Stony Brook, leads the work on discoveries of fully modern human people, who were living in South Africa more than 20 000 years before the Upper Palaeonlithic Stone Age in Europe. At Blombos Cave, evidence was found of engraved signs on ochre with carefully correct rectangular drawings, polished bone points; and artefacts engraved on bone. These were dated as being over 70 000 years old, since the cave was closed by dunes soon after the beginning of the Ice Age 70 000 years ago. The cave was opened only 5000 years ago, when the dunes were moved by wind action and the 25-metre entrance was entered by Christopher Henshlilwood in recent years.

Thus, the Southern tip of the East African Seaboard is the place where man first displayed symbolism. Here he started hoarding ochre with a high haematin content, collected from far and near for personal decoration, identification of position and social signalling. The artefacts found indicate a cognitive ability in connection with exchange of goods for the purpose of trade and otherwise.

Migration to Europe

From the Cape of Good Hope, these first fully modern human people spread from Africa to Australia (Mungo-Lake), to Europe (or Eurasia), to Borneo (Niah Great Caves in Sarawak) and to Swaziland (the Border Cave).

Northwards, along the East African Seaboard, from East London to Cape Guardafui on the horn of Africa, no significant sites of fossils have been found. This area is right next to the Great Rift Valley, in the area where most of the world's richest fossils happen to be. E.g. Sterkfontein, Oldovai, Laetoli, Turkana, Koobi Fora, Swartkrans, Hadar, Omo, Bodo, Kabwe. Yet, the coast and the continental shelves, during their 320 000 years of vegetable and Animal population, must have been occupied by many hundreds of thousands of hominids or hominins in the last half million years.

Conclusion

Due to the recent discoveries, Palaeoanthropologists now realise that the ape in the forest was merely a discard from the human genepool in the course of evolution. The important developments of language, the enlargement of the voicebox, the increase in brain-size and the enlargement of the forehead occurred in hominids on the eastern seaboard of Africa. This was, in fact, the area where the ancestors of modern human beings developed. Can it be that their bones on the ground were kicked in the dust, because they were believed to belong to slaves during the slave trade? Or were the bones left to turn to fish food; and the stone tools became pebbles on the beach in the coastal waves?

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Contributions to this newsletter

will be greatly appreciated. Please forward any news (in electronic format please – and less than 200 words) which might be of interest to members, whether scientific, professional or personal, to Walter Meyer ***wmeyer@postino.up.ac.za***.

Members are also strongly encouraged to make suggestions for potentially interesting speakers for our monthly talks.

Pretoria Branch S_2A_3 News
March 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date: **Monday, 7th April 2003**

Time: **17h15** (to 18h15)

Venue: **Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Prof. C.J.H. SCHUTTE**
Departments of Chemistry
at UP and UNISA
National Bioinformatics Network

Topic: **Discovering paleolithic mathematics**
A journey into the past

Refreshments will be served after the talk.

Talk Summary

It is well-known that “mathematics” in some form or another was extensively used in ancient times in Egypt, Mesopotamia and elsewhere. I asked myself the question: Was this rather astounding empirical knowledge developed by these ancient civilisations, or did it originate in an even more ancient form of “practical” mathematics that was part of the cultural heritage of mankind in the preceding phases of Paleolithic times?

Since no written records of these times exist, I tried to answer the question with my knowledge of modern mathematics by examining Paleolithic objects, such as “works of art” and decorations on objects, as well as artefacts, etc. and then tried to extrapolate backwards in such a way as not to over interpret my results.

My journey of discovery into the past became a great adventure, delving into mankind’s common cultural past, a past we all share. This lecture describes my “mathematical” journey into the Paleolithic past and presents some of the astounding results, using many illustrations.

Early science in South Africa: Determining the shape of the earth

Since the time of Classical Greece scientists have generally accepted that the earth is approximately spherical in shape. The Greek astronomer Eratosthenes (c. 276-296 BC) is credited with the first proper measurement of its size. He determined the height of the sun during the summer solstice at two places in Egypt, present day Aswan and Alexandria, and found the difference to be about seven degrees. Knowing the distance between them along a north-south line (a meridian), he derived a surprisingly accurate estimate of the earth’s diameter. His basic method was applied many times in later centuries. An important improvement that led to increased accuracy was introduced by the Dutch mathematician Willebrord Snell (1591-1626) in 1617: Instead of measuring the whole distance between the two places of known latitude, Snell determined it by means of triangulation from a very accurately measured baseline.

During the late seventeenth and early eighteenth centuries geodetic surveys seemed to indicate that the earth was not quite spherical. In 1735 and 1736 the French Academy of Sciences sent expeditions to Peru and Lapland respectively, to measure arcs of a meridian at these widely differing latitudes. The results showed that the shape of the earth was that of a spheroid slightly flattened at the poles. However, further measurements, especially in the southern hemisphere, were needed to confirm this conclusion.

De la Caille’s arc of meridian at the Cape

South Africa enters the picture at this stage. The French Academy again took the initiative and sent one of its members, the extremely productive astronomer Abbé Nicolas Louis De la Caille (1713-1762) to the Cape in 1751-1753 to measure an arc of meridian and catalogue the southern stars. He used his temporary observatory in Strand Street, Cape Town, as the southern end point of his arc and a spot near the present day village of Aurora in the Piketberg as the northern end point. A baseline nearly 13 km long was accurately measured with wooden rods on the Darling Flats. He used triangulation to determine the north-south distance between the two end points and star observations to determine their precise latitudes. The work was meticulously carried out and thoroughly checked, but the results sent shock waves through the scientific community. They showed that a meridian arc of one degree on the earth’s surface at the latitude of the Cape measured 111,17 km instead of 111,30 km as expected. This implied that, contrary to expectations based on Newton’s theory of gravitation, the shape of the earth’s southern hemisphere differed from that of its northern hemisphere, being slightly peaked rather than slightly flattened at the pole. This conclusion was unpalatable and not supported by later geodetic surveys in other countries, but De la Caille’s work could not be faulted.

Mountains are attractive in more ways than one

A possible solution to this enigma gradually took form. Isaac Newton had proposed late in the seventeenth century that it might be possible to determine the density of the earth by measuring the gravitational attraction of mountains. The French mathematician Pierre Bouguer (1698-1758), a member of the French geodetic expedition to Peru, first attempted to measure the attraction of mountains in the Peruvian Andes in 1738. The method was refined in 1775 by the Astronomer Royal of England, Neville Maskelyne (1732-1811), who determined that the gravitational attraction of the hill Schihallion in Perthshire, Scotland, was sufficient to cause an error of almost six seconds of arc in the measurement of latitude near its base. Thus, De la Caille’s observations of the latitudes of his two end points may have been affected by the attraction of nearby mountains. This possibility was investigated on the spot in 1820 when the famous surveyor

George Everest (1790-1866), after whom the world's highest mountain was later named, visited the Cape. He was on his way to India to participate in the survey of that country and in 1830 became Surveyor-General there. He suggested that De la Caille's anomalous results could indeed by explained in principle by errors of latitude resulting from the gravitational attraction of Table Mountain in the south and the Piketberg in the north. He proposed that new observations be made at the same spots, and that at the same time a longer arc of meredian be measured to circumvent the problem.

Sir Thomas Maclear to the rescue

Early in 1834 Thomas Maclear (1794-1879) arrived at the Cape as His Majesty's Astronomer at the Royal Observatory, Cape of Good Hope, which had been founded in 1820. One of his instructions was to re-measure and extend De la Caille's arc of meridian. Maclear spent much time trying to locate all De la Caille's observation points. However, he could not find the exact spot forming the northern end point of the earlier arc, despite questioning the oldest inhabitants of the region who had seen De la Caille at work when they were young children, more than 80 years earlier! Maclear therefore instituted a fresh survey. Exhaustive field work was carried out under very difficult circumstances from 1838 to 1847, with his assistants, particularly Charles P. Smyth (1819-1900), sitting out rain storms on freezing mountain tops for weeks at a time. The new arc stretched from the Royal Observatory in Cape Town northwards to a point beyond the Kamiesberg in Bushmanland. A baseline of just over 13 km was measured in the Zwartland and triangulation carried out from Cape Agulhas to Bushmanland. The results were published in two volumes in 1866 and proved conclusively that there is no significant difference in the shape of the earth's southern and northern hemispheres. Maclear also showed that the gravitational attraction of mountains, particularly that of "Castle Rock" near De la Caille's northern end point, was sufficient to explain the earlier anomalous results. He was knighted as a result mainly of his outstanding survey work at the Cape.

Postscript

A final episode relating to these geodetic measurements took place a few years ago when professor H. J. Deacon, Head of the Department of Archaeology at the University of Stellenbosch, successfully excavated the site of De la Caille's northern station and found the markers indicating the exact spot from which observations were made, just as De la Caille had described them almost 250 years earlier. A plaque now marks the site.

Cornelis Plug, plugc@mweb.co.za

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Members are also strongly encouraged to make suggestions for potentially interesting speakers for our monthly talks.

Pretoria Branch S_2A_3 News
April 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date: **Monday, 5th May 2003**

Time: **17h15** (to 18h15)

Venue: **Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Prof. WJR Alexander**
Professor emeritus, Department of Civil and Biosystems Engineering
University of Pretoria

Topic: **Climate change and the return of Hurst's Ghost**

Refreshments will be served after the talk.

Talk Summary

Professor Alexander will take us on a guided tour of the structures in ancient Egypt that were used for measuring the water levels in the Nile River. In 1950 Hurst studied these records as well as those of other geophysical processes. He found anomalies that were the subject of much debate, but remained unexplained. These were labelled 'Hurst's Ghost'.

Last year Prof. Alexander assembled and studied 11 804 years of hydrometeorological data. The purpose was to search for characteristics in the data that could possibly be linked to climatic perturbations. Using graphical analyses he found some new insights and others that are contrary to widely held beliefs. He concluded that Hurst's Ghost will continue to haunt those who intend developing models for the determination of the effects of climate change scenarios on environmental processes.

Stiffy disks containing copies of Prof. Alexander's recent publications on climate change, plus the full set of hydrometeorological data used in his analyses will be distributed to participants.

Climate change and the return of Hurst's Ghost – Introduction

Prof. WJR Alexander

The annual flooding of the fertile flood plains of the Nile River was the foundation on which the ancient civilisations of Egypt were built. The earliest evidence of routine hydrological observations, is the regular horizontal engravings on a stone wall on an island at Aswan in the Nile River. These were used for measuring the water levels in the river.

The Temple of Edfu dates back to 240 BC. A series of underground corridors leads to a chamber connected to the river. The temple priests kept records of annual flood levels and probably developed a model relating the rate of rise of the river level early in the season to the maximum level reached later.

Kom Umbu was built in Roman times. There is a large well in the courtyard with a spiral staircase winding down its sides. The bottom of the well is connected to the river. An annual tax was levied on farmers whose land benefited from the inundation by the fertile floodwater. The tax collectors developed a simple model relating the number of steps under water in the well, to the farms that were inundated. By counting the number of steps under water each year, the tax collectors could determine which lands were inundated and therefore taxable.

In 641 AD - more than a 1000 years ago - the architecturally beautiful water level gauging structure was built on Rodda Island in the Nile River at Cairo. The record from the Rodda Nilometer is the longest available hydrological record. In 1950 the civil engineer RE Hurst analysed 1080 years of data recorded during the period 641 AD to 1946 AD in order to determine the required storage capacity of the proposed Aswan High Dam. He found an unexplained anomaly in the data. He then analysed other long continuous records, where he found the same anomaly. These were varve deposits (2000 years), *river flow* (1080 years), tree rings (900 years), *temperature* (175 years), *rainfall* (121 years), sun-spots and wheat prices. His analyses have never been disputed, but they rattled the cages of some theoreticians.

In 1967, Lloyd published his paper on stochastic reservoir theory in which he wrote:

> *We are, then, in one of those situations, so salutary to theoreticians, in which empirical discoveries stubbornly refuse to accord with theory. We are forced to the conclusion that either the theorist's interpretation of their own work is inadequate or their theories are falsely based: possibly both conclusions apply.*

In 1974 Klemes in his paper The Hurst phenomenon: a puzzle?" wrote:

> *Ever since Hurst published his famous plots for some geophysical time series, the by-now classical Hurst phenomenon has continued to haunt statisticians and hydrologists. To some it has become a puzzle to be explained, to others a feature to be reproduced by their models, and to others still, a ghost to be conjured away. The attempts to derive theoretical explanations from the classical theory of stationary stochastic processes have failed.*

Today

Today the situation is unchanged, and we are still faced with opposing views. Academics tend to place their faith in mathematical theory, while pragmatists prefer graphical analyses. Who is right? This will be discussed in the forthcoming talk.

A South African scientific mystery: The locust fungus

Cornelis Plug, plugc@mweb.co.za

Locusts are those members of the large insect family Acrididae (order Orthoptera) that migrate in swarms and destroy vegetation. Two species have been mainly responsible for the locust plagues that periodically affected South Africa in earlier days. The brown locust, Locustana pardalina, formed swarms in the Karoo and Northern Cape and invaded all of southern Africa. The red locust, Cyrtacanthacris septemfasciata, had outbreak areas in flooded depressions to the north and from there invaded most of South Africa. After an invasion it often bred successfully in Natal for some years.

An understanding of how periodic locust plagues arise was achieved only during the early nineteen-twenties. Research at the British Museum and independently by the young South African entomologist Jacobus C. Faure (1891-1973) revealed that the brown locust occurs in two distinct forms, the well-known plague form of swarming hoppers (known colloquially as “rooibaadjies”) and a form like a common grasshopper, leading a solitary life. Faure showed that the plague form arose as a result of high population density. However, the events related below occurred around the turn of the twentieth century, when little was know about locust plagues, and the most common control measure was trampling by herds of cattle.

A.W. Cooper, discoverer of the locust fungus

Arnold W. Cooper, an attorney and justice of the peace, lived in Richmond, Natal. He had artistic talents, for in 1899 he provided illustrations for the book The diamond hunters of South Africa, by the popular author Alfred W. Drayson. He was a naturalist with a lively interest in microscopy, and a fellow of the Royal Microscopical Society. In 1896 he joined the South African Philosophical Society and remained a member to 1907. By 1906 he had also joined the South African Association for the Advancement of Science.

Cooper’s only known scientific publication is a paper, “Notes on a new species of Gymnoplea from Richmond, Natal ...” which was published in the Annals of the Natal Museum (Vol. 1, pp. 97-104) in 1906. He proposed that his new species represented a new genus of this group of small crustaceans.

In 1896 Cooper recognized the presence of a microscopic fungus on dead red locusts brought to him by a local farmer. Many of the insects had been killed by this fungal disease, which led him to start investigating the possibility of using it for locust control. He was awarded a small grant for this purpose by the government of Natal. However, he required expert help and therefore approached the Colonial Bacteriological Institute in Grahamstown that same year, where he and Dr. R.S. Black succeeded in producing a pure culture of the fungus on an artificial medium.

Fungus production at the Colonial Bacteriological Institute

The Colonial Bacteriological Institute was established in 1891 and directed to 1905 by Dr. Alexander Edington (1860-1928), who had qualified in medicine in Edinburgh in 1886. His research was mainly focused on the eradication of stock diseases, particularly horse-sickness. Dr. Robert Sinclair Black, who had qualified in medicine at the University of Aberdeen in 1889, joined the Institute as Edington’s medical assistant in May 1894.

The Institute produced the locust fungus in quantity and distributed it to combat the locust plague in various regions of southern Africa. Very satisfying results were reported, particularly in moist conditions. The Government Entomologist of the Cape Colony, Charles P. Lounsbury (1872-1955) noted in the Agricultural Journal of the Cape Colony in 1896 that the disease seemed allied to a fungal locust disease described earlier in France, and both he and Edington concluded that the fungus belonged to the group Empusa (a division of the Entomophthoreae), which live mainly on and within living animals. Locusts killed in field trials were investigated and the culture again obtained from their bodies.

Edington reported in 1897 that the fungus had been supplied to regions in East and North Africa, the United States, India, Australia, and Argentina, with excellent results. Dr. Black published his “Observations on the morphology and conditions of growth of a fungus parasite on locusts in South Africa” in the Transactions of the Philosophical Society of South Africa for 1896. Soon thereafter he left Grahamstown to take up the post of Medical Officer on Robben Island. Supplies of the fungus were produced and distributed by the Colonial Bacteriological Institute to at least 1904. However, by 1905 Lounsbury reported that the economic value of inoculating locust swarms with the culture was still in doubt. He pointed out that the fungus is naturally of widespread occurrence (hence inoculation may be unnecessary) and that specific weather conditions are required for its rapid development (hence inoculation may be ineffective). Meanwhile the fungus had been studied at the Royal Botanical Gardens at Kew by George E. Massee, who named it Mucor exitiosis in 1901.

I.B. Pole Evans bursts the bubble

Illtyd Buller Pole Evans (1879-1968), a Welsh-born botanist who had specialized in the study of fungi and plant diseases at Cambridge, was appointed as Mycologist and Plant Pathologist in the Transvaal Department of Agriculture in July 1905. One of the tasks he was expected to perform soon after his arrival was to prepare supplies of the locust fungus. However, as stocks were still available and locusts plentiful, he decided to investigate the fungus and its effectiveness before embarking on an expensive production programme. The results were astounding. It had recently been established that locusts are killed by the fungus Empusa grylli. However, this fungus requires living tissue for its development and could not be grown in artificial media. Pole Evans’ experiments showed conclusively that the locust fungus produced in South Africa, Mucor exitiosis, is harmless to locusts, and this finding was fully borne out by other investigators in countries that had received the culture. Pole Evans maintained that, as the original cultivators of the locust fungus “were only amateurs in the field of mycology, they failed to discriminate the Empusa growth from that of Mucor”.

Conclusion

Cooper and Black presumably cultivated the harmless fungus right from the beginning, and, owing to the fortuitous effects of the naturally occurring killer fungus, this ineffective remedy was applied with enthusiasm and acclaim in several different countries for years. Many other mistaken conclusions have caused similar flurries of excitement in scientific circles. The locust fungus episode demonstrates that great care is required in interpreting the results of field experiments. It also shows how important it is that the results of applied research should be backed up by basic research to elucidate the underlying principles.

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Date: **Monday, 2nd June 2003**

Time: **17h15** (to 18h15)
(Note: AGM at 17h00)

Venue: **Transvaal Museum,** Paul Kruger St.
(Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Prof Lucas Venter**
Department of Computer Science
UNISA

Topic: **Are all computer Scientists computer literate?**

Refreshments will be served after the talk.

Talk Summary

Computer Scientists in university departments are often accused of being computer-illiterate. In particular, the computer science lecturer is expected to know every small detail of the latest software as soon as it becomes available. Obviously, this is a very unfair assumption, particularly since lecturers cannot afford to buy a fraction of the software they would like to have.

In this talk we show that computer science is a very old concept, with a clear definition, even though it was not always known by this name. However, this term no longer describes the full scope of the activities in a typical Computer Science department. Hence we also define the modern term Computing, and show that this is the science studied by modern Computer Scientists. We give a very brief overview of this study field from its earliest roots to the modern subject as studied at tertiary level.

We trace the evolution of the term computer literacy from its inception in 1976 to the present. It is interesting to note that the meaning of this phrase has apparently changed substantially over this period. In order to understand this change, we then look at general views of literacy. We note that there are two generally accepted views of literacy, namely an instrumental notion and a view that literacy is a mediational process. This second view leads us to a definition of computer literacy that encompasses both the early and current meanings of the phrase.

We conclude our discussion by giving a motivated answer to the question in our title.

2003 Annual General Meeting

All members are invited to attend the AGM of the Pretoria Branch of the S_2A_3, to be held at the Transvaal Museum on the 2nd June 2003 at 17h00 (just before the monthly talk).

How long is a metre?

Cornelis Plug

Measurement is fundamental to science and technology, and indispensable in commerce and other aspects of life. The measurement of length, or distance, is relatively simple and has been practiced since the beginnings of written history, if not earlier. Thus the ancient Egyptians used a length unit of 524 mm, the so-called Royal cubit, when building the pyramids some 4600 years ago. Since then hundreds of length units have been used in different countries, often with regional and local variants. The resulting inconvenience led to proposals in Europe during the 18th century to introduce a single, universal unit of length, based on the size of the earth or some other natural standard.

Origin of the metre

In May 1790 King Louis XVI of France and his government requested the French Academy of Sciences to develop a system of units suitable for adoption by the whole world. Britain and the United States were invited to participate in the investigation, but both countries declined to do so. The Academy appointed a committee to study the problem. Among its members were two famous astronomer-mathematicians, Joseph L. Lagrange (1756-1813) and Pierre S. Laplace (1749-1827). The committee first recommended that the units of the new system should be decimally divided. In a second report they recommended that a new unit of length be created, equal to one ten-millionth of the distance between the earth's equator and the north pole, as calculated from measurements along part of the meridian through Dunkirk and Barcelona. Further progress was delayed by the French Revolution, but in 1793 the committee proposed the name "metre" (from the Greek "metron", a measure) for the new unit. Thus the distance from the earth's equator to the north pole would be, by definition, exactly 10 000 km. The post-revolution French government adopted the recommendations, and legalized the metric system (including also the gram, liter, etc) in April 1795. Meanwhile the determination of the length of the meridian quadrant, and hence of the metre, was carried out by the astronomers Pierre F.A. Mechain (1744-1805) and Jean B.J. Delambre (1749-1822). They reported their results in 1798.

Equivalents and standards

To describe the length of the metre in concrete terms it was expressed in terms of the best standardized existing French length unit, the toise of Paris (of 6 feet, times 12 inches, times 12 lines). The toise was widely used in earth measurements well into the 19th century, as it was represented by good standard bars in many countries. Having calculated the length of the earth's quadrant in terms of the toise, Mechain and Delambre could describe the metre as a length equal to 443,296 lines of the toise. Several platinum and iron bars of precisely this length were made to be used as metric standards.

Spread of the metric system

The change to the metric system proved to be slow and difficult, though once adopted it constituted a great improvement over earlier systems. By 1840 the system was in general use in France, Belgium, Holland, and Luxembourg. During subsequent decades it was adopted by more and more countries, though its progress in the English speaking world was limited. In 1875 an International Bureau of Weights and Measures (BIPM, from the French) was established, with headquarters in Paris, to develop and maintain suitable metric standards for international use. Guided by this Bureau, the metric system developed into the International System of Units (SI, from the French). Introduced in 1960, this system is now almost universally used in science, and is the only legal system in most countries of the world. A notable exception is the United States, where archaic units remain in use, causing international inconvenience.

From a theoretical to a practical definition

By the middle of the 19th century it had become clear that the theoretical definition of the metre in terms of the length of an earth quadrant did not enable scientists to specify its length very accurately. In fact, the metre based on this definition was later shown to be too short by about 1 part in 5 000. On the other hand, having once produced a standard metre bar, this could be reproduced with considerable precision. Hence the original definition was replaced by a more practical one: henceforth the metre was defined as the length, at a specified temperature, of the primary platinum metre bar that had been constructed in 1799. The length of this bar could be reproduced with an uncertainty of about 1 part in 50 000.

From end standards to line standards

In a continued striving towards greater accuracy, driven by the demands of science and industry, the newly founded BIPM soon reconsidered the definition of the meter once again. The platinum end standard, representing the metre by its total length from end to end, was subject to minute damage to its ends during copying. Hence a new international standard was produced in the form of a platinum-iridium bar with a carefully designed cross-section, on which were engraved two short, parallel lines which were exactly one metre apart at 0ºC. This line standard was adopted as the new prototype metre in 1889. It could be reproduced with an uncertainty of about 1 part in 5 million.

The metre in terms of the wavelength of light

In 1906 an accurate determination of the wavelength of a red line in the spectrum of Cadmium was carried out by three French scientists. The accuracy of their result was partly limited by the accuracy with which the metre could be reproduced. Hence the idea arose to redefine (and reproduce) the metre as a certain number of wavelengths of this spectral line. This practice was followed by spectroscopists, and provisionally sanctioned by the International Congress of Weights and Measures in 1927. However, an even more suitable wavelength standard was found, and in 1960 the BIPM redefined the metre as a length equal to 1 650 763,73 wavelengths in vacuum of a specific line in the orange part of the spectrum of the krypton-86 atom. This definition allowed the metre to be reproduced in national laboratories with an uncertainty of less than 1 part in 100 million.

The metre and the velocity of light

The demand for measurements of ever higher accuracy continued unabated. During the 1970s the accuracy with which the speed of light could be measured began to be limited by the remaining tiny uncertainties in the length of the metre. The speed of light in empty space, denoted by the small letter c, is an important constant in astronomy and physics. Astronomers in particular were keen to keep its numerical value exactly constant, unaffected by uncertainty with regard to the length of the metre. As time could be measured, by means of atomic frequency standards, with greater accuracy than length, astronomers proposed that the metre be redefined in terms of c and the second. This proposal was adopted by the International Congress of Weights and Measures in 1983, and the metre defined as the distance travelled by light (or other electromagnetic radiation) in a vacuum during a time interval of 1/299 792 458 of a second.

This definition is conceptual, rather than operational. Practical working standards of the metre require specific operating conditions, under which certain hyperfine-structure features of selected absorption-stabilized lasers will constitute a consistent set of frequencies and wavelengths that represent the metre accurately. These working standards allow the metre to be reproduced with an uncertainty of about 1 part in 300 million. No doubt the quest for even greater precision will continue.

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Pretoria Branch S_2A_3 News
July 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date: **Monday, 4th August 2003**

Time: **17h15** (to 18h15)

Venue: **Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Dr Paul Swart**
University of Pretoria

Topic: **Complex systems, pattern recognition and evidence based medicine**

Refreshments will be served after the talk.

Talk Summary

Reductionism has rescued medicine from the so-called expert opinion and changed it into a science. We now decide on therapies on the basis of prospective randomised blinded statistically analysed data published in peer-reviewed journals. Problem is that reductionism has severe limitations in a complex system. By explaining what a complex system is and explaining the pattern recognition decision making model as opposed to digital analysis one can understand why there still is so much uncertainty in medical science.

In Memoriam

Prof Govert van Drimmelen passed away on the 17th July. As former S_2A_3 national president and oldest living member he took part enthusiastically in the Pretoria branch meetings as well as on the S_2A_3 Council. He was intellectually active right up to the end of his life – see the February 2003 edition of this newsletter or the S_2A_3 website at s2a3.up.ac.za for some of his recent publications.

Charles Darwin's visit to the Cape in 1836

Cornelis Plug, plugc@mweb.co.za

Charles R. Darwin was a prominent scientist of the 19th century who made significant contributions to geology, botany, and zoology. He is of course best known for his theory of evolution by means of natural selection. This theory not only transformed the biological sciences, but grabbed the public imagination and permanently changed our view on the position of humans in the world. Darwin based his theory partly on his extensive studies in natural history during a long sea voyage in the 1830s. Towards the end of this voyage he briefly visited South Africa. Although he made few observations during his stay, the information he collected none the less helped to shape some of his ideas.

Darwin's early years

Born in Shrewsbury, England, on 12 February 1809, Charles showed a passion for collecting natural history specimens at an early age. He studied at the Universities of Edinburgh and Cambridge, taking a variety of courses. His family expected him to either follow his father in the medical profession, or choose a career in the church. However, neither of these interested him. He was, however, fascinated by zoology and botany. The seal was set on his career path in 1831, when, as a young man of 22, he was invited to serve as ship's naturalist on H.M.S. *Beagle*, commanded by Captain Fitzroy. The ship was about to depart on a scientific expedition to South America and the Pacific. The voyage lasted five years.

Science at the Cape in the 1830s

The decade of the 1830s was a relatively active one at the Cape as far as scientific endeavours are concerned, considering the small size of the European community. Important astronomical work was done at the Royal Observatory, Cape of Good Hope, directed from 1833 onwards by Thomas Maclear (1794-1879). Furthermore, from 1834 to 1838 the celebrated English scientist and astronomer John F.W. Herschel lived and worked at the Cape, mainly to catalogue the nebulae of the southern skies with his own large telescope. During these years there was an active scientific society in Cape Town, the South African Literary and Scientific Institution, which published its proceedings and papers in the *South African Quarterly Journal* (1829-1836), the first scientific journal in South Africa. Many of the papers contributed significantly to knowledge of South African geology, zoology, botany, agriculture, and meteorology. The South African Medical Society (1827-1847), the first of its kind, was also active at this time, as was the Cape of Good Hope Horticultural Society (founded in 1826). In 1833 there arose the Cape of Good Hope Association for the Exploration of Central Africa. Funded by subscriptions, it arranged a scientific expedition into the interior, led by the British zoologist Dr. Andrew Smith (1797-1872), from July 1834 to January 1836. The expedition penetrated to the Tropic of Capricorn in the Transvaal, and brought back large collections of zoological and other specimens. Smith had earlier initiated (in 1825) and maintained a museum collection which formed the nucleus of the South African Museum in Cape Town.

The *Beagle* at the Cape

On the return journey to England the *Beagle* anchored at Simon's Town from 31 May to 18 June 1836. On 4 June, Darwin set out on a short excursion, visiting Paarl and Franschhoek, and returning via Franschhoek Pass and Sir Lowry's Pass to reach Cape Town on the 7th. The ship's departure was delayed by bad weather, allowing him time to meet Dr. Andrew Smith, Thomas Maclear and John Herschel. Smith showed him the contact between the Cape granite and overlying shale at Sea Point, a rare and interesting geological phenomenon first described in 1818 by Clarke Abel (1780-1826). Darwin described the exposure at Green Point in some detail, noting that the thin, isolated beds of shale which occur as if floating in the granite near the contact, are quite compatible with the view that the granite was injected into the shale while liquid. His description was published in *Geological observations on the volcanic islands visited during the voyage of H.M.S. Beagle, together with some brief notes on the* *geology of Australia and the Cape of Good Hope*, published in London in 1844.

A lesson from the Cape
Darwin's *Journal of researches into the geology and natural history of the various countries visited by H.M.S. Beagle from 1832 to 1836* appeared in print in 1839 and established his reputation as a naturalist. The book includes a discussion of observations made by Andrew Smith during his expedition into the interior of South Africa, on the abundance of game and the scarcity of vegetation. Darwin used these observations, with those made by William Burchell and other travellers, to conclude that there is no close relationship between the quantity of vegetation found in a region and the size of the mammals that it supports. He used this conclusion to argue against the view that extinctions of large animals were caused by catastrophic changes in climate.

Darwin's first publication - in South Africa!
During the first few days after leaving Simon's Town Captain Fitzroy and Darwin, responding to what they perceived as a strong feeling against missionaries at the Cape, wrote "A letter, containing remarks on the moral state of Tahiti, New Zealand". They argued that Christian missionaries played an important role in uplifting, developing and enriching the lives of people all over the world. The letter was sent back to Cape Town when the Beagle reached St Helena Bay, and was published in the *South African Christian Recorder* of September 1836. As far as is know it was the first of Darwin's writings to be printed.

Subsequent work
After his epic voyage Darwin settled down in England for the rest of his life. He was a painstaking perfectionist who collected and classified masses of information. Among his contributions to science was a new and soon widely accepted theory of the formation of coral reefs, proposed in his *Journal of researches…* His second book, *The zoology of the Voyage of H.M.S. Beagle*, was published in 1839–1842. From 1844 onwards he was engaged on a major work dealing with natural variation and evolution; however, the announcement of a theory of evolution by A.R. Wallace in 1858 led him to abandon this project in favour of a shorter, now famous book, *On the origin of species by means of natural selection…*, published in 1859. This epoch-making work started a controversy, particularly among those with religious views, that lasted for generations. His theory of evolution was first applied to explain human origins by the geologist Charles Lyell (1797-1875). Darwin supported Lyell's views and in 1871 published *The descent of man, and selection in relation to sex*, in which he discussed the evolution of humans from earlier primates. He also produced many other works on zoology, botany, and geology, in several of which he applied and extended his theory of evolution. He died on 19 April 1882 .

Literature on Darwin's visit
Darwin has become so famous that even his brief visit to the Cape has been discussed several times in the local literature:

Crompton, A.W. & Singer, R. Darwin's visit to the Cape. *Quarterly Bulletin of the South African Library*, 1958, Vol. 13(1), pp. 9–11.

Herrman, L. Charles Darwin's first publication: A Cape discovery. *Quarterly Bulletin of the South African Library*, 1958, Vol. 13(1), pp. 11–12.

Rochlin, S.A. Charles Darwin and the Cape. *South African Journal of Science*, 1959, Vol. 55, pp. 311–316.

Rogers, A.W. The pioneers in South African geology and their work. *Transactions of the Geological Society of South Africa*, 1937, Annexure to Vol. 39, pp. 1–139.

Thackeray, J.F. On Darwin, extinctions, and South African fauna. *Discovery*, 1982/3, Vol. 16(2), pp. 2–11.

Thackeray, J.F. Darwin's comments on South African fauna. *Quarterly Bulletin of the South African Library*, 1987, Vol. 41, pp. 142–144.

Westra, P.E. Charles Darwin's visit to the Cape in 1836 and his first publication. *Quarterly Bulletin of the South African Library*, 1987, Vol. 41, pp. 79–82.

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Pretoria Branch S_2A_3 News

August 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date:	**Monday, 1st September 2003**
Time:	**17h15** (to 18h15)
Venue:	**Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)
Speaker:	**Manfred Scriba** Manufacturing and Materials Technology, CSIR
Topic:	**Nanotechnology - the next "big" wave**

Refreshments will be served after the talk.

Talk Summary

The talk will give an overview of the status of nanotechnology presently. It will show that nanotechnology is definitely a growing technology field internationally. Scientists and engineers are using knowledge of matter at its most fundamental level to develop better and cheaper fuel cells, solar cells, membranes for water purification, advanced catalysts, new plastics that are stronger, lighter and less permeable, faster and more powerful computers, innovative drug delivery systems, on-chip bio detectors and sensors and many more applications. In many of the above examples, the material properties changes dramatically as soon as it is constructed from particles that are less than 100nm in size. This area of science is called nanotechnology. With the development and invention of modern instruments and the availability of techniques and expertise to manufacture and modify nanoparticles, molecules and other nanoscale devices, many new and advanced materials and applications are being researched and developed internationally. Nanotechnology is being accepted as the next "big" technology wave. The research spending patterns of Europe (€1.3b over four years), USA (up to $800m in 2003) and Japan (up to $1b in 2003) confirm this statement. It is anticipated that that impact of nanotechnology will be very big.

South African Standard Time: When you hear the signal...

Cornelis Plug, plugc@mweb.co.za

The assumption of a regular and measurable progression of time is fundamental to science and other human activities. Thus our work and leisure are regulated by an official time scale, in accordance with which we adjust our watches. How did this time scale originate, and how is it maintained?

The beginnings of time measurement

From before the dawn of history time has been measured by observing the regular occurrence of events such as the alternation between day and night, or the recurrence of the seasons. These two phenomena define two natural units of time, the solar day and the tropical year. Subdivision of the day into 24 hours originated around 4000 years ago in ancient Babylonia. At first the hours were unequal, defined as 1/12th of the period between sunrise and sunset (hours of the day) and between sunset and sunrise (hours of the night), their duration varying with the seasons and with the observers latitude. Equal hours of 1/24th day, and subdivision of the hour into minutes, came into general use in Europe only towards the end of the Middle Ages.

Apparent local solar time

Up to the early 19th century civil time (i.e., clock time) in South Africa was regulated by means of sundials. At first the primary unit of time was the apparent (or observed) solar day, that is, the period between two successive crossings by the sun of the meridian (an imaginary north-south line on the sky, passing directly overhead). Each crossing happens exactly at noon (12 h) on the sundial. This form of time is called apparent local solar time.

All days are not equal: Mean solar time

It has been known since classical times that the observed motion of the sun along the star sphere, as projected on the celestial equator, is not entirely regular in the course of a year. Hence, apparent solar time is not strictly uniform, and after the introduction of clocks in the 17th century was no longer considered suitable for civil timekeeping. This led to the introduction of mean solar time, based on the uniform movement of a fictitious sun, the position of which coincides with the real sun only at certain times of the year. Thus in mean solar time the sun crosses the meridian as much as 15 minutes before or after 12 o'clock at certain times of the year. The time shown by sundials was corrected for this difference, which is called the "equation of time".

South African Standard Time

A notable feature of local solar time is its variation with longitude. For every degree of longitude that one travels eastwards the sun passes the meridian 4 minutes earlier. Hence every substantial town in South Africa kept its own local time. However, as more rapid forms of communication and travel were introduced in the form of the electric telegraph and railways (both from 1860 onwards in South Africa), it became necessary to rationalise the many time scales. In the Cape Colony the mean solar time of the Royal Observatory in Cape Town was used by the telegraph service, while each of several unconnected railway systems used the local time of its principal station. Other towns along the railway now had two time scales, local time and railway time. The resulting inconvenience led to the introduction, on 8 February 1892, of a single civil time scale for the Cape, based on mean solar time for the longitude 22,5ºE, that is, Greenwich Mean Time (GMT) plus 1 h 30 m. Later that year, at a conference held in Bloemfontein, this time scale was furthermore adopted as the only system of railway time in the Cape, Orange Free State and Transvaal. It rapidly replaced local time in most towns, though Pretoria continued to use local time for some years. Meanwhile Natal had introduced the mean solar time of the Natal Observatory in Durban for communication purposes, but on 1 September 1894 changed over to mean solar time for a longitude of 30ºE (GMT plus 2 h).

Shortly after the Anglo-Boer War, on 3 March 1903, the Cape, Transvaal, and Orange River

Colony all adopted the time scale of Natal. This time scale came to be known as South African Standard Time (SAST). Similar standard times, differing from GMT by a whole number of hours, have gradually been adopted throughout the world from 1883 onwards.

Regulating mean solar time

The most convenient and accurate method of maintaining SAST during the early part of the 20th century was based on observations of the meridian passage of stars at the observatories in Cape Town, Durban, and Johannesburg. Successive passages of the same stars represent the period of rotation of the earth with respect to the stars (23 h 56 m 4 s). From such observations mean solar time at the observatory, and hence SAST, could be derived. A crucial assumption underlying this procedure is that the rate of rotation of the earth is constant, thus producing a uniform time scale. This assumption was first questioned by the American astronomer Simon Newcomb in 1875, and investigated by, among others, R.T.A. Innes (1861-1933), Director of the Union Observatory in Johannesburg. Innes's professional achievements included the discovery of more that 1600 double stars, and the finding that Proxima Centauri is the nearest star to the solar system. His demonstration that the speed of the earth's rotation is subject to minute variations was soon firmly established. The variations arise partly from changes in the circulation patterns of the atmosphere, oceans, and the earth's interior, and are quite irregular. However, the rotation is also gradually slowing down, mainly as a result of tidal friction, so that after one or two centuries a calendar year of 365 days will be one second longer than at present.

These findings led during the 1950s to the redefinition of the second of time as a fraction of the tropical year, and of the day as 86400 (24 x 60 x 60) such seconds. However, the tropical year is also not exactly constant, and its length is difficult to determine with great precision.

Atomic time

By this time atomic clocks, using constant and accurately known microwave frequencies as timing mechanisms, were attaining greater stability than the earth's rotation. Hence at a meeting of the International Committee on Weights and Measures in 1967 the second as the SI unit of time was defined as 9 192 631 770 periods of the radiation corresponding to the transition between the two hyperfine energy levels of the ground state of the caesium-133 atom. On the basis of this definition the second could be reproduced with an error of less than one part in a hundred thousand million.

South Africa's official time service was established at the National Physical Research Laboratories of the CSIR in Pretoria. Here a caesium clock, which was regularly compared with similar clocks in other countries, generated our time signals. However, this civil time continued to be based on the earth's rate of rotation, as the length of the second was regularly adjusted by tiny amounts so that 86400 seconds would equal the slightly variable mean solar day.

Coordinated Universal Time: Stop the clock!

Rotational time was finally abandoned by most time services on 1 January 1972, when coordinated universal time (UTC) was introduced for general use. The fundamental unit of UTC is the SI or atomic second as defined above. The counting of such seconds (called International Atomic Time) is regulated by a hundred or so atomic clocks in more than 20 countries, and is evaluated by the International Time Bureau (BIH, from the French). To compensate for the earth's uneven rotation and thus keep our clocks in line with mean solar time, UTC is created by occasionally inserting leap seconds into International Atomic Time. This is always done at 24 h on either 31 December or 30 June. Thus at the end of the last minute of the year, or the last minute of June, the UTC clock is sometimes stopped for exactly one second. As the earth slows further over the years, more and more such leap seconds will have to be inserted in our time scale.

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will be greatly appreciated. Please forward any news (in electronic format please – and less than 200 words) which might be of interest to members, whether scientific, professional or personal, to Walter Meyer ***wmeyer@postino.up.ac.za***.

Members are also strongly encouraged to make suggestions for potentially interesting speakers for our monthly talks.

Pretoria Branch S_2A_3 News
September 2003

A newsletter of the Pretoria Branch of the Southern Africa Association for the Advancement of Science

Our forthcoming talk:

Date: **Monday, 6th October 2003**

Time: **17h15** (to 18h15)

Venue: **Transvaal Museum,** Paul Kruger St. (Entrance to secure parking from Minnaar Street, on the south side of the Museum)

Speaker: **Dr Gilbert Siko**
Department of Biochemistry
University of Pretoria

Topic: **Early detection of Tuberculosis**

Refreshments will be served after the talk.

Talk Summary

Wax isolated and purified from bacteria that cause tuberculosis, Mycobacterium tuberculosis, has protective properties towards tuberculosis infection and can be used for early detection of tuberculosis in infected patients.

The introduction of anaesthetics in South Africa in 1847

Cornelis Plug, plugc@mweb.co.za

Imagine the horror of having your leg amputated without the use of either a general or local anaesthetic. In the “good old days” before the mid-19th century such operations were all too common. Amputation was often the only way to save a patient’s life when wounds became infected, which was likely to happen before the introduction of antibiotics in the mid-20th century. To reduce, or at least shorten the duration of the trauma, surgeons prided themselves on being able to cut through the soft tissue and saw through the bone in record time.

Early attempts to produce anaesthesia

The artificial induction of insensibility to pain during surgery has been described by various authors since antiquity. The methods used included ingestion of parts of the *Cannabis* (dagga) and *Mandragora* plants. However, these were only sporadic attempts. In 1800 the English chemist Sir Humphry Davy discovered the anaesthetic properties on nitrous oxide and suggested its use during surgery, but to no avail. Similarly, the anaesthetic effect of diethyl ether was demonstrated in 1818 by the English physicist and chemist Michael Faraday, and subsequently by several American physicians, but remained just a curiosity. Finally, on 16 October 1846, William T.G. Morton, a dentist, gave the first successful public demonstration of an anaesthetic (ether) during surgery at the Massachusetts General Hospital in Boston. Ether inhalation soon became widely used in the US. In England surgeons and dentists started applying it in December the same year, and obstetricians and veterinarians shortly thereafter.

First use of ether in South Africa

News of these exciting developments, with descriptions of operations performed in various British hospitals, appeared in the *South African Commercial Advertiser* (Cape Town) from the 7th of April 1847 onwards. As far as is known the first person in South Africa to apply ether as an anaesthetic was a Cape Town dentist, Alfred Raymond. A very brief account of his first experiment appeared in the Cape Town paper, *De Verzamelaar*, on 20 April 1847. It mentioned that on 17 April he had drawn two teeth from one of his patients, and one tooth from another, after having them inhale ether vapour, and that the extractions were painless. During the next few weeks he administered ether from an inhaler with great success during tooth extractions, and on one occasion to cut a large wart from the finger of one of his patients.

Raymond advertised his services in Cape Town as early as 1837, but left South Africa during that year. He returned in 1842 and from May 1846 practiced at 27 Burg Street, Cape Town. His advertisements in local newspapers claimed that he had ten years experience as a dentist on Mauritius, had gained experience for six months at the best hospitals in Paris, and had obtained his diploma as a surgeon-dentist from the University of Paris - probably between 1842 and 1846. He was still practicing in Cape Town in November 1848, but by 1863 had moved to Port Elizabeth. In 1842 he published a popular booklet on the management of teething in children and in 1847 a paper, “On precocious dentition” in the first issue of the *Cape Town Medical Gazette*, the first medical journal to appear in South Africa.

Meanwhile a medical practitioner, Dr. Henry A. Ebden (1824-1886), also started experimenting with ether as an anaesthetic during April 1847. He had qualified as an MD at St. Andrews, Scotland, in 1845. Upon his return to the Cape he established the short-lived Cape Town Medical Gazette, with himself as editor. In his first experiments he used a large bullock’s bladder containing a sponge soaked in ether and fitted with a mouth-piece. However, he soon obtained an apparatus from England in which valves prevented rebreathing and consequent carbon-dioxide accumulation, making the procedure more comfortable and effective. His experiments were unfortunately not described in detail. As he considered anaesthesia to be an important development in surgery, he urged the medical fraternity at the Cape through his editorials in the *Gazette* to experiment with it.

Ebden left the Cape early in 1848 to enter the Bengal medical establishment of the (English) Honourable East India Company. He returned after almost ten years and settled down to practice in Cape Town for the rest of his life. As one of the most prominent medical men in the colony he became the first president of the newly founded South African Medical Association in 1883.

W.G. Atherstone’s experiments

The first major surgical operation under ether to be fully reported in South Africa was carried out in Grahamstown by Dr. William G. Atherstone (1814-1898). The son of an 1820s settler, he qualified in England (1837) and Germany (1839) before returning to Grahamstown to practice. In addition to his medical work he contributed to South African geology and palaeontology, and played a leading role in several scientific societies in the Eastern Cape.

Atherstone first experimented with ether in different types of apparatus, with and without valves. He finally settled on a simple device, consisting of a large bottle which contained some ether, sealed by a cork through which two glass tubes passed. One of these admitted air to the bottle, while the other was fitted with a mouthpiece through which the patient inhaled the vapour. On 19 June 1847 a local newspaper, the *Grahamstown Journal*, reported his success with the use of this device during an amputation performed three days earlier in the presence of three other physicians. The patient was the Deputy Sheriff of Albany, Frederick Carlisle, who's leg had to be amputated above the knee. After a short period of inhaling ether vapour the patient was rendered semi-conscious and completely impervious to pain, though continuing to breath through the mouthpiece and mechanically opening and closing his nostrils with his own hand. On completion of the operation he gradually recovered from the effects of the anaesthetic and at first refused to believe that the operation had been completed. He had felt no pain at all, though he reported hearing the sound of the bone saw as if in a dream.

Ether in veterinary practice

Cape veterinarians began using ether for operations on animals soon after its first use on humans. In a communication from Stellenbosch dated 10 May 1847 to the Cape Town newspaper *De Zuid-Afrikaan* it was reported that a local veterinarian, Mr. J. Esterhuyse, removed a tumor weighing more that a kilogram from the lower eyelid of a horse while the animal was anaesthetised by ether. The apparatus he designed to administer the vapour consisted of a sheet of wax cloth rolled up to form a cone. The wider end was fitted around the muzzle of the horse, while the other end was attached to an ether bottle. Within 1½ minutes the animal fell down unconscious and remained so for 18 minutes, during which time the operation was performed.

The introduction of chloroform

Chloroform was introduced as an anaesthetic in England at the end of 1847. It was first used in South Africa by W.G. Atherstone in Grahamstown during an operation in May 1849. The patient was a young man, John Swan, who had a wen excised from his neck. The operation proved to be painless and successful. In Cape Town chloroform was first used by Dr. F.L.C. Biccard about a year later.

Anaesthesia as a speciality

For many decades after the introduction of ether local medical practitioners were often both anaesthetist and surgeon. After inducing insensibility the administration of the anaesthetic was handed over to an unskilled assistant. The first specialist anaesthetist in South Africa was Dr. George W.B. Daniell. He qualified as physician and surgeon in England in 1888, came to the Cape and set up as a general practitioner in Caledon. After the Anglo-Boer War he went to England and served as anaesthetist at various hospitals and lectured in anaesthesia to medical students. He returned to South Africa in January 1906 and began to practice in Cape Town, confining himself entirely to his speciality. In 1907 he moved to Johannesburg as specialist anaesthetist to the Johannesburg General Hospital.

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– Contacts:
  - Mnr Walter Meyer / Dr Elise Venter
  - e-mail**:** s2a3@up.ac.za
  - www: http://s2a3.up.ac.za/

What is the S_2A_3?

The ***S_2A_3*** aims to stimulate a broad public interest in science and its applications, research, discoveries, history, ethics and philosophy. To do so, the ***S_2A_3*** arranges regular meetings, with speakers who are both entertaining and knowledgeable, as well as field trips, excursions and other interesting events.

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