Pretoria Branch S_2A_3 News

March & April 2005

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

Since a number of committee members, including myself, will be away during March, we decided to combine the March and April issues of the newsletter. Since 2005 has been declared the World Year of Physics, it is appropriate to start this year's lectures with a historical perspective of the great work done in Physics in the early 1900's. Our April talk will be on Nutrition, where the factual basis of some common beliefs will be discussed. – Ed.

Our March talk:

Date: **Wednesday, 2nd March 2005**

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

Venue: **Discovery Centre,**
University of Pretoria Main Campus
(Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Prof J Boeyens**
Extraordinary professor, Chemistry Department, University of Pretoria.

Topic: **Quantum Personalities**

Refreshments will be served after the talk.

Talk Summary

At the centenary of Einstein's most productive year, that also provided a firm basis for quantum theory, many historians look back at subsequent developments between 1905 and 1935. The debates and personalities that featured in the process are often forgotten. Some incidents, rival theories and the human side of events will be the topic of the lecture.

Our April talk:

Date: **Wednesday, 6th April 2005**

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

Venue: **Discovery Centre,**
University of Pretoria Main Campus
(Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Dr J Kotze**
Specialist food and nutrition consultant

Topic: **Nutrition: Facts and Fiction**

Refreshments will be served after the talk.

Talk Summary

The following nutritional questions will be addressed in this very interesting and topical lecture:

- *Is saturated fat the cause of heart disease ?*
- *What is the effect of trans-fatty acids on heart diseases ?*
- *What is the function of cholesterol in the body ?*
- *Must we eat high-carbohydrate diets ?*

Andrew Geddes Bain (1795-1864): The father of South African geology.

Cornelis Plug, plugc@mweb.co.za

Andrew G. Bain was born in May 1795 in Thurso, Scotland. He was an only child, orphaned at a young age, and received his schooling in Edinburgh. He came to the Cape in October 1816 and two years later married Maria E. von Backstrom in Cape Town. They had twelve children, including Thomas C.J. Bain who followed in his father's footsteps as a road builder.

A life of adventure

After working for some time as a saddler in Graaff Reinet Andrew started a life of trading, hunting and exploring. In 1825 he and Benjamin Kift travelled and traded widely north of the Orange River, visiting the site where Kuruman was later founded. The next year he and John B. Biddulph undertook an expedition into Botswana and were the first Europeans to penetrate as far north as present Gabarone. In 1829 they set out overland for Natal, and though forced to turn back by hostile locals they managed to return with a load of ivory.

He started his last hunting trip in August 1834, travelling towards the Molopo River to procure live animals and skins for American buyers. However, in fleeing from an attack by a Matabele impi he lost his wagon and collections, and after considerable hardship managed to return to Graaff Reinet in December. He then joined the fighting in the Sixth Frontier War of 1834 1835, attaining the rank of Captain. As reward, he received a farm near the present town of Alice, but following a change in British policy it was taken away again when the area was returned to the Xhosa nation in October 1836.

Bain's popular writings

Andrew was a keen observer, a good writer and draughtsman, and endowed with a keen sense of humour. He wrote accounts of his travels and of events in Graaff Reinet for two newspapers, the *South African Commercial Advertiser* in Cape Town and the *Grahamstown Journal*, signing them "an intelligent correspondent at Graaff Reinet". Thus he helped to disseminate knowledge about the interior of the country.

In 1838 he combined his writing ability and shrewd humour to compose a burlesque, *Kaatje Kekkelbek; or, life among the Hottentots*, which was performed on stage in Grahamstown in November that year and subsequently published in various newspapers. It was a satire on the philantropy of the missionaries and as one of the earliest works in Afrikaans became very popular.

Building roads and passes

Having acquired some experience of road building near Graaff Reinet, Bain was appointed as an assistant to the Royal Engineers to superintend the construction of military roads on the frontier. The training that he received in this position, combined with his natural ability, made him into the best South African road engineer of his time.

A reorganisation of the Royal Engineers led to his dismissal in 1845. Fortunately, by that time the Cape government had commenced the building of urgently needed passes across the Cape mountains. Bain accepted an appointment as Inspector of Roads and started building Michell's Pass, near Ceres, in October 1845. The pass was opened in December 1848. The remainder of his career was devoted to building and improving passes. An important innovation that he perfected was the stacking of dry stone retaining walls to support the roadway along steep slopes. Some of these walls are still in good condition after 150 years. Having discovered a passage through the mountains between Wellington and the Breërivier Valley, now named Bain's Kloof, he built a long pass through it between 1849 and 1853 an impressive feat of engineering for which he received public acclaim.

Fossil hunting

Meanwhile his interest in rocks and fossils had been aroused in 1837 by reading Charles Lyell's popular and influential *Principles of geology*. Further reading confirmed his determination to apply geological and palaeontological knowledge in a personal study of the rocks of the Cape – a spirit of enquiry that ruled the rest of his life. In 1838 he and his friend M. Borcherds found their first pieces of fossil bone near Fort Beaufort. One or two days later Baine made his first important discovery just south of the town – a reptile skull with only two large teeth which he named a bidental and which became famous as *Dicynodon* – the dominant herbivorous mammal like reptiles of the Karoo era.

Around this time he submitted his first scientific paper, "On the head of an ox found in the alluvial bands of the Modder [River], South Africa", which appeared in the *Proceedings of the Geological Society of London* for 1838–1842. The animal, an extinct buffalo, was later named *Bubalus baini*. During the next six years Bain amassed a large collection of fossil reptiles. He exhibited them briefly in Grahamstown in 1844 but finding little support for his work sent them to the Geological Society of London, where their importance was immediately recognised. Extracts from his letter to the society were published in its *Transactions*, under the title "On the discovery of the fossil remains of bidental and other reptiles in South Africa". He even received some grants to continue his work. His collection was studied by the paoaeontologist Richard Owen and later purchased by the British Museum. Owen's descriptions were published in the museum's *Catalogue of South African fossil reptiles* in 1876. The species *Pareisaurus baini* was named in Bain's honour. Encouraged by the reception of his finds he continued his fossil hunting and sent further shipments to England, including the first substantial collection of invertebrate remains from the Bokkeveld Group.

Father of South African geology

Meanwhile he had started to compile the first geological map of the Cape, complete with geological sections and a descriptive memoir. It was dispatched to the Geological Society of London in December 1851. Though necessarily incomplete and based on some inaccurate observations his work represented an essential and important first step in unravelling the complex succession of geological strata covering a huge area. He was the first to determine the stratigraphic succession of what came to be known as the Cape Supergroup. It struck him that there were no marine fossils in the Karoo rocks; hence he hypothesized that they had been deposited in a great freshwater lake and named them the Lacustrine Formation. Though this view was accepted for many years, later research showed that the Karoo environment was deltaic rather than lacustrine. The Geological Society, recognising the significance of his work, described it as "the triumphant results of the single handed labours and unaided research of one who, by his own perseverance and talents alone, has not only worked out so grand a geological problem, but has trained and wholly educated himself for the task". His memoir was published as "On the geology of southern Africa" in the society's *Transactions* for 1845–1856.

The description "Father of South African geology" was first applied to Bain by E.L. Layard, Director of the South African Museum, in 1857. This honorary appellation has been confirmed by many other prominent scientists since, including Selmar Schönland (1893), E.H.L. Schwarz (1895), S.H. Haughton (1964), and W.J. de Klerk (1997). It aptly characterises his pioneering achievements in this field.

His role in public life

Bain was transferred to the Eastern Cape in about 1855, while his son Thomas succeeded him as Inspector of Roads for the Western Cape. Despite the nature of his work he managed to participate actively in public affairs. Thus around 1855 1860 he served on the committee of the Albany Public Library; was a Justice of the Peace in Albany; served on the management committee of the Literary, Scientific and Medical Society of Grahamstown (as vice president for some years); was a member of the first executive committee of the Eastern Province Agricultural Association; was a director of Cawood and King's Mining Company; and in 1858 arranged the fossils of the Albany Museum.

In 1860 he began his most ambitious project, the Katberg Pass, some 50 km long, over the Winterberg range between Queenstown and Fort Beaufort. However, in 1863 heart problems forced him to take leave before the work was completed. He went to Britain in April 1864, where he was warmly received by leading geologists and palaeontologists. Returning to South Africa he died in Cape Town on 20 October that year.

What is the S_2A_3?

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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

May & June 2005

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

Our May talk:

Date: **Wednesday, 4th May 2005**

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

Venue: **Discovery Centre, University of Pretoria Main Campus**
(Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Ina Plug**
Research Fellow, UNISA

Topic: **Past climate changes and human habitation in southern Africa**

Refreshments will be served after the talk.

Talk Summary

South Africa's climate is subject to three different weather systems. Fluctuations in the world's climate, combined with the vagaries of these three systems, have had a pronounced influence on human life and settlement in the subcontinent. Although information is often sketchy and sometimes seemingly contradictory, together with archaeological evidence a clearer picture is emerging. The succession of ice ages during the Pleistocene epoch is very clearly visible in the glaciation history of the northern hemisphere and the high mountains of the Andes. In southern Africa, the effects of these ices ages are much harder to detect, as we did not experience glaciation. Nevertheless evidence from the Drakensberg and the Lesotho highlands, drill cores from marine, spring, marsh and meteor crater deposits provide tantalizing evidence of climatic fluctuations. In addition the variable distribution of human occupation, wild animals, and later of domestic animals, also provide evidence that even seemingly small climatic changes had profound effects on human and animal life in this country. These changes influenced the evolution of certain mammal species, as well as changes in animal sizes, and drove human technological development.

Our June talk:

Date: **Wednesday, 1st June 2005**

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

Venue: **Discovery Centre, University of Pretoria Main Campus**
(Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Dan Jacobson**
CEO National Bioinformatics Network

Topic: **New frontiers in Biology: Bioinformatics leads the way**

Refreshments will be served after the talk.

Talk Summary

Bioinformatics is an exciting new discipline in South Africa and is the intersection between the fields of Biology, Computer Science, Mathematics and Statistics.

Biology has undergone a fundamental shift from a discipline that involved small, individual experiments to one that now runs tens of thousands of experiments at a time in a single laboratory.

This change in scope and scale has been made possible by the advent of Bioinformatics which makes the use of computers to manage and analyze huge amounts of biological data. Bioinformatics made the Genome projects possible and is now the underpinning of studies that are intent on understanding how all the components of a cell work in concert.

The moon illusion – unexplained after 23 centuries

Cornelis Plug, plugc@mweb.co.za

When the full moon rises above the horizon it often appears larger than when it is higher in the sky. This phenomenon is known as the moon illusion. Similar illusions affect the rising or setting sun and even the constellations. The angular size of the moon does not change appreciably with height, as can be shown by comparing its disc to that of the tip of one's little finger held at arm's length. This informal experiment will convince most people that the enlargement is apparent rather than real, but this conviction will not cause the illusion to disappear.

Despite the best efforts of many early natural scientists, and later of psychologists, there is still no generally accepted explanation of the moon illusion, although some popular explanations can be ruled out.

The moon illusion in antiquity

The first known mention of the illusion in a scientific work is by the Greek philosopher Aristotle (384-322 BC) in his book *Meteorologica*. Several other authors discussed the illusion in later classical times, including the famous second-century astronomer Claudius Ptolemaeus (or Ptolemy). In China the illusion was mentioned by the astronomer Zhang Heng (78-139 AD) and later authors. In the astronomical chapters of the official history of the Chin dynasty (265-420) the scholar Ge Hong argued about the moon illusion in words almost identical to those used by Ptolemy, proving that scientific writings from the Middle East had reached China.

From antiquity to the present, numerous authors have contributed to the bewildering variety of possible explanations of the illusion. Some of these had a surprisingly long life; partly as a result of the way scientific knowledge was transmitted from one culture to another.

The literary tradition

During the early Middle Ages, when Arabic science flourished, works by Ptolemy and other classical authors were translated into Arabic. Arab scientists significantly expanded this knowledge. As far as the moon illusion is concerned, the most important of them was the physicist Ibn al-Haytham (965-1039).

When the relatively advanced state of Arabic science came to be recognised in Western Europe during the twelfth century, many Arabic works were translated into Latin. A book on optics by Ibn al-Haytham formed the basis of three Latin optical works (one of them by Roger Bacon), written around 1270. As a result, his views played an important role in the scientific tradition of medieval Europe. Following the decline of Latin as the language of science from about the seventeenth century the scientific literature developed to some extent independently in the major national languages of Western Europe. Hence, during the twentieth century many papers on the moon illusion written in French or German were ignored by English speakers (especially in the US), with the result that explanations were often re-invented.

Atmospheric refraction

According to an explanation which started with Aristotle but was stated as a specific theory by Ptolemy in the second century, the horizon moon is enlarged as a result of refraction by moisture in the lower atmosphere, just as an object is enlarged when submerged in water. Such was the authority of Ptolemy that this explanation remained influential among scientists for some 15 centuries. It is still uncritically accepted by many laypersons today.

The main problem with the refraction theory is that it implies that the horizon enlargement is measurable – but no such enlargement has been found by meticulous measurements over many centuries of astronomical investigation. By the middle of the seventeenth century, most authors accepted such measurements as proof that the theory is wrong.

The flattened sky

Ibn al-Haytham was the first scientist of note to provide an explanation of the moon illusion in terms of visual, rather than physical, processes. He argued that the sky appears flattened, rather than hemispherical, because the scenery between us and the horizon causes the horizon sky to appear distant, whereas the lack of scenery causes the sky above us to appear relatively near. Because the moon seems to be at the same distance as the sky around it, it too looks further away on the horizon. But as it subtends the same angle (about half a degree) at all times, it looks physically larger on the horizon - just as a distant house looks larger than a nearby toy that subtends the same angle.

This theory remained the most popular explanation of the illusion to the mid-twentieth century. Investigators found that the sky does indeed look more or less flattened to most people, and that the illusion is often enhanced by a distant and detailed horizon scene. However, one finding contradicted the theory: Most persons who experience an enlarged horizon moon claim that it looks closer, not further away, than when high in the sky.

The angle of regard

Another explanation that dates back to antiquity claims that the act of looking upwards makes objects seem smaller, therefore the elevated moon looks smaller than the horizon moon. Around 1830 the famous mathematician K.F. Gauss suggested that this theory could be investigated by experimenting with mirrors - looking at the elevated moon in a mirror at eye level, and at the horizon moon in an elevated mirror. A number of experimenters followed these suggestions, but found that results were affected by the perceived distance of the mirror. Various later laboratory experiments tested the effect of rolling the eyes up or down, or moving the head, or tilting the whole body, but found that size estimates were only slightly affected.

A plethora of theories

Many other theories have been proposed and investigated. The explanatory mechanisms include aerial perspective (lack of contrast in distant horizon scenes), chromatic aberration in the lens of the eye; inappropriate focusing of the eye, involuntary convergence of the eyes when looking upwards; angular size contrast between the moon and angularly small objects on the horizon, assimilation of the moon's perceived size to that of physically large objects on the horizon, lack of experience in viewing distant objects high in the sky, and an effect of the balance organs.

Experiments with moon machines

A major methodological advance in the study of the illusion was the design of the so-called "moon machine"in 1960. This is an optical apparatus that displays one or more discs of light (representing the moon) as if projected against the sky at different heights. As the discs are at optical infinity the distance cues that bedeviled earlier experiments with physical discs at various distances are eliminated. Several investigators have used such machines to test various theories.

What does "looks larger" mean?

After a great deal of experimentation and theorising the answer to a fundamental question remains controversial: Does the moon look physically larger on the horizon (more centimeters across), or angularly larger (covering a larger portion of the sky)? The answer is important because it determines how the perceived enlargement should be measured. It would seem that both types of enlargement may be involved, but the answer one gets when questioning subjects who view either the natural illusion or a simulation in the laboratory depends to a large extent on how the question is asked. It has gradually become clear, however, that the illusion often involves apparent angular enlargement, a finding that should help to focus both future experiments and theorising.

Read all about it

The complete story of the moon illusion is told in Ross, H.E. and Plug, C. *The mystery of the moon illusion*. Oxford University Press, 2002.

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Pretoria Branch S_2A_3 News

August 2005

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

Our August talk:

Date: **Wednesday, 3rd August 2005**

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

Venue: **Discovery Centre (Sci-Enza), University of Pretoria Main Campus**
(Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)

Speaker: **Prof Robin Crewe**
Vice Principal, University of Pretoria

Topic: **Social parasitism by Cape honeybee workers: understanding evolutionary lotteries.**

Refreshments will be served after the talk.

Talk Summary

In the early 1990's large numbers of Cape honeybee colonies were introduced into Gauteng by commercial beekeepers. As a result of this introduction, Cape honeybee workers invaded colonies of local honeybees with devastating effects on the colonies of commercial beekeepers. The question that arose was: why were workers of one race of honeybee invading the colonies of another race of honeybee and leading to their destruction? Since parasitism within a species is rare, it was important to investigate the underlying causes of this interesting natural experiment that was inadvertently initiated by commercial beekeepers.

Genetic analysis of the social parasites has revealed that they all clones of a single individual with traits that make them particularly successful social parasites. Both the genetic and the pheromonal basis for the success of the social parasite will be explored. Its implications for biodiversity of local populations will be explored as well as the evolution of social parasites in general.

The rise and fall of Kalahari irrigation schemes

Cornelis Plug, plugc@mweb.co.za

From 1918 to1946 there was great public enthusiasm for schemes to irrigate the Kalahari desert by diverting the Kunene, Chobe and Okavango rivers. The idea was eventually rejected as unworkable, but only after prolonged debate and investigation. The schemes were based partly on three beliefs or assumptions, discussed below, which persisted for many decades mainly because a lack of reliable knowledge prevented their rejection.

1. South Africa is drying up

The view that the western interior of southern Africa is drying up was first published in 1851, in a letter to the *Geographical Journal*, by the British missionary and explorer David Livingstone (1813-1873). He reached this conclusion after visiting Lake Ngami in 1849 (the first European to do so), mainly on the basis of anecdotal evidence supplied by the local population. His subsequent pioneering travels through the Kalahari and regions to the north during 1849-1856 confirmed his view, which he expanded in subsequent publications. Other authors soon followed suit and in time the belief became almost universally accepted. Thus during 1913 and 1914 no fewer than 41 letters from the public were published in the *Agricultural Journal of SA* in response to the question, “Is South Africa drying up?”. All 41 writers affirmed the progressive dessication of the country, though the perceived causes, in addition to declining rainfall, included the extraction of underground water, veld burning, and deforestation. Later analyses of rainfall figures have not supported the belief that rainfall over the western interior has declined during historical times.

2. Our inland lakes have disappeared

When Livingstone first saw the Victoria Falls in 1855 he speculated that the huge gorge below the falls was formed by a single catastrophic flood, during which a vast inland lake was emptied. The belief that the landscape is shaped by single catastrophic events was gradually replaced by the view that environmental changes occur slowly over long periods. However, the belief that there were recently great lakes in the interior of which Etosha Pan, Lake Ngami and the Makgadikgadi Pans are small remnants, persisted for quite some time despite a lack of supporting evidence.

3. Rainfall can be increased by preventing run-off

Ferdinand Gessert (1870-1953), a German colonist and pioneer irrigation and livestock farmer in southern Namibia, believed that most of the rainfall over land represents moisture that has evaporated from the land itself. Hence, if run-off is captured and stored in open dams, evaporation will increase and so will rainfall. He first published these ideas, which were partly based on the work of the German geographers Supan and Bruckner, in the German journal *Globus* in 1897. Although later studies of atmospheric circulation above southern Africa disproved Gessert’s key assumption, the belief that rainfall could be increased by creating bodies of open water was uncritically but enthusiastically accepted by many.

Combining beliefs: The first Kalahari irrigation scheme

Gessert put his money where his mouth is and applied his theory on his farm by constructing dams to retain runoff. However, he also thought big and in his 1897 article proposed that building a dam in the Kunene River to divert its water into the Kalahari would lead to evaporative cooling of the land breezes and increased humidity. In 1904 he published a more specific proposal in the same journal. He argued that the interior of southern Africa was drying up; that the water of the upper Kunene River in Angola could be diverted southwards into Etosha Pan; that the overflow of Etosha Pan could be channeled to Lake Ngami; that irrigation farming could be practiced along the newly created waterways; and that the introduction of the extra water into the interior would increase its rainfall. The German authorities rejected his proposal on the grounds that the Kunene would have to be diverted in Angola, and that the main beneficiaries of the scheme would be the British who controlled the Kalahari region.

South Africans respond: The Schwarz scheme

As early as 1897 William Roe, a photographer in Graaff Reinet, published an article on irrigation in the *Agricultural Journal of the Cape Colony* in which he proposed that our inland lakes should be restored to prevent the further dessication of South Africa, though he did not indicate how this should be done. In 1910, in the same journal, J.A. van Zyl drew attention to Gessert's scheme and proposed diversion of not only the Kunene, but also the Okavango River, the latter into Lake Ngami. Gessert responded with an article of his own later that year. Eight years later, the South African geologist Ernest H.L. Schwarz (1873-1928) proposed a comprehensive Kalahari irrigation scheme in an article in *The Star* of 31 January 1918. He followed this up with a paper read at the annual congress of S2A3 in July that year, and many other scientific and popular publications. An expanded and modified scheme was published in his book, *The Kalahari, or thirstland redemption*, in 1920.

Schwarz claimed that large permanent lakes had existed at Etosha Pan, the Makgadikgadi Pans and Lake Ngami. He claimed that these had dried up only during the last few centuries when their catchment areas began to be drained by the Kunene, Chobe and Zambesi Rivers, whose beds were lowered by natural erosion. The aridification of the region then led to a decrease in its rainfall from about 1860 onward. Restore those lakes, he said, and the progressive aridification of southern Africa will stop. To achieve this he adopted Gessert's proposal regarding the Kunene River, and also proposed a dam in the Chobe River, just above its junction with the Zambezi, to divert water through currently dry river beds into the Makgadikgadi Pans. The resulting lake of some 40 000 square kilometers he thought would improve the rainfall over a large part of southern Africa by up to 250 mm per year. Farming prospects would improve, while some of the water could also be used for irrigation along dry river valleys south of the lake down to the lower Molopo River.

The scheme investigated and abandoned

Schwarz's proposals led to a flood of scientific and popular literature. In broad terms, the general public supported the scheme enthusiastically and admired Schwarz for his breadth of vision. However, most scientists, including the Secretary of Irrigation F.E. Kanthack, rejected the scheme, questioning the geographical assumptions on which it was based and claiming that its benefits were grossly overestimated. In 1925 the government of the Union of South Africa decided that the practicality of the scheme should be investigated by an expedition of the Department of Irrigation under the leadership of the eminent geologist Dr Alexander L. du Toit. The expedition visited the northern Kalahari from June to October that year to collect data pertaining to the eastern part of the proposed scheme and a number of alternative proposals. In the resulting report du Toit pointed out that many assumptions made by Schwarz with regard to declining rainfall, the recent disappearance of large lakes in the Kalahari, the climatic consequences of the scheme, the amount of water carried by the Chobe and other rivers, ground elevations, dry river courses and other geographical features, and the cost of the scheme, were either wrong or could not be supported by available data. The scheme was rejected as unworkable, although some minor irrigation schemes in the region appeared worthy of further investigation.

Twenty years later the drought of 1943 – 1944 caused renewed interest in Schwarz's proposals, particularly because the government was seeking additional farmland on which to settle soldiers returning from World War II. A second expedition was sent out to investigate the matter, and a report compiled by the Director of Irrigation, L.A. Mackenzie. He reached much the same conclusions as du Toit, with the result that all Kalahari schemes were abandoned.

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S2A3 Website & List server

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Our September talk:

Date:	**Wednesday, 7th September 2005**
Time:	**17h15** (to 18h15)
Venue:	**Discovery Centre (Sci-Enza), University of Pretoria Main Campus** (Use the Prospect Street Entrance to the campus. The Discovery Centre is in the large white building on the right of the road approx 100 m from the Prospect Street Entrance.)
Speaker:	**Dr Jan Rijn Zeevaart** Head, Dept. Radiochemistry, NECSA
Topic:	**What wrong with the bones, Holmes?**

Refreshments will be served after the talk.

Talk summary

Contrary to popular belief, our skeleton is not a dormant structure that keeps us upright and provides the adhesion points for our muscles. It is in fact a very active and vital organ of the body that is constantly being remodelled in a process of breaking down and rebuilding small sections at a time. As with all physiological processes, things can also go wrong with this harmonious equilibrium. This is symptomatic of osteoporosis, Paget's disease and bone metastasis. The way how these anomalies are formed will be shown and a few strategies how these are tackled will be explained. One of these techniques involves Radiopharmaceuticals. In the case of bone agents, this type of pharmaceuticals consists of a metal ion that is radioactive coupled to a carrier that pulls the metal ion selectively towards the bone and more particularly to the disease area on the bone. Due the different radioactive properties of metal ions quite a selection of combinations is possible which gives fascinating drug design options.

The speaker

Dr Zeevaart holds a PhD from the Delft University of Technology (The Netherlands), and is Departmental head of the Radiochemistry Department at NECSA. The scope of his work includes development of new radiopharmaceutials used in the treatment of secondary bone metastasis and the application as radionuclides as in vivo biological tracers as well as the development of isotope production methods to exploit the use of the SAFARI-I research reactor for commercial ends.

He has a number of publications in international journals as well as contributions to conferences.

Please note: There will be no S_2A_3 talk in October.

The clergy in South African science

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Science as a profession became established mainly during the latter half of the 19th century. Before that time (and to some extent in later years) scientific research was often carried out by persons who were largely self-trained. A surprising number of these were members of the clergy, of whom about 80 are known to have contributed to research in the natural sciences in southern Africa while many more were active in the study of ethnology and the indigenous languages. Today there is little direct contact between the natural sciences and religion. One reason for this changed relationship is that today a much smaller proportion of university students undergo religious training than during the 19th century, when it was often combined with a variety of other subjects, including the sciences. However, a more fundamental reason why the clergy were drawn to the study of nature in days gone by has to do with a set of beliefs known as natural theology.

Natural theology and science

Until the time of the reformation most Christian theologians believed that knowledge of God can be obtained only through revelation, mainly as represented in the Bible. However, as early as 1436 the Spanish physician Raymond de Sebonde in his *Theologia Naturalis...* argued that knowledge of God can also be gained by studying nature. This view became widely accepted in England from the late 17th century. An important early work on the topic was John Ray's *The wisdom of God as manifested in the works of the creation* (1691). Natural theology means using the study of nature to prove God's existence and his goodness, and it stimulated interest in both science and comparative religion. The relevant data of natural theology are all the works of God in nature, that is, all natural phenomena studied by science. Scientific research, it was argued, demonstrates the design and order of creation, hence it cannot be in conflict with revelation and is in fact an appropriate religious pursuit. The supporters of natural theology included prominent early scientists such as Isaac Newton and Robert Boyle.

Natural theology arose at a time when there were no convincing scientific explanations of how the earth was formed and how plants and animals came into being. Hence, the study of nature allowed much scope for divine intervention, in the form of either sudden creative acts (for example, the creation of specific life forms), or catastrophic natural events (during which landscapes such as mountain ranges might be formed). These creationist views of nature suffered a major setback with the publication of Charles Lyell's *Principles of geology* (1833), in which he argued convincingly that past geological changes can best be explained by the gradual action of natural processes such as erosion and deposition, rather than by catastrophic events. Hence, the need for miracles to explain geological changes diminished. An even more severe setback for natural theology occurred with the publication of Darwin's *Origin of species* (1858) and later supporting literature. Darwin ascribed the origin of species (including humans) to gradual evolution, a natural process that required no divine intervention.

Many theologians and others objected to the theory of evolution because it left little or no place for God in nature and therefore threatened to disrupt the harmony between science and religion. Some soon realised that the theory did not differ from other scientific explanations in this respect and adapted their views to accommodate it. For example, Rev. D.P. Faure, founder of the Unitarian Church in South Africa, argued in an address published in Cape Town in August 1876 that Darwinism need not be inconsistent with Christian religious views. However, as gradualism and natural causation came to be widely accepted, science lost its relevance to religion in the eyes of most theologians and natural theology gradually faded. Meanwhile many members of the clergy had made their mark in science, also in southern Africa.

Early clerical pioneers of astronomy in SA

The first astronomer of note to make observations from the Cape was the French Jesuit priest Father Guy Tachard, who stayed at the Cape for a while with a party of his colleagues in 1685, on their way to the East. Tachard determined the longitude of the Cape using eclipses of Jupiter's satellites, and observed some of the southern stars. During the next century, the most prominent astronomer to work at the Cape was the Frenchman Abbé Louis Nicholas De La Caille. The religious title Abbé was conferred upon him when he completed his classical education, but he became a renowned professional astronomer. During his work at the Cape in 1751-1752 he observed the positions of some 10 000 southern stars and observed an arc of meridian to help determine the precise shape of the earth. In the next century the astronomer who chose the site and supervised the construction of the Royal Observatory, Cape of Good Hope, and conducted work there until his death in 1831, was Reverend Fearon Fellows. He was ordained in the Church of England, but like De La Caille became a professional astronomer. A later example of a religiously trained astronomer and meteorologist was the Jesuit Father Edmund A. Goetz, who arrived in Zimbabwe in 1903 to take over the direction of the Government sponsored meteorological observatory in Bulawayo. An astronomical observatory was added to the institution in 1913. Goetz, who was a fellow of the Royal Astronomical Society, remained in charge of the observatory until 1928. It was later named the Goetz Observatory in his honour.

Clerics as explorers and geographers

The outstanding example of the missionary explorer in sub-Saharan Africa is Dr David Livingstone (1813-1873) of the London Missionary Society, who put more information on the map of Africa that any other explorer. He was the first to describe Lake Ngami in the Kalahari, the sources of the Zambezi and Congo rivers, the Victoria Falls, and many other geographical features of central Africa. Most of his geographical observations were published in the *Journal of the Royal Geographical Society* and in his *Missionary Travels* (1857).

Other clerics who contributed to geographical knowledge of southern Africa include Rev. Thomas Arbousset (1810-1877) of the Paris Evangelical Missionary Society, who named Mont-aux-Sources in 1836; Rev. George Blencowe (1817-1893), who published on the geology and physical geography of Zululand; and Francis Fleming (1823-1895), an Anglican priest who published a book on the geography of southern Africa in 1856.

Students of natural history

The single most popular scientific activity of religious workers was plant collection. Their specimens are housed in many herbaria in southern Africa and overseas, and constitute a substantial contribution to knowledge of the flora of the sub-continent. Somewhat less common, though no less enthusiastic, were investigators of the country's fauna. For example, the Swiss missionary Henri Junod (1863-1934), anthropologist, linguist and plant collector, also collected scorpions, spiders, insects and other land invertebrates in South Africa and Mozambique for the Transvaal Museum, South African Museum, and institutions in Switzerland. He published several papers on his specimens, and many species were named after him by others. The South African born Roman Catholic priest, Friedrich Kolbe (1854-1936), poet, author and philosopher, made important collections of insects and other land invertebrates for the South African Museum. Reverend Nendrik Abraham, a Wesleyan minister in the Eastern Cape and Natal, published on a species of tree trapdoor spider (1887) and on the fish and frog eating spiders of Natal (1923). The Jesuit Father Joseph O'Neil (1867-1952) was a pioneer entomologist who collected many new species between 1893 and 1914, and helped to arrange the beetle collection of the Albany Museum. Reverend Robert Godfrey (1872-1948), a Presbyterian minister in the Eastern Cape, collected and described birds, and presented ants to the South African Museum and false scorpions to Albany Museum. Finally, the brothers Robert and John Woodward, both Anglican missionaries, published a pioneering book, *Natal birds*, in Pietermaritzburg in 1899.

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