Southern Africa Association for the Advancement of Science
Suider-Afrika Genootskap vir die Bevordering van die Wetenskap

Rudolf Marloth
Brochure - Brosjure

Annual award ceremony: November 2008

The South Africa Medal (gold):
Awarded to Professor Patrick George Eriksson

The South Africa Medal (gold) has been awarded annually since 1908 to recognise exceptional contributions to the advancement of science on a broad front or in a specific field, by an eminent South African scientist. Professor Eriksson received this prestigious award in 2008 for his important contributions to South African geology.

Pat Eriksson matriculated in 1969 from Kearsney College, Natal. He obtained his BSc degree in geology from the University of Natal in 1974, following which he worked as an exploration geologist for Anglo American in Namaqualand for two years. During this time he also saw active military service in the Namibian border war. Returning to the University of Natal in 1977, he obtained his BSc Honours degree in geology, followed by an MSc (1979) and a PhD (1984). In July 1982 he joined the Department of Geology at the University of Pretoria as a lecturer, and was promoted through the ranks, becoming professor in 1994. In 1998 he obtained the Dr rer nat habil (higher doctorate) from Ludwig-Maximilians University in Munich, Germany. In December 2006, he was appointed as head of the Department of Geology at the University of Pretoria, and in June 2008 as acting Chair of the School of Physical Sciences.

Professor Eriksson taught sedimentology, basin analysis, historical geology and crustal evolution from 1982 till 2006, and currently lectures in the first two. He has authored or co-authored over 170 scientific papers and book contributions, and has co-edited two books: *The Precambrian Earth: tempos and events (2004)*, and *Atlas of microbial mat features preserved within the siliciclastic rock record (2007)*. He has been an outstanding academic achiever of the University since 1999, and his awards include the Medal for Academic Excellence, Centenary Research Medal, the Chancellor's Award for Research (all from the University of Pretoria) and the National Research Foundation President's A award. He is currently editor-in-chief of the *Journal of African Earth Sciences* and co-editor of the journals *Gondwana Research* and *Marine and Petroleum Geology*. He is a Fellow of the Geological Society of South Africa and a member of the New York Academy of Sciences.

Most importantly, Professor Eriksson is married to Marianne.

Professor Patrick George Eriksson

Summary of the 2008 Rudolf Marloth Lecture by Prof. Pat Eriksson:

Microbial mat features preserved in sandstones

Microbial mats are relatively tough, leathery fibrillar meshworks, mainly of cyanobacterial origin, that grow upon sedimentary substrates and which bind into such loose sediment beds. These mats form around 80 recognisable features through their growth, metabolism, destruction, decay and diagenesis (transformation into sedimentary rock). The mats themselves are not preserved, as they rapidly decay and are destroyed after burial of the associated sediments. However, they leave behind proxy features within these sediments, reflecting the presence and action of the mats. These proxy features are termed mat-related structures

In his lecture Professor Eriksson addressed some mat-related structures, specifically those related to mat destruction. There are three major groups of these: (1) Cracks formed in mats, which propagate down into underlying cohesive sand (made cohesive by the binding action of the mats). Associated with a large variety of cracks are crack-fillings which commonly form positive ridge-like features, known as "petees". (2) So-called "roll-up" structures, reflecting mat desiccation and curling, with the mats providing binding and strength to enable thin (often muddy) sediment layers to curl well beyond the natural curling limits of drying mud. (3) "Mat chips" (microbially bound, rounded sandy grain collections) and mat fragments, bearing witness to mat destruction processes. These are often associated with roll-ups.

Mat cracks take on many forms. Incipient cracking often begins with sets of discrete spindle-shaped, sinuous and tripartite (y-shaped) crack intersections and as these develop further, networks of cracks result. If the cracks are filled with sediment from above, then the sands of the substrate and those forming the petees are usually different in character (e.g., grain composition, shape, sizes, etc.). However, if petees form through sands from below, then the sands in the ridges and those of the substrate layer are indistinguishable. Other sets of cracks show particular relationships with ripples formed through current or wind action on loose sandstone surfaces. Sometimes, cracks in sandstones are preferentially found within the ripple troughs, while at other times they are restricted to ripple crests. Curled crack margins are fairly common, reflecting the curling-back of a mixture of microbial mat and sandy sediment. Mat chips become totally detached from their substrates and from surrounding mat portions, and are commonly removed by wind or water currents. The fragments thus come to rest far from their original settings. Roll-ups, which are often relatively long and cumbersome, do not transport easily and therefore usually remain close to their original setting.

What do mat-related structures tell us of the genesis of their enclosing sedimentary rocks? Firstly, the structures are very widespread in terms of genetic setting, forming in all environments from deep marine shelves, through coastal settings (where their numbers and variability reach a maximum) into continental interiors and even deserts. Their real importance lies in what they tell us of sedimentation regimes and palaeo-climates on the Precambrian Earth (>570 million years ago). Tough leathery mats that lend themselves to developing mat-related structures require weeks or even months of non-burial to form, which strongly supports the idea that sedimentation regimes at coastlines (where the structures are most abundantly preserved)

Professor Eriksson (right) receives the South Africa Medal (gold) from Dr Ian Raper, President of the Association

were episodic rather than continuous. This supports independent evidence that ancient Precambrian river systems may have been equally episodic. Episodic sedimentary regimes point to episodic rainfall, which is best accomplished through a greenhouse palaeo-atmosphere wherein gases such as carbon dioxide and methane were paramount. These palaeo-environmental and palaeo-atmospheric inferences are most strongly suggested for the time period 2.3-1.8 billion years ago, a time when Earth's atmosphere is thought to have accumulated oxygen following the spread of photosynthetic organisms. The evidence from the humble microbial mat proxy features observed in many sedimentary basins provides the basis for a counter-argument, that oxidation of Earth's atmosphere may rather have been strongly diachronous and may also have been geographically highly variable, with some terrains remaining under the influence of strong greenhouse conditions while others were subject to cooler, more oxygenated settings.

The British Association Medal (silver): Awarded to Professor Thokozani Majozi

Professor Thokozani Majozi

The British Association Medal (silver) was instituted in 1932 and is awarded annually to a scientist under the age of 40 who is actively engaged in research and has, by way of international participation and publications, shown outstanding capability and achievements. In 2008 the medal was awarded to Professor Thokozani Majozi in recognition of his outstanding research in Chemical Engineering, particularly process integration.

Thokozani Majozi was born in 1972 in KwaMashu, north of Durban. He completed his secondary school education at Mqhawe High School in Inanda and subsequently obtained the degrees BSc (Engineering) in 1994 and MSc (Chemical Engineering) in 1998 at the University of Natal. In 2002 he completed his PhD (Chemical Engineering) at the University of Manchester Institute of Science and Technology in the United Kingdom. He started his professional career as a junior process engineer at Unilever in 1994. In 1996 he was appointed as a senior process engineer at Dow AgroSciences and in 2002 joined Sasol Technology as a technology leader for optimization and integration. He was appointed as an associate professor in the Department of Chemical Engineering, University of Pretoria, in 2004, and was recently promoted to full professor. He is also an associate professor in the Department of Computer Science at the University of Pannonia in Hungary.

Professor Majozi's main research interest is in process integration. His major contributions to research to date are the development of a continuous-time framework for the synthesis of batch plants and a novel technique for utility systems optimization. Both these contributions have been adopted by industry. He is a member of various committees and organisations, including the European Symposium on Computer Aided Process Engineering (ESCAPE), the European Process Integration Conference (PRES), and the Academy of Sciences of South Africa (ASSAf). He is also a Fellow of the Water Institution of Southern Africa, a board member of Pelchem (Pty) Ltd, and a member of the editorial board for Chemical Engineering Transactions Journal. He has received numerous awards for his research, including the Commonwealth Scholarship award (1999), the Star Performer of the Year award (Sasol Technology; 2003), Zdenek Burianec Memorial award (Italy, 2005), UP award for Outstanding Young Researcher, NSTF award for Distinguished Researcher in the last five to ten years (2006), Leading Minds Centenary award (2008) and the National Research Foundation President's award (P-rating, 2007). Professor Majozi is author or co-author of more than 70 publications in scientific journals and refereed conference proceedings, and has contributed 3 chapters in books. A book by him on batch process integration will be published during 2009.

Professor Majozi (right) receives the British Association Medal (silver) from Dr Ian Raper

Summary of Professor Majozi's lecture: Research is what I am doing when I don't know what I am doing

Process integration as a discipline is relatively young, having been introduced in the late nineteen-seventies to optimise energy use in major chemical industries. Evidently its introduction was spurred by the energy crisis experienced at that time. It is based on conceptual analysis that is supported by deep insights, rather than mathematical modelling as traditionally encountered in chemical engineering. These insights allow us to probe into the process and gain understanding which would otherwise be lost in the interplay of mathematical equations characterised by thousands of variables and parameters. The sad reality though, is that there are a myriad of practical problems the nature of which militates against the capabilities of this approach. Embedded in all of these complex problems is one common feature: they inherently cannot be reduced to two dimensions. Traditional process integration can safely be applied in situations where the problem at hand can be analysed in two dimensions without any loss of exactness or accuracy. My research, since 1997, has focused on problems that refuse to be confined to two dimensions. Paramount among these is the optimum scheduling, synthesis and design of batch chemical processes with a view to minimising energy use and water consumption.

Unlike continuous chemical processes, batch processes cannot attain a steady-state that is time invariable. Suppressing time reduces the dimensionality of the problem, which invariably reduces the complexity of the subsequent analysis. Treating time as an important independent variable is the main source of our challenges in batch process optimization. This implies that one has to establish a solid framework for capturing the effects of time before addressing water and energy optimization. In 2001 my research group at the University of Pretoria developed a continuous-time mathematical framework based on the so called state-sequence-network recipe representation which outperformed other published methods in terms of CPU time, as a result of the drastic reduction in binary dimensions. Using this framework as a basis we have developed techniques for wastewater minimization in batch plants in media that involve single and multiple contaminants. This contribution has been further extended to address effluent problems in processes wherein water features as a major ingredient in the final product, as encountered in some pharmaceutical operations. Consequently, a near-zero effluent optimization framework has been developed and adopted by a multinational pharmaceuticals facility. The same framework has also been used to take advantage of a unique feature in batch chemical plants, namely idleness of some of the processing units. This novel concept is aimed at eliminating the necessity of dedicated storage, thereby reducing capital cost investment in both processing units and plant space.

In collaboration with our colleagues in Hungary, we have recently developed a graph-theoretic technique for scheduling batch plants that does not require any involvement of binary variables. This approach, which has been published in one of the leading chemical engineering journals, is currently the only one of its kind in the published literature. For years I told my students 'there can be no scheduling method without binary variables'. Thank God Almighty, I have proved myself wrong in my own lifetime.

Recipients of the South Africa Medal (gold) who attended the 2008 award ceremony. From left to right: Prof Pieter S. Steyn (2004), Prof Patrick G. Eriksson (2008), Dr C.K. (Bob) Brain (1997) and Prof Michael Wingfield (2005), with Dr Ian Raper, President of the Association

S_2A_3 Medals for Original Research at the Masters Level awarded during 2008

The Association's Masters Medals (bronze) serve to commend outstanding South African science students graduating at the Masters level. During 2008 medals were awarded to the following students.

University of Pretoria

Li-Chang Johnny Lo, MSc (Computer Science): "A framework for cryptography algorithms on mobile devices."

Rhodes University

Rhett Hamilton Bennett, MSc (Ichthyology): "Optimisation of a sampling protocol for long-term monitoring of temperate reef fishes."

University of KwaZulu-Natal

Ismail Yunus Akhalwaya, MSc (Theoretical Physics): "A single qubit in a random environment: From random matrices to free probability."

University of the Free State

Mbulelo Desmond Ncango, MSc (Microbiology): "Oxylipins in the yeast genus Ascoidea."

University of the Witwatersrand

Youtaro Shibayama, MSc (Genetics and Developmental Biology): "Rapid screening for antimicrobial genes in novel nocardiophages."

Stellenbosch University

Maria Johanna (Marlie) Lottering, MSc (Extractive Metallurgical Engineering): "Characterisation of the uranium leaching behavior of low grade Vaal River ores."

North-West University

Petrus Jansen van Vuren, MSc (Biochemistry): "Development of a recombinant antigen for the detection of antibodies against Rift Valley fever virus in humans and animals."

Central University of Technology

Deirdré Long, MTech (Radiography): "An analysis of dose effectiveness and incidence of late rectal complications of high dose-rate brachytherapy in the radical treatment of cervical cancer."

Nelson Mandela Metropolitan University

Louis George von Wielligh, MTech (Mechanical Engineering): "Characterization of laser cladding process variables on a light metal substrate."

Tshwane University of Technology

Pieter Julian Jacobus Marais, MTech (Mathematical Technology): "Application of non-smooth eigenfunction to partial differential equations."

University of KwaZulu-Natal

Jothi Moodley, MSc (Mathematics): "Global beddings of pseudo-Riemannian spaces."

At a ceremony held at the Nelson Mandela Metropolitan University on 13 August 2008 the Association's Masters Medal (bronze) was handed to Mr Louis von Wielligh by Dr Shaleen Els, Vice-President for the Eastern Cape. From left to right: Prof Danie Hattingh, Dr Shaleen Els, Mr Louis von Wielligh, and Dr Annelize Els-Botes

Report of the President, Dr Ian Raper, for 2008

This Association proudly celebrated its centenary in 2002. We have seen many changes in the country and in the world during the past century. Perhaps a period of somewhat greater peace is at hand internationally, following the election results in the USA. However, in parts of Africa and elsewhere there are constant humanitarian tragedies. We as S2A3 can only continue to recognise scientific achievement and endeavour, honouring great South Africans and hoping to inspire new great South Africans – and great New South Africans! In the world at large much attention is being given to decreasing carbon emissions and finding alternative sources of energy. The latest possibility on the news is a Patagonian tree fungus. Locally, the time is ripe for nation building through national responsibility in preserving and enhancing our heritage, as we identified in 2002.

Our new, free-standing website holds great promise for communicating developments and projects, so as to inform an ever greater and widespread audience of the achievements of South African science. We can only trust that our efforts will stand in service of the planet.

As President I can now report in some detail as follows:

The S2A3 Masters Medals (bronze)

As in previous years the Association has awarded bronze medals to one outstanding Masters student in science at each South African university. The candidates for these medals are selected by the institutions themselves and the purpose of the awards is to recognise outstanding research for the Masters degree. The eleven recipients of medals awarded during 2008 are listed elsewhere in this brochure.

Membership

Paid-up membership of S2A3 as on 31October 2008 was as follows: Ordinary members 56; student members 1; life members 5; honorary members 6.

Ms Irene Hitchcock passed away in June 2008. She was an honorary member who joined the Association before 1958. Professor Fred Ellery resigned as the Vice President in KwaZulu-Natal. He is succeeded by Prof Bice Martincigh. During 2008 we gained 8 new members, one being Mrs Gerda Botha, who was co-opted to serve on the S2A3 Council in February 2008. Dr Kobie Smit was congratulated on obtaining her PhD degree and has been upgraded to full membership. Six ordinary members failed to renew their 2008 membership and have been removed from the membership list.

We do not want to be "fastened to a dying animal" (WB Yeats). We need new incentives to attract new members. Even when awarding medals at universities, we are told that there are none of their science students with S2A3 membership, and few if any of the members of Faculty. The Council invites interested paid-up members to volunteer to be co-opted onto the S2A3 Council or the Pretoria Branch Committee.

Lectures arranged by the Pretoria Branch

We thank the Pretoria Branch Committee for organising the following interesting and well attended public lectures, held during 2008 at the Sci-Enza Centre, University of Pretoria:

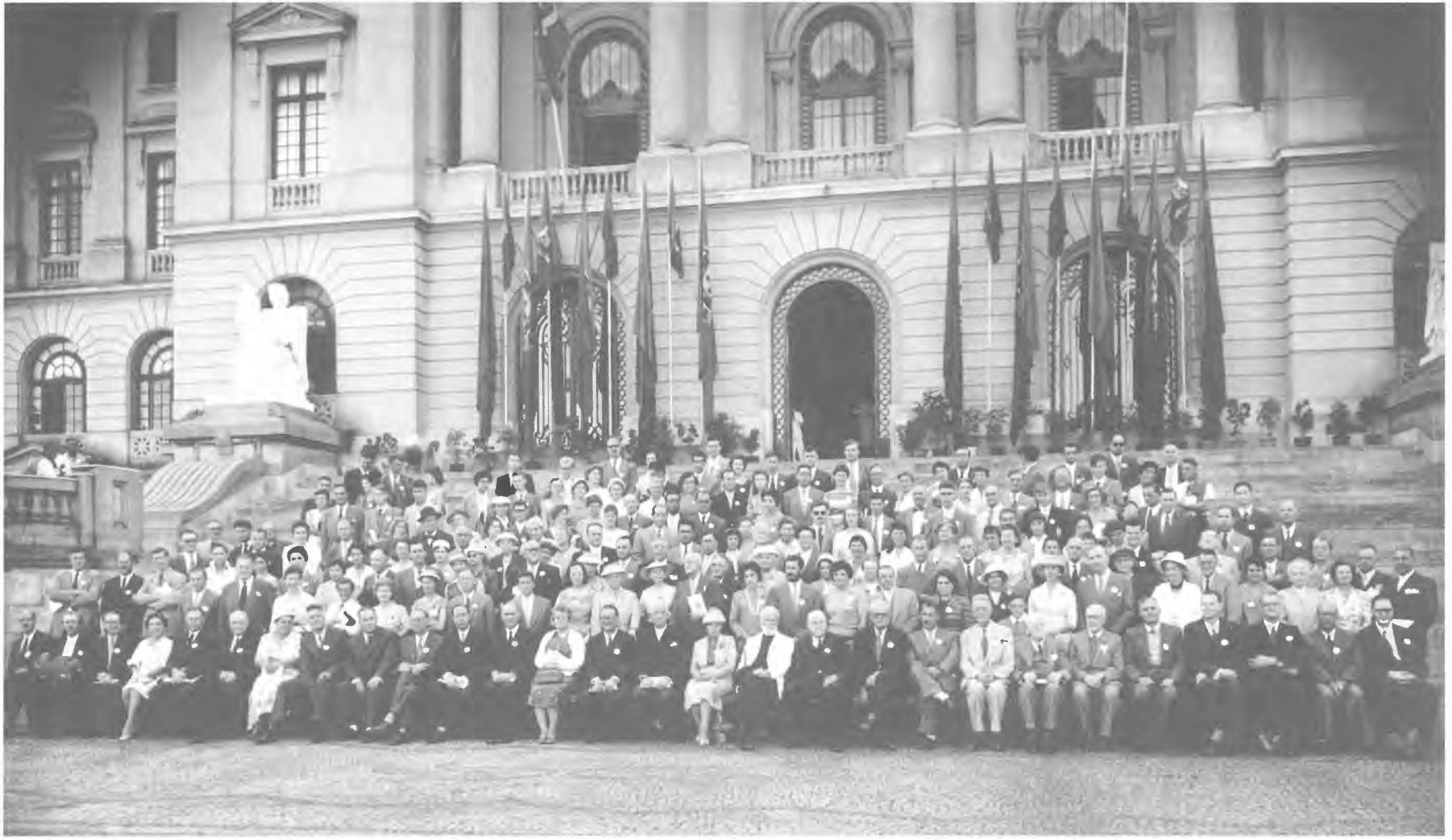
"The power of a scientific computer cluster" (5 March), by Dr Jannie Pretorius, scientific consultant in the chemical and process industry in South Africa. Recent years have seen a new approach to large scale computing, named cluster computing. Dr Pretorius explained how we define a cluster computer, how these machines are addressed by users and software developers, how its components communicate, the kinds of computations typically performed on these systems, and why cluster computing will play an increasingly commanding role in our lives.

"Emotion regulation" (2 April), by Dr Ruric Vogel, counselling psychologist. Emotion regulation is a relatively new topic of research. Dr Vogel explained the nature of emotion and how it is regulated. Emotions, which can be beneficial or detrimental to the individual, play an important role in our lives by their effects on our behaviour, decision making, memory, and interpersonal interactions. We all use emotion regulation to dampen, intensify, or maintain the emotion required to achieve specific goals.

"Towards energy sufficiency in a house" (7 May), by Professor Dieter Holm, former head, Department of Architecture, University of Pretoria. Professor Holm lives in a house that is self sufficient with regard to electricity (generated by photovoltaic panels) and water (stored rain water), yet he has all the amenities that one would expect in a modern household. He explained how this was achieved and what the average South African can do to save energy and reduce his dependence on municipal services.

"Climate change over South Africa: projections and perceptions" (4 June), by Dr Francois Engelbrecht, Department of Geography, Geoinformatics and Meteorology, University of Pretoria. Dr Engelbrecht

Fifty years ago



Delegates attending the annual congress of the Southern Africa Association for the Advancement of Science held in Maputo, Mozambique, in 1958. The President of the Association for that year was Professor Arthur E.H. Bleksley (1908-1984), applied mathematician.

explained how mathematical models of the atmosphere can be used to predict how climate, and particularly rainfall patterns over South Africa, will change in response to increased concentrations of greenhouse gasses. Despite uncertainties in the predictions it appears that South Africa, and particularly the winter rainfall areas, will become generally drier. It is also clear that anthropogenically induced climate change is unavoidable.

"Remote sensing: A remote concept or a practical tool for agriculture?" (6 August), by Mr Terry Newby, Institute for Soil, Climate and Water, Agricultural Research Council. So-called eyes in the sky are now routinely used to gather information about the nature and condition of the earth. Electromagnetic energy, including light, has proved most useful in such remote sensing, using imagery captured in space and from aircraft. Application of the technique has facilitated improved decision making in agriculture, particularly with regard to land cover mapping, monitoring invader vegetation, precision farming, drought monitoring, and crop estimation.

"Current frontiers in astronomy" (8 October), by Professor Derck Smits, Department of Mathematical Sciences, Unisa. Although astronomy is the oldest science, new discoveries are continually being made. Professor Smits discussed some of the topics that are at the forefront of astronomical research, including the latest results from telescopes such as the Spitzer and VLT, gamma ray bursts, and the nature of dark matter and dark energy. He also considered what can be expected from new instruments such as the planned James Webb Space Telescope and ESO's Extremely Large Telescope.

The S_2A_3 National Council

Contact us

Persons who support the advancement of science are invited to become members of S2A3. Please contact the Secretary, Mrs SA Korsman, for details of current membership fees and an application for membership form:
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