



Southern Africa Association for the Advancement of Science

# Rudolf Marloth Brochure 2012

ISSN 2219 - 1569

***Annual award ceremony, November 2011***

## **The South Africa Medal (gold): Awarded to Professor C.J.H. Schutte**



*Professor C.J.H. Schutte*

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 southern African scientist. Professor

Schutte received

this prestigious award in 2011 for his important contributions to physical chemistry, particularly quantum theory and the structure of matter.

Prof. C.J.H. Schutte, former Professor of Physical Chemistry and Dean of the Faculty of Science at the University of South Africa (UNISA), retired as Chief Executive Director: Science, Technology and Informatics at UNISA in 1998. He was appointed Honorary Professor of Chemistry at the University of Pretoria in 2003, as well as a member of the Unit for Advanced Scholarship. He is at present also involved with the IBM-Supercomputer of the University of Pretoria, with special emphasis on scientific computing.

Professor Schutte is one of the founder members of the prestigious Academy of Science of South Africa (ASSAf). He was President of the South African Chemical Society for four years and was awarded the

Havenga Prize for Chemistry of the Suid-Afrikaanse Akademie vir Wetenskap en Kuns, as well as the James Moir Memorial Medal of the South African Chemical Institute. In 2011 he was awarded the gold medal of the South African Chemical Institute for his research in Chemistry.

From 1973 to 1997 he was a member of the South African delegation to the bi-annual meetings of the International Union of Pure and Applied Chemistry (IUPAC), served for many years on the IUPAC Commission for Molecular Spectroscopy and Structure, and was its chairperson for four years. He also served on the Publications Committee of IUPAC for many years, and was chairperson of the Editorial Board of IUPAC's Journal *Pure and Applied Chemistry*.

Professor Schutte's main research interest in chemistry centres on quantum theory and the structure of matter. He acted as promoter or co-promoter of more than 30 PhD and 20 MSc students, has published over 70 research papers in international scientific journals (the latest appeared in 2012) and participated in numerous scientific conferences both locally and overseas. He is the author of two textbooks, *The Wave Mechanics of Atoms, Molecules and Ions* (1968) and *The Theory of Molecular Spectroscopy* (1976). Both books were prescribed at universities around the world.

More recently, as a specialist in distance education, Professor Schutte's interest also shifted to telematics and education, especially to education using a confluence of techniques on the internet, with special emphasis on the teaching of mathematical subjects

via distance education. He has delivered papers at many South African and international conferences on informatics and telematics, and presently serves on the advisory committee of the annual Berlin On-Line EDUCA conferences. He also acted as IT consultant for the South African Department of Education,

contributing to the very important TELI Report. He is co-author of the review dealing with the internet and telematics education on the African continent, published by the Commonwealth of Learning, Vancouver, Canada.

## Summary of the 2011 Rudolf Marloth Lecture by Professor C.J.H. Schutte: The Physics and Chemistry of Single Molecules.

Ever since chemistry developed as a separate branch of science in which we study the reactions of elements and their over sixty million identified and characterized compounds, we have always worked with “swarms” of molecules containing many billions of molecular entities. However, in trying to understand the mechanisms of such reactions, we have always implicitly assumed that they take place between single molecules. This is not quite true, as the chemical and physical properties of every individual molecule in such a swarm of molecules are profoundly influenced by the other molecular entities surrounding it. This, naturally, also influences the reaction mechanism and the way that a specific molecule reacts in a particular situation. As a typical example, I can point out that every organic chemist knows that some reactions may be quite solvent-dependent – an effect that can be either a nuisance, or used as an advantage.

During the past two decades a new branch of science has developed: Nanotechnology, that is, the study of the chemistry and physics of collections of a few molecules in the form of small clumps of mass ranging in size from 10 to 100 nanometers across. This new branch of science holds many surprises for chemists and physicists, because the rules that have been perfected over several centuries to predict reactions, do not work at this small scale in most cases! Enough knowledge has been acquired about this field in the meantime to use it to produce new substances, such as very effective nano-medicines, to improve catalysts used in industry, and to make new and useful compounds.

Experimental techniques have now advanced to such a stage that we can “see” individual molecules isolated on so-called “non-reacting surfaces”, and can thus study some of their physical properties. Some of these isolated molecules do look more or less just like we thought that they would from our studies of the macro world. However, others look quite different from what we thought, and some such examples were shown and discussed in the lecture.

The fact that we can now observe truly isolated molecules on non-reacting surfaces, generated several important questions, such as:

- Can we induce such an isolated single molecule to undergo a chemical reaction by itself?
- Can we induce such an isolated single molecule to move by itself on a surface?
- Can we induce such an isolated single molecule to be “pushed around” on a non-reacting surface?
- Can we induce such an isolated single molecule do some work for us?
- Can we induce two such isolated molecules on a non-reacting surface to move towards one-another (or be pushed closer to each other) so that we can place them in a position where they can react in a truly bimolecular chemical reaction? And if we manage to push them together, will they react, and if so, how will they react?

These and other questions were discussed in Professor Schutte’s lecture. He dealt, among others, with a single molecule that can be electrolyzed on its own; a single molecule that can swing around on a surface if it is correctly activated, acting as a kind of “molecular motor”; and with how we can simulate such reactions using modern computational chemistry.



*Professor C.J.H. Schutte receives the South Africa Medal (gold) from the President, Dr Ian Raper.*

## **The British Association Medal (silver): Awarded to Professor Alta E. Schutte**

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 publication, shown outstanding capability and achievements. In 2011 the medal was awarded to Professor Alta Schutte in recognition of her important research in human cardiovascular physiology.

Alta Snyman was born in Klerksdorp on 8 July 1977. She studied at the former Potchefstroom University for Christian Higher Education (now North-West University), where she was awarded the degrees BSc (1998), BSc Hons (1999) and MSc (2000) in Physiology, all three with distinction. She continued with her PhD in Physiology (2002), which focused on the cardiovascular effects of specific dietary macro- and micronutrients in African children and adults. Her doctoral research gave rise to four peer-reviewed publications in ISI rated journals.

After completing her PhD Alta performed postdoctoral research in Aboriginal communities in the Northern Territory of Australia, at the Menzies School of Health Research. During this time she was selected as one of 100 young PhD's worldwide to become a BioVision.Nxt fellow. As part of the BioVision programme in Lyon, France, she had the opportunity to attend exclusive sessions with leading scientists, Nobel Prize winners and world leaders.

In 2001 Alta joined the Department of Physiology at the North-West University as junior subject specialist. Since obtaining her PhD she was Principle Investigator of two large multidisciplinary research projects and co-investigator of another. She has been an invited speaker at international meetings in Australia, Denmark, Germany and Italy, and shared her knowledge with the public at the National

Science Festival in Grahamstown in 2011. Her research outputs include 75 peer-reviewed papers, mostly in international journals, and she was or still is the supervisor of 3 postdoctoral, 7 PhD, 15 MSc and 17 BSc Honours students. She has reviewed papers for 23 different international journals, regularly presents research results at international conferences and engages with numerous collaborators around the world.



*Professor Alta E. Schutte.*

In 2010 Alta was the winner of the Distinguished Young Women Scientist in the Life Sciences Award, presented by the Department of Science and Technology. In 2011 she was inaugurated by Deputy Minister Hanekom (DST) as one of the twenty founding members of the South African Young Academy of Sciences, hosted by the Academy of Sciences of South Africa. Since 2010 she is Professor of Physiology and the Director of the Hypertension in Africa Research Team or HART, at the Potchefstroom campus of the North-West University. The research focus of HART is the identification of early markers for the development of hypertension, and ultimately the prevention of cardiovascular disease in the black South African population. Her personal passion is the unexplored territory and discoveries in human cardiovascular physiology, and she enjoys taking enthusiastic students with her on such journeys.

Alta is married to Paul-Jaco Schutte, and they have two children, Jacques (5) and Anita (3).

---

## **Summary of lecture by Professor Alta Schutte: Perspectives on “A long and healthy life for all South Africans”**

For centuries humans have been preoccupied with extending their longevity. This seems even more true in the modern era, where longevity research is supported by bodies such as the Methuselah Foundation. Although such support is mostly provided by the developed world, third world countries, such as South Africa, have good reason to focus their attention on improving life expectancy. Although countries in Sub-Saharan Africa are mostly plagued by HIV-infection and tuberculosis, the importance

of noncommunicable diseases in threatening life expectancy should not be underestimated. With a present life expectancy of 51.6 years for South Africans, it is therefore not surprising that the vision of the South African Department of Health is to have “a long and healthy life for all South Africans”. The question therefore arises whether science has something to offer in order to improve lifespan? The focus of this lecture is to address five of the current hot topics in longevity science, namely the role of

genetics, telomere length, caloric restriction, studies on centenarians, and the role of the insulin-like growth factor (IGF)-axis.

More than a century ago (1898) William Osler already said: "Longevity is a vascular question, which has been well expressed in the axiom that a man is only as old as his arteries". These wise words are confirmed in the twenty-first century, with the World Health Organization acknowledging that cardiovascular disease is the number one cause of mortality. This is a global phenomenon and South Africa is no exception. The prevalence of cardiovascular disease is increasing rapidly, resulting in end-organ damage, heart failure, stroke, coronary artery disease, and ultimately reduced longevity. Furthermore, the underdiagnosis and poor control of hypertension add to this threat. The Hypertension in Africa Research Team (HART) focus their attention on preventing hypertension in the long run – even if it means the early detection of vascular changes. Findings from a recent study of HART in black South Africans suggest that young Africans have an early decline in IGF-I – which is a hormone with significant vascular protective and insulin sensitising properties. The loss of these protective benefits of IGF-I was strongly associated with poor vascular function (arterial stiffness) and lifestyle (alcohol intake and smoking).

The possibility to identify early markers of vascular function, such as IGF-I, provides opportunities to detect those at risk before the disease sets in. Together with IGF-I experts in Italy (Dr. Elena Conti, Prof. Massimo Volpe), IGF-I and its binding proteins are now being investigated in a large South African sample of 2000 Africans, and the five year cardiovascular effects in the follow-up study should shed more light on the functioning of this important hormone. IGF-I treatment is an area that is investigated on a global scale, but it may also have a significant impact in prevention programmes. Ultimately it may improve quality of life as well as longevity. In the words of Albert Einstein, "Intellectuals solve problems, geniuses prevent them".



*Professor Alta E. Schutte receives the British Association Medal (silver).*

## ***S<sub>2</sub>A<sub>3</sub> Medals for Original Research at the Masters Level, awarded during 2011-2012***

The Association's Masters Medals (bronze) are awarded annually to the most outstanding research student in a scientific subject, graduating at the masters level, at each South African university. During 2011-2012 medals were awarded to the following students:

### **University of the Free State (May 2011)**

Christina Wilhelmina Miles, MSc (Plant Breeding): "Mixogram parameters and their relationship to other bread wheat quality characteristics."

### **Central University of Technology, Free State (March 2011)**

De Ville Ian Weppenaar, MTech (Electrical Engineering): "Intelligent maintenance management in a reconfigurable environment using multi-agent systems."

### **University of KwaZulu-Natal (Sept 2011)**

Garreth David Sparks, MSc (Agriculture): "The economic feasibility of on-farm biodiesel production in KwaZulu-Natal."

### **Nelson Mandela Metropolitan University (November 2011)**

Timothy Vernon Light, MEng (Mechatronics): "Dynamic modelling of a reconfigurable machine tool."

## North-West University (October 2011)

Suné van Solms, MEng (Computer Engineering):  
“Exploiting the implicit error correcting ability of networks that use random network coding.”

## Tshwane University of Technology (September 2010)

Frank C. Lujaji, MTech (Mechanical Engineering):  
“Effects of fuel blends containing croton oil, butanol and diesel on the performance and emissions of diesel engines.”

## University of Stellenbosch (December 2011)

M.J. Janse van Vuuren (born Leeuwner), MScEng (Metallurgic Engineering): “On-line monitoring of hydrocyclones by use of image analysis.”

## University of Cape Town (May 2011)

Fhumulani Nemulodi, MSc (Physics): “Third order relativistic dissipative fluid dynamics for heavy-ion collisions.”

## University of Pretoria (February 2012)

Matteus Theodor Loots, MSc (Mathematical Statistics): “The development of the quaternion normal distribution.”

## Rhodes University (April 2012)

Rory Biggs, MSc (Mathematics): “A study of four-dimensional oscillator groups and the associated left-invariant control affine systems.”



*One of the Association's Medals for Original Research at the Masters Level was presented to Mr Timothy Light by our Eastern Cape Representative, Ms Jacqueline Barnett, at the Nelson Mandela Metropolitan University on 4 November 2011.*



*At the North-West University the Masters Medal was presented to Suné van Solms by Professor N. Stoker.*



*The medal and certificate received by Mr Timothy Light at the Nelson Mandale Metropolitan University.*



*At Rhodes University the Masters Medal was presented to Rory Biggs by Professor R.T.F. Bernard, Dean of the Faculty of Science.*

# Report of the President, Dr Ian Raper, for 2011

It is again my privilege this year to pay tribute to specific scientists for their achievements at the highest levels, which I do most cordially on behalf of the Council and members of  $S_2A_3$ . On the one hand, our awards of bronze medals at universities throughout South Africa during the year culminate in this ceremony. On the other hand, tonight's tributes recognise the endeavours and discoveries of dedicated researchers and senior scientists. The South Africa Medal (gold) and the British Association Medal (silver) represent the Council's decision on the best of the nominations received for this year.

During 2011 and the early part of 2012 a number of universities each awarded the  $S_2A_3$  Medal for Original Research at the Masters Level. A list of the institutions and the recipients of the awards appears elsewhere in this brochure. We can be proud of the number of universities which recognise the value of our awards and provide this incentive to their senior students on their way to doctorates and a lifetime of service to science.

While we reach for the sky, it is proper to remember that this should not be done at the expense of the quality of life of people in the region. As the association for the advancement of science in southern Africa we should no doubt also encourage, for example, work to counter desertification, desalinate sea water, and combat the diseases that ravage our people.

Our total membership at the end of 2011 was 79. This modest figure has not changed significantly in the past few years. I would like to invite interested members to offer their services to be co-opted onto the Council and especially to the Pretoria Branch Committee. In order to survive as an association, it is essential that extra people become involved with the running of both the Council and the Pretoria Branch. Please consider offering your help and time, as in our current situation the association is struggling to perform its functions.

The Pretoria Branch Committee, and specifically Dr Walter Meyer, deserve our thanks for arranging a number of extremely interesting and well attended lectures during 2011/12 at the Sci-Enza Centre, University of Pretoria, details of which appear below.

Heartily thanks also to the following  $S_2A_3$  members for their work during 2011:

- The  $S_2A_3$  Council members and Pretoria Branch members for their dedication and hard work throughout 2011. We should remember that

without their willingness the association would not be in a position to function as it does.

- In particular, the National Secretary, Mrs Shirley Korsman, who despite severe illness has been our mainstay and remained prompt and cheerful all the way. What a wonderful example of selflessness she personifies.
- All those  $S_2A_3$  members who have helped make this evening a splendid success, arranging snacks and refreshments, the venue and all other logistics.
- The Marloth Trust for financing the 2011 Annual Awards Ceremony and the Marloth Brochure, which records the awards ceremony held during November 2011 and other aspects of the association's work during 2011/12.

## Lectures arranged by the Pretoria Branch

During the year from May 2011 to May 2012 the following lectures were delivered at the Sci-Enza Centre, University of Pretoria:

"Eight years of Giant Bullfrog research revealed" (4 May 2011), by Caroline Yetman, Centre for Environmental Studies, University of Pretoria. The Giant Bullfrog (*Pyxicephalus adspersus*), one of the world's largest, most aggressive and elusive frog species, is near-threatened in South Africa owing to habitat loss. In 2003 a research project on the bullfrog's ecology was initiated, with a view to compiling a comprehensive conservation management plan for the species. The study revealed the bullfrog's distribution range, genetic structure, gene flow between populations, spatial habitat requirements and other vital information. Eight years of pioneering research on the species has cleared many misconceptions about this fascinating amphibian.

"Can the mind-body problem be solved? – Reflections on the emergence of mind from matter" (1 June 2011), by Werner H. Griess, Honorary Professor, Department of Physics, University of Pretoria. The age-old and as yet unresolved mind-body problem (how mind can emerge from matter) is important because its solution promises to reveal the natural constraints on human reasoning. The problem is studied by cognitive scientists, but has received little attention from physicists. The speaker's investigation of the cognitive aspects of physical science and his contemplation of the mind-body problem over a period of almost ten years, have led to a first-order

solution of the problem, based on a model of nature in which complexity, emergence, and biological evolution are key elements.

The S<sub>2</sub>A<sub>3</sub>, Sci-Enza and the Department of Physics of the University of Pretoria invited members to watch a lunar eclipse on the evening of 15 June 2011. The evening started with a short lecture in the Sci-Enza auditorium, followed by viewing of the total eclipse, which started at 21:23. A few telescopes were also set up.

“Talking hunger: The food security “lens” moves into the city” (3 August 2011), by Leonie Joubert, science writer. This lecture was arranged in association with the Sci-Enza and SAASTA during the National Science Week. Rural food security has been well studied, but urban food security has been largely neglected. With over half of the population of southern Africa living in cities, the focus should shift to city dweller’s access to food, and the link between poverty and food security. The speaker discussed in particular what food security means for the urban poor. She is currently writing a popular book on the subject.

“The stratigraphic significance of life for the Precambrian Eon” (14 September 2011), by Wladyslaw Altermann, Kumba-Exxaro Chair in Geodynamics, University of Pretoria. The oldest probable evidence for life on earth is the carbon-isotope signature of 3.7 billion year old rocks in Greenland. Much more convincing evidence, including stromatolites and microbial body fossils, is contained in, among others, the Barberton greenstone belt. And with the expansion of carbonate platforms on stable continental shelves evidence for life becomes abundant. Although individual arguments for life in the Archean may be equivocal, the geological and evolutionary context links all the evidence into a well-fitting, robust scenario of prokaryotic life thriving in sedimentary environments well before 3.5 billion years ago.

“Cryptococcus – an underestimated fungal pathogen of humans in Africa” (12 October 2011), by Maralize van Wyk, Medical Scientist in the Centre

for Opportunistic, Tropical and Hospital-acquired Infections of the National Institute for Communicable Diseases. One of the most important HIV-related opportunistic diseases is *Cryptococcus neoformans*. It has a high mortality rate and most of the about one million cases recorded per year occur in sub-Saharan Africa. Active surveillance through the GERMS-SA project allowed the speaker and her colleagues to track differences in resistance and other changes, while molecular studies are used to characterise different strains. Late presentation and failure to comply with the treatment regimen appear to be major causes of mortality from the disease.

“An earth saving revolution: An insight into the technology of effective micro-organisms” (7 March 2012), by Grant Morgan, Technical Director, Efficient Microbes. This talk dealt with the basic technology of producing suitable mixtures of microbes and their application to improve human and animal health, soil quality, agricultural yields, water quality and waste management. Various possibilities for further developing the technology in co-operation with the scientific community were indicated. The application of such microbial cultures is expected to produce substantial economical benefits and significant improvements in our environments.

“The CO<sub>2</sub>-rich Precambrian atmosphere, Bushveld Mining and CO<sub>2</sub> sequestration opportunities in South Africa” (9 May 2012), by Wlady Altermann, Department of Geology, University of Pretoria. The recently launched Atlas on Geological Storage of Carbon Dioxide in South Africa reported an estimated storage capacity of 150 Gt of CO<sub>2</sub>, mostly located offshore and therefore expensive to utilize. During the Archean, 3.5 to 2.5 billion years ago, the earth’s atmosphere was some 3000 times richer in CO<sub>2</sub> than it is today, leading to natural sequestration of CO<sub>2</sub> through weathering of rocks, carbonate sedimentation and bacterial life. In the same way, mining waste could be used today to sequester anthropogenic CO<sub>2</sub> in South Africa on an industrial scale, to combat global warming.

# The $S_2A_3$ National Council

## **President**

Dr Ian Raper

## **Vice-Presidents**

Professor Bice Martincigh (KwaZulu-Natal)

Dr Frans Korb (Gauteng)

Ms Jacqueline Barnett (Eastern Cape)

Professor Pieter Stoker (North-west)

## **Treasurer**

Dr Walter Meyer

## **Secretary**

Mrs Shirley Korsman

## **Council Members**

Mrs Esme den Dulk, Mr Eugen Hanau,  
Professor Cornelis Plug, Mr Braam Smit,  
Professor Michael Wingfield.

## **Past President serving on Council**

Professor Paul J Smit

## **The Pretoria Branch Committee**

Dr Walter Meyer (Chairman)  
Ms Rejaene van Dyk, Ms Retha Bezuidenhout

## **Contact us**

Persons who support the advancement of science are invited to become members of  $S_2A_3$ . Please contact the Secretary, Mrs SA Korsman, for details of current membership fees and an application for membership form:

P.O. Box 366, Irene 0062

Tel: 012-667 2544

Fax: 086-6714054

E-mail: [s2a3@global.co.za](mailto:s2a3@global.co.za)

Visit our website at <http://www.s2a3.up.ac.za>

Consult the  $S_2A_3$  biographical database of southern African science at <http://www.s2a3.org.za/bio/Main.php>