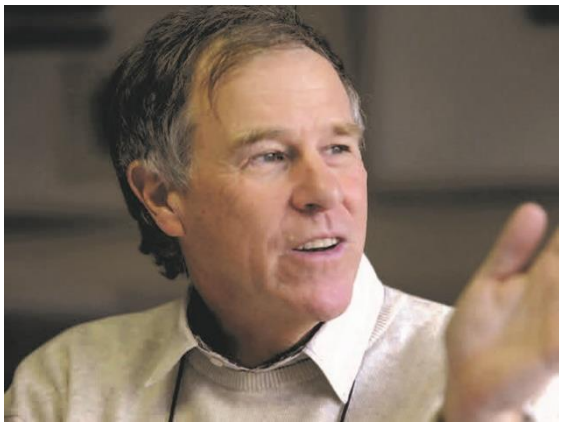
Southern Africa Association for the Advancement of Science

Rudolf Marloth Brochure 2015

The 2014 South Africa Medal (gold): Awarded to Professor Timothy Noakes

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 Noakes received this prestigious award in 2014 for his outstanding contributions to sport physiology.



Professor Timothy Noakes

Tim Noakes was born in Harare, Zimbabwe and studied at the University of Cape Town where he obtained the degrees MB ChB in 1974, an MD in 1981, and a DSc (Med) in Exercise Science in 2002. He retired as Professor of Exercise and Sports Science at the University of Cape Town in 2014 and is now an emeritus professor at UCT. He is co-founder with Morné du Plessis of the Sports Science Institute of South Africa (SSISA).

Professor Noakes has produced more than 500 scientific publications, has been cited more than 15 000 times in the scientific literature, has an h-index of 66 and is rated an A1 scientist by the National Research Foundation of South Africa. In 2003 he received the UCT Book Award for *Lore of running* (4th edition), which is considered the "Bible" of the sport. Among his other published works are *Rugby without risk, Bob Woolmer's Art and Science of Cricket* (co-authored with the late Bob Woolmer), his scientific autobiography *Challenging beliefs*, and *Waterlogged: The serious problem of over-hydration in endurance sports. The real meal revolution*, co-authored with Jonno Proudfoot, David Grier and Sally-Ann Creed, was launched in November 2013 and has sold more than 160 000 copies in its first year and has become the largest selling e-book in South African publishing history. It was released

internationally in February 2015 with multiple translations. His most recent book, *Always believe in Magic*, co-authored with Kevin Musikanth and Jonathan Kaplan, describes the story behind the UCT Ikey Tigers rugby team's miraculous comeback to win the 2014 Varsity Cup in the 83rd minute of the game.

In 2002 Professor Noakes was awarded the International Cannes Grand Prix Award for Research in Medicine and Water, for his work on Exercise-associated Hyponatraemia (EAH). In 2004 *Runner's World* (USA) included this work as one of the 40 most important "persons or events" in the sport of running in the past 40 years. In 2008 he was elected an honorary fellow of the Faculty of Sports and Exercise Medicine (UK), the first foreigner to be so recognised. In that year he also received the Order of Mapungubwe, Silver, from the President of South Africa for his "excellent contribution in the field of sports and the science of physical exercise". In 2012 he received the Lifetime Achievement Award from the National Research Foundation for his contribution to sports science research.

Professor Noakes has been physically active all his life and has run more than 70 marathons and ultra-marathons, including seven 90 km Comrades Marathons. At age 65 he now takes part in races up to 21 km.

Summary of the 2014 Rudolf Marloth Lecture by Professor Noakes: Reversing the greatest blunder in the history of medicine. Can South African medical science (and activism) lead the way?

In 1977, for political and economic reasons, the United States Department Agriculture (USDA) produced the Food Pyramid that promoted substitution of especially saturated fat in the diet with increased daily servings (6 to 11) of cereals and grains. It was argued that replacing fat in the diet with (less energy dense) carbohydrates would reduce calorie consumption, thereby preventing obesity. A diet lower in saturated fats would also lower blood cholesterol concentrations and according to the diet-heart hypothesis of American biochemist, Dr Ancel Keys, prevent the development of coronary atherosclerosis, thereby preventing heart attack.

Prof Noakes and S_2A_3 Council members at the awards ceremony. Front: Mrs Shirley Korsman, Dr Claudia Zander; back: Dr Ian Raper, Dr Marelise van Wyk, Dr Albe van der Merwe, Prof Noakes, Prof Walter Meyer, Mr Braam Smit

Unfortunately these guidelines were introduced even though there was no evidence from randomised controlled clinical trials that this radical change from what humans have eaten for more than two million years, would produce these desirable outcomes. Instead, as so often happens when radical interventions are introduced without proper thought and in the absence of detailed scientific testing, there are likely to be unforeseen and unfortunate consequences.

The first unforeseen consequence was a global obesity epidemic that began after 1980, three years after the promulgation of the USDA Food Pyramid. This is

associated with an increased consumption of both carbohydrates and calories as established from data on US citizens. On simple biological principles this was entirely predictable, as carbohydrates do not satiate hunger; instead they drive appetite and the over consumption of calories. Dietary fats especially and proteins satiate human hunger as they have for the greater than two million years of human adaptation to high-fat protein diets provided by our (only recently documented) success as hunters of the largest (and fattest) animals of the planet. That evidence is the ability of humans to exterminate all the largest mammals on each continent within a few centuries of our first arrival there.

Somewhat less foreseeable was the global diabetes epidemic that began 15 to 20 years after the 1977 guidelines were first promulgated. Whilst this epidemic is clearly associated with higher carbohydrate and sugar intakes, the exact biological mechanisms for causation have still to be established. [The initial defect in Type 2 Diabetes Mellitus (T2DM) is, as Professor Johan Koeslag of Stellenbosch University predicted in 2002, a failure of the normal intra-pancreatic inhibition of glucagon production by insulin. For without appropriate inhibition of glucagon secretion when carbohydrate is ingested, the metabolic state of T2DM must develop leading ultimately to the metabolic syndrome and heart disease, and perhaps also cancer and dementia, although links to those latter conditions are as yet less clearly established. A Nobel Prize awaits the person who identifies the initiating mechanisms explaining this intra-pancreatic failure of insulin's action and who develops mechanisms to block the uncontrolled action of glucagon in T2DM].

However, it is now clear that the key driver of the obesity-diabetes epidemic has been the development of the highly processed "industrial" diet that the 1977 USDA Food Pyramid helped to establish. For when fat is removed from foods they lose their taste. And the processed food industry soon discovered to its unashamed delight that replacing the fat with sugar and high fructose corn syrup produced highly appetising (non) foods that are also utterly addictive.

The reversal of the current obesity/diabetes epidemic will come, not from the government, but from the people who, when properly informed, will begin to demand healthy food choices. This means eating real foods, not highly processed industrial foods that are full of obesogenic and diabetogenic ingredients, but completely lacking in the nutrients we need to eat to be healthy.

The British Association Medal (silver): Awarded to Professor Genevieve S. Langdon

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 2014 the medal was awarded to Professor Genevieve Langdon in recognition of her outstanding research on the effects of explosion loading on lightweight materials.

Prof Genevieve Langdon

Genevieve Sarah Langdon (born Smart) studied at the University of Liverpool from 1996 and was awarded the degree B.Eng (Hons) in 1999, with an average mark of 85%. That year she received the McLaren International Award for the Best Mechanical Engineering Student in the UK. Her final year project was entitled "Investigation of the failure modes of aluminium plates subjected to pulse pressure loading". Continuing her studies at the same university, she obtained the PhD (Engineering) degree in 2003, with a thesis on "Failure of corrugated panels and supports under blast loading: experimental, analytical and numerical studies". After a short period as a senior research assistant in the Department of Engineering at Liverpool she came to South Africa in 2004 as an 1851 Royal Commission Research Fellow (postdoc) at the University of Cape Town. In 2006 she was appointed as Senior Lecturer in Mechanical Engineering at UCT and in due course promoted to Associate Professor (2010) and Professor of Mechanical Engineering (January 2014). In addition to teaching at undergraduate and post-graduate level, Professor Langdon is actively involved in the development and evaluation of blast resistant materials for use in structural and transportation applications. The aim of her research is to make the world a safer place through improved understanding of structural response to explosion loading. She has focussed on the study of lightweight materials such as composites, hybrids, metals, foams and lattices, in order to improve their design and to inform the materials selection process. Her contributions are mainly experimentally based, but supported by modelling work. The research includes the manufacture or construction of small scale prototype structures and materials and subjecting them to a range of impact and explosion loading under carefully controlled laboratory conditions. This is followed by meticulous failure characterisation, aimed at quantifying different types of damage in the structures and providing information for modelling about the important phenomena present in the results. This reduces the cost and improves the efficiency of predictive modelling tools which are vital for future industrial applications.

Professor Langdon has published some 50 journal articles, five book chapters and numerous conference papers. She received the Simon Perry Award for the best paper presented at the 6th International Conference on Shock and Impact Loads on Structures held in Australia in 2005, and received a highly commended paper award at the 7th International Conference held in China in 2007. She is a founder member of the South African Young Academy of Sciences since 2011, and received the College of Fellows Young Researcher Award at UCT in 2010.

Summary of lecture by Professor Langdon: Explosion protection and lightweight materials

Explosions may have many causes, including terrorist bomb blasts, structural integrity breeches in pressurised structures (such as aircraft or pressure vessels), vapour cloud ignitions and landmine

explosions. Damage is accentuated when the explosion occurs in a confined space, such as in a subway tunnel or a transport vehicle. Various techniques have been developed to try and protect us from the destructive effect of blast waves. These techniques include mitigation devices designed to absorb, disrupt, contain and ultimately reduce the effect of the blast wave before it reaches the structure or people we wish to protect.

Professor Langdon receives the British Association Medal from Dr Ian Raper

Transportation structures also have other design requirements such as the need to be lightweight, manoeuvrable and environmentally sustainable. Explosion protection is just one aspect of the many considerations involved in designing and manufacturing a vehicle. The use of composite materials in transport has expanded because they possess excellent stiffness and strength (for their mass) and the ability to tailor their properties to suit individual applications. Fibre reinforced polymer composites, foam core sandwich panels and fibre metal laminates are three types of composite materials commonly used in land, sea and air transportation. At the Blast Impact and Survivability Research Unit (BISRU), University of Cape Town, small scale experiments are performed on lightweight materials to evaluate their ability to protect against explosions. These experiments involve the detonation of plastic explosives under carefully controlled laboratory conditions. By using the results from a combination of experimentation and computer simulation, questions such as these can be considered:

- What do we mean when we talk about blast protection?
- How do lightweight materials such as composites respond to explosion loading?
- What failure modes are important to consider when predicting their response?
- Are some materials better than others?

The lecturer described recent experimental work on the response and failure of lightweight materials subjected to explosion loading. She started answering these questions and provided insights into how she views the world when considering the problem of blast protection. She showed that lightweight materials can fail in many different ways compared to metals such as mild steel, by delamination, debonding, fibre fracture, and fragmentation. Many lightweight materials employ composites which are almost elastic up to the point of breaking, which can cause some interesting responses when they are subjected to explosion loading and also leads to disagreement between computer modellers who are trying to predict their behaviour. It also makes the use of high speed cameras important for capturing the transient response of lightweight structures, something which is very challenging to achieve in conditions of high pressures and temperatures like those created by explosions.

Award of two merit certificates

The Association's merit certificates are awarded to persons or institutions who have contributed, each in their own way, to either the advancement of science or the Association's activities. At the annual award ceremony in November 2014 two merit certificates were presented, one to Mr Arden Meyer for his services to the Pretoria Branch of S_2A_3, the other to Ms Isabel Davis, science teacher at Menlo Park Primary School, for initiating and running a popular and successful Science Club for Grade 7 pupils.

Ms Isabel Davis receiving a merit certificate from Dr Ian Raper, President of S_2A_3

Mr Meyer and Dr Ian Raper

S_2A_3 Medals for Original Research at the Masters Level, awarded during 2014-2015

The S_2A_3 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 2014-2015 medals were awarded to the following students:

Stellenbosch University (2012)
Mr Herman Kamper, MEng (Electronic Engineering): Speech recognition of South African English accents. Supervisor: Prof Thomas R. Nieser

Stellenbosch University (2013)
Mrs Karen Edith Marais (born Friemelt), MSc (Conservation Ecology): Postfire regeneration of mountain fynbos by resprouting: A comparison of species with different life history types. Supervisors: Prof J. Keeley (University of California) and Prof P. Rundel (University of California).

Stellenbosch University (2014)
Mr Thomas Weighill, MSc (Mathematical Sciences): Bifibrational duality in non-abelian algebra and the theory of databases. Supervisors: Prof M. Johnson (Macquire University), Prof S. Mantovani (University of Milan), and Prof. T. van der Linden (Catholic University of Lovain).

University of KwaZulu-Natal (2014)
Mr Patrick Thabang Sekoai, MSc Microbiology: Modelling and optimization of microbial production of hydrogen on agro-municipal wastes. Supervisor: Dr E.B. Gueguim Kana.

Transvaal University of Technology (2014)
Mr Ojo Sunday Isaac Fayomi, Magister Technologiae (Engineering – Metallurgy):

Corrosion study and surface characterization of Zinc (Zn) and Zinc-Aluminium (Zn-Al) on mild steel in a saline environment. Supervisors: Prof C.A. Loto and Dr A.P.I. Popoola.

Rhodes University
Ms Samantha Joy Beckley, MSc (Biochemistry): The role of stress inducible protein 1 (STI 1) in the regulation of actin dynamics. Supervisors: Dr A. Edkins and Prof G. Blatch.

Central University of Technology (2014)
Nthabiseng Nhlapo, MTech (Environmental Health): Hygiene and nutritional content of the National School Nutrition Programme in Bloemfontein, South Africa. Supervisors: Dr W.H. Groenewald and Prof J.F.R. Lues.

University of Cape Town (2015)
Kevin Sack, MSc (Eng): Biological tissue mechanics with fibres modelled as one-dimensional *Cosserat* continua. Supervisor: Dr Sebastian Skatulla.

Xandri Schoultz received the S2A3 medal at NMMU from Ms Jaci Barnett, vice-president of S2A3 for the Eastern Cape, in September 2014. At left, Prof Thomas Gerber. (Details in last year's Brochure).

Lectures arranged by the Pretoria Branch

During the period August 2014 to June 2015 the following public lectures were arranged by the Pretoria Branch Committee. The lectures were delivered at the Sci-Enza Centre, University of Pretoria, and were well-attended and received with enthusiasm.

What will we eat if… (6 August 2014) by Cornelis Human, Assistant Breeder, Sakata-Mayford.

The United Nations declared 2014 as the International Year of Family Farming (IYFF), in order to promote a shift towards a more equal and balanced development for all. As a result of modern science and farming methods we produce enough food for the population of the world, but where is all the food if it is not on the tables of the poor? Is the problem the result of a shortage of money, or is genetic modification to blame? And is family farming the answer to food security? These issues were addressed in the light of the sustainable use of plant genetic resources.

Where will you be when an asteroid hits earth? (1 October 2014) by Dr Henry Throop, Senior Scientist at the Planetary Science Institute and Guest Lecturer at the Department of Physics, University of Pretoria.

Dr Throop pointed out that all the planets and satellites of the solar system were formed by repeated collisions between smaller bodies. Ancient and more recent impact craters on earth (for example the Vredefort Dome and Tswaing Crater), and particularly the meteorite that fell at Chelyabinsk, Russia, in 2013, show that such collisions continue. At present meteoric dust and meteorites reach the

earth at a tempo of some 40 tons per day. The largest near-earth asteroids have all been detected and the smallest pose no significant danger. However, medium-sized (over 100 m diameter) near-earth asteroids that have not been detected pose the greatest risk of deadly impacts and receive most attention in NASA's detection programme. Work done in South Africa in support of this programme includes the measurement of the orbital elements, shape, spin and other characteristics of near-earth asteroids. Possible measures to mitigate the threat of an asteroid impact were also discussed.

On 4 March 2015 Professor Timothy Noakes, winner of the South Africa Medal (gold) in 2014, presented the Rudolf Marloth Lecture in the Sanlam Auditorium, University of Pretoria. The lecture, which is summarised elsewhere in this brochure, drew a large audience.

On 9 March 2015 members of S_2A_3 were invited to a public lecture arranged by the University of Pretoria and the Academy of Science of South Africa (ASSAf) and deliverd by Professor Bengt Gustafsson, on "Black holes: Past, present and future".

The S_2A_3 National Council

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