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National Science and
Technology Forum

Media Release

S.E.T. for socio-economic growth

Basic Sciences for Sustainable Development

There is ongoing debate in the science community and in society, on whether it is valuable to pursue science for the sake of simply gaining knowledge or does scientific knowledge only have worth if we can apply it to solving specific problems or improving people's lives? Basic sciences are often overlooked and undervalued as their influence is not always obvious to the broader public.

However, basic sciences play a pivotal role in improving the quality of life for human beings through their contributions to medical sciences, agricultural sciences, space sciences, computer sciences, and beyond. The applied sciences, which are built on the foundations of basic sciences have generated technologies and solutions that can and often have dramatically improved the quality of life of humans and (to a lesser extent) animals and plants, the environment, industry, etc. Applied sciences and technology inform and influence decision-making on multiple levels and basic sciences form the foundations on which applied sciences explore, develop and transform. Basic sciences can have significant, but indirect, influence on public policies, personal decisions, and communities across the touch-points of energy, conservation, agriculture, health, transportation, communication, defence, economics, leisure, and exploration. And so much more.

The [National Science and Technology Forum](#) (NSTF) hosted a two-day discussion forum on [basic sciences for sustainable development](#) from 26-27 October 2022, and focused on its multiple facets and contributions to the world and society.

Basic sciences – foundations, innovations and value

Prof Bruce Mellado, Director: Institute for Collider Particle Physics, University of the Witwatersrand (Wits); and iThemba LABS, a research facility of the National Research Foundation (NRF); and [Winner: TW Kambule-NSTF Researcher Award 2021](#) unpacked the [importance of particle physics as the foundation of cutting-edge research and its implications](#).

The NSTF provides neutral collaborative platforms where issues and sectors meet:

- One of the National Science and Technology Forum (NSTF) functions is to hold [discussion forums](#), bringing the private and public sectors together to address important issues and engage with government policy.
- Feedback from these [discussion forums](#) is disseminated to role players and stakeholders.
- The NSTF represents about [120 member organisations](#) participating as key stakeholders of the science, engineering and technology (SET) and innovation community.

He introduced the case for physics and how it contributed to modelling of the pandemic using techniques developed by the Large Hadron Collider in Europe. He unpacked the different types of physics from particle physics that look at the structure of the nucleus through to the other side of the spectrum where astrophysics and cosmology live.

Covering the standard model of particle physics, the Higgs Boson, the Hadron Collider, and the CERN consortium, Mellado unpacked advanced physics achievements, the role that South Africa has played in these, and the awards won by local organisations and experts. He concluded with how important these discoveries are and how they have applications and implications across health, science, the environment and more. The sky isn't the limit, he says, not even the universe is.

Mr Mthokozisi Moyo, PhD candidate: Global Change Institute, School of Animals, Plants and Environmental Sciences, Wits, then spoke about [understanding ecosystem processes in order to deal with climate change](#). Moyo offered a fresh perspective around climate change and how basic sciences can help fill the gaps and mitigate the challenge. He discussed the importance of understanding the processes that drive climate change and the factors that influence it. He went on to talk about some of the devastating results of this change from flooding to hotter and drier weather, and to migration and livelihoods. Then he unpacked how a lot of research around climate change has focused on the northern hemisphere and how it is not really applicable to the southern hemisphere. It is important to develop a model for Africa, particularly around the role that grasslands play in the ecosystem. He concluded by emphasising that Africa would lose much biodiversity if the climate became more seasonal. There tends to be higher biodiversity in areas that have low seasonality. In addition, Moyo emphasised how important seasonality is in African ecosystems and that by understanding ecosystem processes we can hopefully deal with climate change more effectively.

Dr Farai Dziike, Researcher: Materials Chemistry, Wits, presented on [advancement in waste-water treatment technologies](#). His presentation focused on the role of basic science and innovation in providing clean water and sanitation and he started out with a look at how complex the situation has become in KwaZulu-Natal. Water in the area smells unpleasant because of extremely high levels of e.coli which comes from raw sewerage that has ended up in streams and the ocean, and is rapidly becoming a health risk for communities in the region. This is exacerbated by high temperatures and the knock-on impact of dried-up streams that lead to crop failure and animal deaths. This, he said, highlights how important it is to undertake basic science, research, innovation, technology development and water treatment technologies.

The challenge in South Africa is that conventional water treatment methods are not designed to cater for the levels of contamination in the water. In addition, the infrastructure has aged and it is too expensive to replace in the current conditions. With manufacturing, growing population pressure and industrial use, the magnitude of contamination is at the point where it can collapse ailing infrastructure. Infrastructure replacement or restoration is not happening in South Africa due to limited resources and availability. Dziike went on to discuss some of the key solutions available right now such as electrodeionisation equipment (EDI), membrane bioreactor technology (MABR), thermal water treatment, and how these are too expensive to be realistically implemented by local municipalities. He concluded by saying that it is a race to find an efficient process of purifying water. Current work on TiO₂ Photocatalysis is being finalised and could potentially prove to be the solution that the country, and the planet needs.

The final speaker of the first day was **Prof Sam Mashele**, Dean: Faculty of Health & Environmental Sciences, Central University of Technology (CUT), who spoke on [how basic sciences like botany contribute to human health](#). He said that the basic science of botany is a fundamental science that can contribute to human health and yet it remains a largely

unknown field for many. People don't see plants as part of wildlife even though they make up around 80% of the world's biomass and are key to human and animal health. Science has shown that introducing plant-based foods into a person's diet will improve their well-being and potentially mitigate the risk of contracting certain diseases. He also unpacked the research that showed how plants were used to help develop the COVID-19 vaccine. It is important to encourage more people to learn about plants and use them to come up with other solutions for society.

Mashele then looked at different plant-based drugs that are being considered to treat certain conditions, like cancer, less invasively. He says that usually drugs use a single ingredient to tackle a specific issue and that this is not an ideal approach, especially when looking at the complex diseases that humanity is facing today. His team has been working on drugs in collaboration with pharmaceutical companies that can improve quality of life and that synergise multiple compounds to have a positive effect without potentially causing serious side-effects. He concluded by saying that if there is more study done on plants, there is no limit on what they can help humanity achieve when it comes to illness, chronic disease and human health.

Basic sciences – teaching, awareness and education

Starting off the conversation on the second day of the basic sciences for sustainable development event was **Prof Mike Bruton**, Mike Bruton Imagineering; and Winner: NSTF Lifetime Award 2002. He focused on [how the basic sciences should be taught for environmental sustainability](#) and kicked off the discussion by saying that he believes basic sciences should include astronomy and chemistry, as well as the environmental sciences of biology and geology. Bruton did a deep dive into the educational challenges facing Africa across language barriers. There are between 2000 and 3000 languages in Africa; populations are large and to a substantial degree they are young; long distances have to be travelled across rural areas; and the formal education sector currently has limited reach in most countries. He said that education can be achieved in Africa through partnerships between formal and informal education institutions across museums, science outreach centres and schools.

The NSTF Awards, since 1998, recognise outstanding contributions to science, engineering, technology (SET) and innovation in South Africa:

- Known as the 'Science Oscars of South Africa', the [NSTF Awards](#) profile scientific research that is professional, innovative, forward looking and relevant to both SA and the rest of the world.
- The solution-driven work of the [Award Winners](#) raise awareness among the general public about local research and its relevance to socio-economic issues.
- Award Winners are profiled to youth as [role models](#) through the NSTF Share 'n Dare Programme providing [inspirational and knowledge sharing talks](#) to encourage them to study in science, engineering and technology (SET)-related fields.

While no African country has achieved universal primary education, there are opportunities. He believes there is no reason why basic sciences should not be taught in countries with so-called low- and middle-incomes. Instead of talking about the developed and developing world, one should be talking about the overdeveloped world and the appropriately developed world. He said that the sustainable ways of life that have been developed in many African countries are an example that the so-called developed countries should follow, and will be forced to follow in the near future.

He went on to unpack some of the extraordinary innovations made by African ingenuity in

recent times and how important it is for us to communicate knowledge, change mindsets and become ambassadors for the education value chain. He concluded by saying that school curricula need to showcase African contributions to science and technology to inspire the next generation and bring science into mainstream society.

Prof Andrew Robinson, Extraordinary Professor; Deputy Dean: Health Sciences Faculty, North-West University (NWU), spoke on [regenerating basic sciences for healthcare](#). He acknowledged the relevance of basic sciences and the necessary paradigm shift required as outlined by the previous speakers at the event. He then went on to talk about his role as public health physician. Public health is more focused on the environment around the patient and how this is contributing to health conditions. He also emphasised that Africa has the talent that can change the future of health on the continent and highlighted some of the achievements made by professionals during the pandemic.

He concluded by saying that an approach to planetary health is needed that leverages the knowledge in indigenous knowledge systems and that reduces reliance on technology, instead focusing on connection with nature. He said that if we can adapt natural science teaching to social sciences, then there are opportunities to decolonise the educational framework and re-establish African intellectual capital.

The presentation by **Dr Jenitha Badul**, Senior Manager/Policy Advisor: Sustainability Programmes and Projects, Department of Forestry, Fisheries and the Environment, (DFFE), was entitled '[Addressing the Conundrum: Planet Earth – Maximum Carrying Capacity](#)'. She spoke on how many of the planetary boundaries have been compromised and that it is time to look at where sustainable development, climate change and the basic sciences intersect. She mentioned that the altering of Earth's systems is a clear indication that we need to rethink the existing body of knowledge because human activity is influencing the natural systems that we have come to know over the centuries. She concluded by saying that it is key to undertake a multi-disciplinary approach instead of people sitting in silos trying to solve the problems. Instead, it should be ensured that industrialisation, especially in emerging economies, is done in a responsible way.

Finally, **Dr Khangelani Sibiya**, Maths and Science Educator, spoke on, and [how the role of the teacher in advancing maths and science has never been more important](#). He believes that teachers are key to creating the leaders of the future and are the catalyst for change. He unpacked the challenges that face students and teachers including: lack of motivation, access and success rates, and then how this can be addressed by giving teachers more tools, less administration tasks and more opportunities to connect with learners.

Basic sciences are key to the future

The presentations and the discussions emphasised how basic sciences can have significant, but indirect influence on public policy and communal or personal decisions on: energy, conservation, agriculture, health, transportation, communication, defence, economics, leisure, and exploration, among others. While some of the impacts of science on society may not be obvious, many are. With the help of science, we have knowledge about promoting health, safety, and environmental stewardship. Scientific knowledge also

The National Science and Technology Forum (NSTF) is:

- Independent [non-profit stakeholder body](#) and network – a civil-society forum
- [Voice to government](#) for the science, engineering, technology (SET) and innovation community
- Includes [private and public sectors](#)

forms the basis for technological advancement. From a simple light bulb to a complex computer, to genetic engineering and space travel, they are all human-made technologies, which are not possible without basic scientific knowledge. And Africa has the opportunity and potential to sit at the forefront of this change.

- [Promotes SET and innovation](#) in South Africa since 1995

Speakers can be contacted through the spokesperson, [Ms Jansie Niehaus](#). Further information can be found on the [NSTF website](#) and the [NSTF YouTube channel](#).

Read about previous NSTF Discussion Forums on related topics:

- [STEM education – disruptions and the future](#), 29-30 August 2022
- [Climate Change Just Transition Framework](#), 8 April 2022
- [Creative economy, science and the 4IR](#), 24 March 2022
- [Plant health in South Africa – threats to biosecurity, biodiversity and food security](#), 10-11 June 2021
- [Preparing for epidemics in South Africa – human and animal](#), 25-26 February 2021

About the NSTF

The [National Science and Technology Forum](#) (NSTF), established in 1995, is a broadly-representative stakeholder body for all science, engineering and technology (SET) and innovation organisations in South Africa, which seeks to influence policy formulation and delivery.

The [NSTF Awards](#) are unique in SA, recognising the outstanding contributions of individuals, teams and organisations to SET and innovation.

The science [bursaries](#) page provides information on bursaries and bursary providers for science, engineering and related studies.

[STEMulator.org](#) attracts learners and students to the exciting world of science, technology, engineering and mathematics (STEM). It provides a virtual world full of stimulating content to excite and inform the youth, including STEM career guidance. Established under the auspices of the [NSTF proSET membership sector](#) (Professionals in *science, engineering and technology*).

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