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National Science and Technology Forum (NSTF)

# media release

## World AIDS Day, 1 December 2024

### Prof Patience Mthunzi-Kufa introduces nanotechnology and optic biosensing for efficient HIV diagnostics

On 1 December the World Health Organization (WHO) joins partners and communities to commemorate World AIDS Day 2024. The theme for this year's World AIDS Day is "Take the rights path: My health, my right!". The WHO is calling on global leaders and citizens to champion the right to health by addressing the inequalities that hinder progress in ending AIDS. This day serves as a reminder for the world to remain steadfast in the commitment to prevent new HIV infections and provide essential services to all people living with HIV. Showing our support for them and remembering those we have lost.

The world has the potential to end AIDS (*acquired immunodeficiency syndrome*) by 2030 if human rights are protected and communities are put in the forefront. Progress in the HIV (*human immunodeficiency virus*) response is linked to progress in human rights awareness. Engaging everyone affected by HIV, especially marginalised communities and ensuring gender equality, is essential. Laws, policies, and practices that discriminate against or stigmatise sufferers, and obstruct access to HIV prevention and care, are important. Stigma and discrimination can be as devastating since it may entail abandonment by a partner or family members, social exclusion, job and/or property loss, school expulsion, denial of medical services, lack of care and support, and violence. These factors cause people to become more reluctant to do HIV testing, disclosing their HIV status to others, and adopting HIV preventive behaviour or seeking treatment, care and support. Upholding human rights and inclusion of all communities are crucial for ending AIDS and ensuring sustainable development.

The campaign "Take the rights path" emphasises the importance of removing harmful laws and enacting laws that uphold rights. The message will be at the core of activities leading up to World AIDS Day on 1 December and beyond. This World AIDS Day is a call to action to protect everyone's health by protecting everyone's rights.

Prof Patience Mthunzi-Kufa, as Research Group Head for Bio-photonics and Manager at the Photonics Centre at the Council for Scientific and Industrial Research (CSIR) and Professor Extraordinarius at the University of South Africa (UNISA) is the recipient of the 2024 NSTF-South32 TW Kambule-NSTF Researcher Award. Her research is focused on the use of lasers of different regimes to optically micro-manipulate embryonic stem cells for tissue engineering investigations, as well as, among others: HIV-1 infected cells for targeted antiretroviral drug delivery in latent viral sites and to answer basic questions in HIV-1 pathogenesis.

**"HIV is such a big problem across the world. I want to be among those who are trying to bring a solution to HIV. I know it's an ambitious goal but it might not be impossible".**

Nanotechnology and label-free optical biosensing have opened up new possibilities for point-of-care HIV quantification in resource-limited settings. Optical biosensors are small analytical devices that detect and measure the concentration of a substance using biological materials like antigens and antibodies.

Professor Mthunzi-Kufa's research investigates a more accurate and cost-effective alternative to traditional HIV-1 diagnostics. It looks at tag-free detection of HIV-1 infected and uninfected cells using advanced spectroscopy and optical trapping techniques to improve data reliability. This approach employs optical laser trapping together with Raman spectroscopy (LTRS), allowing for non-invasive immobilisation and label-free analysis of single infected cells. The optical system isolates single cells, so that their chemical fingerprint can be analysed by shining laser lights of varying wavelengths and carefully structured beams on them, offering a better alternative to traditional HIV-1 diagnostics, such as the enzyme-linked immunosorbent assay (ELISA) and nucleic acid-based tests that require the use of labels and substrates respectively.

**"Addressing issues of accuracy, cost and time were important for the purpose of this research. In light of HIV/AIDS being a serious disease claiming the lives of many in developing countries, particularly in sub-Saharan Africa, it is important that our research addresses the challenges of the day."**

In one of her investigations she demonstrated that photonic crystal biosensors are sensitive enough to detect differences in virus concentrations. Therefore, photonic crystals have potential in the development of photonic crystal-based biosensors for viral load detection. This breakthrough research essentially, accurately and affordably informs patients about their HIV status and provides more information such CD4 count at the point of testing.

**"If a patient knows this at the point of testing, then you can give treatment immediately rather than having to wait."**

Prof Mthunzi-Kufa was awarded the TW Kambule-NSTF Researcher Award at the 2024 NSTF-South32 Awards ceremony, held on 11 July [pictured here with Honourable Minister Blade Nzimande and Society for Automation Instrumentation Mechatronics and Computer Engineering (SAIMC) Director and CEO, Mr Johan Maartens, on behalf of pro*SET*, the prize sponsor].

Prof Mthunzi-Kufa received the award for her research on the construction and application of photonics-based diagnostic devices for point-of-care detection of HIV-1, TB, COVID-19, as well as non-communicable diseases to achieve early detection and to facilitate timely treatment. Her groundbreaking work is a long-awaited bridge in virus detection and monitoring, which makes all the difference when it comes to saving lives.

She has received many significant accolades over the years, which include a National Order from the President, the Order of Mapungubwe in Bronze, for her contribution in biochemistry and bio-photonics. She states however, that the most rewarding aspects of her work is witnessing the success of her students.

**"It is amazing when parents express gratitude and acknowledge my contribution to a student's development, and it's particularly exciting to see postgraduates under my supervision obtain their degrees Cum Laude."**

Mthunzi-Kufa says winning the NSTF-South32 Award for a Researcher (prize sponsored by pro*SET*) is an amazing incentive to keep going the extra mile.

**"I've noted how much peer acknowledgement and international attention I'm attracting, which provides crucial strategic positioning for many opportunities going forward… Winning also confirms that my family and research team are truly epic — I am because they are!"**

**About the NSTF (National Science and Technology Forum):** NSTF is an independent non-profit stakeholder body and network – a civil-society forum of over 130 organisations involved in science, engineering, technology (SET) and innovation in SA.

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**References/Sources:**


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**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
- gathers stakeholders around burning issues of national and global interest, across the public and private sectors, including matters of public policy
- includes a network of professional societies in SET and STEM education (STEM = science, technology, engineering and mathematics) - the NSTF pro*SET* membership sector.
- recognises, awards and profiles the outstanding contributions of individuals and groups to SET and innovation through the prestigious NSTF Awards
- runs and supports collaborative projects and youth outreach, including recognition of top performance in mathematics and science, role modelling, bursary and STEM career information
- runs and supports the STEMulator.org which attracts youth and educators to Explore>Discover>Learn the world of STEM including careers. (Established by NSTF pro*SET*)


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