NIGERIAN ASSOCIATION OF MEDICAL PHYSICISTS (NAMP)

in collaboration with

NIGERIAN NUCLEAR REGULATORY AUTHORITY (NNRA) & NIGERIA ATOMIC ENERGY COMMISSION (NAEC)

13th Medical Physics Annual Scientific Conference & Workshop Abuja 2024

Theme:

MEDICAL PHYSICS:
Improving Medicine, Shaping the Future of Healthcare

Mon 4th to Fri. 8th Nov. 2024

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ABOUT

NIGERIAN ASSOCIATION OF MEDICAL PHYSICISTS

i. To promote and develop to the highest standards, the application of the methods and concepts of physics in medicine, biology and related sciences through clinical services,education and research

ii. To encourage professional interest in training and safety in the application of Physics in medicine.

iii. To prepare and disseminate technical information, scholarships, scientific resources related to Medical Physics and related fields to members.

iv. To promote cooperation in scientific research, development and education within the field of medical physics.

v. To promote scientific exchanges on medical physics and related fields of science.

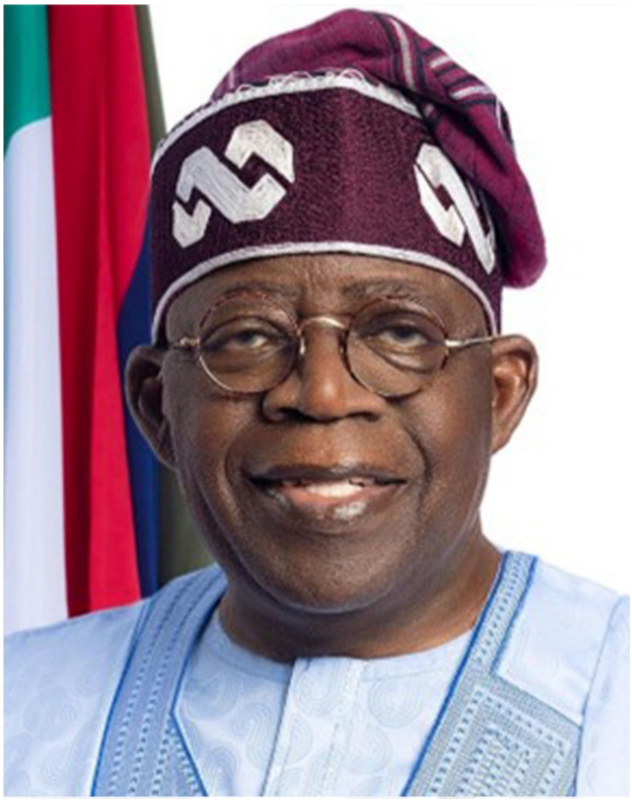
vi. To recommend standards for education, training and accreditation programmes within the field of medical physics.

vii. To initiate and/or support in approved centres and institutions, research and educational programs in medical physics.

viii. To promote certification of medical physicists.

ix. To develop the field of medicine and healthcare in the country through the application of concepts of physics.

x. To be the voice of Nigerian medical physicists in the international community.



His Excellency,
ASIWAJU BOLA AHMED TINUBU
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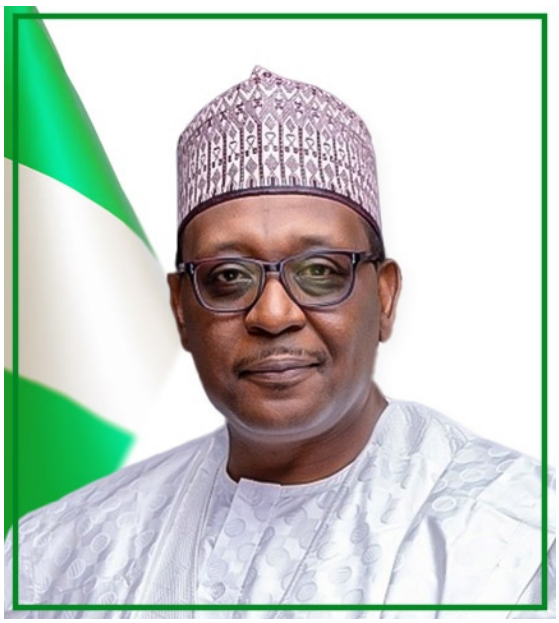

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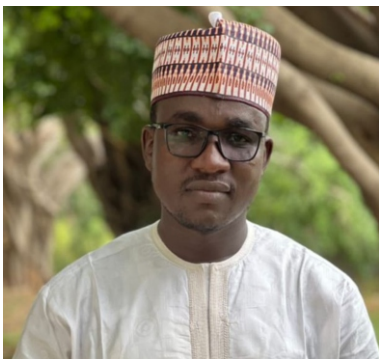

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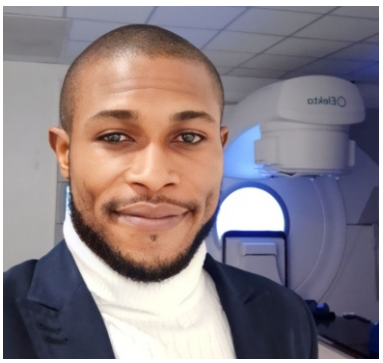

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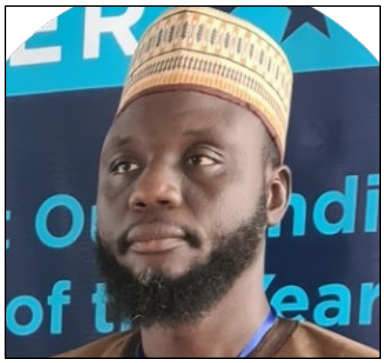

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Keynote Speaker

Prof. Wil Ngwa
Professor of Global Health,

Wilfred Ngwa is a global oncology researcher and medical physics expert who is developing technologies that integrate with radiation therapy to reduce cancer treatment times and costs. He is a professor of global health at Rutgers Global Health Institute and a professor in the Department of Radiation Oncology at Rutgers Cancer Institute of New Jersey and Robert Wood Johnson Medical School. He also is a Rutgers Presidential Faculty Scholar.

The broad aim of Ngwa's research and global collaboration is to increase access to cancer treatment and reduce health disparities, particularly in low- and middle-income countries.

He leads a research group that is developing low-cost approaches and technologies that can substantially reduce treatment times and costs and that can be implemented in resource-poor settings. One such technology incorporates artificial intelligence and smart radiotherapy biomaterials, such as nanoparticle drones that can be injected intravenously and will emit missile-like electrons when activated by photon beams during radiation therapy. This process is designed to increase damage to cancerous tumors while minimizing toxic effects on body tissues. This technology also can be programmed to sustainably deliver cancer-fighting immunotherapy drugs in resource-effective and measurable ways. This research is supported by the National Institutes of Health and industry partners and is in clinical translation.

Ngwa's overall research program is designed to address many types of cancer, and he is leading studies related to treating prostate, breast, and cervical cancers in Nigeria, South Africa, Tanzania, and the United States. Since 2019, he has been the chair of The Lancet Oncology commission on cancer in sub-Saharan Africa. He also is an external adviser to the U.S. presidential administration's Cancer Cabinet, convened by President Joe Biden to help establish and make progress on the administration's reignited Cancer Moonshot initiative, and he is a co-chair of the U.S. Cancer Moonshot 2.0 Lancet Oncology commission. He is editor of IOP Publishing's scientific series in global health and radiation oncology and an editorial board member for Journal of Global Oncology, Frontiers in Oncology, and ecancermedicalscience.

He is the founding director of the Global Health Catalyst Summit, designed to catalyze high-impact international collaborations and initiatives to eliminate health-related disparities in the U.S. and globally.

Ngwa is originally from Cameroon, where he studied physics and computer science at the University of Buea, receiving a bachelor of science degree. He earned his master's and doctoral degrees from University of Leipzig in Germany then completed postdoctoral education and training in radiation oncology at MD Anderson Cancer Center at the University of Texas and at Brigham and Women's Hospital, Dana-Farber Cancer Institute, and Harvard Medical School.

Prof. Wil Ngwa is the Keynote Speaker at the 2024 Medical Physics Conference, Nigeria

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Derivation of Multidimensional Force for Magnetic Tweezer as a Function of T_1 and T_2 Relaxation Times using Magnetic Resonance Diffusion and Langevin Equations

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Abstract
Magnetic tweezer is an instrument that has the ability to exert force in terms of magnitude and direction on biomolecules, such as deoxyribonucleic acid (DNA). It is a force spectroscopy technique with wide range of applications ranging from determination of elastic properties of DNA, study of DNA-protein interactions, study of topology of DNA, study of cancer cells, among others. Magnetic field is produced when magnetic tweezer applies force on a biomolecule. The force applied is along the axis of the molecule and field direction. Several models of magnetic tweezer have been developed overtime for measurement of force applied on a particle, but each developed model is marred with limitations such as magnetic hysteresis of the core material in the tweezer and low level spatial resolution. Also, there is limited availability of knowledge on the incorporation of nuclear magnetic resonance (NMR) relaxation time constants (T_1 and T_2), with NMR diffusion and Langevin equations to determine force applied on a particle along different axis. Therefore, this study derived a multidimensional force for magnetic tweezer from T_1 and T_2 relaxation times using NMR diffusion and Langevin equations. As this model helps to overcome the limitations encountered by the previous models. The NMR diffusion equation: $\frac{\partial M_y}{\partial t} = D\nabla^2 M_y + \frac{F_0}{T_0}\gamma B_1(r,t)$, and Langevin equation: $M\frac{dV}{dt} = -\zeta V + X(t)$ were utilised in the study to derive a multidimensional force at different boundary conditions. The equations are used to derive power spectrum from T_1 and T_2 relaxation times, given that $T_0 = \frac{1}{T_1} + \frac{1}{T_2}$. The multidimensional force derived in this study is in x, y, and z orientation with each axis having its characteristic variable. The result obtained from this study can be used to simulate T_1 and T_2 relaxation times values of DNA-binding proteins, an essential protein which enhance DNA-protein interactions. The results of the simulation can depict different features of DNA, thereby availing knowledge on DNA classification, genetic abnormality in cancer cells, among others.
Keywords: Magnetic tweezer, DNA, NMR Diffusion Equation, Langevin Equation, Relaxation Times.

Evaluation of Generative Medical Artificial Intelligence based on Fine-tuned Large Language Models (LLM)

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Abstract
The integration of large language models (LLMs) into medical applications has opened new frontiers in clinical decision support and patient management. Fine-tuned generative models can significantly improve diagnostics and personalized care but require rigorous evaluation for reliability and accuracy. While LLMs excel in natural language generation, their medical applications face challenges, including accuracy, clinical relevance, and ethical use. Ensuring these models align with real-world practices and data privacy is crucial for adoption. This study fine-tunes a GPT-style LLM using a curated medical dataset, comprising publicly available resources (e.g., PubMed articles, clinical guidelines, medical textbooks, electronic health records (EHR). Etc.) and anonymized patient records. The dataset was curated by removing irrelevant data, anonymizing sensitive information, and annotating key medical concepts for improved model learning. The model's performance was evaluated across tasks like generating medical summaries and proposing diagnoses, using accuracy, precision, recall, F1 score, and human evaluations as key metrics. The fine-tuned model achieved an accuracy of 85% in generating patient summaries and 80% for differential diagnostic suggestions. The F1 score was 0.82, reflecting a good balance of precision and recall. However, in complex cases, accuracy dropped to 70%, and factual inaccuracies emerged. Ethical concerns, such as biases in training data, were also noted, emphasizing the need for ongoing improvements and oversight. Generative medical AI based on fine-tuned LLMs holds significant potential for enhancing healthcare delivery. Nonetheless, challenges related to accuracy, transparency, and ethical compliance must be addressed before integration into clinical practice. Future work will focus on improving model robustness and alignment with regulatory standards.
Keywords: Large language models, Generative medical AI, GPT-style LLM, Healthcare delivery.

Machine Learning-based Medical Image Compression Using Principal Component Analysis (PCA) and Autoencoders

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Abstract
Medical imaging creates large datasets crucial for diagnosis, posing storage and transmission challenges in digital health systems. Traditional compression methods like JPEG and PNG often lose critical diagnostic details, necessitating more