BIOPHYSICS IN AFRICA

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African Conference on Fundamental and Applied Physics (ACP2023)

African School of Fundamental Physics and Applications

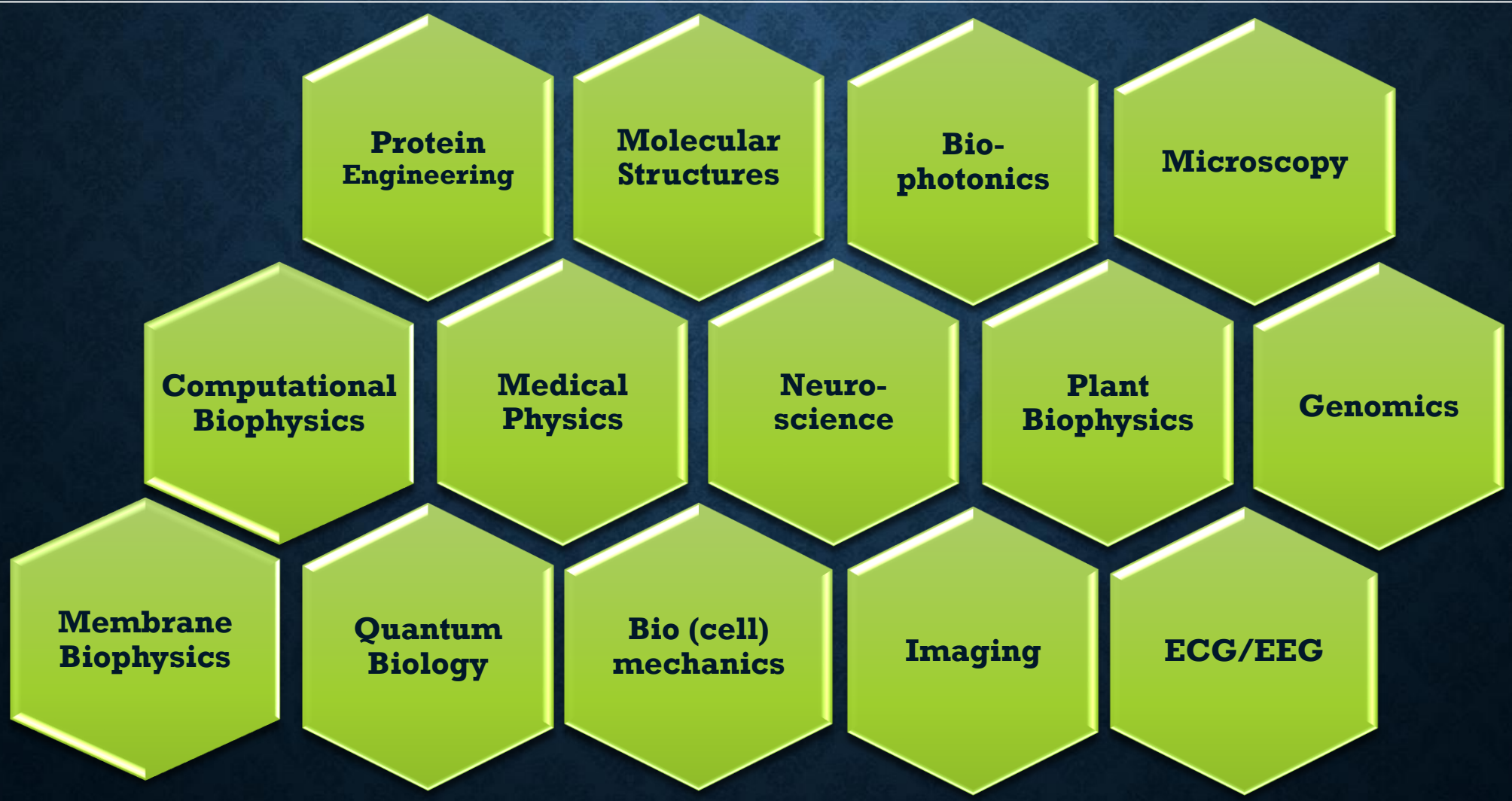
OUTLINE

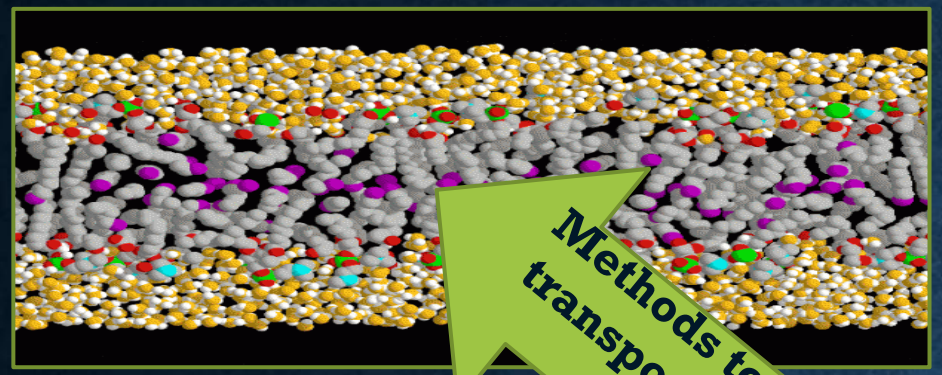
- Biophysics concepts
- Subfields of biophysics
- Facilities/Tools used in biophysics
- Africa in Brief/ Countries with active biophysics related research activities
- Impacts of biophysics to the society
- Current trends (research interest) in Biophysics
- Major challenges in Africa
- Roles of biophysicists in Africa
- Biophysics community and collaborative state in Africa
- Conclusion
- Acknowledgement

BIOPHYSICS DEFINITION/CONCEPT

- Biophysics is an interdisciplinary field of study that involves the use of physics methods and tools to unravel the details and/or mechanism of operation of biological systems. The studies range from 'invisible' features in biological systems to features that are visible to human naked eyes. In biophysics, the functions, dynamics and structural organization of biological systems are revealed using basic and sophisticated physics-derived tools.

SUBFIELDS OF STUDY IN BIOPHYSICS: EXPERIMENT AND THEORETICAL

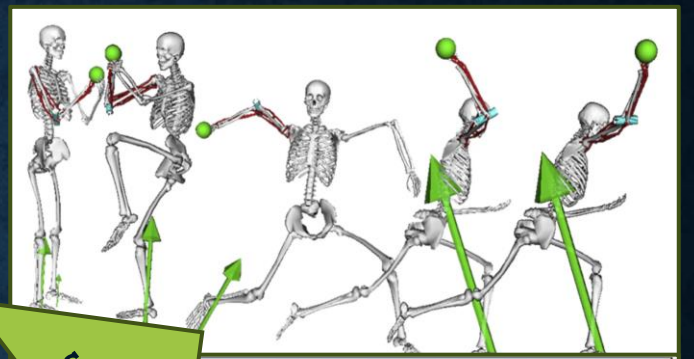


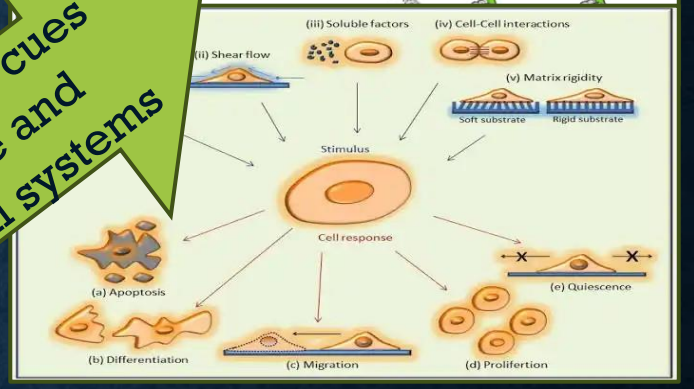


This involves the use high performance computing and simulation tools to c ut investigations in bio s.

Methods to evaluate and control transport of molecular contents across the membrane

Mostly uses molecular dynamics to understand the structure, dynamics and the function of biomolecules

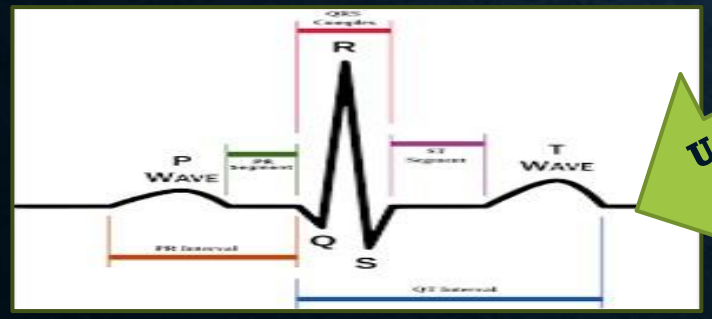




Influence of mechanical cues (forces) on structure and function of biological systems

Biophysics

Uses electrical impulses/signals for non-invasive test



Radiation for healthcare management

TOOLS USED IN BIOPHYSICS

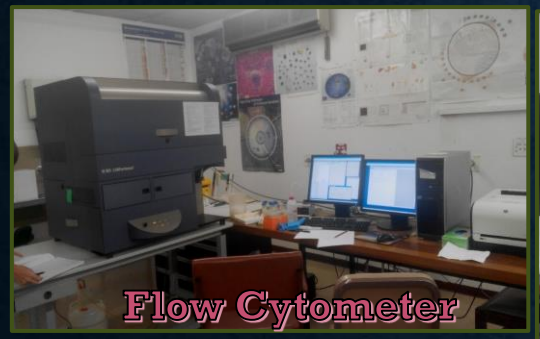
Laboratory/institutional tools


SEM


AFM


NMR

Reagents


Flow Cytometer


Spectrophotometer


Centrifuge

Crystallography
Microscopy/Imaging
Spectroscopy
Force manipulation techniques

SAIP

Huge/National/international facilities


Synchrotron radiation light source


Zeiss Microscope

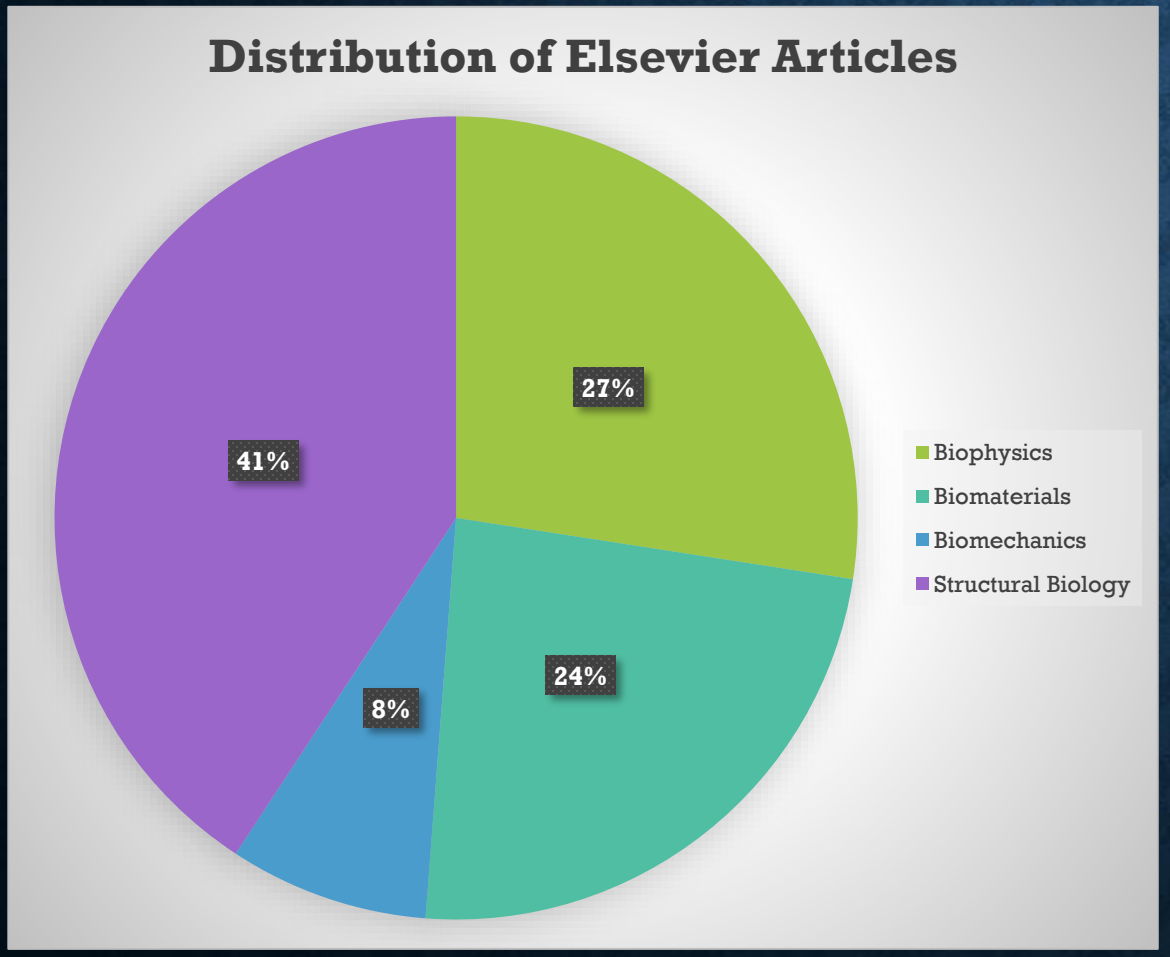
BRIEF STATISTICS OF AFRICA

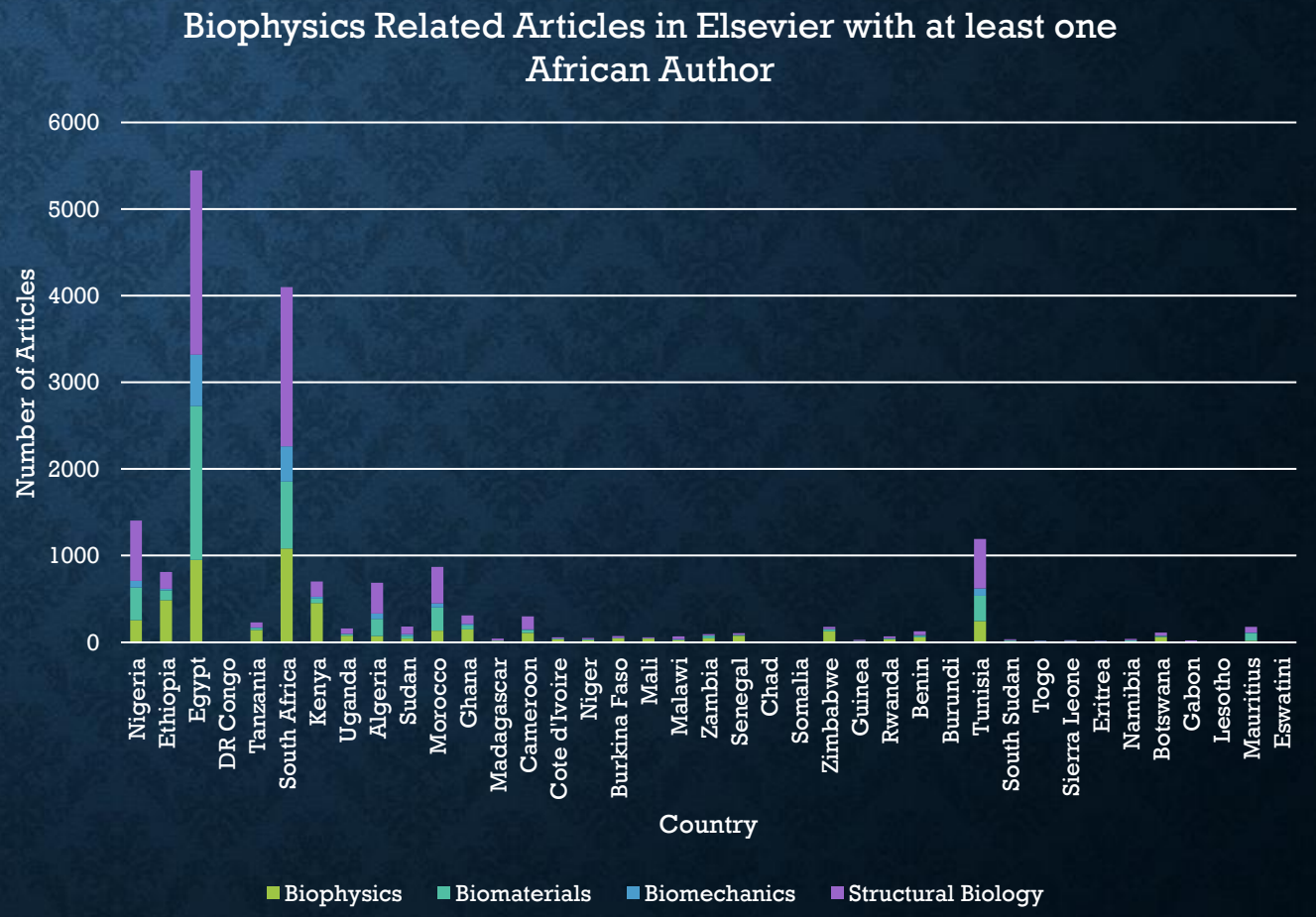
Population	**1,419,360,415**
Regions	5
Umbrella	African Union
Number of countries	54
Sources	https://www.worldometers.info/geography/how-many-countries-in-africa/Others https://data.worldbank.org/indicator/SP.POP.TOTL?locations=ZG

CHALLENGES IN AFRICA

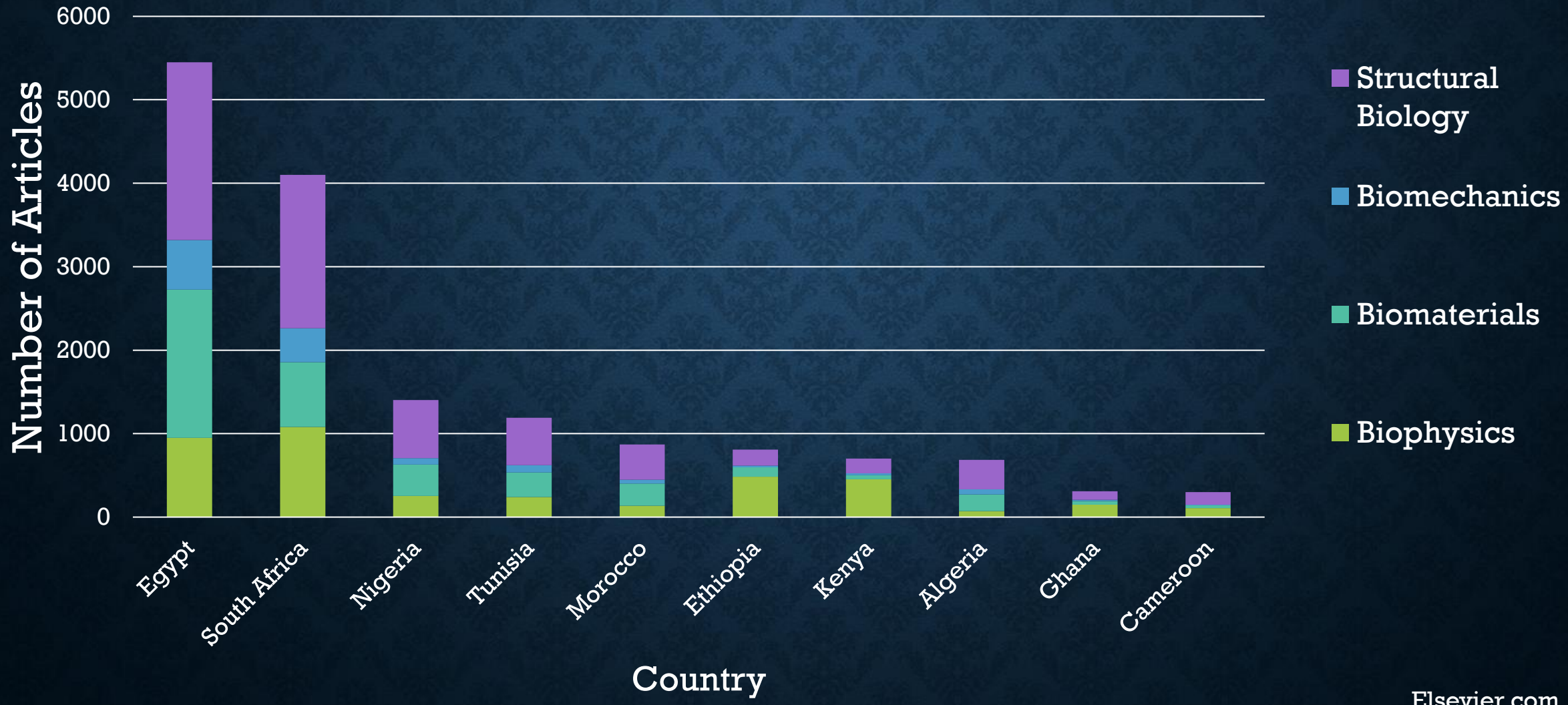
Challenge	Incidence (% world)	Fatality (% world)	Year	Source
Malaria	95	96	2021	W.H.O.
Cholera	21	80	2021	W.H.O.
HIV/AIDS	65.64	60.32	2022	W.H.O.
Tuberculosis	25	25	2016	World Bank
	Persons	Estimate (million)		
Food Crisis	1 in 5	140	2022	World Bank

COUNTRIES WITH ACTIVE BIOPHYSICS RESEARCHERS





Major countries with Biophysics related research output (2013 - 2023)



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AREAS OF FOCUS/APPLICATIONS/RELEVANCE

- Environment
- Agriculture (Plant Photosynthesis)
- Biology (Immunology, microbiology)
- Medicine and Dentistry
- Chemistry/Biochemistry/Genetics/Genomics
- Energy/Bioenergy
- Social sciences

IMPACT OF BIOPHYSICS IN HEALTH CARE MANAGEMENT

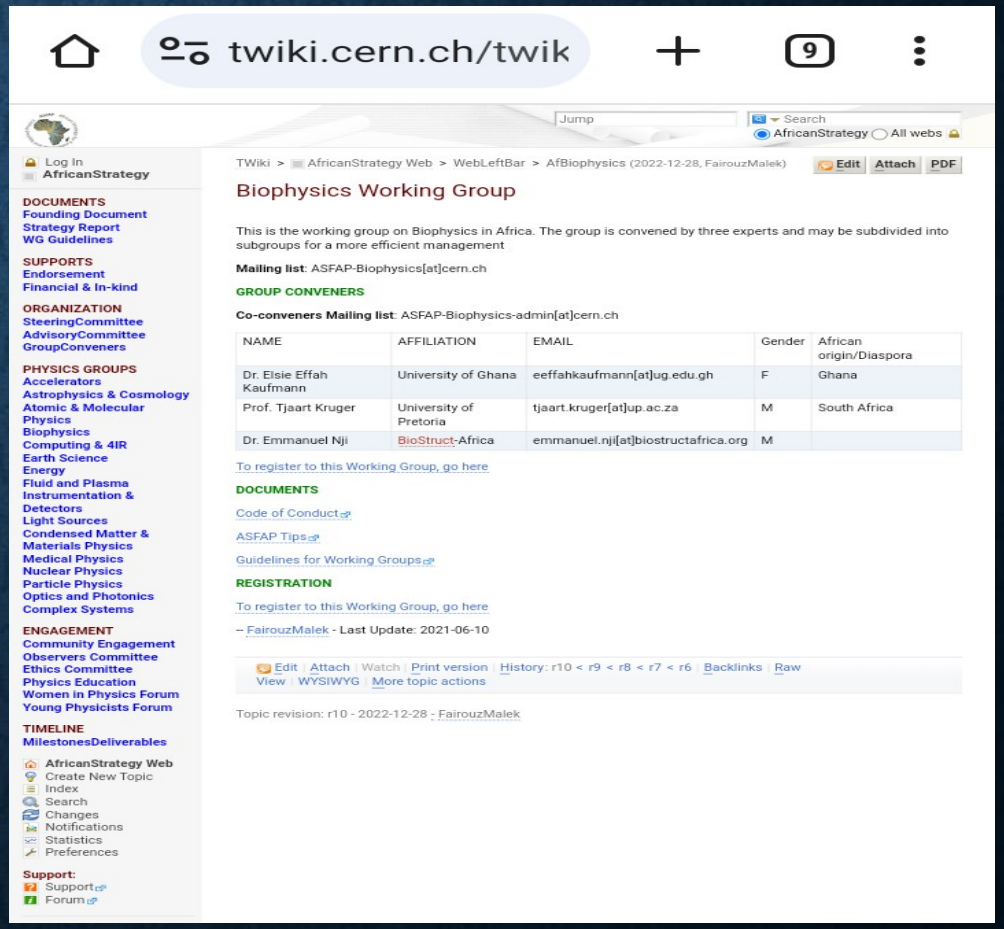
- Discovery/Application/Modification of X-rays for medical imaging
- Structure of DNA using X-ray diffraction techniques
- Electron microscopes for studying microstructures
- Virus invasion in cells
- Motion/movements of motor proteins
- Development and/or production of vaccines / drugs

CURRENT TREND IN BIOPHYSICS (IN AFRICA)

- How environmental plants harness the energy from the sunlight for food production?
- Mobility and the invasive nature of viruses and/or cells within and outside their microenvironment.
- How does protein synthesis occur?
- Rate (speed) of transmission of signals by the neural impulses
- How to cells interact/communicate and send signals between one another?
- What is the Quantum nature of biological architectures?

BIOPHYSICS COMMUNITY AND COLLABORATIVE STATE AMONG AFRICAN RESEARCHERS

- African Physics Strategy (Biophysics group)
- South African Institute of Physics
- *Presently, no active continental community that is exclusive for Biophysics research activities.*



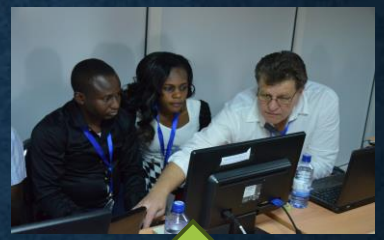
CURRENT CHALLENGES FACING BIOPHYSICS RESEARCH

Awareness

Access to funds

Mobility

Access to facilities



Mentoring

MENTORING

Availability of mentors

Willing mentors

Access to mentors

Mentee's Responsibility

NEED FOR MENTORING, CONTINUING EDUCATION AND COLLABORATION

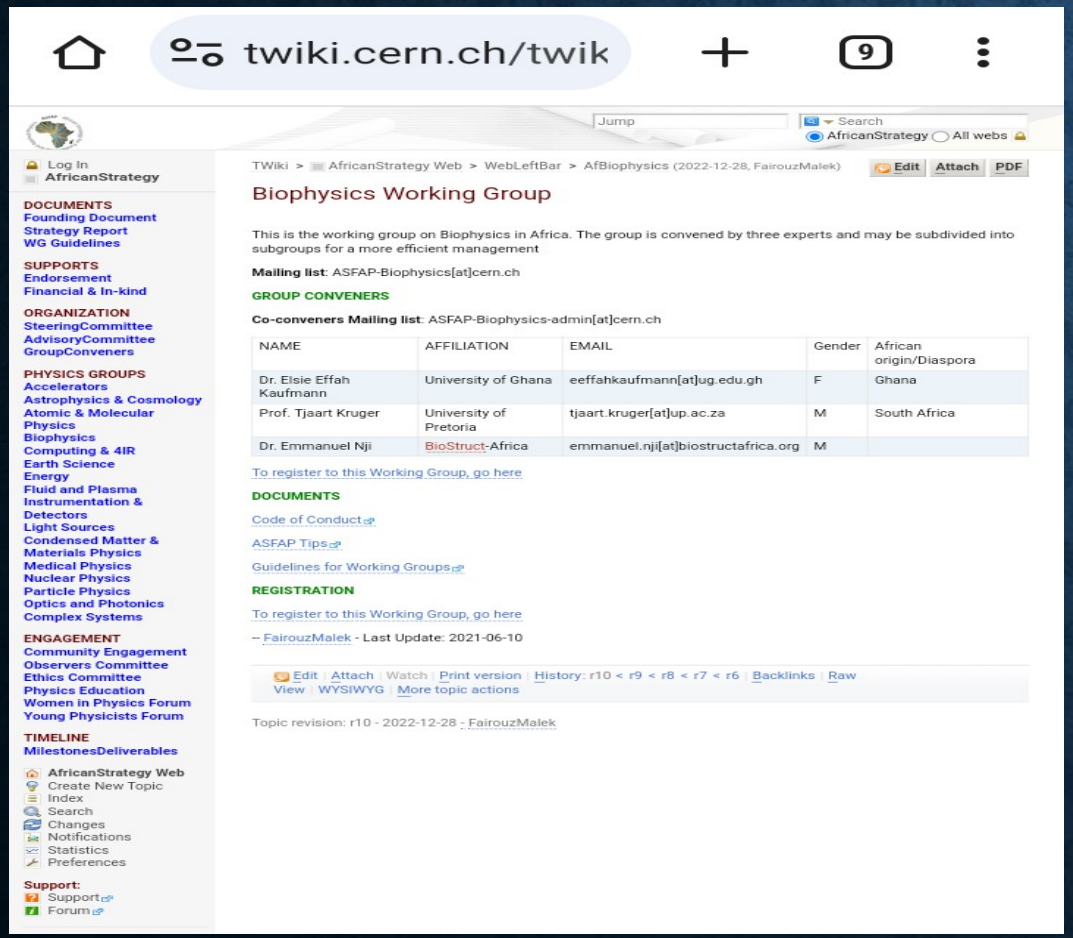
- **Mentoring of early career scientists by established researchers in biophysics**

  "…..standing on the shoulder of giants." : Sir Issac Newton

- **Regular meetings on current and relevant topics in biophysics**
  - **Training on the use of biophysics research tools and software**
  - **Use of novel techniques in biophysics**
  - **Analysis of technical biophysics results/data**

- **Sharing of research facilities**

COLLABORATION IN SOLVING NATIONAL OR REGIONAL CHALLENGES



- conferences/
- workshops

MOBILITY

- Visa restrictions/constraints
  - Exclusive visas for Academics/Researchers
- Cultural differences

CONCLUSION

- Biophysicists have a huge role to play in the development of Africa.
- This cannot be done alone and all must work as a team.
- There are various aspects of biophysical research that need to be explored.
- Biophysics researchers in Africa should start actively translation of their works from laboratory to the society.

CONCLUSION

Together, we can make a better and greater Africa

APPRECIATION/ACKNOWLEDGEMENT

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WITS/NUCLEAR MEDICINE

UJ/MECHANICAL, THE BUILD ENVIRONMENT

AFRICAN SCHOOL OF PHYSICS

CONFERENCE ORGANIZERS (LOC/IOC)

Thank you all for listening. Questions, comments, etc?