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A note about the Cover Image: LNLS is an inspiration to the AfLS. It originated in a developing country. It has provided world leadership in novel light source concepts. The young emerging scientists have massively stepped up to the challenge to become world leaders in their fields. The science productivity has seen massive growth. Local industry have been launched on a trajectory of global profile. Note the space provided for the future mega-science park.

http://www.africanlightsource.org/
AfLS Steering Committee Chair’s Comment

Written by Simon Connell

Welcome to the third edition of the African Light Source Newsletter, keeping you in touch with the AfLS related activities, supplementing our web-pages, blog and social media pages.

We remain in the grip of the COVID-19 pandemic. The African Light Source project has continued to progress, albeit with adaptations. The 3rd AfLS Conference and Workshop scheduled for 16-21 November 2020 is postponed, and we will instead hold the AfLS2020 Virtual Workshop from 18-21 November 2020 via Zoom. Work proceeds apace to develop the User base, in terms of science and capacity. In parallel, we are making progress with the Conceptual Design Report, the profile of the AfLS at government and Pan African level, the relationships with all stakeholders and the establishment of the AfLS International Advisory Committee. We intend to report on and also virtually launch aspects of these matters in the AfLS2020 Virtual Workshop.

It is important to reflect a moment on the African context of the AfLS. Most significantly, this is an Africa-led and globally inclusive Initiative. It aims at a premier light source for the world, located in the continent of Africa. When one mentions the word “light source”, one is cognizant that this expands in the realization to a host of milestones. These include the scientific user base and their research outputs, the advanced human capacity building, the local and regional associated research infrastructure and the industrial linkages for innovation and competitive industry. It also is a major achievement of Science Diplomacy, for Africa, and ings in role for the Africa Union. A 4th generation light sources can produce data at rates beyond that of the Large Hadron Collider and the Square Kilometer Array. This means that it becomes a premier site for innovation in Big Data and Machine Learning. Furthermore, one expects a focus on research issues relevant to Africa, including its disease burden, mineral beneficiation, sustainable environment, security of green energy and its special global position in heritage studies, paleontological and archeological. One expects delivery to all 17 of the UN SDGs. Participation in a modern light source builds protection against future epidemics. Not only does the medical research at a light source provide an essential service in the development of medical interventions, but they are now becoming user facilities that are conveniently exploited robotically and remotely. The community learns to develop networked collaborative tools for online productivity in advance of any future lockdown. For all these reasons, light sources as major research infrastructures, are the most urgent next expenditure for Africa.

Another aspect of the African context is the concept of Ubuntu. This famous word is prevalent in a similar form throughout the African continent. It has no simple parallel in English and often it is under-described as simply "humanity." It’s much more extensive, and also contains the concepts - "I am because we are," or "humanity towards others," or again, "umuntu ngumuntu ngabantu" in a word, Ubuntu. It further has the deeper more philosophical meaning - "the belief in a universal bond of sharing that connects all humanity." This is the basis for the inclusive and transparent approach towards the AfLS project. From the outset, the AfLS developed in a manner that respects Ubuntu: inclusivity, transparency, democracy, diversity. The two -decade old conversations held in Africa and globally, coalesced towards an Interim Steering Committee. This was dissolved to give birth to the fully mandated Committee based on the platform of a special 1st AfLS Conference, with a well-advertised lead-in to a nomination and participation process. This process resulted in the AfLS Vision and Mission statements, the AfLS Terms of Reference, and the AfLS Roadmap. All of this history is documented in various publications, all linked at the AfLS website https://www.africanlightsource.org.

The same Ubuntu approach has now been developed for the drafting of the AfLS Conceptual Design Report. This document will essentially form the Foundation of the African Light Source. It is in a sense the “Bible”, the “Periodic Table”, as well as the “DNA” of the African Light Source. As such, AfLS CDR has four volumes and covers these areas:

- Volume I. Political, Economic Development and Management Concepts
- Volume II. Machine Design Concepts
- Volume III. Scientific Capabilities and Beamline Concepts
- Volume IV. Integrated Site Design and Construction
The AfLS is seeking, in particular, African donor funding in the development of the AfLS CDR. Please contact us should you require more information.

We hope you enjoy reading our newsletter. Feel free to provide us with feedback using our web portal: http://www.africanlightsource.org/. Follow us on Twitter: @AfSynchrotron and on Facebook: @AfricaLightSource.

South African Structural Biologists Are Addressing an Important Clinical Issue in COVID-19 Disease

*Prospectus written by Lawrence Norris*

The SARS-CoV-19 virus binds to angiotensin-converting enzyme 2 (ACE2), an enzyme expressed on the surface of many cell types. One of the first structural biology reports concerning this virus was of the so-called spike protein bound to the ACE2.

ACE2 is a structural homologue to ACE. (It’s not called ACE1.) ACE2 and ACE can be thought of as two levers in blood pressure regulations, with opposite effects. Upon infection, not only is ACE2 encumbered with SARS-CoV-19 virus, but it becomes down-regulated as well, leaving the mechanisms of ACE un-attenuated.

For its part, ACE is a central enzyme in the regulation of blood pressure through the renin–angiotensin–aldosterone system (RAAS). ACE inhibitors are a major class of blood pressure reducing drugs. One such drug, Lisinopril, is reportedly the world’s most prescribed drug.

A serious clinical question has been, do ACE inhibitors put the ACE2/ACE effects out of balance, and does that put hypertensive COVID-19 patients, either treated with ACE inhibitors or not, at greater risk or reduced risk in terms of infection, morbidity and mortality. (The answer seems to be, probably not; and ACE inhibitor therapy should not be discontinued as viral prophylaxis, or as a response to COVID-19 disease.)

Inhibiting ACE can lead to increased levels of another peptide called bradykinin. The effect of that is two common side effects: a persistent cough (clinically known as the ‘bradykinin cough’), and angioedema, a very serious condition that even a little bit of cannot possibly be helpful in SARS-COVID-19 infected patient. That is, SARS-COVID-19 mediated ACE2 down-regulation, coupled with bradykinin up-regulation probably results in increased endema, vasoconstriction, bronchoconstriction, influx of inflammatory cells to the lung, which are all part of the cascade of maladies in COVID-19 sickness. People of African descent have up to 5x increased risk of ACE inhibitor induced angioedema, which is likely mediated via bradykinin.

ACE actually has two homologous catalytic domains, one at its C-terminus and the other at its N-terminus. It turns out that N-terminus inhibition is associated with the bradykinin-mediated side effects, while C-terminus inhibition is not. So a key pharmacological target is to find a C-terminus selective ACE inhibitor.

Enter the work on structure-based design of ACE inhibitors led by Edward Sturrock and Trevor Sewell of University of Cape Town, along with Erick Strauss of Stellenbosch University. Their XRD structure of ACE with Lisinopril suggested that modifying the proline end of the drug to a tryptophan would result in greater binding affinity in the C-terminus active site, and greater selectivity over the N-terminus site. This led to increased the selectivity of C-over N-terminus inhibition by 250-fold, and exhibited slightly better control of hypertension. Moreover, animals models using their modified Lisinopril exhibited lower levels of bradykinin, indicating that bradykinin-mediated side-effects would ameliorated.

[Figure 1.] (a) Lisinopril structure. Image from https://en.wikipedia.org/wiki/Lisinopril

[Figure 2.] (a) Linsinpril in ACE active site. Image from https://www.researchgate.net/figure/Snapshots-of-the-ACE-active-site-bound-to-lisinopril-A-and-enalaprilat-B_51077830

They then proceeded to design compounds that are simultaneously C-terminus selective and also inhibitors of neprilysin, a zinc-dependent metalloprotease that produces neprilysin... Continued on page 10
The Effect of COVID-19 in Africa

Review of “A Study of COVID-19 Data from African Countries” Written by Tabitha Dobbins

On July 31st, as part of the African School of Physics (ASP2020) remote presentations, Dr. Ketevi Assamagan (Brookhaven National Laboratory, USA) presented a paper which described how the impact of COVID-19 in African countries could be modeled. Dr. Assamagan recruited a veritable “army” of students and post-doctoral researchers who either reside in or were native to countries across Africa. Students were made responsible for contributing World Health Organization (WHO) data on COVID-19 infections, recoveries, and deaths for an African nation as well as reporting on the conditions on the ground so that the project would have a deeper understanding of the COVID-19 impacts. The student and post-doctoral researcher participants were: Dr. Somiealo Azote (Université de Lomé, Togo), Cerille E. Haliya (University of Abomey-Calavi, Benin), Toivo S. Mabote (Universidade Eduardo Mondlane, Mozambique), Kondwani C.C. Mwale (University of Rwanda, Rwanda), Ebode F. Onyie (University of Yaounde 1, Cameroon), and George Zimba (University of Jyväskylä, Finland).

Findings:

Key findings of their work is that the simple SIR Model (S=Susceptible, I=Infectious, R=Recovered) failed to model the data set. Below was presented as the example of the SIR model fits to WHO data from Togo. Although fitting to the Recovered (green) and Active (blue) data seems adequate (sans the misfit to the Active data between the dates of 3/16/2020 and 3/26/2020), the SIR model should fit both datasets simultaneously. Shown are optimizations for each case, Active and Recovered.

The researchers moved on to a more complex model named SIDARTHE. SIDARTHE was developed originally using Italian data and includes a number of states described using the acronym SIDARTHE.

S = Susceptible  R = Recognized
I = Infected    T = Threatened
D = Diagnosed   H = Healed
A = Ailing      E = Extinct

The states are connected by time varying coefficients and those coefficients determine population’s overall health at a given moment.

Read more about this exciting work at: https://arxiv.org/pdf/2007.10927.pdf


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Article Written by Diouma KOBOR

Senegal is a developing country located in West Africa. Within the sub-region, it has always been recognized as offering a good education system. It also makes a lot of effort in science, but like in many African countries High Energy Physics remains unexplored.

In order to contribute to this effort and introduce HEP research in Senegal, the ICTP Physics without Frontiers program was conducted in 4 different universities in Senegal. From 15th November to 1st December 2019, within ICTP PWF project the team composed by Diallo BOYE from ATLAS (Switzerland), Dr Lily ASQUITH University of Sussex (UK) and Dr Amadou BAH Johns Hopkins University (USA) and hosted by Prof. Oumar KA from Université Cheikh Anta Diop of Dakar, Prof. Abdou Karim Diallo from Université Gaston Berger of Saint Louis, Prof. Lat Grand Ndiaye from Université Assane Seck of Ziguinchor and Dr. Ibrahima KA from Dakar American University of Sciences and Technology work with a selected group of the brightest students (approximately 30 to 50 at each institute). The goal was to stimulate, motivate, train and inform about opportunities in the field of High Energy Physics through day-long particle physics masterclasses.

The project aims at inspiring young Senegalese physics students to engage in scientific research focusing on high energy physics, providing role models within an intense masterclass framework in order to motivate the students to go on to further study and consider pursuing research careers, nourishing the scientific wealth of Senegal.

Thus the objectives were twofold:

- To stimulate the students interest in physics research with focus on current research and activities in the field of high energy physics;
- To educate and invigorate the students with further study opportunities in physics and possible career paths in research.

The focus was on undergraduate and master students believing that this target group will benefit most from the training given their high academic level. They are an ideal target to be introduced to high energy physics, a field which they could join later and help grow a community of specialists in their country.

To achieve these above objectives many activities were delivered for example “lectures on particle physics on topics such as the Standard Model (SM), phenomenology and detector physics”, “holding a hands-on session where the students experienced the challenge of experimental high energy physics by analysing LHC data collected by the ATLAS experiment along with Monte Carlo samples”, “a virtual visit live to the ATLAS control room at CERN with a live web-cast that is available to watch on line and which would be recorded for future viewing” and “careers session comprising of a dedicated lecture and a discussion session”. The talk outlined the various opportunities available to students wanting to continue further study in physics highlighting institutions such as ICTP.

Such project could be multiplied in many African universities and can be a mean to facilitate the dissemination of synchrotron techniques use in Africa.

Photos on top row of students in session during the masterclass lectures by Dr. Diallo BOYE (top left) and Ibrahima BAH (top right). Photos on bottom row of students in session (bottom left) and group of students and attendees with Dr. Lily ASQUITH (bottom right).
Save-the-date for the 3rd African Light Source Conference AfLS3: towards a brighter future

AfLS3 CONFERENCE

**Save-the-date for the 3rd African Light Source Conference Nov 16th-21st, 2020.** The conference will be held in Kigali, Rwanda and hosted by the Centre for Theoretical Physics (ICTP)/East Africa Institute for Fundamental Research (EAIFR) located at the University of Rwanda (UR), College of Science and Technology. Read more at: http://events.saip.org.za/conferenceDisplay.py?confId=1

Don’t miss out on this historical event! During the first AfLS conference, a steering committee was elected and a roadmap developed. As well, a set of resolutions (the Grenoble Resolutions) were adopted and a detailed strategy for implementation was developed. Since then, actions to move the roadmap forward have been operationalized during sessions at the conferences and be a part of this wonderful endeavor!

The conference program will feature sessions on:
- News from Light Sources around the world
- Heritage Sciences (Archeo- and Paleo-)
- Environmental Sciences
- Energy Sciences
- Pan-African Initiatives in Science and Technology
- Strategy and Vision for the African Light Source
- Capacity Building


Due to COVID-19 Travel Restrictions, the AfLS3 (Virtual) Workshop will take place 18-20 November 2020. The Workshop will feature talks on: the Political/Economic Leadership for an African Light Source, Pan-African Initiatives, the AfLS Conceptual Design Report advising session via a Light Sources Round Table, Poster Session, and much, much more!


The African Light Source Virtual Workshop AfLS2020
Towards a brighter future
THE AfLS EXECUTIVE STEERING COMMITTEE 2020

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African Light Source Project

AfLS Executive Steering Committee

See details of the Organizational Chart at: [http://www.africanlightsource.org/organizational-chart/](http://www.africanlightsource.org/organizational-chart/)
Introducing the International Conference Organizing Committee (ICOC)

Written by Tabbetha Dobbins (ICOC Chair) and ICOC members

The International Conference Organizing Committee (ICOC) of the African Light Source was created in order to provide continuity and scientific direction to the conference. Other activities of the ICOC includes increasing the visibility for the AfLS project via making contributions to the AfLS Quarterly Newsletter, providing high quality journal proceedings and/or special topics issues, and ensuring excellent content for each conference or workshop. New members on our International Organizing Committee includes: Saphina Biira (Busitema University); Simon Connell (Univ. of Johannesburg); Tabbetha Dobbins (ICOC Chair, Rowan University); Abram Ledbetter (Brookhaven National Laboratory); Diouma Kobor (University Assane Seck of Ziguinchor); Sekazi Mtingwa (TriSEED, LLC); Prosper Ngabonziza (MPI-Stuttgart); Nkem Khumbah (Univ. of Michigan); Lawrence Norris; and Bjorn von der Heyden (Stellenbosch University). Below, we present a profile of the ICOC membership in the segment below titled: “In their own words”.

In Their Own Words: the ICOC of the AfLS answers “Why is the AfLS Project Important to You?”

Saphina Biira, Ph.D.
Senior Lecturer, Busitema University

Duration on the AfLS Project: Four Months.
In her own words: I can satisfy two important passions, learning and discovering new knowledge, and more importantly, the role of Science as an Engine for Democracy and Socio-Economic Development, so all can reach their full human potential in a just society. I would like to participate in and contribute to the Transformation of Society, the African Science Renaissance, the globalisation of the the Culture of Learning. In this I would like to see diversity celebrated and valued.

Simon Connell, Ph.D.
Professor, University of Johannesburg, Dept of Mechanical Engineering Science, Faculty of Engineering and the Built Environment

Duration on the AfLS Project: Twenty Years.
In his own words: I can satisfy two important passions, learning and discovering new knowledge, and more importantly, the role of Science as an Engine for Democracy and Socio-Economic Development, so all can reach their full human potential in a just society. I would like to participate in and contribute to the Transformation of Society, the African Science Renaissance, the globalisation of the the Culture of Learning. In this I would like to see diversity celebrated and valued.

Tabbetha Dobbins, Ph.D.
Associate Professor and Interim VP for Research and Dean of the Graduate School, Rowan University

Duration on the AfLS Project: Five Years.
In her own words: The AfLS project is important to me because as a light source user at facilities around the U.S. since 2003, I realize the importance of a light source for gaining insights into materials structures in order to understand their properties. Additionally, student training at state-of-the-art facilities is extremely beneficial to them. I understand the urgency of a light source on the continent of Africa.

David Dodoo-Arhin, Ph.D.
Associate Professor, University of Ghana

Duration on the AfLS Project: Two Years.
In his own words: The AfLS project is important to me because I have been a light source user at facilities in Europe since 2008 for studying nanostructured materials for energy and environmental applications. Additionally, student training at state-of-the-art facilities is extremely beneficial to them; however, no such facility exists on the African continent. Hence, an urgent need of a light source on the continent of Africa.
Michel Fodje, Ph.D.

*Senior Scientist-Beamline Responsible, Canadian Light Source, Inc.*

**Duration on the AfLS Project:** Four Months.

**In his own words:** I’ve been involved with synchrotron research for over 20 years and appreciate the importance of such facilities to basic and applied research in a wide variety of subject areas. The lack of a synchrotron facility in Africa is a deficiency that inhibits scientific productivity and technological development on the continent. The AfLS project will address this deficiency and I am proud to be a part of the effort.

Abram Ledbetter, Ph.D.

*Research Associate, Brookhaven National Laboratory*

**Duration on the AfLS Project:** Six Months.

**In his own words:** The push for synchrotrons within the continent of Africa represents as much a social justice imperative as a scientific one. This effort is critical to bolstering technological infrastructure and scientific programming which enables greater access to research modalities and collaborative possibilities for scientists within the Continent.

Diouma Kobor, Ph.D.

*Professor, University Assane Seck of Ziguinchor (Senegal)*

**Duration on the AfLS Project:** Five Years.

**In his own words:** I did participate in the AfLS conference (ESRF Grenoble November 2015), the first time I heard the AfLS project and synchrotron facility techniques. Since then, thanks to the LAAAMP project carried out by AfLS, we were awarded for two stays in two synchrotrons (ESRF and APS) which allowed us to be trained and use these excellent facilities to characterize new materials. For us, African synchrotron is more than a necessity but an urgency.

Sekazi Mtingwa, Ph.D.

*Principal Partner, TriSEED Consultants, LLC*

**Duration on the AfLS Project:** Twenty Years.

**In his own words:** The AfLS will be a necessary infrastructure to place Africa among the leading nations in the world that are pursuing science and technology for their socioeconomic development. I proposed a Pan-African synchrotron light source to EBASI in 2000 and after fruitful discussions decided that first building up regional laser infrastructures would be the best way to lay the groundwork for an AfLS. Therefore, I partnered with others to found the African Laser Centre.

Prosper Ngabonziza, Ph.D.

*Scientist, Max Planck Institute for Solid State Research, Stuttgart GERMANY*

**Duration on the AfLS Project:** Three Years.

**In his own words:** The AfLS project is important to me because as African in diaspora who has been using synchrontron light sources around Europe since 2010, I believe in the importance of Synchrotron light sources for proper characterizations of quantum Material with potential applications in diverse current and future electronic devices. I also believe in the vision of building an African Light Source on the Africa continent that will contribute significantly to the African science renaissance, the return of the African science diaspora and the enhancement of University education on the continent.

Peter Ngene, Ph.D.

*Asst. Prof., Debye Institute for Nanomaterials Science, Utrecht Univ.*

**Duration on the AfLS Project:** Six Months.

**In his own words:** As a regular user of synchrotron facilities, I can say that Synchrotrons are extremely important to the discovery and understanding of novel materials required for sustainable economic and social development. Having a light source on the African continent will be a major boost to
the scientific activities and training of future generation of African scientists.

Lawrence Norris, Ph.D.

**Duration on the AfLS Project:** Eight Years.

**In his own words:** The future looks bright for Africa in Structural Biology. The African Light Source has the potential to address many key issues in structural biology and the rules of life. For this reason, Africa as a continent must become a key player in the technologies of light sources. Each African national government should incentivize its universities to build infrastructure in all the fields that support biophysics, including chemistry and biochemistry labs, computing, as well as facilities for spectroscopy, light scattering, imaging, crystallography and microscopy, i.e., advanced light source facilities. The African Union as a body should spark policies that encourage industries to invest in the Africa’s bioeconomy.

Bjorn von der Heyden, Ph.D.

Stellenbosch University, SA

**Duration on the AfLS Project:** Nine Years.

**In his own words:** I see the AfLS initiative as being crucial towards enhancing the competitiveness of African scientists within the global research community. I think that it will be a great leap forward for the continent’s research prowess, and it will certainly help to accelerate the so-called “African Science Renaissance”.

Nkem Khumbah, Ph.D.

Professor, University of Michigan

**Duration on the AfLS Project:** Five Years.

**In his own words:** Dr. Nkem Khumbah is a mathematician at the University of Michigan and member of the STEM-Africa Initiative at the University of Michigan. Previously he was an Assistant Professor of Mathematics at North Georgia College and State University. His research has been on development and application of mathematical structures that facilitate the compression of massive data sets with minimal distortion to the statistical structure of the data. He is an avid ambassador of international scientific capacity and human development. He has been consulting for and closely working with multiple regional and international organizations, including the African Union, select African governments, the World Bank African Centers of Excellence Project, UNESCO, Washington-based Constituency for Africa (CFA), the Association of African Universities, the African Network of Science and Technology Institutes (ANSTI), among others. He served in 2015 as Founding Executive Curator of the Next Einstein Forum (NEF): Africa’s Global Forum for Science, Policy and Society. He served as the Science and Technology chair of the first ever African Continental Summit on Higher Education in 2015, and co-authored recommendations that were adopted by the African Union, at its establishment of a Committee of 10 African Heads of States as continental Champions of Science and Education.

Continued from Page 3 (South African Structural Biologists are Addressing an Important Clinical Issue in COVID-19 Disease)

vasocontricting, natriuretic peptides that tend to raise blood pressure. Such a combination drug would be expected to efficacious in patients that are refractory to ACE inhibitory therapy alone, or whose progressive heath failure has gotten to stage where more aggressive drug therapy is warranted.

Those results were encouraging, and work is continuing on designing a compounds that have great selectivity for the C-terminus of ACE and good inhibition activity against nepriyls.

Altogether this work will potentially lead to high blood pressure medicines that would be better tolerated by people of African descent, and possibly by COVID-19 patients that present with hypertension.


Editor’s Note: The Editorial Board of the African Light Source Newsletter is led by Tabbetha Dobbins. Please submit content for inclusion in the newsletter to the email address: secretariat@africanlightsource.org (and mention Newsletter in the subject line) ©2020