

African Light Source Virtual Workshop

*An Extremely Bright Light
to address global challenges*

Francesco SETTE
Director General, ESRF

PIONEERING SYNCHROTRON
SCIENCE





22 PARTNER COUNTRIES

13 Member states:

France	27.5 %
Germany	24.0 %
Italy	13.2 %
United Kingdom	10.5 %
Russia	6.0 %
Benesync (Belgium, The Netherlands)	5.8 %
Nordsync (Denmark, Finland, Norway, Sweden)	5.0 %
Spain	4.0 %
Switzerland	4.0 %

10 Associate countries:

Austria	1.75 %
Israel	1.75 %
Centralsync (Czech Republic, Hungary, Slovakia)	1.05 %
Poland	1.00 %
Portugal	1.00 %
India	0.66 %
South Africa	0.30 %

ESRF
Grenoble
France

**ESRF-EBS,
THE FIRST OF A
NEW GENERATION
OF HIGH-ENERGY
SYNCHROTRON
SOURCE**

- A 150M€ innovative project over 2015-2022
- A new high-energy x-ray storage ring, EBS
- New state-of-the-art beamlines & platforms
- A major scientific instrumentation programme
- A data strategy to fully exploit the performances of the new X-ray source

Since 25 August 2020: the new EBS storage ring is up and running with design performance, providing new exciting opportunities in X-ray science for the synchrotron community worldwide

1. **Health, Health Innovation**, and overcoming cancer and neuro-degenerative diseases
2. **Material for tomorrow** and innovative and sustainable industry
3. **Clean Energy transition**, sustainable energy storage and clean hydrogen technologies
4. **Planetary** (terrestrial and extra-terrestrial) research
5. **Environmental and climatic challenges**, water supplies and earth atmosphere
6. **Bio-based economy and food security**
7. **Humanity and world cultural heritage**

36 beamlines already opened to users





The Top Ten Scientific Discoveries of the Decade

By Jay Bennett smithsonianmag.com - December 31, 2019



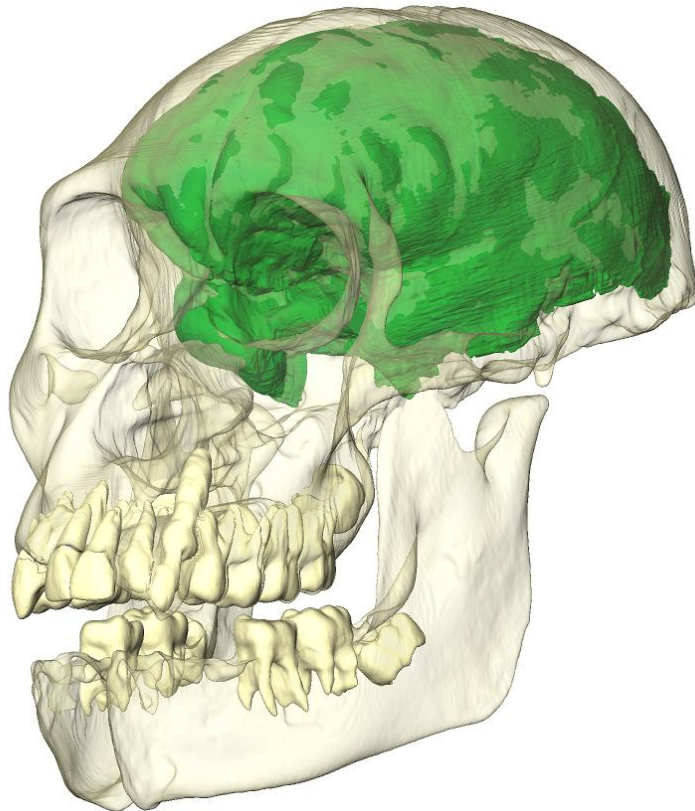
1. New Human Relatives - *Australopithecus Sediba*
2. Taking Measure of the Cosmos – Gravitational Waves
3. The Hottest Years on Record – Global temperatures anomalies
4. Editing Genes
5. Mysteries of Other Worlds Revealed – New Horizons, Cassini, Kepler, Tess, Rosetta
6. Fossilized Pigments Reveal the Colors of Dinosaurs
7. Redefining the Fundamental Unit of Mass - now expressed in terms of Planck's constant
8. First Ancient Human Genome Sequenced
9. A Vaccine and New Treatments to Fight Ebola
10. CERN Detects the Higgs Boson



<https://www.smithsonianmag.com/science-nature/top-ten-scientific-discoveries-decade-180973873/>

Understanding the origins of Humanity: Australopithecus Sediba at the ESRF

A great example of the strong and fruitful collaboration with South Africa



9 Sept 2011

Five papers on:

- Brain (ESRF)
- Hand
- Hip bone (pelvis)
- Foot and ankle
- Exact age

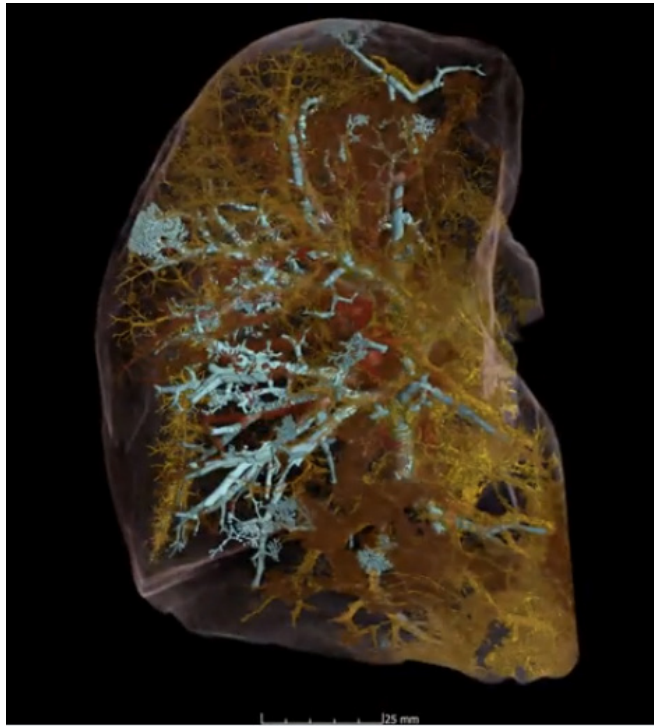
"The many very advanced features found in the brain and body ...make it possibly the best candidate ancestor for our genus, the genus Homo."

Lee Berger, Wits Univ.,
Johannesburg

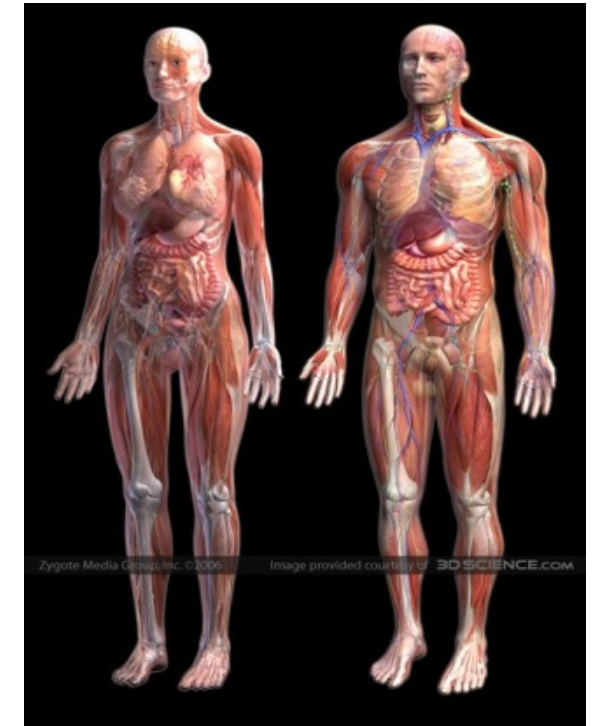
<http://www.esrf.eu/UsersAndScience/Publications/Highlights/2011/imaging/ima7>

MULTISCALE PHASE-CONTRAST IMAGING OF COMPLETE COVID-19 HUMAN ORGANS

FIRST EBS DATA: A REVOLUTION IN MEDICAL IMAGING

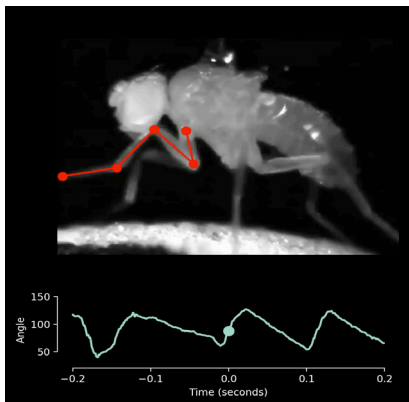


Tafforeau, ESRF



Unpublished results:
do not copy

3D virtual histology: 3D scan of a body from anatomical to cellular scales, with sub-micron resolution X-ray imaging anywhere in the body.



Automatic
reconstruction of
neurons connecting
VNC (spinal cord) to
muscles in the leg of
Drosophila

UNRAVELLING THE SECRETS OF BRAIN CONNECTIONS

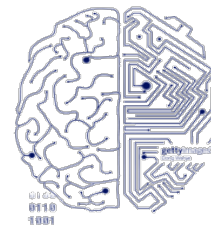
One of the great challenges of our century is to uncover the brain circuitry at neuronal level: understanding learning and cognition processes and neurological diseases.

Third generation sources

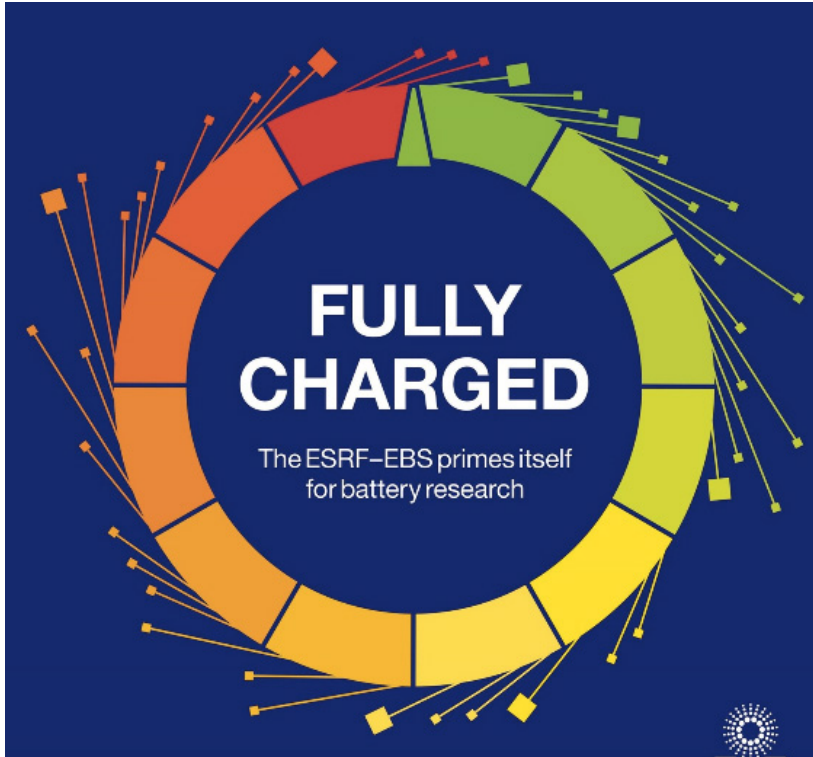
First attempts in imaging neuron fibres

Goals with EBS

- Resolve neural circuits to the synaptic level
- Enable rapid imaging of large tissue volumes
- Develop sample statistics



European
Research
Council



FASTER, BETTER, SAFER BATTERIES

One of the great challenges of our century is to store and distribute efficiently clean energy: boosted by EBS, the ESRF is helping to satisfy demands for more advanced low-carbon battery technology.

Third generation sources

First attempts in following the fate of lithium atoms during charging / discharging cycles

Goals with EBS

- Atomic structure evolution at extremely fast charging / discharging rates
- Enable direct connection with sample processing and AI-driven smart design

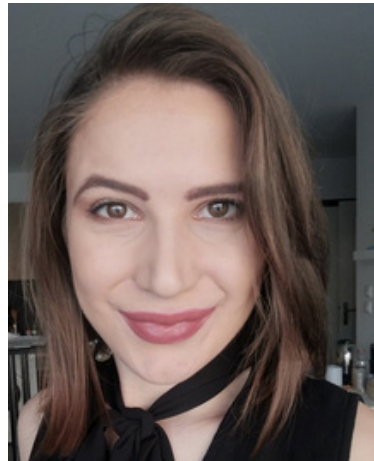


**TRAINING THE NEXT GENERATION OF SCIENTISTS
TO CONTINUE TO TACKLING GLOBAL CHALLENGES WITH SYNCHROTRON SCIENCE,
FOR A SUSTAINABLE AND PEACEFUL FUTURE**



Fortune MOKOENA
MCs student
(South Africa)

Participates in the design of
the new phase contrast
tomography beamline
(BEATS) of SESAME (Jordan)



Alicia POTGIETER
PhD student
(South Africa)

Works on theoretical and
experimental activities
related to the design,
modelling & testing of novel
prototype cooling systems.



Kudakwashe JAKATA
Post-doc researcher
(Zimbabwe)

Works on the computed
tomography beamline (ID19
and BM05), focussing on
palaeontology research.



THANK YOU FOR YOUR ATTENTION

