

# Haitham A. Shaban, PhD

Senior Research Fellow, Agora Translational Cancer Research & Lausanne University Hospital, Switzerland

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## Area of Expertise

Immuno-Oncology, Digital Pathology, Single-cell Imaging, Gene Regulation, Genome Organization, Advanced Imaging Technology, Image Processing, Biophysics, Data Analysis, Scientific Consultation & Communication, and Grant Writing.

## Work Experience

**Agora Cancer Research Centre &, Lausanne University Hospital, Lausanne, CH** 2022-Present

Senior Research Fellow at the Precision Oncology Center, Oncology Department

- Leading a project to define how chromatin of cancer and immune cells can be used as a predictive biomarker for immunotherapy response.
- Developing single-cell imaging-artificial intelligence-based chromatin features for cancer diagnostics and spatial mapping of cancer cells and tumor microenvironment (immune cells) interaction.

**Swiss Federal Institute of Technology Lausanne (EPFL), Lausanne, CH** 2020-2022

Marie Curie Fellow at Bioengineering Institute

- Led a project on deciphering the role of pioneer transcription factors in the dynamic conformation of chromatin in pluripotent embryonic stem and differentiated cells.

**Harvard University, Cambridge, MA, USA** 2019-2020

Postdoctoral Fellow at Center for Advanced Imaging, Faculty of Arts and Sciences

- Developed live-super resolution imaging modalities based on artificial intelligence.
- Studied the genome-wide spatial organization of chromatin and transcriptional activities.

**Oxford University, Oxford, UK** 2019

Visiting Research Fellow in Biochemistry Department

- Spatial mapping of the 3D epigenome and chromatin-associated RNAs

**National Research Centre, Cairo, Egypt** 2022- Present

Associate Professor of Biophysics, Physics Research Institute (*In leave*)

Assistant Professor of Biophysics, Physics Research Institute

**CNRS, University of Toulouse, France** 2015-2018

Postdoctoral Researcher at the Center for Integrative Biology

- Developed quantitative single-cell imaging methods for mapping the dynamic, conformation, and long range correlation properties of chromatin at the nanometer scale in human cancer cell lines.
- Studied the role of RNA Pol II & estrogen receptors in regulating transcription in human cancer cells.

**Institut Fresnel, Aix-Marseille University, France and LENS institute, Florence University, Italy** 2012-2015

- Built and optimized polarized super-resolution localization microscopy.
- Performed single-molecule and molecular orientation imaging of biological structures.
- Studied DNA-protein orientational interaction with polarized microscopy.

**National Research Centre, Cairo, Egypt** 2006-2011

Research Assistant of Biophysics at Physics Research Institute

- Performed molecular biophysics analysis of metalloenzymes and proteins.

## Education

**Aix Marseille University, Marseille, France** 2012-2015

**University of Florence, Florence, Italy**

Dual Ph.D. Degree in Biophysics/Photonics, Optics, and Image Processing

Dissertation Title: "Quantitative molecular orientation imaging of biological structures by polarized super-resolution fluorescence microscopy"

**Al-Azhar University, Cairo, Egypt** 2010

M. Sc. in Molecular Biophysics, Physics Department, Faculty of Science

B.Sc. in Biophysics, Physics Department, Faculty of Science 2004

## Leadership Experience

<b>Federation of American Societies for Experimental Biology (FASEB), USA</b> <i>Co-organizer for the first FASEB conference in Africa, Accra, Ghana</i>	2023
<b>Massachusetts Institute of Technology (MIT), Boston, USA</b> <i>Associate Editor, MIT Science Policy Review-Journal</i>	2019 – Present
<b>Harvard University, Cambridge, USA</b> <i>Board member of the Faculty of Arts and Sciences Postdoc Association</i>	2019 – 2020
<b>European Cooperation in Science and Technology, Brussels, EU</b> <i>Member of the International Nucleome Consortium, COST Action (CA18127)</i>	2019-2023

## Fundraising

<b>ISREC Foundation, Switzerland; CHF 256k,</b> <i>Digital Chromatin Pathology for Cancer Diagnosis</i>	2022 - 2024
<b>EU-Horizons 2020, EU; € 210k</b> <i>Deciphering the dynamics of pluripotency TFs and chromatin in embryonic cells.</i>	2020 – 2022
<b>AfOx-Oxford University, UK; £ 10k</b> <i>Quantitative analysis of chromatin domain dynamics in living human cells.</i>	2019

## Prizes, Awards, and Fellowships

- The Biophysical Society, USA; International travel award	2023
- EU Horizons 2020, European Union; Marie-Curie Fellowship (EuroTech program)	2020
- Harvard University, Boston; The research exchange program	2019
- The Japan Society for the Promotion of Science (JSPS); Young scientist fellowship to attend the 11 <sup>th</sup> HOPE meeting with Nobel Laureates, Okinawa, Japan	2019
- JSPS, Japan; Best flash talk and poster presentation in the 11 <sup>th</sup> HOPE meeting	2019
- The Africa Oxford Initiative fellowship - Oxford University; Visiting Fellowship	2019
- The Biophysical Society, USA; International travel award	2018
- Cancéropôle GSO, France; Young scientist award	2017
- Physics Department at Syracuse University, NY; Junior Scientist Grant	2016
- Europhotonics Program, Erasmus Mundus, EU; Ph.D. Fellowship	2012

## Teaching Experience

<b>Swiss Federal Institute of Technology Lausanne (EPFL)</b> <i>Instructor, Life Sciences Engineering Master Program</i>	Lausanne, CH Spring 2021
- Fundamental in Bio-photonics	
<b>The American University in Cairo (AUC)</b> <i>Teaching Assistant, Physics Department; courses ranged from PHYS 100 to 400</i>	Cairo, Egypt 2008-2011
- Prepared lab materials, supported students in carrying out experimental and/or creative work in labs and studios, assisted in grading assignments and exams, and held office hours	
- Trained several fresh-teaching assistants and guided undergraduate students at different task levels up to undergraduate research	

## Professional Associations

- Member of the International Nucleome Consortium, European Cooperation in Science and Technology, COST Action (CA18127), Brussel, EU.	2019-2023
- Reviewer for Nature Communications, PNAS, Nucleic Acid Research, Journal of Molecular Biology, Biophysical, and BBA - Gene Regulatory Mechanisms Journals	2017 - Present
- Member of the Biophysical Society, USA	2014 - Present

## Scientific Collaborations

- Prof. G. V. Shivashankar, PSI & ETHZ, Switzerland <i>Digital Pathology</i>	2022 -Present
- Prof. Carl Wu, Johns Hopkins University, USA <i>Histones (H2A, H2A.Z) and remodeler SWR1 dynamics at eukaryotic gene promoters</i>	2022 -Present

- Prof. Hiroshi Kimura, Tokyo Institute of technology <i>Dynamics of epigenetic and RNA polymerase II regulation in vivo</i>	2022 -Present
- Prof. Anne Dejean, Pasteur Institute, France <i>Effect of SUMO modification status on chromatin dynamics in cancer cells</i>	2021 -Present
- Prof. Jerome Mertens, University of Innsbruck, Austria <i>Genome organization in aging and Alzheimer's disease</i>	2020 -Present
- Prof. Daniel Jost, ENS de Lyone, France <i>Chromosomes modelling</i>	2020 -Present
- Prof. Lothar Schermelleh, Oxford University, UK <i>Imaging the functional genome organization</i>	2019 -Present

## **Presentations**

### **Selected Invited Seminars**

University of Geneva, Faculty of Sciences, Geneva, Switzerland <i>"Visualizing spatio-temporal coordination between chromatin structure, dynamics, and transcription"</i>	2022
ENS de Lyon, Lyon, France <i>"Visualizing coordination between chromatin structure, dynamics, and transcription in space and time"</i>	2022
University of Zurich, Department of Molecular Mechanisms of Disease, Switzerland <i>"Genome-wide nanometer-scale imaging of chromatin organization and dynamics"</i>	2021
International Nucleome Consortium Academy, COST action, EU <i>"Nanoscale imaging of chromatin structure and dynamics in single living cells"</i>	2021
New York University Abu Dhabi, Science Division, Abu Dhabi, UAE <i>"Real-time imaging of nanoscale genome organization and dynamics"</i>	2021
Babraham Institute, Cambridge, UK <i>"Spatially and temporally resolved chromatin dynamics and organization in living cells"</i>	2020
University of Washington, Genome Sciences, Seattle, USA <i>"Spatial organization and dynamic regulation of chromatin in living cells"</i>	2019
Stanford Medical School, Palo Alto, USA <i>"Chromatin dynamics within the entire nucleus"</i>	2018

### **Selected Conference Talks**

FASEB Catalyst Conferences, USA <i>"Live super-resolution imaging of chromatin structure and dynamics"</i>	2021
Chromosome Territories & Nuclear Architecture, IBM Conference, Mainz, Germany <i>"Coupling chromatin structure and dynamics by live super-resolution imaging"</i>	2019
The genome in three dimensions, EMBO Workshop, Kyllini, Greece <i>"Unifying chromatin structure and dynamics by super-resolution imaging"</i>	2019
11 <sup>th</sup> Hope meeting with Nobel Laureates, Okinawa, Japan <i>"Nanoscale mapping of DNA dynamics in live human cells"</i>	2019
13 <sup>èmes</sup> Journées Cancéropôle GSO Poitiers, France <i>"Quantitative analysis of chromatin dynamics at sub-diffraction resolution during transcription"</i>	2017
Chromatin Meets South, CNRS Toulouse, France <i>"High-resolution mapping of chromatin dynamics within the entire nucleus during transcription"</i>	2017
Focus On Microscopy, Bordeaux, France <i>"High-accuracy determination of chromatin and the transcription machinery motions"</i>	2017

## **Media and Outreach**

- TV interview with BBC News Arabia channel <https://bit.ly/3g4e62d>
- Interview with Sky News Arabia <https://bit.ly/3Zgp5Zb>
- Media interview at Oxford University <https://bit.ly/324Ahgp>

## List of Publications ([Google Scholar](#))

### Five Key Articles (1-5)

- 1- **Shaban, H.A.†**, Suter D. †, 2022. Individual activator and repressor transcription factors induce global changes in chromatin mobility. *bioRxiv*, doi: <https://doi.org/10.1101/2022.04.12.488001> (†) Co-corresponding Authors
- 2- Barth, R., Bystricky, K., **Shaban, H.A.†**, 2020. Coupling chromatin structure and dynamics by live super-resolution imaging, *Science Advances*; 6: eaaz2196. (†) Corresponding Author
- 3- **Shaban, H.A.†**, Barth, R., Recoules, L., Bystricky, K.†, 2020. Hi-D: Nanoscale mapping of nuclear dynamics in single living cells. *Genome Biology*, 21(1), 95. (†) Corresponding Author  
*Highlighted as one of the 20 most accessed and interesting articles over the last two decades by Genome Biology.*  
<https://genomebiology.biomedcentral.com/20years?s=09>
- 4- **Shaban, H.A.†**, Barth, R., Bystricky, K.†, 2018. Formation of correlated chromatin domains at nanoscale dynamic resolution during transcription. *Nucleic Acids Research*, 46 (13), e77-e77. (†) Corresponding Author
- 5- **Shaban, H.A.\***, Cruz, C.A.V. \*, Kress, A., Bertaux, N., Monneret, S., Mavrakis, M., Savatier, J. and Brasselet, S., 2016. Quantitative nanoscale imaging of orientational order in biological filaments by polarized super-resolution microscopy. *PNAS*, 113(7), pp. E820-E828.
- 6- Abdellah, M.\*, Valades-Cruz, CA.\*, Barth, R., **Shaban, H.A.†**, 2022. Genome-wide analysis of the dynamic and biophysical properties of chromatin and nuclear proteins in living cells with Hi-D. *Nature Protocols (In Revision)*. *bioRxiv*, doi: <https://doi.org/10.1101/2022.11.17.516893> (†) Corresponding Author
- 7- **Shaban, H.A.†**, 2022. Nucleus-wide analysis of coherent RNA Pol II movement in the context of chromatin dynamics in living cancer cells. *Nucleus* 13(1):313-318. (†) Corresponding Author
- 8- Barth, R., **Shaban, H.A.†**, 2022. Spatially coherent diffusion of human RNA Pol II depends on transcriptional state rather than chromatin motion. *Nucleus* 13(1):194-202. (†) Corresponding Author
- 9- Miron, E., Oldenkamp, R., Pinto, D.M.S., Brown, J., Carvalho Faria, A. R., **Shaban, H. A.**, Innocent, C., Rhodes, J. D.P., de Ornellas, S., Buckle V., Schermelleh L., 2020. Chromatin arranges in chains of mesoscale domains with nanoscale 3D functional topography in a cohesin-independent manner. *Science Adv.*, 6(39): eaba8811
- 10- Barth, R., Fourel, G., **Shaban, H.A.†**, 2020. Dynamics as a cause for the nanoscale organization of the genome. *Nucleus*, 1;11(1):83-98. (†) Corresponding Author
- 11- **Shaban, H.A.†**, Barth, R., Bystricky, K.†, 2020. Navigating the crowds: Visualizing coordination between genome dynamics, structure, and transcription. *Genome Biology*, 21(1), 278 (†) Corresponding Author
- 12- Akwasi A., A. \*, Amitai, A. \*, Buenrostro, J. D. \*, Chakrabarti, A. \*, Chu, L. \*, Hansen, A. S.\*, Nozaki, T.\*, Seeber, A.\*, **Shaban, H.A. \***, Spille, J-H.\*, Stephens, A. D. \*, Ovchinnikov, S. \*, Liu, S. \*, Koenig, K. \*, Su, J-H.\*, Wadduwage, D. \*, 2020. Advances in chromatin and chromosomes research: perspectives from multiple fields. *Molecular Cell*, 79. (\*) All authors are Equally Contributed
- 13- **Shaban, H.A.†**, Seeber, A.†, 2020. Monitoring the spatio-temporal organization and dynamics of the genome. *Nucleic Acids Research*, 48(7), 3423-3434. (†) Corresponding Author
- 14- **Shaban, H.A.**, Seeber, A., 2020. Monitoring global chromatin dynamics in response to DNA damage. *Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis*, 111707.
- 15- **Shaban, H.A.**, Barth, R., Bystricky, K., 2018. High-resolution mapping of chromatin dynamics during transcription in mammary tumor cells. *Biophysical Journal*. 114(3), 257a.
- 16- Germier, T., Kocanova, S., Walther, N., Bancaud, A., **Shaban, H.A.**, Sellou, H., Politi, A.Z., Ellenberg, J., Gallardo, F. and Bystricky, K., 2017. Real-time imaging of a single gene reveals transcription-initiated local confinement. *Biophysical Journal*, 113(7), pp.1383-1394.
- 17- **Shaban, H.A.**, Valades-Cruz, C.A., Savatier, J. and Brasselet, S., 2017. Polarized super-resolution structural imaging inside amyloid fibrils using Thioflavine T. *Scientific Reports*, 7(1), p.12482.
- 18- **Shaban, H. A.**, Valades-Cruz, C A, Savatier, J., Monneret, S, Rigneault H., Bertaux, N., and Brasselet, S., 2014. Polarized resolved single-molecule localization-based super-resolution fluorescence microscopy reveals orientation order in bio-molecular assemblies. *Biophysical Journal*. 106(2), 203a– 204a.

- 19- **Shaban, H. A.**, Shaltout, A. A., Abdou, M., Al Ashkar, E. A., I El Gohary, M., 2011. Determination for Cu, Zn and Se micro volumes of liquid biological samples. *Journal of Applied Spectroscopy*, 6(77), pp. 771-777.
- 20- Shaltout, A.A., Mostafa, N.Y., Abdel-Aal, M.S. and **Shaban, H.A.**, 2010. Electron number density and temperature measurements in laser produced brass plasma. *The European Physical Journal Applied Physics*, 50(1).
- 21- Abdou MI, **Shaban, H. A.** 2010. Changes in serum zinc, copper and ceruloplasmin levels of whole body gamma irradiated rats. Tenth Radiation Physics & Protection Conference, 27-30 November 2010, Nasr City - Cairo, Egypt. pp 17-26.

#### **Submitted articles**

- 22- **Shaban, H.A.** ‡, and Susan Gasser‡. Dynamic 3D genome reorganization during senescence: defining cell states through chromatin. *Submitted to Cell Death & Differentiation* (‡) Co-corresponding Author