## BIOGRAPHICAL SKETCH

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NAME: Abou-el-Enein, Mohamed

eRA COMMONS USERNAME (credential, e.g., agency login):

POSITION TITLE: Associate Professor of Clinical Medicine (Oncology), Pediatrics, and Stem Cell Biology & Regenerative Medicine, Executive Director of USC/CHLA Cell Therapy Program

EDUCATION/TRAINING *(Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)*

| INSTITUTION AND LOCATION | DEGREE *(if applicable)* | Completion Date MM/YYYY | FIELD OF STUDY |
|---|---|---|---|
| Mansoura University, Mansoura, Egypt | MBBCh | 2005 | Medicine and Surgery |
| Quality Management Institute, American University (AUC) Cairo, Egypt | PgDip | 2007 | Quality Management for Healthcare Reform |
| University of Strasburg, France | Master | 2014 | Pharmaceutical Sciences and Technologies |
| Charité – Universitätsmedizin, Berlin, Germany | MD/Ph.D. | 2014 | Economics of Manufacturing Cell Therapy |
| Charité – Universitätsmedizin, Berlin, Germany | Postgraduate | 2017 | |
| London School of Hygiene and Tropical Medicine, University of London, UK | MSPH | 2020 | Public Health – General Stream |
| University of Granada, Spain | Master | 2020 | Manufacturing of Cell Therapy (Qualified Person) |

### A. Personal Statement

Mohamed Abou-el-Enein is associate Professor of Clinical Medicine (Oncology), Pediatrics, and Stem Cell Biology & Regenerative Medicine at USC Keck School of Medicine and Executive Director of USC/CHLA Cell Therapy Program. He is a physician by training, received a master's degree in pharmaceutical sciences and biotechnologies from Strasbourg University, a clinical research certificate from Harvard Medical School, a doctoral degree in the economics of manufacturing cellular therapies from Charité and a master of public health from London School of Hygiene and Tropical Medicine. He is also trained as a qualified person (QP) for production and quality control of advanced therapies. Dr. Abou El-Enein is one of the recipients of the inaugural Lawrence Goldstein Policy Fellowship, was awarded the Max-Rubner Prize for innovation and the prestigious Eisenhower Fellowship, acted as the regional secretary of the International Society for Cellular Therapy (until June 2020) and is an active member of many international expert networks and committees. He is a nationally and internationally recognized expert in planning and executing clinical development programs, designing and operating academic GMP facilities, and in translating cell and gene therapy products from preclinical research to clinical applications. He has over 10 years of experience in clinical research and regulatory affairs, and has successfully brought several cell-based therapies to early phase clinical trials such as regulatory T cells, virus (EBV/CMV)-specific T cells, cardiac-derived stromal cells and placenta-derived stromal cells. His research focuses on devising methods and tools to improve the manufacturing, clinical translation and evidence synthesis for cell and gene therapies. He is also studying the clinical factors around pre-existing and adaptive immune responses affecting CAR-T cell product safety, efficacy and persistence. Dr. Abou El-Enein is a strong advocate for equitable access to safe and effective medical innovations. He is committed to addressing the global rise of clinics marketing unproven stem cell interventions, as well as the misuse of emerging health technologies such as genome editing.

## B. Positions and Honors

**Positions and Employment**

2006-2010 General Practitioner, Hospitals of the Ministry of Health, Dakahlia Governorate, Egypt
2008-2010 Healthcare Quality Manager, Hospitals of the Ministry of Health, Dakahlia Governorate, Egypt
2010-2017 Visiting Clinical Scientist, Department of Nephrology and Internal Intensive Care, Charité – Universitätsmedizin Berlin, Berlin, Germany
2013-2015 Project Manager & Acting Head, Clinical Development Platform, Berlin-Brandenburg Center for Regenerative Therapies (BCRT), Charité – Universitätsmedizin, Berlin, Germany
2014-2017 Postgraduate Research Fellow, Berlin-Brandenburg Center for Regenerative Therapies (BCRT), Charité – Universitätsmedizin, Berlin, Germany
2015-2018 Teaching Assistant in Clinical Research, Principles and Practice of Clinical Research (PPCR) course, Harvard. T. H. Chan School of Public Health, Boston, USA
2015-2020 Head, Clinical Development Platform, Berlin Institute of Health (BIH) Center of Regenerative Therapies (BCRT), Charité – Universitätsmedizin, Berlin, Germany
2017-2020 Scientific Coordinator, Translational Research in Regenerative Medicine Track - Berlin-Brandenburg School for Regenerative Therapies (BSRT), Charité – Universitätsmedizin, Berlin, Germany
2017-2020 Junior (Assistant) Professor of Clinical Development of Regenerative Medicine, Berlin Institute of Health (BIH) Center of Regenerative Therapies (BCRT), Charité – Universitätsmedizin, Berlin, Germany
2018-2020 Associate Member & Group Leader, Berlin Center for Advanced Therapies (BeCAT), Charité – Universitätsmedizin, Berlin, Germany
2021- Associate Professor of Clinical Medicine (Oncology), Pediatrics, and Stem Cell Biology & Regenerative Medicine
2021- Executive Director of USC/CHLA Cell Therapy Program

**Honors**

2014 Doctoral scholarship, Charité – Universitätsmedizin, Berlin
2014 Clinical Research Scholar Award, Harvard Medical School
2015 Teaching staff Outstanding Performance Award, Harvard Medical School
2015 Excellence Scholarship, University of Geneva
2016 Elected Member, Arab-German Young Academy of Sciences and Humanities (AGYA) Award, Supreme Council for Family Affairs, Sharjah, United Arab Emirates
2018 Max Rubner Award for Innovation, Stiftung Charité, Germany
2018 Young Physician Leader, The InterAcademy Partnership (IAP), The World Academy of Sciences (TWAS)
2019 Global Eisenhower Fellowship
2019 Elected Member, Global Young Academy, German National Academy of Sciences Leopoldina
2019 Inaugural Lawrence Goldstein Policy Fellowship, The International Society for Stem Cell Research (ISSCR)
2019 CARAT Training Fellowship, MACS Academy at Miltenyi Biotec, Germany.
2020 ISSCR Zhong Mei Chen Yong Awards for Scientific Excellence, The International Society for Stem Cell Research (ISSCR)

**Other Experience and Professional Memberships**

2015- Berlin Chamber of Physicians, Germany
2015-2017 Member, Scientific Board, Global Health Next Generation Network (GHNGN), Barcelona, Spain
2016- International Society for Cell & Gene Therapy (ISCT)
2016-2020 European Society of Gene and Cell Therapy (ECCGT)
2017- German Stem Cell Network (GSCN)
2019- Member, Advisory Board, Lancet EclinicalMedicine, The Lancet
2019- American Society of Gene & Cell Therapy (ASGCT)
2019- International Society for Stem Cell Research (ISSCR)

**Additional functions:**

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|---|---|
| 2016- | Ad Hoc Reviewer, "BMJ Open", "BMJ Evidence-Based Medicine", "Clinical and Translational Science", "Journal of Market Access & Health Policy", "Expert Review of Clinical Pharmacology", "CPT: Pharmacometrics & Systems Pharmacology", "Clinical Pharmacology & Therapeutics", "Human Gene Therapy Clinical Development", "Value in Health", "Drug Discovery Today" |
| 2016- | Founder & Co-Chair, Health and Society Working Group, Arab-German Young Academy of Sciences and Humanities (AGYA) |
| 2017- | Member, European Legal and Regulatory Affairs Committee (EU LRA), International Society for Cell & Gene Therapy (ISCT) |
| 2017-2020 | Regional Secretary, Europe, International Society for Cell & Gene Therapy (ISCT) |
| 2018 | Member, Organizing Committee, Europe 2018 Regional Meeting, International Society for Cell & Gene Therapy (ISCT) |
| 2019 | Expert Reviewer, BIH Johanna Quandt Professorships, Berlin Institute of Health (BIH), Berlin, Germany |
| 2020- | Member, Junior Faculty Council, Berlin Center for Advanced Therapies (BeCAT), berlin, Germany |
| 2020- | Member, cGMP Steering Committee, Keck School of Medicine of USC, Los Angeles, CA, USA |
| 2020- | Associate Editor & EiC Support, Molecular Therapy – Methods and Clinical Development of the American Society of Gene & Cell Therapy (ASGCT) |
| 2020 | Expert Reviewer, Council of Canadian Academies –Panel report on Legal, Ethical, Social, and Policy Dimensions of Somatic Gene Therapies |
| 2020 | Grant Reviewer, ERC Starting Grant, European Research Council, Brussels, Belgium |

**Licensure and Certifications**

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|---|---|
| 2005 | Egyptian Medical License, the Egyptian Medical Syndicate, Egypt, Active |
| 2006 | Certificate of Basic Science Examination for Ophthalmologists (including Optics and Refraction), International Council of Ophthalmology (ICO), Cambridge, UK |
| 2007 | Healthcare Quality Specialist, Egypt, Active |
| 2007 | International Computer Driving License (ICDL), European Computer Driving License Foundation |
| 2013 | Limited German Medical License (Berufserlaubnis), the German Medical Association (Bundesärztekammer), Germany, Active |
| 2014 | Certificate of Clinical Research, Harvard Medical School, Boston, USA |
| 2014 | Certificate of Good Clinical Practice (GCP), KKS-Network (Network of the coordination center for clinical studies), Berlin, Germany |
| 2015 | Full German Medical License (Approbation), the German Medical Association (Bundesärztekammer), Germany, Active Cairo office of UNESCO (UCO) |
| 2015 | Global Health and Human Rights Course, University of Geneva, Geneva, Switzerland Intellectual Property Course, World Intellectual Property Organization (WIPO), Geneva, Switzerland |
| 2016 | Teaching Assistant Preparation Course, Harvard. T. H. Chan School of Public Health, Boston, USA |
| 2016- | Volunteer/Mentor, Academics in Solidarity, Freie Universität Berlin, Germany |
| 2018 | Certificate of MBA Essentials, London School of Economics and Political Science, London, UK |
| 2019 | Certificate of Entrepreneurship Essentials, Harvard Business School, Boston, USA |

## C. Contributions to Science

### 1. Clinical development of cell and gene therapies

My primary responsibility is leading the translational/clinical development services for cell and gene therapies at University of Southern California. I design mainly early-phase clinical trials in various disease areas such as immunology, cardiovascular, musculoskeletal and cancer. I have a particular interest in genetically modified T cells and regulatory T cells (Tregs) since the latter possess immunosuppressive properties that are essential for the maintenance of immune homeostasis. I contributed to the development and execution of one of the first

projects that investigated the safety and feasibility of multiple doses of autologous Tregs (part of the ONE Study) as a potential therapeutic modality in solid organ transplantation to enable us to taper down the immunosuppression and their toxicities while maintaining graft acceptance. I also contributed to developing and investigating other products, such as virus (EBV/CMV/BKV)-specific T cells, cardiac-derived stromal cells, placenta-derived stromal cells, tissue-engineered heart valves and vessels, as well as TCR-transgenic and CAR-T-cells in different disease entities from rare to common diseases.

*Andy Roemhild, Natalie Maureen Otto, Guido Moll,* ***Mohamed Abou-el-Enein*** *….Hans-Dieter Volk, Petra Reinke. Regulatory T cells for minimising immune suppression in kidney transplantation: phase I/IIa clinical trial. BMJ. 2020 Oct 21;371:m3734. doi: 10.1136/bmj.m3734.*

**2. Devising data-driven solutions to translational barriers**

My research is organized into three overarching streams: 1) developing robust mechanisms to generate, collect, report and evaluate clinical evidence from cell and gene therapies, 2) examining and implementing novel scalable product manufacturing approaches, 3) addressing the ethical and legal issues associated with stem cell research. In the first stream, we aim to improve the clinical/translational tools that developers (including us) use to generate evidence on the safety and efficacy of cell and gene therapies, de-risk the process and provide guidance as to "best practices" in this field. We performed a study to evaluate the sufficiency of the evidence in regulatory submissions of advanced therapies for marketing authorization and to benchmark them against more established biological products such as monoclonal antibodies. My work in the second stream focuses on the optimization of the manufacturing approaches as well as clinical trial designs for cell and gene therapies. The third stream focuses on the investigation of ethical dilemmas surrounding stem cell research, such as the spread of clinics offering untested, unproven, and unauthorized stem cell treatments. This dangerous phenomenon may dilute the value of ethical and legitimate therapies currently being developed for patients through rigorous pre-clinical and clinical testing. In 2018, I led a study, which provided an analysis of serious adverse events (AEs) following putative stem cell treatments reported in the scientific and mass media to-date.

***Mohamed Abou-el-Enein****, Ahmed Elsanhoury, Petra Reinke: Overcoming Challenges Facing Advanced Therapies in the EU Market. Cell stem cell 09/2016; 19(3):293-297.*

*Gerhard Bauer, Magdi Elsallab,* ***Mohamed Abou-e-Enein****: Concise Review: A Comprehensive Analysis of Reported Adverse Events in Patients Receiving Unproven Stem Cell-Based Interventions. STEM CELLS TRANSLATIONAL MEDICINE 07/2018; 7(9).*

*Enrico Fritsche, Hans-Dieter Volk, Petra Reinke,* ***Mohamed Abou-el-Enein****. Toward an Optimized Process for Clinical Manufacturing of CAR-Treg Cell Therapy. Trends in Biotechnology. 2020 Jan 22;S0167-7799(19)30304*

*Magdi Elsallab, Christopher A. Bravery, Andreas Kurtz,* ***Mohamed Abou-el-Enein****. Mitigating Deficiencies in Evidence during Regulatory Assessments of Advanced Therapies: A Comparative Study with Other Biologicals. Mol Ther Methods Clin Dev. 2020 Jun 3;18:269-279*

**3. Enabling faster and more efficient uptake of CAR T cells into clinical routine**

It is increasingly becoming evident that Chimeric Antigen Receptor (CAR) T cell therapies are here to stay, and their product portfolio is expanding rapidly. To enable their integration into routine clinical practice, my research is exceedingly focusing on issues such as 1) optimizing the manufacturing workflow of CAR T/NK therapies, 2) improving the CAR structure to enhance the engineered T cells expansion and anti-tumor effects while reducing potential toxicities, 3) understanding the clinical factors around pre-existing and adaptive immune responses affecting product safety, efficacy and persistence, 4) standardizing the clinical trial design of these products to allow for an adequate interpretation of clinical result and valid pooling of data, and 5) devising workable models for a decentralized production to streamline logistics.

*Magdi Elsallab, Bruce L. Levine, Alan S. Wayne,* ***Mohamed Abou-el-Enein****. CAR T-cell product performance in haematological malignancies before and after marketing authorization. Lancet Oncology. 2020 Feb;21(2):e104-e116.*

**3. Educating future generations of translational investigators**

I designed and offered different courses through the DFG-funded graduate school Berlin-Brandenburg School for Regenerative Therapies (BSRT) at Charite University Berlin to postgraduates. One of them is an annual interactive introductory course to train the Ph.D. candidates enrolled in the BSRT on translational research in regenerative medicine. In late 2018, I started developing a course on the fundamental knowledge necessary to translate basic science discoveries into clinical applications in the field of advanced therapies. This program should appeal to scientists, clinicians, and engineers who seek to bring innovative cell therapies into standard clinical practice. In January 2019, I was awarded the Max Rubner Award for innovation from the Charité Foundation for developing such course.

## D. Additional Information: Research Support and/or Scholastic Performance

**Ongoing Research Support**

**820292** Hans-Dieter Volk (PI) 2019
Horizon 2020, European Commission
RESTORE
The unifying goal of the RESTORE is to make the transforming promise of Advanced Therapies (Cell & Gene therapies, Tissue-Engineering products, Biologised Medical Devices) a reality through the development of new Advanced Therapies and their implementation in clinical practice to enhance the value-based outcome of patients.
Role: Co-investigator and lead of work package 11 and 14

**825392** Reinke (PI) 2019
Horizon 2020, European Commission
ReSHAPE (Reshaping undesired Inflammation in challenged Tissue Homeostasis by Next-Generation regulatory T cell (Treg) Approaches)
Description:
Role: Co-investigator and lead of work package 6: clinical development and early health technology assessment

Abou El-Enein (PI) 2016
German Federal Ministry of Education and Research
Several projects received funding under the membership of Arab-German Young Academy of Sciences and Humanities (AGYA)
The list of projects is available upon request.
Role: Principal investigator

**Completed Research Support**

**260687** Reinke (PI) 2010-2017
The ONE Study
Preventing immunological rejection of transplanted organs without the need for long-term use of pharmacological immunosuppression is a primary objective.
Role: Clinical Development and Regulatory Affairs duties

Abou El-Enein (PI) 2015-2018
Federal Ministry of Education and Research (BMBF)/Land Berlin
Clinical Development Platform - Berlin-Brandenburg Center for Regenerative Therapy (BCRT)
The CDP is experienced drug development, clinical and regulatory affairs unit focused on providing strategic advice and operational services within a number of related areas, such as regulatory affairs, clinical research, pharmacovigilance and risk management, health technology assessment and quality assurance to the institute as well as external collaborators.
Role: Project Lead