



Clusters of Scientific Innovation in the Middle East and North Africa (COSIMENA)

Event Report

Name of the Event:	Current Trends in Neurosurgery: Innovative Approaches and the Role of Artificial Intelligence
Date of the Event:	January 21 st , 2022
Type of Documentation:	Long report
Author:	Marlies Van Coillie

Digitalisation is becoming an integral part of research strategies, and the role of Information and Communication Technology (ICT) and Artificial Intelligence (AI) is increasingly in the spotlight of the scientific community, including the medical fields. To bring this matter into discussion, the DAAD Regional Office Cairo conducted an interdisciplinary expert session on January, 21st, 2022, with researchers and scientists active in the fields of Neurology, Neurosurgery, Oncology, ICT, Computer/Data Science across Germany and Egypt. The event took place in the framework of the project “Clusters of Scientific Innovation in the Middle East and North Africa” (COSIMENA).

Ms. Isabell Mering, Director of the DAAD Regional Office Cairo, inaugurated the digital event by expressing that *“AI has become increasingly essential to medicine practice in regard to diagnostics, modelling of diseases, and developing treatments. By facilitating a breakthrough in methodology, AI might potentially revolutionise the medical field”*. Within the ‘Health Cluster’ of “COSIMENA”, the session presented examples of interdisciplinary collaboration in four vital topics.

Through the DAAD-funded “Cairo-Greifswald Fellowship”, the **University of Greifswald (UG)** in Germany and **Cairo University (CU)** in Egypt are harvesting the seeds of a longstanding, successful, and innovative cooperation in neurosurgery, alongside the **German University in Cairo (GUC)** which contributes to this collaboration in the ICT/AI fields. Under the DAAD banner “Change by Exchange”, the universities set “An Exemplary Model for International Collaborative Surgical Training”.

One of the pillars of this liaison is the DAAD alumnus **Prof. Dr Ehab El Refaee**, Coordinator of the “Cairo-Greifswald Cooperation Project” at **CU**, who personifies a representative model of DAAD-supported network capabilities. Congruent with the “COSIMENA” mission, the session threw a light on the vivid network development between DAAD alumni, associates, universities and was set in motion upon the initiative of the DAAD alumnus. Cultivating the COSIMENA call for intersectoral solutions, he stated that *“the unique profession of neurosurgery has a long history in connecting to other disciplines like the arts and vocational disciplines”*. The event was significant for him to appeal to other prospective partners across the disciplines of ICT/AI: *“To improve our work, we need this integration. By presenting the state of the art of our project and listening to other experts’ achievements, merging the fields, the event effectuated a fruitful common ground to go forward, attesting to the need for interdisciplinary collaborations”*.

In providing “A Prescription for a successful Medical German-Egyptian Cooperation”, the project related the nucleus of their first-hand experiences. By means of a flashback to 2008, **Prof. Dr Ahmed Zohdi**, Supervisor of the “Cairo-Greifswald Fellowship” at **CU**, revisited how the memorandum of understanding between **CU** and **UG** came to life. He moreover highly valued the DAAD contribution: *“The DAAD is not merely a sponsor, but a partner”*. Aiming to expand this scientific community to the whole MENA region, the “COSIMENA” expert session knitted a sequel to this existing partnership by increasing the visibility of the project on an international level.

“The idea of the joint effort is to promote neuroendoscopy”, added Prof. Dr Henry W. S. Schroeder, Supervisor of the fellowship at UG, to the conversation. From the German perspective, “Cairo offers plenty of occasions for surgery, beneficial for the German fellows. There are substantially more cases, which are unseen in Germany”. The cooperation gains are multiple: “Two German medical theses, two German Board Certifications, three joint Cairo-Greifswald meetings, exchange of residents, free attendance of Cairene fellows at UG Courses, and most importantly friendship. With more than twenty-five joint papers, and many in the process of review, the collaboration is very successful in terms of scientific output”.

In turn, the expert session also highlighted the digital role for further scientific connection. Midst the pandemic, face-to-face interactions became a great challenge, noted **Prof. Dr El Refaee**: *“Neurosurgical education depends on in-person contact and hands-on learning, but we were forced to partly switch over to distant learning”*. In this regard, **Prof. Dr El Refaee** presented the “Blended Learning Experience in the Surgical Field: Challenges and Opportunities”. While *“E-learning cannot substitute hands-on training”*, he offered insights into how e-learning can foster interactive education rather than a passive learning experience. He concluded that *“science is always changing and so its methods of education. We need to cope with the change both of science and how to deliver this science”*. Future perspectives including elements of ICT/AI in the neurosurgical field were as well put on the map by the cooperating universities. **Prof. Dr Schroeder** noted that without a doubt high-tech equipment is beneficial for the patient: *“Regarding detection and recognition analysis of x-rays, the potential is already amazingly noticeable. Radiologists become tired, but machines never do”*. However, the experts unanimously agreed on the current irreplaceable human factor in neurosurgery, even as a high-tech specialty.

In a similar spirit, **Prof. Dr Slim Abdennadher**, Computer Scientist and President of the **German International University (GIU)**, related how *“machine learning is a hint, an advice, but the final decision lays with the physicians”*. In cooperation with the **GUC**, the “Cairo-Greifswald Cooperation Project” is foreseeing a much greater role of AI in their research work and at their operation table. Or in the words of **Prof. Dr Abdennadher**, *“We don’t have a choice. The future is directed to AI; therefore, we must understand the limitations of AI and the ethical concerns. The medical curriculum needs to include ICT courses”*. The call for an interdisciplinary approach posits, according to **Prof. Dr El Refaee**, the challenge of the future. He bore this idea to create a new ICT/AI module for the project in mind as a background to initiate the event. Following the “COSIMENA” vision, the event catered to this global challenge by fostering a network platform to address the possibilities for interdisciplinary collaboration, aiming to improve the quality of health service.

Currently, the “Cairo-Greifswald Cooperation Project” consists of six modules: an online basic module, a live surgery session, an advanced digital interactive course, a virtual career development forum, a hands-on training module and a revision seminar with the final exam. Involved in the organisation of the latter, **Dr Ahmed Abdelrahman**, Lecturer of Neurosurgery at **CU**, presented “The First hands-on Course in the Time of Corona: The Challenges we faced”, noting *“travel bans and restrictions, vaccination statuses, virus transmission, and return*

problems, among other emerging difficulties". Fortunately, he underlined those joint everyday efforts resulted in a fruitful German-hosted cadaveric course experience. In transferring to blended learning, the project also gained two years of experience in "Online Exams in Neurosurgical Training". **Mr. Marc Matthes**, Administrative Staff of the fellowship at **UG**, addressed in this respect the necessary building blocks: "A question bank, an exam builder, and result management". 'ClassMarker' is thereby the provider of choice. "The question bank requires randomization and renewal for every exam due to returning candidates, possible screen recordings of old questions, and to render cheating nearly impossible. Proper configuration is key to creating a fair but also challenging setting. Hence, online exams require high effort".

In addition to the conversation-led insights and the three presentations on "The Digitalisation of Learning and Teaching in Neuroendoscopy", **Prof. Dr Abdennadher** from **GIU**, presented "From AI to VR: How the emerging Tech is shaping the Future of Health Care". Exemplary thereof is the interdisciplinary '**Human Computer Interaction Research Lab (HUMAN++)**', the plus signs refers to how technology augment human capabilities and intelligence. To improve health care, the lab implements the following pipeline: "Visualise/analyse, communicate, educate, monitor/evaluate, and innovate". Within the pipeline's first aspect, **Prof. Dr Abdennadher** presented how VR technology can visualise "the penetration of molecular COVID-19 cells within human cells and how antibodies can prevent this". By using 'ChimeraX' software, prospective biotechnology students can reap the benefits of this emerging tech. He, furthermore, presented Automated Neurobehavioral Experiment Analysis by the use of machine learning and computer vision techniques. An example of how communication applications assist in treatment is 'CHASE': a Character-Based Chatbot for Covid-19 that "chases away the virus". Immersive VR further offers possibilities to enhance social interactions, targeting different individuals with special needs and disabilities. Regarding evaluation, he noted how "a VR examination platform is still future music. However, VR enables remote examination, a reduction of stress through immersion, and facilitates interactive questions by 3D models and animations".

In general, the educational objectives of VR in the neurosurgical field include "supporting representations of tumour shapes, sizes and locations and creating visual realism and dynamic simulation environments through portable or semi-portable set-ups". To welcome AI and innovate the medical field, **Prof. Dr Abdennadher** opts for 'XAI', whereby the X stands for explainable AI: "Through 'XAI', we can foster transparency to break the barriers".

Besides the **HUMAN++ Lab**, the Germany-based **BrainLab** offers another example of health informatics in practice. Researcher **Dr Michael Schwerter** presented the competencies of **BrainLab** and the possibilities of "VR and AI in Neurosurgical Planning and Education". **BrainLab's** software-based technology is represented around the globe by over 5,000 hospitals. **Dr Schwerter** addressed the benefits of Mixed Reality in relation to display, interaction with imaging data, integration of information into one scene, patient education, representation of complex anatomical structures for both students and laypersons, and explanation of pathologies and planned surgical procedures. In regard to future prospects, **BrainLab** is "preparing for interdisciplinary planning and diagnostics of treatments for optimal surgical outcomes through expert consultation via virtual co-presence through mixed reality".

Relating to the topic “New Trends in Management of Nervous System Diseases”, **Dr Heba Azouz**, the first female graduated Neurosurgeon at **Ain-Shams University**, currently affiliated with **CU**, took the participants on a historical journey. From the pharaonic period, through the Ottoman Empire, the Medieval Age towards the modern history of neurosurgery, she engaged the arts as a rich archive of neuroscience practices. She, further, encouraged “The evolution and Gap bridging in Neurosurgery” in the scientific direction of integrating AI in neurosurgery across cultures and multi-science collaborations, while questioning the patriarchal society: *“The act of questioning in itself is also core to doing science. ‘Trust the science’ is the most anti-science statement ever. The first science is still philosophy”*.

Dr Mohamed Soliman, Lecturer in the Department of Neurosurgery at **CU**, further enlightened the session by his presentation: “History, Current, and Future of Robotic Science Surgery”. He mentioned three potential types of Robotic Control Systems in surgery: firstly, the “shared-control system”, secondly, a remotely operated robotic surgery, and thirdly, surgeon supervision of the fully automated operation. *“All current robotic platforms in the market fall under the shared-control systems”*.

However, the plausibility of fully automated operations through a “supervisory controlled system” was questioned by the participants. In this regard, **Prof. Dr El Refaee**, stated that *“we are not at the point to shift a hundred percent to robotic surgery. There are also many present criticisms debating to which extent the machine can help us”*. Looking back on the event, he concluded that *“this does not mean to do away with machines. The significance of the session was thinking through how, not if, to use ICT/AI technologies”*.

In regard to “New Trends in Brain Cancer Therapy”, **Dr Sascha Marx**, DFG-fellow at the **Dana-Farber Cancer Institute, Harvard Medical School**, US, and former Neurosurgical Resident at **UG** under **Prof. Dr Schroeder**, discussed immuno-therapeutical approaches. While overviewing the state of the art in curing brain cancer, he stated that *“glioma poses a lot of challenges that other kinds of tumours do not present”*. To overcome this challenge, he firmly takes the position that *“we need to listen, look, and understand the truth that is within tumour”*. Responding to **Prof. Schroeder’s** inquiry about the current research direction at the institute, **Dr Marx** noted that T cells as *“the killer cells”* of the immune system give the lead. Subsequently, **Prof. Dr Schroeder** wished him the best of success in finding a treatment.

In relation to evidence-based medicine, **Ms. Reem Elwy**, active member of the Hydrocephalus Research Group at **CU**, related about the importance and potential of “Systematic Reviews in Neurosurgery”: *“Integrating evidence, clinical expertise, and patient’s values form the three pillars to come to a clinical decision. The reviewers represent the first”*.

The expert session’s last section was dedicated to “Further Research Projects in Neurology and Medical ICT in Germany”. In presenting “Pathological Oscillatory Activity of Basal Ganglia in Movement Disorders’ Patients”, **Dr Roxanne Lofredi**, Neurology Resident at **Charité-Universitätsmedizin** Berlin, presented the effects of Deep Brain Stimulation (DBS) in case of Parkinson’s disease and Dystonia. Celebrating the recent identification of bio markers, the bio marker-based Adaptive DBS is currently under trial: *“Biomarkers may be used in the future to adjust brain stimulation, which results in on-demand treatment rather than continuously applied treatment”*.



Within the 'Health Cluster', the session illuminated various interventional ICT/AI approaches to medical school, research, and professional clinical practices. In the spirit of the "COSIMENA" slogan: "Sustainability: A call for action in our daily life", the event harnessed the synergies in the related fields, whereby innovative ICT/AI approaches augment the quality of human health care. In the perspective of **Prof. Dr Refaee** is *"the aim of the Cairo-Greifswald project to integrate ICT/AI in the medical field is in direct correlation with what the DAAD stands for; integrating cultures, disciplines, and scientists"*. Especially for neurosurgery, which is a rapidly developing specialty in the surgical field, the event visualised the vibrant liaison networks to an international scholarly public. By spreading the call to expand scientific connection, the event successfully reflected the "COSIMENA" mission to intensify interdisciplinary networking opportunities across Germany and the MENA region.

Annex

University Greifswald: Neuroendoscopy Fellowship

Link: http://www2.medizin.uni-greifswald.de/neuro_ch/index.php?id=596&type=98&L=2&%3BL=2

Cairo University: Cairo-Greifswald Neurosurgery

Link: <http://neurosurgery.kasralainy.edu.eg/>

Facebook: Cairo-Greifswald Neurosurgery

Link: <https://www.facebook.com/CG.Neurosurgery/>

ClassMarker Online Testing Website

Link: <https://www.classmarker.com/>

CHASE: *Chase* Away the Virus: A *Character*-Based *Chatbot* for *COVID-19*

Link: https://www.researchgate.net/publication/342705278_Towards_a_Generic_Framework_for_Character-Based_Chatbots

Link: https://www.researchgate.net/publication/356074049_Applying_the_Character-Based_Chatbots_Generation_Framework_in_Education_and_Healthcare

BrainLab

Link: <https://www.brainlab.com/>

DFG, German Research Foundation

Link: <https://www.dfg.de/en/>

Dana-Farber Cancer Institute

Link: <https://www.dana-farber.org/>

Hydrocephalus Research Group: Article “Hydrocephalus: beyond physical pain”

Link: <https://dailynewsegypt.com/2017/10/24/hydrocephalus-beyond-physical-pain/>

Charity-University Medicine Berlin

Link: <https://www.charite.de/en/>