

Editorial

Preface of the Fifth IEEE Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability, 2023 (IEEE ECBIOS 2023)[†]

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This volume represents the proceedings of the fifth IEEE Eurasia Conference on Biomedical Engineering, Healthcare and Sustainability 2023 (IEEE ECBIOS 2023). This conference was held at Chia Nan University of Pharmacy & Science, Tainan, Taiwan, on 2–4 June 2023; it was co-organized by Chia Nan University of Pharmacy and Science, the Institute of Electrical and Electronics Engineers (IEEE), and the International Institute of Knowledge Innovation and Invention (IIKII). The conference provided a unified communication platform for researchers in the topics of biomedical engineering, healthcare and sustainability. The healthcare domain is currently experiencing a sector-wide transformation thanks to advances in computing, networking technologies, big data, and artificial intelligence. Healthcare is not only changing from reactive and hospital-centered to preventive and personalized medicine, but from disease-focused to well-being-centered treatment. Healthcare systems, as well as fundamental medicine research, are becoming smarter due to developments in biomedical engineering. Furthermore, with cutting-edge sensors and computer technologies, healthcare services and technologies are being used with better efficiency, higher quality and lower costs. However, these innovations often do not bring sustainability, health and happiness to all people. Science and technology are complemented by arts, humanities, social sciences and indigenous know-how and wisdom, therefore increasing the benefits for the needy in all regions and classes of people. We need an ethically aligned and driven healthcare system which is also sustainability. In this regard, this conference has promoted the interdisciplinary collaboration of science and engineering technology specialists in the academic and industrial fields, as well as fostering international networking. During the conference, there were extensive presentations and discussions in which attendants participated in various activities and gathered together in diverse groups across disciplines to generate new ideas, collaborations and business opportunities.

IEEE ECBIOS 2023 was held in a hybrid form of on-site and online presentations. Figure 1 depicts a group photo of the conference opening. The first keynote speech, entitled “Regulatory functions of glycosylation in cancer and neuroinflammation and the possibility of application”, was delivered by Dr. Jian-Guo Gu, a Professor at Tohoku Medical and Pharmaceutical University, Japan. He divulged that glycosylation plays numerous roles in protein folding, targeting, recognition and other functions, and showed that the changes in glycan structures are associated with many physiological and pathological events, including



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cell adhesion, migration, growth, differentiation and tumor invasion. He mainly focused on N-glycans remodeled by several glycosyltransferases in cell growth, adhesion and the process of epithelial-to-mesenchymal transition (EMT) and cancer multidrug resistance (MDR) to address the potential roles of N-glycans in cancers. These results demonstrated that N-glycans can serve as an on/off switch to regulate cell adhesion and growth and provide new insights into the molecular mechanisms of cancer metastasis and chemoresistance. In the speech, the importance of core fucosylated N-glycans was also pointed out, addressing the molecular mechanisms of core fucosylation in several diseases, including hepatocellular carcinoma, pancreatic carcinoma and neuroinflammation. Possibilities for clinical applications were discussed.



Figure 1. Group photo at the opening ceremony of IEEE ECBIOS 2023.

The second keynote speech, entitled “Developing AI-based brain-computer interfaces in immersive VR environments”, was presented by Dr. Po-Lei Lee, a Professor at the Department of Electrical Engineering, National Central University, Taiwan. The motor imagery (MI)-based brain-computer interface (BCI) is an intuitive interface that enables users to communicate with external environments through their minds. However, contemporary MI-BCI systems ask naïve subjects to perform unfamiliar MI tasks with simple textual instruction or visual/auditory cues. Dr. Lee stated that the unclear instructions for MI execution not only result in large inter-subject variability in the measured EEG patterns, but also cause difficulties in grouping cross-subject data for big data training. Dr. Lee introduced the design of a BCI training method in a virtual reality (VR) environment in which a head-mounted device (HMD) is used for action observations (Aos) with MI (i.e., AO+MI) in VR environments. EEG signals recorded in the AO+MI task are used to train an initial model, which is then continually improved using EEG data in subsequent BCI training sessions. In this experiment, five healthy subjects and each test subject participated in three tasks: an AO+MI task, an MI task, and an MI task with visual feedback (MI-FB) three times. By adopting a transformer-based spatial-temporal network (TSTN), users’ MI intentions were decoded. In contrast to other convolutional neural network (CNN) or recurrent neural network (RNN) approaches, the TSTN extracted spatial and temporal features and applied attention mechanisms in spatial and temporal dimensions to perceive the global dependencies. The mean detection accuracies of TSTN were 0.63, 0.68, 0.75, and 0.77 in the MI, first MIFB, second MI-FB, and third MI-FB sessions, respectively. It

was demonstrated that the AO+MI approach made it easier for subjects to conform to their imagery actions, and the BCI performance was improved with the continual learning in the MI-FB training process.

The third keynote speech was presented on “Optimizing Alternative Methods for Skin Sensitization Prediction: An Integrated Approach Using PaDEL and Machine Learning with the OECD QSAR Toolbox” by Dr. Kuan-Han Lee, a Distinguished Professor in the Department of Pharmacy, Chia Nan University of Pharmacy and Science, Taiwan. He emphasized that skin sensitization is critical in ensuring the safety and efficacy of chemicals used in various industries. The OECD QSAR Toolbox is an alternative tool for predicting skin sensitization with promising results; however, its current hit rate of 70–85% leaves room for improvement. He proposed the integration of machine learning techniques and PaDEL to analyze the molecular descriptors and fingerprints of the dataset to establish a skin sensitization prediction model using machine learning techniques such as grouping, combination selection and rolling corrections. In this speech, he explained that by enhancing the accuracy of the QSAR Toolbox, the resulting workflow was fed back into the QSAR Toolbox. A summary of the superior detection range and inaccurate aspects of allergens in OECD QSAR was provided to optimize the model and improve the prediction accuracy. The explained approach resulted in a higher hit rate than the present rate of 70–85% in the automated workflow of the QSAR Toolbox. By integrating PaDEL and machine learning techniques, a skin sensitization prediction model was constructed with enhanced accuracy. In his conclusion, the potential of integrating PaDEL and machine learning techniques with the OECD QSAR Toolbox was suggested to improve the accuracy of skin sensitization predictions. This technique is believed to promote animal welfare and the development of alternative methods and provide a valuable reference for future research on alternative skin sensitization tools. It is also expected to advance animal welfare and the safety of chemicals used in various industries.

In addition to the keynote speeches, IEEE ECBIOS 2023 provided six Regular Sessions and two Invited Sessions, covering various related topics of biomedical engineering, healthcare, and sustainability. Figures 2 and 3 show several on-site and online oral presentation sessions.



Figure 2. Presentation at an on-site session of IEEE ECBIOS 2023.



Figure 3. Online presentation of IEEE ECBIOS 2023.

Many substantial results were shared again at IEEE ECBIOS 2023 by enthusiastic participants. In total, 105 excellent papers in relevant engineering fields were selected through peer review for the publication of the IEEE ECBIOS 2023 proceedings. The proceedings are expected to help accelerate interdisciplinary collaboration and international networking within science and engineering technology specialists in the academic and industrial fields.

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