



# 4. International Conference on Medical Devices (ICMD'2021)

## Abstract Book



Abstract Book of  
4. International Conference on Medical Devices  
(ICMD'2021)

Yalçın İŞLER      Mehmet Lütfi YOLA

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Eserin hukuki ve etik sorumluluğu yazarlara aittir. Tüm hakları saklıdır. Bu kitabın yayın hakkı İzmir Kâtip Çelebi Üniversitesi'ne aittir. İzinsiz kopyalanamaz ve çoğaltılamaz.



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# Preface

4th International Conference on Medical Devices, ICMD'2021, will be organized by Hasan Kalyoncu University (HKU) and Izmir Katip Celebi University (IKCU) with international participation on June 10-12, 2021 in Gaziantep, Turkey. All presentations were online because of the pandemic.

ICMD conferences (where former abbreviation was TIPCIH) bring together the students, users, manufacturers, researchers, and public representatives working in the field of medical device technologies. It also aims to share the information investigated from scientific researchs on the medical fields, and propose common communication platform to solve specific problems on the medical device sectors. Main conference language is English, but all the full papers must include Turkish title, abstract, and keywords, too.

This conference holds all the theoretical subjects and applications related to medical devices including but not limited to the list given below:

- Artificial Intelligence, and Expert Systems
- Bioinformatics
- Biomechanics
- Biomedical Signal Processing
- Biomedical Image Processing
- Biomedical Robotics
- Biosensors
- Biostatistics
- Biotechnology
- Brain-Computer (BCI), Human-Machine (HMI), and Human-Human (HHI) Interfaces
- Calibration and Maintenance
- Computer-Aided Diagnostic Systems
- Data Acquisition and Instrumentation Issues
- Device Safety, Privacy, and Security

- Diagnosis and Treatment Systems
- Hospital Information Systems (HIS)
- Machine Learning, and Pattern Recognition
- Medical Device Design and Implementation
- Medical Imaging Systems
- Medical Informatics and Communications
- Medical Software Design and Applications
- Molecular Biology and Biochemistry
- Patient Safety, Privacy, and Security
- Quality Management and Accreditation
- Radiological Information Systems (RIS)
- General Topics in Biomedical, Clinical, and Rehabilitation Engineering

All submitted papers were reviewed by at least 2 referees from the Scientific Committee members who are experts in the related field. All accepted papers were appeared in the Conference Abstract Book with ISBN and full-length versions of these papers were published in supporting journals.

# Organization Committee

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- Yakup KUTLU (Iskenderun Technical University, Turkey)
- Yasin OROOJI (Nanjing Forestry University, China)
- Yılmaz Kemal YÜCE (Alanya Alaaddin Keykubat University, Turkey)

# Opening Talk

**Turkay DERELE**  
**Rector of Hasan Kalyoncu University**

Welcome to the 4th International Conference on Medical Devices. As you know, due to the Covid-19 pandemic, which has occupied our life for a long time, the importance of investments to be made in the health sector is again with striking results. Medical devices are generally produced for the usage of doctors, health-care professionals, and patients in hospitals, health units, and houses. Since the production capacity of medical devices is around 15% in our country, the results show that we are foreign-dependent on many products. For this reason, the quality of medical device production and service is vital for the development of the health sector. In addition, R&D studies carried out in universities as a model to support the development of medical devices and medical products, and university-industry collaborations should be increased.

Therefore, medical devices, having critical importance for the treatment of patients in the field of health, should be developed and renewed in parallel with the developing technology. In addition, the correct training of the people using the medical device will bring about solving the problems that cause time loss and more efficiency in work. Therefore, I attach great importance to such scientific meetings in terms of eliminating the existing deficiencies in the health sector.

Finally, I believe that the 4th International Conference on Medical Devices will be unforgettable with its expert speakers consisting of distinguished scientists and many valuable oral presentations. As the Rector of Hasan Kalyoncu University, I would like to greet everyone who contributed to the conference by wishing that such important scientific meetings will be held face to face with unique social activities in Gaziantep in the future.



# Opening Talk

**Mehmet Lutfi YOLA**  
**Chair from Hasan Kalyoncu University**

I would like to welcome all researchers participating in the 4th International Conference on Medical Devices.

First of all, I would like to personally thank Assoc. Prof. Dr. Yalçın İŞLER as congress co-chair from İzmir Katip Çelebi University for his efforts to organize the conference.

As it is known, the rapid progress of medical device technology leads the important developments in the health sector. The contribution of medical devices to health science in the diagnosis and treatment of diseases determines the direction of medical developments. Medical device technology, which significantly affects the treatment preferences of patients, has currently raised the bar of competition between health institutions that have and do not have this technology. For this reason, countries that give priority to medical device technologies and allocate a significant part of their R&D investments to this sector increase their level of development by giving direction to their economies. In conclusion, I think that it is very important to organize such scientific meetings and increase the number of such scientific meetings at the point of development of the medical device sector in Turkey.

Finally, on behalf of the organizing committee of the 4th International Conference on Medical Devices, I respectfully greet your interest in our conference and wish you a productive conference.



# Opening Talk

**Yalcin ISLER**  
**Chair from Izmir Katip Celebi University**

Dear participants, welcome to the 4th International Conference on Medical Devices (ICMD'2021).

First of all, I would like to thank Prof. Dr. Türkay DERELİ as the rector of Hasan Kalyoncu University for his unlimited support and encourage us to organize the 4th conference of this conference series. I also thank Prof. Dr. Mehmet Lütfi YOLA as the chair of the hosting university for his sincere effort throughout the conference.

Medical device technology exposes dizzy development, makes it hard to follow for everybody. That is the reason why we started this international conference series to create a common platform for researchers, students, industry, and public institutions from the technology of the medical device to share their experiences four years ago.

It is a great honor to see the progress of this conference series. There are 18 accepted regular papers, three invited talks, and two industry talks. The 49 distinct authors contributed to these papers in total. Two studies, which took the highest score from our reviewers, were awarded the Best Paper Award at the conference. We donated a total of 103 saplings through the TEMA FOUNDATION for our burning forests in Hatay / Turkey (70 were certified on behalf of our conference series, 24 were certified to the best paper's authors, and 9 were certified to invited speakers).

Finally, we wish that both the studies shared at the conference and our contribution to afforestation will be beneficial. We greet you on behalf of the organizing committee of the conference.



**Part I**  
**Invited Talks**



# The Role of 3D Modeling, 3D Medical Printing and Simulation on Future Medicine and Healthcare System

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ICMD'2021

June 10-12,  
2021

Gaziantep  
Turkey

Invited Talk

Oral  
presentation

*E. Huri is Full Professor at Hacettepe University.*

**Abstract:** He talked about the 3-dimensional (3D) modeling and printing applications in state-of-art medical applications and its opportunities in the future.

**Keywords:** 3D modeling; medical printing; future medicine; healthcare system.



# Molecular Dynamics Simulations of DNA- and RNA-Protein Systems

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ICMD'2021

June 10-12,  
2021

Gaziantep  
Turkey

Invited Talk

Oral  
presentation

*Hiqmet Kamberaj is Full Professor at International Balkan University. He was an Acting Dean of the Faculty of Engineering from January 2017 to September 2019. Hiqmet completed his Ph.D. (in Computational Physics) in 2005 from Manchester Metropolitan University and Post-Doctoral studies from the University of Minnesota, Arizona State University, and National Institute of Nanotechnology at University of Edmonton. He received his Bachelor of Science (in Physics) in 1996 from the University of Tirana and his Master of Science (in Physics) from the University of Siegen in 2000. Hiqmet has published more than 20 articles and book chapters in reputed journals and has been serving as editor-in-chief, editorial board member, and ad-hoc reviewer of repute. Very recently, Hiqmet Kamberaj has published a book at Springer publisher in Scientific Computation Series. His articles focus on understanding the structure, dynamics, and thermodynamics of macromolecular systems using the laws of physics and biochemistry, and applied mathematics. Please email [hkamberaj@ibu.edu.mk](mailto:hkamberaj@ibu.edu.mk) to contact Hiqmet or by visiting his professional profiles to learn more about how Hiqmet's research articles could contribute your research and teaching activities.*

**Abstract:** Molecular dynamics (MD) simulation is a standard technique in studying the biological systems' dynamics, such as proteins, DNA/RNA, membranes, and complexes. Dynamics, based on the atomistic motions, involve transitions between different conformational states. The considerable time and size scale of physical and chemical phenomena will require new statistical and computational approaches to be studied efficiently.

This talk will discuss the rigorous protocols used to perform computer simulations using the MD technique of biological systems, such as DNA- and RNA-protein complexes. Also, it will present some approaches suggested for analyzing the MD simulation results using efficient statistical models. In particular, the focus is on the Weighted Histogram Analysis Method (WHAM), Symbolic Transfer Entropy (STE), and Graph Theory (GT).

Artificial neural network methods are recently employed to build up a deep learning architecture for molecular modeling and molecular dynamics. This talk will focus on recent advanced methodological studies in applying machine learning approaches in MD simulations and predicting molecular properties and their role in enabling rational design technologies.

**Keywords:** computer simulations; DNA/RNA-protein complexes; statistical analysis; molecular dynamics; machine learning.



# Machine Learning Methods on Biomedical Image Processing

ICMD'2021

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June 10-12,  
2021

Gaziantep  
Turkey

Invited Talk

Oral  
presentation

*M. Alper Selver received the B.Sc. degree from Gazi University, Ankara, Turkey, in 2002, and the M.Sc. and Ph.D. degrees from Dokuz Eylül University (DEU), Izmir, Turkey, in 2005 and 2010, respectively, all in electrical and electronics engineering (EEE). He has studied with FH-Juelich, Medical Informatics Laboratory, Aachen, Germany (2004–2005), and the Heffner Biomedical Imaging Laboratory, Columbia University, New York, USA (January–August 2009). He is currently an Associate Professor with the DEU EEE. His research studies include multiscale and hierarchical data analysis and development of ensemble models for industrial and medical, particularly radiological, signal/image processing applications. Dr. Selver has served as the coordinator/researcher for several The Scientific and Technological Research Council of Turkey (TUBITAK) research projects and the advisor for various TUBITAK-Technology and Innovation Grant Programs Directorate (TEYDEB) industrial projects including Turkey's first European Union project having Euripidies2 label, SIL Certified Advanced Integrated Data Recording and Analysis System for Railway Transportation Systems—SIL Certified Advanced Integrated Data Recording and Analysis System for Railway Transportation Systems (ADORAS), which was conducted in partnership with South Korea, Czech Republic, and Spain.*

**Abstract:** Machine learning methods consistently provide state-of-the-art results at various fields of research including biomedical imaging and image processing applications. Comparison of resulting image(s) with the ground truth to evaluate the success rate and quality of the process is an important part of measuring the progress, understanding pitfalls and assessing clinical feasibility. Due to their nature, biomedical image processing applications often require utilization of several metrics than can provide evaluation from multiple perspectives. In this respect, determination of the performance of a machine learning strategy requires selection of the appropriate metrics and obtaining a consensus of how to combine them. This corresponds to finding “quantitative correlation of qualitative human expert perception”, which seems to be satisfied only moderately as stated in.

On the other hand, biomedical image analysis challenges become the primary mechanism to determine the best approach by comparing algorithms on common data sets. The number of these international competitions increase each year as well as the number of participating teams and submissions. Accordingly, the evaluation of the results play a very critical role on determining the leading methods. However, recent studies pointed that adequate interpretation and reproducibility of results are limited. To elevate the impact of challenges and increase their quality, the Biomedical Image Analysis ChallengeS (BIAS) initiative developed a set of recommendations for the reporting of challenges.

In this respect, this talk focuses on the existing evaluation metrics, their implementations and available tools for their use. The strategies suggested by BIAS to

improve the transparency of the reporting of a challenge regardless of field of application, image modality or task category will be discussed in the light of the related literature. Another focus of the talk will be on ensemble systems, which combine multiple models and achieve superior results. The reliability of these systems in terms of peeking phenomena and other machine learning related challenges will be discussed.

**Keywords:** biomedical challenges; medical image analysis; machine learning; performance evaluation.

# MedicaUroSim, a Surgical Training Simulator

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ICMD'2021

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Turkey

Industry Talk

Oral  
presentation

**Abstract:** MedicaUroSim is a surgical training simulator from Medicawell company. Its construction started in 2018. In 2020, It was supported by TUBITAK. MedicaUroSim simulator is a gamified and enhanced version of endoscopic procedures using real patient scenarios with software and hardware. MedicaUroSim is the first domestic and national urology simulator in Turkey.

It has a new and pioneering technology in its field. It supports the education of medical faculty students with advanced artificial intelligence technology. In addition, it has a structure that will increase the practicality of urologist surgeons.

MedicaUroSim, which can be used both physically and web-based, shows its difference from its competitors abroad at this point. In particular, it can be used as educational material for medical school students within the scope of the distance education model that emerged with the COVID-19 Pandemic. Web-based technology that can be used in hybrid education models is suitable for development in many areas.

**Keywords:** urology; simulator; medical education.



## Part II

# Abstract Papers of Regular Talks



# Frequency Recognition from Temporal and Frequency Depth of the Brain-Computer Interface based on Steady-State Visual Evoked Potentials

ICMD'2021

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June 10-12,  
2021

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<sup>2</sup>*Department of Computer Engineering, Alanya Alaaddin Keykubat University, Antalya, Turkey.*

Gaziantep  
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Talk

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Oral  
presentation

**Abstract:** Brain-computer interface (BCI) system based on steady-state visual evoked potentials (SSVEP) have been acceleratingly used in different application areas from entertainment to rehabilitation, like clinical neuroscience, cognitive, and use of engineering researches. Of various electroencephalography paradigms, SSVEP-based BCI systems enable apoplectic people to communicate with outside world easily, due to their simple system structure, short or no training time, high temporal resolution, high information transfer rate, and affordable by comparing to other methods. SSVEP-based BCIs use multiple visual stimuli flickering at different frequencies to generate distinct commands. In this paper, we compared the classifier performances of combinations of binary commands flickering at seven different frequencies to determine which frequency pair gives the highest performance using temporal and spectral methods. For SSVEP frequency recognition, in total 25 temporal change characteristics of the signals and 15 frequency-based feature vectors extracted from the SSVEP signal. These feature vectors were applied to the input of seven well-known machine learning algorithms (Decision Tree, Discriminant Analysis, Logistic Regression, Naive Bayes, Support Vector Machines, Nearest Neighbour, and Ensemble Learning). In conclusion, we achieved 100% accuracy in 7.5 - 10 frequency pairs among these 2,520 distinct runs and we found that the most successful classifier is the Ensemble Learning classifier. The combination of these methods leads to an appropriate detailed and comparative analysis that represents the robustness and effectiveness of classical approaches.

**Keywords:** brain-computer interface; steady-state visual-evoked potential; EEG; machine learning.

## Spirulina Platensis and Bioremediation of Phosmet, Ethion, Methyl Parathion Pesticides

ICMD'2021

June 10-12,  
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Turkey

Talk

Oral  
presentation

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**Abstract:** In this study, the bioremediation efficiency of some pesticides in Toxic Industrial Chemical category of CBRN (Chemical, Biological, Radioactive, Nuclear) threats with blue-green microalgae was investigated. Although these pesticides are highly harmful to human, living and environmental health, they are highly persistent in nature. Recently, the increasing demand and use of pesticides in the agricultural field poses risks in production, transportation and storage areas. The microalgae we have used are already known for its ability to metabolize pesticides, as well as its use in important areas, especially in the medicine and pharmaceutical industry. Using environmentally friendly bioremediation technique to eliminate or minimize the harmful effects of pesticides contributes to nature and the future. The fact that the selected microalgae and pesticides have not been investigated before proves the originality of our study. Pesticide remediation amount measurements were made by electrochemistry method and it was determined that *Spirulina platensis* removed Phosmet, Ethion and Methyl Paration by 70.0%, 61.0%, 50.0%, respectively, at the end of the 7th day.

**Keywords:** CBRN (Chemical, Biological, Radioactive, Nuclear); pesticide; bioremediation; microalgae.

## Devices Used by 112 Personnel in the Covid-19 Pandemic Process, Validation and Problems Encountered

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ICMD'2021

June 10-12,  
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Gaziantep  
Turkey

Talk

Oral  
presentation

**Abstract:** The emergency health service is for all interventions that are made up of people who have received special education in their field, who work together in order to provide the best emergency response to the sick and injured in the shortest time possible in line with the possibilities available. In this context, although the emergency health service provided during the pandemic process requires the implementation of special procedures for healthcare professionals, it is important in the validation of the biomedical devices used during the provision of this service. Especially the fact that this process was a disaster that took place in an unexpected time period caused everyone to be caught unprepared and this situation caused the current workload of healthcare workers to increase even more. In this study, we conducted a literature search to shed light on the problems experienced by 112 emergency healthcare professionals during the pandemic period and how the validation of the biomedical devices used by these personnel in the ambulance should be. The type of research is descriptive research. The Covid-19 pandemic was accepted as a case and the literature was reviewed, with this case being the focus. During the literature search, up-to-date keywords such as "emergency health service, Covid-19, disaster preparedness, emergency aid unit employees, biomedical device technologies", which are also mentioned in the keywords, were scanned. Care was taken to ensure that the studies included in the review section were up to date and in accordance with the academic guide. In addition, due to the limitation of resources in the validation section of the research, assistance was received from the relevant legislation and expert medical company engineers and from the active staff in the field of healthcare professionals' problems. As a result of this research, we have reached the conclusion that legal regulations should be made regarding the problems experienced by healthcare professionals due to the pandemic and that existing standards related to device validation should be updated after the pandemic.

**Keywords:** emergency health service; disaster preparedness; Covid-19; 112 emergency aid unit employees; biomedical device technologies.

## Medicinal Plants for Prevention and Treatment of Coronavirus Disease

ICMD'2021

June 10-12,  
2021

Gaziantep  
Turkey

Talk

Oral  
presentation

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**Abstract:** The 2019-nCoV (new Corona Virus) outbreak was announced by the World Health Organization (WHO), the International Emergency Public Health Organization, on January 30, 2020, and WHO reported the 2019-nCoV pathogen to SARS-CoV-2 and Corona virus Disease 2019 on 12 February. (COVID-2019). COVID-19 was officially recognized as a Pandemic by WHO on March 11, 2020. Plants have been used all over the world as traditional medicine for centuries to treat many chronic infections, including viral diseases. In recent years, scientists have been trying to verify the potential of functional compounds to protect human health and cure diseases with their research on functional and nutraceutical foods. Traditional medicinal plants have a long history supported by many researches such as maintaining a healthy life, toxins taken in daily life, fighting and preventing diseases, and longevity. Studies on the antiviral, anti-inflammatory and antioxidant properties of ethnomedical plants and natural phytochemicals can be considered as a great potential drug source against various ailments as well as Covid-19 treatment. Based on this study, plant extracts increase immunity with the increase in the number of white blood cells and lymphocytes in viral infections such as Covid-19, which can lead to fatal consequences, regulating the production and release of proinflammatory cytokines, showing an anti-inflammatory effect with a decrease in the C-reactive protein and erythrocyte sedimentation rate. It appears to have a positive effect such as interfering with the development and potential antiviral agent activity. In this study, phytochemicals and effects associated with COVID-19 infection were reviewed.

**Keywords:** Covid-19; medical plants; herbal drugs.

# Forecasting Model to Predict the Spreading of the COVID-19 Outbreak in Turkey

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ICMD'2021

June 10-12, 2021

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presentation

**Abstract:** This study aimed to forecast the future of the COVID-19 outbreak parameters such as spreading, case fatality, and case recovery values based on the publicly available epidemiological data for Turkey. We first performed different forecasting methods including Facebook's Prophet, ARIMA and Decision Tree. Based on the metrics of MAPE and MAE, Facebook's Prophet has the most effective forecasting model. Then, using Facebook's Prophet, we generated a forecast model for the evolution of the outbreak in Turkey fifteen-days-ahead. Based on the reported confirmed cases, the simulations suggest that the total number of infected people could reach 4328083 (with lower and upper bounds of 3854261 and 4888611, respectively) by April 23, 2021. Simulation forecast shows that death toll could reach 35656 with lower and upper bounds of 34806 and 36246, respectively. Besides, our findings suggest that although more than 86.38% growth in recovered cases might be possible, the future active cases will also significantly increase compared to the current active cases. This time series analysis indicates an increase trend of the COVID-19 outbreak in Turkey in the near future. Altogether, the present study highlights the importance of an efficient data-driven forecast model analysis for the simulation of the pandemic transmission and hence for further implementation of essential interventions for COVID-19 outbreak.

**Keywords:** Covid-19; forecasting; Facebook's prophet; Turkish population; intervention.

# Ovarian Cancer Prediction Using PCA, K-PCA, ICA and Random Forest

ICMD'2021

June 10-12,  
2021

Gaziantep  
Turkey

Talk

Oral  
presentation

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**Abstract:** Ovarian cancer, which is the most common in women and occurs mostly in the post-menopausal period, develops with the uncontrolled proliferation of the cells in the ovaries and the formation of tumors. Early diagnosis is very difficult and in most cases, it is a type of cancer that is in advanced stages when first diagnosed. While it tends to be treated successfully in the early stages where it is confined to the ovary, it is more difficult to treat in the advanced stages and is often fatal. For this reason, it has been focused on studies that predict whether people have ovarian cancer. In our study, we designed a RF-based ovarian cancer prediction model using a data set consisting of 49 features including blood routine tests, general chemistry tests and tumor marker data of 349 real patients. Since the data set containing too many dimensions will increase the time and resources that need to be spent, we reduced the dimension of the data with PCA, K-PCA and ICA methods and examined its effect on the result and time saving. The best result was obtained with a score of 0.895 F1 by using the new smaller-sized data obtained by the PCA method, in which the dimension was reduced from 49 to 6, in the RF method, and the training of the model took 18.191 seconds. This result was both better as a success and more economical in terms of time spent during model training compared to the prediction made over larger data with 49 features, where no dimension reduction method was used. The study has shown that in predictions made with machine learning models over large-scale medical data, dimension reduction methods will provide advantages in terms of time and resources by improving the prediction results.

**Keywords:** dimension reduction; machine learning; ovarian cancer; random forest algorithm.

# Pulse-Galvanic Skin Response Analysis with Multiple Sensor Device Design

ICMD'2021

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Talk

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Oral  
presentation

**Abstract:** In this study, the development of a low-cost electronic card-based medical device measuring and recording patient data was described via non-invasive methods. Both the descriptive statistical analysis and the regression model was performed from the pulse and galvanic skin response (GSR) from the volunteer' data. It is important to measure and record different data simultaneously with multiple sensors from the patient during the treatment, medical operation and care periods of the patients. The data measured from the designed device was evaluated for the patient's position, GSR, the respiration rate, the blood oxygen content, and the heart rate. The designed measurement and recording device were implemented with an embedded system-based microcontroller card. The designed device might provide for monitoring and recording data with led display, serial port, microSD card or internet of things.

**Keywords:** galvanic skin response; pulse measurement; multiple sensor; medical device design.

# Comparison of Feature Reduction and Selection in Early Diabetes Diagnosis

ICMD'2021

June 10-12,  
2021

Gaziantep  
Turkey

Talk

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Oral  
presentation

**Abstract:** Diabetes is one of the most common health problems in the world. This problem is increasing day by day with unbalanced and unconscious nutrition. Once a person is diagnosed with diabetes, the likelihood of recovery from the disease is very low. Once someone is diagnosed with diabetes, he/she has to continue her/his life depending on the medication and/or a strict diet program. This isn't hard for patients living in developed countries. However, it is much more difficult for a developing country citizen to access these opportunities. Because it is much more difficult for the citizens of this country to access medicine and healthy nutrition. Therefore, in this study, the way to diagnose diabetes as easily and quickly as possible from some of the symptoms easily obtained from the person was examined with machine learning techniques. In the diagnosis of diabetes, parameters such as age, sex, polyuria, polydipsia, sudden weight loss, fatigue, polyphagia, genital fungus, blurred vision, itching, irritability, delayed recovery, partial paralysis, cramps, hair chitin, and obesity were analysed.

**Keywords:** machine learning; diabetes.

# Histopathological Evaluation of Tissue Specific Responses of Subacute Clothianidin Administration in *Oncorhynchus mykiss*

ICMD'2021

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Oral  
presentation

**Abstract:** Clothianidin, one of the latest members of neonicotinoids, is a systemic insecticide of the neonicotinoid group that affects the central nervous system by acting as a nicotinic acetylcholine receptor agonist. Although it is stated that it has no dangerous potential for aquatic organisms, accumulation in water basins is important in terms of environmental toxicity. In this study, the histopathological changes caused by clothianidin applied in subacute application (7 days) form and in environmental doses (3, 15 and 30 µg/L) in the brain, kidney, muscle and gill tissue of juvenile *Oncorhynchus mykiss* were determined. Parallel to the administration of increasing doses of clothianidin, an increase in the severity of pathological lesions is observed in the brain, muscle, kidney and gill tissue. In particular, it shows that as a result of the accumulation of pesticides in aquatic organisms, lesions may develop as tissue-specific responses, thus leading to tissue dysfunction.

**Keywords:** Clothianidin; *O. mykiss*; brain; kidney; muscle; gill; histopathology; subacute administration.

# Manufacturing Multicolor LED-Based Phototherapy Device with a Novel 3D Design

ICMD'2021

June 10-12,  
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Turkey

Talk

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Oral  
presentation

**Abstract:** Jaundice is a condition that results from an increase in bilirubin level in the blood. Its prevalence in newborns is around 60–70%. When this temporary jaundice becomes pathological and left untreated, significant damages may occur such as brain damage, vision loss, lung and kidney dysfunction, and even death. One of the methods used for the treatment of jaundice is phototherapy. In this study, a design has been made with 3 foldable LED panels to increase the target area. In addition, high-voltage LEDs with blue-greenwhite wavelengths were used. Thus, it was aimed to minimize the risks of nausea and dizziness caused by intense blue light. An automatic system has been achieved by using temperature and light intensity sensors. The system will warn the user at temperatures and light intensity that are harmful to the baby.

**Keywords:** phototherapy; jaundice; LED; Arduino; newborn baby.

# Investigating the Biphasic Dose Response of HUVEC Cells in Low-Level Light Therapy

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**Abstract:** Photobiomodulation (PBM) and Photodynamic Therapy (PDT) applications work by producing reactive oxygen species (ROS). PBM is used for wound healing and cell proliferation while PDT is used to destroy pathogen and cancer cells. It has also been observed that low-dose PDT can cause the proliferation of pathogens and cancer cells, as well as the proliferation and differentiation of the cells, such as osteoblasts. However, the possible effects of low-dose PDT on endothelial cells inducing the differentiation and proliferation profile have not been investigated. This study aimed to enable the formation of low dose reactive oxygen species by using 808-nm wavelength laser radiation in the presence of Indocyanine green, and thus, to trigger various cellular mechanisms as in the PBM mechanism, for the differentiation of HUVEC cells. As a result of the applications, it has been observed that low-dose PDT increased the cell viability by 20% and supported an approximately 20% increase in endothelial tubular structure formation compared to the control group. Intracellular ROS formed after the light applications were the mediator molecules for these outcomes to happen. In the light of these results, it is assumed that ROS formed by low-dose PDT can trigger vasculogenesis.

Oral  
presentation

**Keywords:** photodynamic therapy; photobiomodulation; 808-nm; indocyanine Green; HUVEC cells.

ICMD'2021 **Artificial Intelligence Applications in Nutrition and Dietetics**

June 10-12,  
2021

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Talk

Oral  
presentation

**Abstract:** Artificial intelligence (AI) is a branch of computer science whose purpose is to imitate thought processes, learning abilities, and knowledge management. The increasing number of applications in experimental and clinical medicine is striking. Artificial intelligence applications in the field of nutrition and dietetics is a fairly new and important field. Different apps related to nutrition are offered to the use of individuals. The importance of individual nutrition has also triggered the increase in artificial intelligence apps. It is thought that different apps such as food preferences and dietary intake can play an important role in health promotion. Researchers may have some difficulties such as remembering the frequency or amount of intake in assessment of dietary intake. Some applications used in the assessment of food consumption contribute to overcoming these difficulties. Besides, these apps facilitate the work of researchers and provide more reliable results than traditional methods. The apps to be used in the field of nutrition and dietetics should be developed by considering the disadvantages. It is thought that artificial intelligence applications will contribute to both the improvement of health and the assessment and monitoring of nutritional status.

**Keywords:** nutrition and dietetics; artificial intelligence; health.

# The Investigation of the Effect of PEEK-Rod Fixation Systems on Pedicle Screws and The Adjacent Intervertebral Discs

ICMD'2021

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Oral presentation

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**Abstract:** In recent years, orthopedic fixation devices have been widely used in the treatment of spinal injuries and deformities. In order to decrease the degree of these pathologies in theory, novel spinal motion preservation methods have been developed. In this study, the spine model of an adolescent idiopathic scoliotic patient was developed and the biomechanical effects of a traditional spine implant system and the system of polyetheretherketone (PEEK) were compared. The three-dimensional lumbar spine from L2 to L5 vertebra was developed from computed tomography data. The model involved lumbar vertebrae, intervertebral discs, facet joints, and ligaments. In our study, the L2-L5 lumbar model was subjected to the loads and lateral bending moments. The efficacy of the discs, screws and rods in the models that were composed of two different fixation systems (titanium-rod and PEEK-rod) were evaluated regarding the Von Mises stress and, the maximum shear stress distributions. The finite element analysis was performed and Ansys Workbench was employed in the simulation process. It was determined that the PEEK rod fixation system reduced the equivalent and shear stress values when compared with the titanium-based fixation system. Since adjacent segment disease has become a common drawback of fusion surgeries, intervertebral discs were also examined in each loading condition. According to the results, the PEEK rod system decreased the total deformation and stress values on the adjacent discs (L3-L4 and L4-L5) of the model compared to the other system. Therefore, it was concluded that the fixation devices reduced the loading on the model especially on the discs and ligaments. Besides, compared to traditional rod fixation systems, PEEK rod systems expressed better load-sharing with the reduction of stress at the bone-to-screw interface.

**Keywords:** finite element analysis; titanium rod; von Mises stress analysis; PEEK rod; adjacent segment disease.

# A Comparison of Different Strategies for The Modification of Quartz Tuning Forks Based Mass Sensitive Sensors Using Natural Melanin Nanoparticles

ICMD'2021

June 10-12,  
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**Abstract:** Quartz tuning fork (QTF) is a measurement tool that is gaining attraction nowadays due to remarkable features like their low cost, stable resonance frequency, and considerably low working frequency. However how to functionalize a QTF as a chemical or a physical sensor is still an important problem that need to be solved for a widespread usage. This paper describes approaches to functionalize QTFs by utilizing melanin nanoparticles (MNP) in order to create a recognition layer for the creation of a target specific mass sensitive biosensor. In order to achieve this aim, electroplating and dip coating methods are chosen for their relative ease of use and cheap operating costs for the purpose of being industry-friendly and reproducible as a product for field applications. Moreover a comparative study on chemical etching of QTFs was conducted with the goal of improving MNP attachment during dip coating process.

**Keywords:** quartz tuning fork; melanin nanoparticle; mass sensitive biosensor; nanobiosensor.

# Evaluation of Wigner-Ville Distribution Features to Estimate Steady-State Visual Evoked Potentials' Stimulation Frequency

ICMD'2021

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2021

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Oral  
presentation

**Abstract:** Brain Computer Interface (BCI) is a system that enables people to communicate with the outside world and control various electronic devices by interpreting only brain activity (motor movement imagination, emotional state, any focused visual or auditory stimulus, etc.). The visual stimulation based recording is one of the most popular methods among various electroencephalography (EEG) recording methods. Steady-state visual-evoked potentials (SSVEPs) where visual objects are blinking at a fixed frequency play an important role due to their high signal-to-noise ratio and higher information transfer rate in BCI applications. However, the design of multiple (more than 3) command systems in SSVEPs based BCI systems is limited. The different approaches are recommended to overcome these problems. In this study, an approach based on machine learning is proposed to determine stimulating frequency in SSVEP signals. The data set (AVI SSVEP Dataset) is obtained through open access from the internet for simulations. The dataset includes EEG signals that was recorded when subjects looked at a flickering frequency at seven different frequencies (6-6.5-7-7.5-8.2-9.3-10Hz). In the machine learning-based approach Wigner-Ville Distribution (WVD) is used and features are extracted using Time-Frequency (TF) representations of EEG signals. These features are classified by Decision Tree, Linear Discriminant Analysis (LDA), k-Nearest Neighbor (k-NN), Support Vector Machine (SVM), Naive Bayes, Ensemble Learning classifiers. Simulation results demonstrate that the proposed approach achieved promising accuracy rates for 7 command SSVEP systems. As a consequence, the maximum accuracy is achieved in the Ensemble Learning classifier with 47.60%.

**Keywords:** brain-computer interface (BCI); electroencephalography (EEG); steady-state visually-evoked potentials (SSVEPs); time-frequency (TF) representation; Wigner-Ville distribution.

ICMD'2021

## Detecting Abnormalities in Heart Sounds

June 10-12,  
2021

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Talk

Oral  
presentation

**Abstract:** Heart sounds are important data that reflect the state of the heart. It is possible to prevent larger problems that may occur with early diagnosis of abnormalities in heart sounds. Therefore, in this study, the detection of abnormalities in heart sounds has been studied. In order to detect abnormalities in heart sounds, the heartbeat-sounds data set obtained free of charge from the kaggle.com website was examined. Mel frequency cepstral coefficients (MFCCs) were used in the selection of the characteristics of the sounds. Parameters such as the number of filters to be applied for MFCCs, the number of attributes to be extracted are examined separately with different values. The classification performance of heart sounds with feature matrices extracted in different parameters of MFCCs with K-nearest neighbor algorithm was investigated. The classification performance of different feature extractions was compared and the best case was tried to be determined. Two different records that make up the data set were examined separately as normal and abnormal. Then, the new data set obtained by combining the two records was examined as normal and abnormal.

**Keywords:** MFCCs; k-nearest neighbors; heart sounds; classification

# Determining the Relation Between the Count Number and X-Ray Energy Level in Pyroelectric Materials using Linear Regression Analysis

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ICMD'2021

June 10-12,  
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Turkey

Talk

Oral  
presentation

**Abstract:** X-rays are a type of electromagnetic energy which widely used in different areas. Since their discovery, x-rays used, especially for medical imaging applications. On the other hand, new efficient x-ray generation methods have still been under investigation. Although new imaging modalities arose, xrays have never lost their popularity in many applications like computed tomography and dental imaging. Among these new methods, x-ray generation using pyroelectric crystal materials is one of the promising technologies. Pyroelectric crystals generate an electric field when a temperature change occurs and are affected by various parameters like how many times (count) the crystal's temperature changed in a second. Hence, this new technology needs more research. In this study, we investigated the relationship between the count number and x-rays' energy level of pyroelectric materials using linear regression analysis. We used a commercial software package, which is called the Statistical Package for the Social Sciences (SPSS), for this purpose. As a result, we achieved a good fit value of  $R^2 = 0.91$ .

**Keywords:** pyroelectric; x-ray; linear regression.

ICMD'2021

June 10-12,  
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Oral  
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## Design of Portable Multicolor LED-Based Optical System for the Photobiomodulation Therapy on Wound Healing Process

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**Abstract:** Photobiomodulation is a practical and noninvasive treatment that triggers cell proliferation, cell differentiation, wound healing, new tissue formation, inflammation and pain reduction with low-level light therapy. Light-emitting diodes (LEDs) are energy-saving, affordable and safe alternatives to laser devices which are recently preferred in photobiomodulation. Although the wavelengths between 600-700 nm are most preferred ones, there is a lack of practical optical systems which study this mechanism in vitro with different wavelengths simultaneously. In this study, a portable and remotely controlled multicolor LED-based system was designed and tested on the wound healing process of human keratinocytes by irradiating the cells homogenously with 3 different wavelengths (460-475 nm as blue, 515-535 nm as green, and 585-595 nm as orange) on different experimental groups at the same time. Its proliferative and wound healing effect was evaluated with cell viability (MTT) analysis and cell migration (scratch) assay, respectively. It was observed that orange-LEDs were designated as the most triggering wavelength in terms of cell proliferation. Also, it was revealed with this device that different wavelengths can reach the intended accelerated wound healing process, so this optical system will be an advantageous design for future practical photobiomodulation studies in vitro.

**Keywords:** photobiomodulation; blue LED; green LED; orange LED; wound healing.

Part III  
Appendices



# Banner



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10 - 12 June 2021  
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# 4th International Conference on Medical Devices (ICMD'2021)

## Technical Program (June 10th, 2021 – THURSDAY)

10:00	Opening Talk	Türkey Dereli, Rector
10:30	Opening Talk	Mehmet Lütfi Yola
10:45	Opening Talk	Yalçın İşler
11:00	Industry Talk: MedicaUroSim, a Surgical Training Simulator	İbrahim Balaban
11:20	Forecasting Model to Predict the Spreading of the COVID-19 Outbreak in Turkey	Ceyhun Bereketoğlu, Nermin Özcan, Tuğba Raika Kiran and Mehmet Lütfi Yola
11:40	Investigating the Biphasic Dose Response of HUVEC cells in Low-Level Light Therapy	Dilara Portakal Koç, Günnur Onak and Nermin Topaloğlu
12:00	LUNCH BREAK	
13:30	Invited Talk: Molecular Dynamics Simulations of DNA- and RNA-Protein Systems	Hiqmet Kamberaj
14:30	Pulse-Galvanic Skin Response Analysis with Multiple Sensor Device Design	Mehmet Ali Dinçer, Kübra Evren Şahin and Savaş Şahin
14:45	Spirulina Platensis and Bioremediation of Phosmet, Ethion, Methyl Parathion Pesticides	Özlem Gül, Bahar Bankoğlu Yola, Tuğba Raika Kiran and Mehmet Lütfi Yola
15:00	Devices Used by 112 Personnel in the Covid-19 Pandemic Process, Validation and Problems Encountered	Ahmet Şanverdi, Eda Nur Karagöz and Mehmet Lütfi Yola
15:15	Medicinal Plants for Prevention and Treatment of Coronavirus Disease	Onder Otlı, Ceyhun Bereketoğlu, Tuğba Raika Kiran and Aysun Bay Karabulut
15:30	Artificial Intelligence Applications in Nutrition and Dietetics	Izzet Ulker and Feride Ayyıldız
15:45	The Investigation of the Effect of PEEK-Rod Fixation Systems on Pedicle Screws and The Adjacent Intervertebral Discs	Saliha Zeyneb Akinci, Derya Karabulut, Hasan Kemal Sürmen, Onur Yaman and Yunus Ziya Arslan
16:00	A Comparison of Different Strategies For The Modification Of Quartz Tuning Forks Based Mass Sensitive Sensors Using Natural Melanin Nanoparticles	Derya Demir, Sude Gündoğdu, Şeyda Kılıç, Tuğçe Kartallıoğlu, Yusuf Alkan, Engin Baysoy and Gizem Kaleli Can
16:15	Histopathological Evaluation of Tissue Specific Responses of Subacute Clothianidin Administration in <i>Oncorhynchus mykiss</i>	Gökhan Nur, Demet Doğan and Hacı Ahmet Deveci
16:30	Invited Talk: Evaluating the Performance of Machine Learning Methods at Biomedical Image Processing Applications	Mustafa Alper Selver
17:30	End of the First Day	

# 4th International Conference on Medical Devices (ICMD'2021)

## Technical Program (June 11th, 2021 – FRIDAY)

13:30	<b>Invited Talk: The Role of 3D Modeling, 3D Medical Printing and Simulation on Future Medicine and Healthcare System</b>	Emre Huri
14:30	<b>Industry Talk: Evaluation of the Negative Pressure SteriDome (NPS): The FDA's Emergency Use Authorization of a Protective Barrier Enclosure with Negative Pressure and Oxygen Support to Contain Infectious Aerosolized Pathogens and Facilitate Respiratory Procedures for COVID-19</b>	Wisam Breegi, Danny Breegi, Anh Nguyen, Nicole Lincoln
14:45	<b>Frequency Recognition from Temporal and Frequency Depth of the Brain-Computer Interface based on Steady-State Visual Evoked Potentials</b>	Ebru Sayilgan, Yilmaz Kemal Yuce and Yalcin Isler
15:00	<b>Ovarian Cancer Prediction Using PCA, K-PCA, ICA and Random Forest</b>	Asiye Sahin, Nermin Ozcan and Gokhan Nur
15:15	<b>Erken Diyabet Teşhisinde Öznitelik Azaltma ve Seçiminin Kıyaslanması</b>	Abdullah Caliskan
15:30	<b>Kalp Seslerinde Anormalliklerin Belirlenmesi</b>	Muhammed Telçeken and Yakup Kutlu
15:45	<b>Evaluation of Wigner-Ville Distribution Features to Estimate Steady-State Visual Evoked Potentials' Stimulation Frequency</b>	Murside Degirmenci, Ebru Sayilgan and Yalcin Isler
16:00	<b>Determining the relation between the count number and x-ray energy level in pyroelectric materials using linear regression analysis</b>	Saadet Sena Egeli and Yalcin Isler
16:15	<b>Design of Portable Multicolor LED-Based Optical System for the Photobiomodulation Therapy on Wound Healing Process</b>	Nermin Topaloglu Avsar, Ufuk Balkaya and Ziysan Buse Yarali Cevik
16:30	<b>Manufacturing Multicolor LED-Based Phototherapy Device with a Novel 3D Design</b>	Busra Yasar, Yalcin Isler and Nermin Topaloglu
16:45	<b>Closing Talk</b>	Mehmet Lutfi Yola, Yalcin Isler
17:00	<b>Private Meeting for the Organization Committee</b>	

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