

BOOK SERIES - 50th Year of Hacettepe University
Series Editor: Adil Denizli

SMART BIOSENSING TECHNOLOGIES: PAST, PRESENT AND FUTURE

***Azum Erdem Gürsan
Mustafa Kemal Sezgintürk
Editor***



**HACETTEPE
UNIVERSITY
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Kitapta yer alan yazı, resim ve şekil 5846 sayılı yasanın hükümlerine göre kısmen ya da tamamen basılamaz, dolaylı dahi olsa kullanılamaz, teksir, fotokopi ya da başka bir teknikle çoğaltılamaz. Her hakkı saklıdır, HACETTEPE ÜNİVERSİTESİ'ne aittir.

PREFACE

We have proudly celebrated the 50th anniversary of the foundation of Hacettepe University. We take pride in being one of the most successful universities in Turkey and being ranked among the leading universities in the World. Since the year 1967, when Hacettepe earned the status of ‘*University*’, it has never given up on its principle of continuously going ahead and reaching for the very best. Hacettepe, always preserving its values and basic principles, has become a pioneer university that has been intertwined with the society and pursued innovations, achieving many “firsts” ahead of others.

From medicine to biology, philosophy, statistics, physics and chemistry; from history of arts to the English, German and French languages; from sociology to engineering, fine arts and conservatory, Hacettepe University started almost 50 years ago developing interdisciplinary collaborations across a wide range of scientific fields, a research trend which has achieved a status of global recognition in the 21st century.

Hacettepe University, which was recognized as “*Research University*” by the decision of Council of Higher Education, dated September 26, 2017, has built a strong “brand” image over these 50 years with its qualified and unique contributions to science in Turkey and has been the country’s gateway to global scientific advances. It has graduated tens of thousands of students, each of whom has been our source of pride with their contributions to science, society and humanity as well as with their worldwide achievements. So have its graduates always been proud of Hacettepe.

Hacettepe University owes its success to its people who have always aimed to move forward by promoting interdisciplinarity and without giving up on the understanding “*To the leading edge... Toward being the best...*”

The Turkish and English series of books you are presented have been prepared in memory of the 50th anniversary of Hacettepe University by Prof. Dr. Adil Denizli, a distinguished researcher and faculty member who has heartily devoted himself to his university and science. Among the editors and authors of the book series are respected scientists from Hacettepe University, Turkey and abroad. The series covers the studies from the multi-/interdisciplinary research areas of sciences, mainly from Medicine, Science and Engineering Sciences, which particularly stand out among the World’s and Hacettepe’s research interests.

Readers benefiting from these books will certainly appreciate the value of the profound contributions Hacettepe University made to science both in the country and in the World each time they see the name of “*Hacettepe University*” in the context of the authors, editors, footnotes, citations and bibliographies. This work is an expression of respect for Hacettepe University and for those who have meticulously served in this university for 50 years with an interdisciplinary understanding.

Thank you Adil Denizli... I would like to express my sincere gratitude and thanks to all those who have contributed to this precious work.

I wish many 50 more years to go forward in line with our motto “*To the leading edge... Toward being the best...*”

Prof. Dr. A. Haluk ÖZEN
Rector

PREFACE

In 1954 “Hacettepe” was founded in two chambers of an old Ankara house as a Chair of Child Health, then in 1967 officially earned “university” status. Hacettepe University celebrated its 50th anniversary in 2017 by proud of rich heritage and the positive, life-changing impact globally through the strength of our research, teaching, innovation and enterprise. In just 50 years Hacettepe University has managed to forge a powerful global reputation as a strong research-led university. To celebrate 50th anniversary numerous standout events were planned and performed by proud of past and dreaming of the future.

The Hacettepe Book Series are published to honor the five decades of work not only for the field but also for society at large and to leave the scientific mark of Hacettepe University to the history.

Adil Denizli, Ph.D

Series Editor

PREFACE

The book entitled with “***Smart Biosensing Technologies: Past, Present and Future***” is the special edition dedicated to the 50th year celebration of the establishment of Hacettepe University that is the one of the oldest universities in Turkey.

This book is organized in such a way to provide the main categories of biosensing technologies according to i.e. *Chapter 1: Evolution of Biosensors: Where Are We Now?* *Chapter 2: Biosensors Designed By Molecularly Imprinted Polymers*, *Chapter 3: Enzyme-Based Photoelectrochemical Biosensors*, *Chapter 4: Recent Progress On Electrochemical Biosensors Monitoring Nucleic Acid Hybridization*, *Chapter 5: Fluorescent Protein Based Biosensors To Monitor Cellular Functions At Spatiotemporal Resolution*, *Chapter 6: Smart Nanobiosensors In Pharmaceutical Area: Recent Advances And Future Challenges*, *Chapter 7: Current Trends In Commercial Biosensor Devices*, *Chapter 8: Recent Advances In Wearable Biosensor Applications*, *Chapter 9: Nano/Micro Motors For Sensing*.

Distinguished and well-known Turkish researchers from different Turkish universities and organizations have contributed to this book, and we wish to thank all for their great contribution and cooperation.

An honour is for us to prepare and edit this book; we also thank specially to Prof. Adil Denizli and the rectory of Hacettepe University for their kind invitation to organize this book “***Smart Biosensing Technologies: Past, Present and Future***”.

Arzum Erdem Gürsan, Ph.D
Mustafa Kemal Sezgintürk, Ph.D
Editors

Smart Biosensing Technologies: Past, Present and Future

Edited by Arzum Erdem Gürsan and

Mustafa Kemal Sezgintürk

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Arzum Erdem received Bachelor in Pharmacy from Ege University, Izmir, Turkey in 1993. She received the master degree in 1996 and PhD degree in 2000 in Department of Analytical Chemistry at the same university in Izmir. She worked as an Assistant Professor from 2000 to 2003 and as an Associated Professor from 2003 to 2009 at the Analytical Chemistry Department of the Faculty of Pharmacy in Ege University. She has been working at the same department as a Full Professor since 2009. Prof. Arzum Erdem was awarded by the Turkish Academy of Sciences (TÜBA) as the one of highly skilled young scientists selected in 2001, and she also received "Junior Science Award 2006 of TÜBİTAK " and "The Science Award 2015 of TÜBİTAK" given by The Scientific and Technological Research Council of Turkey (TUBITAK). She was elected as an associate member of TÜBA in 2007, and a principal member of TÜBA in 2016. Prof. Arzum Erdem has authored or co-authored more than 130 papers in refereed journals and conference proceedings, she has given more than 20 invited talks in international meetings and conferences, is the co-author of 9 book chapters and review papers. She has received more than 3300 citations according to Web of Science records with h-index: 34. Prof. Arzum Erdem has initiated many national and international collaborative research on development and applications of electrochemical (bio)sensors based on drug, enzyme and nucleic acids. Her recent research is on the development of novel transducers and chemical and biological recognition systems by using different nanomaterials (e.g. graphenes, magnetic nanoparticles, carbon nanotubes, gold and silver nanoparticles, dendrimers, nanowires, nanorods etc.) designed for electrochemical sensing of nucleic acid (DNA, miRNA) hybridization, and also the specific interactions between drug and DNA, or protein and DNA, aptamer-protein and also the development of integrated analytical systems for environmental monitoring, food safety, industry and biomedical monitoring.

Mustafa Kemal Sezgintürk is a Professor in the Bioengineering Department at the University of Çanakkale Onsekiz Mart where he has been a faculty member since 2016. Sezgintürk completed his PhD at Biochemistry Department of Ege University in 2007, his M.Sc. at Biochemistry Department of Ege University in 2002 and his undergraduate from Chemistry Department of Ege University in 1998. His research interests lie in the area of biochemistry, biosensors, cancer biomarkers, electrochemical impedance spectroscopy, enzymology, protein purification and characterization. Professor Sezgintürk has 66 publications and his works are referred over 1000 times in refereed journals, in the field of biosensors, and a H Index of 19. He has supervised 5 PhD students and 11 Master dissertations in Turkey. Professor Sezginturk also successfully coordinated several scientific projects such as TÜBİTAK (The Scientific and Technological Research Council of Turkey), BAP (Projects of Scientific Investigation), so on and so forth. In 2016, He has won the Awards for Outstanding Young Scientist (Turkish Academy of Sciences-GEBİP), which is one of the prestigious scientific award.

