

# IFMBE Proceedings

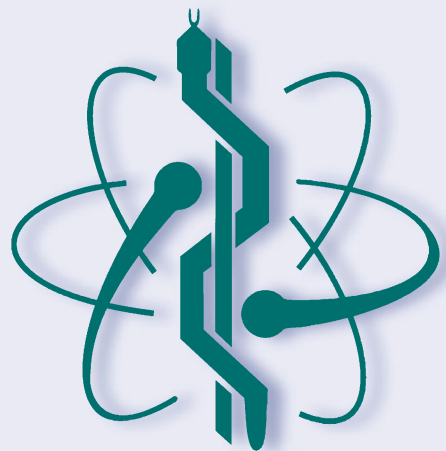
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## Volume 86

# XLV Mexican Conference on Biomedical Engineering

Proceedings of CNIB 2022, 6–8 October,  
Puerto Vallarta, México

 Springer





# **IFMBE Proceedings**

Volume 86

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# Preface

The XLV Mexican Conference on Biomedical Engineering (CNIB2022), organized by the Mexican Society on Biomedical Engineering (SOMIB), was held on October 6–8, 2022, in Puerto Vallarta-México. The main goal of CNIB2022 was to promote the latest scientific, academic, and industrial advances in biomedical engineering and any other fields related to the medical and life sciences. The conference brought together leading researchers, academics, professionals, and representatives from the healthcare industry to discuss the latest trends in research, medical technology, regulation, innovation, needs of the healthcare industry, and potential solutions.

We are proud to present in this book a selection of papers reporting the latest scientific and technological findings in the field of biomedical engineering. The content is divided into twelve chapters according to outstanding scientific research topics on biomedical engineering. The academic high quality of the content has been evaluated by a strict peer review process guided by the scientific committee and academic reviewers. The final acceptance rate was 58%; therefore, the content represents the effort of more than 600 participants including researchers, students, academics, reviewers, and scientific and organization committees. We are sure this book will provide our readers with a deeper insight into the latest contributions to the biomedical engineering field.

Our greatest appreciation to the plenary and scientific sessions speakers, as well as to the representatives from the healthcare industry for making this conference a high-quality recognized event. We would like to thank the scientific committee as well as the organizing committee for their invaluable contribution, hard work, enthusiasm, and optimism along the stage before the conference. Moreover, we would like to thank all the authors, reviewers, and session chairs for their participation and invaluable contribution to the biomedical engineering field. The success of CNIB2022 would not have been possible without all of you.

Rafael Gonzalez-Landaeta  
Co-chair Program CNIB 2022  
Citlalli Jessica Trujillo-Romero  
Chair Program CNIB 2022

# Distinguished Lecturer Message

The roots of medicine lie at the dawn of human experience on Earth and will forever be part of humanity. Dedicated and often gifted people are entrusted by tribe or society with the very special task of counseling people and helping them heal with a combination of empathy and knowledge. Over the millennia, medicine has evolved into a very complex web of activities that is far too diverse to be left to a single physician to master. Biomedical engineering is one of the cross-cutting approaches needed in modern medicine. The profession of biomedical engineering involves much the same vocation as that leading to other medical professions. You are welcome to read the results of research produced for the XLV Mexican Conference on Biomedical Engineering (CNIB2022) that took place in Puerto Vallarta, Jalisco, by Mexican research groups, authors from most Latin America Countries and beyond. The recent COVID-19 pandemic has brought living difficulties, suffering, and death to humanity. But the consequences could have been much worse—e.g., the influenza pandemic at the beginning of the twentieth century—if there had been no science/technology and international cooperation. This congress is precisely about science/technology shared in a big international event, where students and scientists from different countries and from the Mexican states participate in more than 100 activities among lectures, posters and plenary talks.

Given the uncertain and challenging global situation on our planet, the spirit of Puerto Vallarta is related to three aspects: First, what was shared during the Congress is largely the result of collaborative efforts of Mexican, Latin American, and transnational researchers, with the Mexican Society of Biomedical Engineering (SOMIB) as the host organization; second, unlike bellicose behaviors in other regions, the strong determination of Latin America to act along concepts of Democracy and Federalism evolved from original Indian tribal tradition, western philosophy, and religious ethics, to be shared globally; third, the importance of Biomedical Engineering—or medical engineering—which made our species

“Human-technological” rather than just biologically “Homo Sapiens.” As a species, we should be proud to be able to make our life better on Earth, thanks to medical engineering. Enjoy reading the following pages!

Franco Simini  
Distinguished Lecturer CNIB2022

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CNIB 2022 was organized by the Mexican Society of Biomedical Engineering (SOMIB)

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