

**REPORT ON CLAIB 2016, BUCARAMANGA, COLOMBIA**

The VII Latin American Conference on Biomedical Engineering (CLAIB 2016) was held in Bucaramanga, Santander state, Colombia, from October 26 to 28, 2016. This event is held every three years in a Latin American, and this was the first time that CLAIB was brought to Colombia. The professors Isnardo Torres, John Bustamante and Daniel Sierra were the Chair, Co- Chair and scientific director of Publications and Documentation Area in CLAIB 2016



**ISNARDO TORRES**  
Conference Chair



**JOHN BUSTAMANTE**  
Conference Co- Chair



**DANIEL SIERRA**  
Scientific director of Publications



**Figure 1: Conference Directive, Bucaramanga, Colombia, Home of CLAIB 2016**

Isnardo Torres, president of Colombian Association of Biomedical Engineering, Dr. John Bustamante, Director of Bioengineering Center, “Universidad Pontificia Bolivariana” and Dr. Daniel Sierra, Director of Planning and Development, “Universidad Industrial de Santander”. The organization of the VII Latin American Conference on Biomedical Engineering was carried out by the Regional Council of Biomedical Engineering for Latin America – CORAL and it was being organized and summoned by the Colombian Association of Bioengineering and Medical Electronics–ABIOIN at the “Universidad Autonoma “ de Bucaramanga, Colombia”. It was also sponsored by the IFMBE and IEEE-EMBS among other organizations.

The conference organization relied on a Regional Conference Organizing Committee –CORAL – with representatives from Latin American IFMBE member’s societies, and International Scientific Committee of 216 members, and a Local Organizing Committee of 30 members. The directive group of “Universidad Autonoma de Bucaramanga- UNAB” (see figure 2), doctors Gilberto Ramirez, Eulalia Garcia, Wilson Briceño, German Oliveros and Nayibe Chi Cho provided hospitality at the host university and especially the tireless work of the professors Carlos Arismendi and Alejandro Arboleda to achieve the organization of spaces and logistics in the development of the conference in la UNAB. The executive board developments by the engineers and /or doctors Jorge Reynolds, Ignacio Escobar (Committee of Honor -

ABIOIN), Carlos Mesa like economic and financial affairs, Jesus Ma. Soto like academic oversight and scientific activities, Carolina Salazar like coordinator Workshop and Commercial Staff, Delfin Albarracin like coordination of the Green Day, Martha Zequera extra activities Congress Academic Network and Scientific Societies and Nydia Paola Rondón like Scientific Communicator. The valuable collaboration of the student group of UIS and UNAB (see Figure 3) coordinated by the engineer Pedro Albarracin, who made the preparations and aspects related to attending the CLAIB 2016.

The President of CLAIB 2014, Professor de la UNER, Dr. Ariel Braidot of Argentina, participates also Administrative Adviser of This Conference



Figure 2: UNAB, University host of CLAIB 2016



Figure 3: Student support group at CLAIB 2016

The International Scientific Committee evaluated more than 350 scientific papers with three independent reviewers, of which 297 were accepted and of these only 197 were published in the IFMBE proceeding. This conference covered 17 themes:

- 1- Signal Processing Biomedical,
- 2- Biomedical Imaging and Image Processing,
- 3- Biosensors and Bioinstrumentation,
- 4- Technology Bio-Micro-Nano,
- 5- Biomaterials,
- 6- Biomechanics and Bio robotics,
- 7- Neural Rehabilitation Engineering and Bio prosthetic implant
- 8- Cardiovascular Engineering, Pulmonary and Endocrine,
- 9- Molecular Engineering and Cell and Tissue,
- 10- Modelling and Simulation,
- 11- Bioinformatics and Computational Biology,
- 12- Clinical Engineering and Technology Assessment in Health,
- 13- Health Informatics, Health-E (Health and tics),
- 14- Education in Biomedical Engineering,
- 15- Telemedicine, Health Care,
- 16- Medical Physics and Nuclear Medicine,
- 17- Micromechanical Systems – MEMS, Control and Nonlinear Systems

There were also 17 keynotes talks delivered by distinguished international scientists, 1 representative IEEE – EMBS and 6 IFMBE administrative (see figure 4) and 10 members from different societies of countries that are members of CORAL, such as:

- ❖ Andrew Laine, President IEEE/EMBS Professor of Biomedical Engineering, Chair Department of Biomedical Engineering, Columbia University, New York USA.
- ❖ James GOH, President, International Federation of Medical and Biological Engineering (IFMBE), PhD (1982), University of Strathclyde, Glasgow, UK
- ❖ Ratko Magjarević, Past President IFMBE, Faculty of Electrical Engineering and Computing, University of Zagreb, Croatia.
- ❖ Shankar Krishnan, Ph.D. Elected President IFMBE. Professor & Chair. Department of Biomedical Engineering. WIT, Boston, USA.
- ❖ Kang-Ping Lin, Ph.D. Secretary General IFMBE Distinguished Professor, Chung-Yuan Christian University.
- ❖ Marc Nyssen, Treasurer IFMBE, Medische Informatica, Faculteit Geneeskunde en Farmacie Vrije Universiteit Brussel

- ❖ Luis Kun, Editor in Chief - Journal of Health & Technology - Springer - IUPESM - WHO, IFMBE Chairman Global Citizen Safety and Security WG.
- ❖ Renato Garcia – Ex president of CORAL, PhD, Professor, Researcher and Coordinator of the Institute of Biomedical Engineering, Universidad Federal de Santa Catarina.
- ❖ Antonio Hernández, video conference, Founder and member of the Board of Directors of Global Health International Advisors (GHIA). ACCE - U.S.A.
- ❖ Juan Pablo Graffigna- president of SABI- Professor University Nacional de San Juan, Argentina
- ❖ Martha Lucia Zequera. Ph.D. Professor of biomechanics and bioengineering, Universidad Javeriana, Bogotá Colombia
- ❖ Jaime Delgado, Physicist and professor of the new physics, Research FISICA NOVA, Bucaramanga, Colombia
- ❖ Guillermo Avendaño, President of CORAL, Ms. Research Center of biomedical Research, Universidad de Valparaíso, Valparaíso, Chile
- ❖ Ariel Braidot. PhD. Professor bioengineer and Biomechanics Research, Universidad Nacional Entreríos- UNER, Paraná, Argentina
- ❖ John Bustamante, Ph.D. Director and research of Bioengineering Centre, Universidad Pontificia Bolivariana, Medellín, Colombia
- ❖ Miguel Cadena. PhD. Professor-Researcher at the Universidad Autónoma Metropolitana, Iztapalapa Unit (key note presented by Drs. Joaquin Aspiroz and Fabiola Martinez)
- ❖ Jorge Reynolds. Scientific research in Nano cardiac pacemakers, electrophysiology and cardiovascular engineering. The Department of Research in Electronics and Nanotechnology in Shaio Clinical Foundation, Bogotá Colombia



**FIGURE 4. Members IFMBE administrative Professors James Goh(president), Kan- Ping Lin (secretary), Engineer Alejandro Arboleda UNAB, Marc Nyssen(Treasurer), Shankar Krishnan (Elected President) and Ratko Magjarević (Past President)**

The CLAIB 2016 program also included 7 courses pre-congress such as:

1. Microscopy image processing by Drs. Virginia Ballarin and Juan Pastore,
2. Prospects of engineering and technology biomedical rehabilitation of disability. Engineers Mario Aguilar, Rafael Kohanoff,
3. Nanotechnology in Bioengineering by Professors Lina Marcela Hoyos and others
4. Analysis of Potential Micro ECG Cardiac Logs High Resolution by professor Eric Leber Laciár
5. Applications of Clinical Biomechanics and Sport by Dr. Ariel Braidot
6. Curriculum design in Biomedical Engineering by Dr. Joaquin Aspiroz
7. Clinical Applications of bio impedance by Franco Simini

The UNAB organized a meeting between Latin American experience in the biomedical technologies and Engineering; the professors Rafael Kohanoff, Franco Simini and Ariel Braidot shared with the future biomedical engineers of the UNAB - CLAIB 2016, Host University, Bucaramanga, Colombia see figures 5, 6





**FIGURE 5: Prospects of Engineering and Technology Biomedical Rehabilitation of Disability.**



**FIGURE 6: The professors Rafael Kohanoff, Franco Simini and Ariel Braidot shared with the future biomedical engineers of the UNAB - CLAIB 2016, Host University, Bucaramanga, Colombia**

The WORKSHOPS were held on October 26, 2016 within the framework of the congress, such as:

- Engineering workshops Hospital and/or Clinic at INTERNATIONAL FOSCAL (see figure 7) and INTERNATIONAL HOSPITAL OF COLOMBIA, both of them Metropolitan area of Bucaramanga.
- Workshop of social projection of the disability's technology, with the participation of Professor James GOH, President, IFMBE and Jean Marc Van Hissenhoven, chief scientist Mobility Group "High technology and rehabilitation."
- Workshop over Education in Bioengineering and Biomedical Engineering organized by Universidad EIA - CES at UNAB, Bucaramanga, Colombia.
- Workshop on Innovation and Business Development Organized by the Medellin Metropolitan Institute (ITM), led by medical equipment companies at UNAB, Bucaramanga

The international relation was an activity important made by Dra. Martha Zequera, see figure 8. The IFMBE administrative committee in plenary and the IEEE-EMBS world president as the massive assistance of all the presidents of the national societies was a unanimous response to support the most important CORAL event in Latin America.



Some pioneers of the biomedical engineering of Colombia, Uruguay, Cuba and Argentina shared with the actual and new generations of biomedical engineering in CLAIB 2016(See figure 9). The honorary members of the organizing committee were always supporting us with their wonderful experiences (See figure 10).



FIGURE 7. Work shop group at FOSCAL INTERNATIONAL at Bucaramanga, Colombia



Figure 8. Doctors Martha Zequera, Marc Nyssen, Ratko Magjarević, James Goh and Shankar Krishnan interrelating themes of biomedical engineering with social projection



FIGURE 9. Some pioneers of bioengineering and biomedical engineering in Latin American with the new generation





**FIGURE 10. Drs. Jorge Reynold Pombo and Ignacio Escobar, members of honor of ABIOIN sharing their experiences with Dr. John Bustamante, Engineer Alejandro Arboleda and another assistant to CLAIB 2016**

With representative from Latin American IFMBE member societies, during this conference several IFMBE and CORAL meetings took place (see figures 11, 12)



**FIGURE 11. CORAL DIRECTIVE MEETING, Professors Eric Laciari (Vice president), Guillermo M Avendaño (President), Ernesto Rodriguez Dennis (Secretary), Isnardo Torres (treasurer, absent)**



**FIGURE 12: CORAL MEMBER from Latin-American's societies different and delegates IFMBE**

The opening ceremony was held Auditorium Carlos Gómez Albarracin of “Universidad Autonoma de Bucaramanga” see figure 13, 14, 15, 16, 17



**FIGURE 13 Opening Ceremony. James Goh (IFMBE president), Andrew Laine(President IEEE/EMBS) Isnardo Torres( president CLAIB 2016), German Oliveros(Biomedical engineering Director, UNAB)**



**FIGURE 14. Opening remarks by . James Goh, IFMBE**



**FIGURE 15. Andrei Laine opens ceremony for IEEE**



**FIGURE 16. Words of welcome by Isnardo Torres**



**FIGURE 17. German Oliveros- UNAB invites CLAIB 2016 attendees to feel at home**

The opening Ceremony was followed by a plenary Lectures by professor Andrew Laine and Luis Kun. In the evening, the universities UNAB and UIS presented a beautiful cultural activity of singing and dancing of the folklore of the region de Santander and Colombia with some Latin American melodies (see figures 18-19)





FIGURE 18. Group of song and dance of the UNAB



FIGURE 19. Tuna of the UIS

A numbers of companies and firms displayed their products and exchanges views with the participants, such as Materialize, Medinistros, Advanced Instruments, Set & Gad, FOSCAL INTERNATIONAL

Over 493 delegates participate in the conference with representation of persons from all countries of America Latina, some the USA, Spain, Croatia, Singapore, Taiwan, Portugal, Poland, Holland between others. CLAIB 2016 was an event characterized by the low cost of registration (us \$ 118 dollars’ average), internal transportation support for all scheduled activities, welfare for the attendees and an excellent presentation of recreational and cultural activities. With a social function represented approximately in a 100 scholarships for the collaborators of this great event. There were also some free costs of accommodation, stays and national and international air transportation for some professors. The technical program was structures into 7 plenaries and 10 semi-plenary conferences, 16 oral sessions and 6 poster sessions/2 PER DAY / 20 articles (see figure 20): The oral sections were carried out in two major auditoriums, one smaller and 5 special rooms equipped with appropriate technology and almost the whole of the event house (all the infrastructure of the host University - UNAB). The pre-congress courses were developed at several universities in the metropolitan area of Bucaramanga such as UIS, UPB, UNAB and the clinical and hospital engineering workshops at FOSCAL-INTERNACIONAL and HIC-Hospital International of Colombia.



FIGURE 20. Poster sections. Mayor auditory UNAB

CLAIB 2016 also included a Young Investigator with 10 best works presented by students were preselected. This selection were based on the evaluation performed by the reviewers (review to accept works to CLAIB 2016 performed by two or three independent reviewers) and the evaluation of the presentation given by the Room President or the Posters Evaluation Panel. For this valuation, works presented in oral or poster format will be considered in similar way: 60% Reviewers valuation (E1) and 40% Room President valuation (E2). The reviewers valuation was in a scale from 1 to 10 and given that the accepted works have a valuation on scale from 0 to 3.0, based on EasyChair, then a normalization process was made, ordering all the works by the Final Evaluation in descendent order, therefore the 10 best works presented by students were selected and mentioned in the Final Results Act. From this list of the 10 best works by students, ordered in descendent way by Efinal, the best work in each category (Bachelor, Masters, Doctoral) were selected to assign the Best Young Investigator Award. From a total of 370 works received and reviewed, CLAIB 2016 accepted 285 works given their quality, pertinence with the topics of the congress and fulfillment of normativity. 190 of these works written in English were send to Springer-Verlag for publication.



The 190 works written in English and send to Springer-Verlag were evaluated following the previuos protocol. The winners of the Best Young Investigator Award, considering each one of the academic categories for the student leader are :

Authors	Tittle of the Work	Category	Country
<i>Diana Carolina Castaño, Jeanneth Mosquera-Rendón, Mauricio Corredor</i>	Structural and functional genomics analysis of methyltransferase genes and networks associate to understand an bio-resistance inside the pangenome of Pseudomonas aeruginosa	Bachelor	Colombia
<i>N. Alemán-García, A. Pérez-García, J. Sánchez-Melecio, F. Silva-Aguilera, E. Gutiérrez-Herrera, M.R. Ortiz-Posadas, J. Hernández-Ruiz, D. Kershenobich, C. Sánchez-Pérez</i>	Fibrosis evaluation of animal liver tissue by thermal conduction	Masters	México
<i>L Schiafino, A Rosado Muñoz, J Francés Villora, M Bataller, A Gutiérrez, I Martínez Torres, V Teruel-Martí, J Guerrero Martínez</i>	Feature selection for KNN classifier to improve accurate detection of subthalamic nucleus during deep brain stimulation surgery in Parkinson's patients	Doctoral	Argentina

In the Thursday night there were a culture dinner at Girón, Santander, Colombia. A cultural evening there where ideas and projects of academic and social field and future plans of biomedical engineering for Latin America along with taste a rich food to the music of the region and a dance presentation of a tango studio. See figure 21, 22



FIGURE 21 The mind relaxation time after the arduous works of the IFMBE and CORAL, Restaurant “La Casona”, Girón Santander

At the same time several groups were walking in this beautiful colonial town of more than 500 years of history with musical bands and presentation of the national folklore tasting the delicious fritting’s and juices of this part of Colombia- See figure 23



FIGURE 22. The excellent presentation of the tango that integrates Uruguay, Argentina and Colombian and the memory of the famous chapel Las Nieves de Girón



FIGURE 23. A night of culture, tourism, joy tasting the cocktails of mandarin and frintanga to the rhythm of music and dance in this colonial town of Giron

The professor Andrew Laine, president of the IEEE-EMBS with other academic experts organized a panel under the direction of Martha Zequera and Alejandro Arboleda to project the support of this organization to the development of biomedical engineering in Latin America (see figure 24)



FIGURE 24. Student, Drs. Andrei Laine and Martha Zequera Panel IEEE-EMBS

There were a IFMBE- Industry working Group Symposium at the CLAIB 2016 on October 28 at room Venezuela HOSTAL- UNAB. The thematic was oriented to successful cases of research, Innovation and transfer technology to promote a link between the scientific community, industry and health services providers, with assistant od professors Piotr Ladyzynski from Poland, Martha Zequera from Colombia, Carlos Mesa by HIC- International Hospital, Paulo Carvalho from Portugal, Ratko Magjarevic from Croatia and another representative of companies of Biomedical instruments like also delegates of social protection ministry. See figure 25.





FIGURE 25. IFMBE – Industry working group Symposium at the CLAIB 2016

The closing ceremony was preceded by a keynote lecture by professor Kang-Ping Lin, secretary General IFMBE, afterwards we moved to the "CERRO EL SANTISIMO" where the awards ceremony and closing ceremony took place, see figures 26, 27



FIGURE 26: Members of the evaluation committee, Presidente of CORAL, IFMBE keynotes professors and the 8 finalists for awards to the best researcher of undergraduate, masters and doctorate

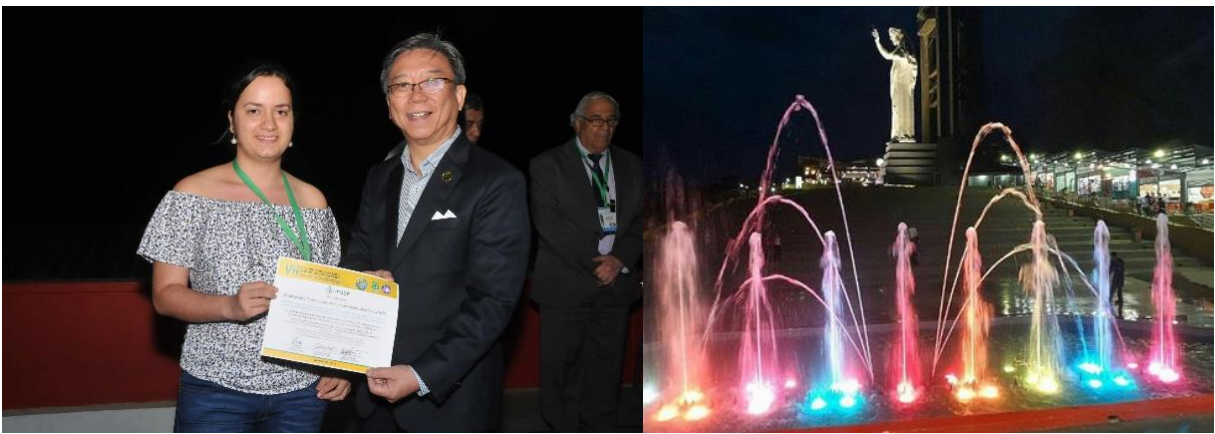


FIGURE 27. Closing Ceremony on the hill the "SANTISIMO" at Floridablanca, Santander. Professor James Goh in the Award ceremony. Professor Guillermo Avendaño, CORAL President. Water dance on the hill the "Santisimo"

After to next day to the closing ceremony some delegates went on ecological day in the famous great canyon of CHICAMOCHA, 100 km to the south of Bucaramanga. See figure 28





FIGURE 28. The CORAL and IFMBE congresses ready to travel to the great canyon of Chicamocha. Profesors Hadat, Pastore, Ballarin, Grafiña, Braidot from Argentina, Professor Daniel Sierra and UIS students

*TO REMEMBER*



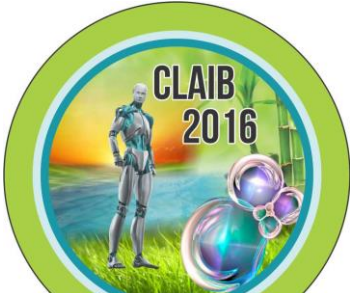
GIRON, Santander, Colombia, Cultural heritage of Humanity, profesores Ariel Braidot and Ratko Magjarević, great leaders and orientators of CLAIB 2016



Our restaurant El Gallineral, San Gil, Santander, Colombia where we had lunch in the ecological day and our beautiful waterfall of "Juan Curi" where some the members of CORAL and IFMBE take a comfortable bathroom and natural jacusses.



We wish many successes to CLAIB 2019 to be held in Viña del Mar, Chile. That CLAIBs are always the guiding principle of biomedical engineering in Latin America.



The following table of honor or mosaic of the people who made possible the organization and regional leadership, national, in Latin America and the world



