



Editorial for ‘Issue focus on 2nd Costa Rica biophysics symposium — March 11th–12th, 2021’

Gustavo Chaves¹ · José Ángel Rodríguez-Corrales² · Christopher Solís³

Received: 29 November 2021 / Accepted: 16 March 2022 / Published online: 19 April 2022
© Society for Reproductive Investigation 2022

Abstract

This Editorial describes both the motivation for, and the five articles appearing in, the Issue Focus dedicated to the 2nd Costa Rica Biophysics Symposium which was held in March 2021. Some recent history about both the symposium and developments in science occurring within Costa Rica is described.

The Costa Rica Biophysics Symposium was conceived as a forum for faculty, scholars and students interested on cutting-edge topics in biophysics and related fields. Following the success of the first event organized in 2019 (Solís et al (2020), the second edition of the symposium took place on March 2021 with the support of the Academia Nacional de Ciencias de Costa Rica (ANC, National Academy of Sciences of Costa Rica), the International Union of Pure and Applied Biophysics (IUPAB), the German Society of Biophysics (DGfB), and the Universidad Nacional of Costa Rica (UNA). The symposium aimed to reinforce and enhance the novel network of investigators established in the 2019 event. Participation of Costa Rican presenters, either located in the country or abroad, and foreign scientists from the USA, Germany, France, and Switzerland (Solís et al. (2021a) translated into an expansion and internationalization of the previous network. Moreover, the symposium attracted a broad international audience, which increases the opportunities of further international collaboration.

The meeting was organized into 14 presentations and one keynote lecture. It was attended by researchers of the three main universities of Costa Rica: Universidad Nacional (UNA), Universidad de Costa Rica (UCR) and Tecnológico de Costa Rica (TEC). Presenters from international universities were also present, including UT Southwestern Medical Center, USA; Klinikum Nürnberg Medical School, Germany; École Polytechnique Fédérale de Lausanne, Switzerland; Institut de Neurosciences de Montpellier, France; University of California Berkeley, USA; and The University of Chicago, USA. The topics presented in the symposium were diverse and covered cutting-edge biophysical research areas. The presentations ranged from channel electrophysiology, machine learning focused on cellular microscopy, prediction of protein–protein interactions, channelopathies and novel biophysical techniques, among others (Solís et al., 2021a). Furthermore, each lecture was followed by questions from the audience, allowing discussion, engagement and interaction between researchers in spite of the limitations of a virtual symposium.

The closing event for the symposium was a lecture by the world-renowned biophysicist Francisco Bezanilla from the University of Chicago, who engaged the audience into a master presentation of his vast research on protein voltage-sensor domains (VSD) with a focus on his recent work on the non-canonical mechanisms for VSD-mediated regulation of pore domains in voltage-gated potassium channels (Carvalho-de-Souza and Bezanilla 2019). After the consequent discussion, the symposium finished with a networking activity, where audience and presenters were able to socialize and share experiences.

✉ Christopher Solís
csolisoc@uic.edu

¹ Center of Physiology, Pathophysiology and Biophysics, Klinikum Nürnberg Medical School–PMU Nürnberg, Nuremberg, Bavaria, Germany
² Escuela de Química, Universidad Nacional, Heredia, Costa Rica
³ Department of Physiology and Biophysics, College of Medicine, The University of Illinois at Chicago, Chicago, IL, USA

Organization under the COVID-19 pandemic emergency: challenges and opportunities

Originally thought as an *in-person* meeting, the COVID-19 pandemic emergency forced the symposium to be conducted using a virtual platform.

Online conferences and related activities face several challenges. Lack of personal interaction is undoubtedly a key component missing in virtual settings. Other associated drawbacks, such as “Zoom fatigue”, time-zone differences and technical issues with digital platforms might also impact negatively and should be accounted for when planning (Remmel 2021). Nevertheless, virtual conferences present opportunities that are appreciated by attendees. For example, a survey by *Nature* showed that 74% of respondents considered that virtual conferences should continue after the COVID-19 pandemic (Remmel 2021). Positive aspects of this format include cost reduction (e.g. travelling, registration fees and logistics), decreased carbon footprint associated to travel (Remmel 2021; Wu et al 2022) and increased audience size, diversity and inclusion (Wu et al 2022).

In this regard, the Second Costa Rica Biophysics Symposium followed the trend. According to the registration platform, the event had near 136 registrations from 11 different countries and four different continents, representing an increment of 60% in the number of registered participants in comparison with the first *in-person* conference, which only hosted Costa Rican attendees. Furthermore, the second symposium increased the number of expositors from 8 to 15. Failures with the digital platform were not observed, and the selected time schedule allowed the participation of presenters and audience from America (GMT – 8 to GMT – 5) and Europe (GMT 0 to GMT + 2) without issues. The “Zoom fatigue” was lessened by programming breaks in-between sessions, while minimizing session’s length. Despite the reduced personal interaction, the networking activity at the end of the symposium helped the participants to circumvent partially this important drawback.

As organizers, we consider that the Second Costa Rica Biophysics Symposium was successful. The virtual mode enhanced internationalization and increased participation of presenters and attendees, while avoiding exposure to SARS-CoV-2. Further *on-line* or hybrid *on-line/in-person* modalities will be considered in the organization of further editions.

Current issue focus

The current issue focus shows a selection of three *reviews* and a *career commentary* of some of the speakers who participated in the Second Costa Rica Biophysics Symposium

based on a prior announcement in this journal (Solís et al., 2021b). It collects a sample of the research presented by early career and senior scientists, investigating either in Costa Rica or abroad. The reviews show the state-of-art of investigations in optocapacitance, machine-learning focused on microscopy and single-cell models for epileptic disorders. A career commentary exposed by a Costa Rican scientist uncovers the opportunities and challenges of investigating biophysics in Costa Rica, which might be shared with other developing countries. We hope that these topics will be of the interest of the readers of *Biophysical Reviews*.

In the review “Invertebrate neurons as a simple model to study the hyperexcitable state of epileptic disorders in single cells, monosynaptic connections, and polysynaptic circuits”, Brenes, a researcher and Associate Professor at UCR, describes the use of *Helix* land snail neurons as single-cell models for epilepsy (Brenes 2022). The review discusses the harvest, subtypes, and properties of isolated neurons that make them a suitable model for *in vitro* studies. Furthermore, the author provides a description of the experimental conditions required for cellular excitability, outgrowth, and synaptogenesis. The article finishes with an overview of key uses of the model in the evaluation of potential drugs and the extrapolation of *in vitro* into *in vivo* activity.

The review “Optocapacitance: Physical basis and its application” by Pinto et al. describes the details and possible applications of a novel technique called optocapacitance (Carvalho-de-Souza et al 2018; Pinto et al 2022). The technique is based on light-induced capacitive currents provoked by associated temperature jumps (Pinto et al 2021). Thus, light stimulus can be effectively used to depolarize the cell membrane and, consequently, to generate an action potential. By means of nanoparticles, optocapacitance can be used for remote stimulation of neurons *in vivo* without the need for genetic manipulations. The authors describe, in a detailed manner, the physical basis of the technique, the advantages and disadvantages over similar technologies and the challenges for its potential *in vivo* application.

In the review presented by Acuña-Rodríguez et al. entitled “Live-cell fluorescence spectral imaging as a data science challenge”, the authors provide a description of the fluorescence microscopy and image analysis challenges that arise from imaging live cells containing multiple fluorescent markers (Acuña-Rodríguez et al 2022). The authors describe with detail the principles and limitations of fluorescence spectral imaging. Suggestions are provided on how to “unmix” multichannel fluorescence images to resolve the individual contribution of multiple fluorophores to individual imaging channels. An outlook is provided on how novel approaches, such as deep learning, will expedite spectral unmixing and

the use of other techniques e.g. fluorescence lifetime imaging (FLIM), to provide an additional layer of information for visualizing the progress of cellular signalling pathways in real time.

In the commentary “Solid-state NMR and hyperpolarization methods for the Research, Development, and Innovation in Costa Rican science”, Céspedes-Camacho and Matysik delve into the brief history of solid-state NMR in this developing nation and highlight the importance of inter- and multidisciplinary collaborations for the generation of new knowledge (Céspedes-Camacho and Matysik, 2022). Starting with a description of the limited instrument availability in Costa Rican and Central America, the authors discuss the importance of solid-state NMR and the integration of hyperpolarization, for different applications relevant to the region. Finally, key research accomplishments in the topic are presented.

Acknowledgements We would like to thank all speakers and participants of the Second Costa Rica Biophysics Symposium for their collaboration and engagement in the activity. Special thanks to Prof. Francisco Bezanilla for accepting our invitation to collaborate as main speaker.

To the Editor-in-Chief of Biophysical Reviews, Damien Hall, for his support during the editing process and to give us, as early career scientists and organizers, the opportunity to serve as guest editors.

To the Academia Nacional de Ciencias de Costa Rica (ANC, Costa Rica), the Universidad Nacional (UNA, Costa Rica), the International Union of Pure and Applied Biophysics (IUPAB) and the German Biophysical Society (Deutsche Gesellschaft für Biophysik e.V., DGfB, Germany) for sponsoring and promoting the symposium. We also thank to the Biophysical Society (USA) and the Universidad de Costa Rica (UCR, Costa Rica) for advertising.

We also would like to acknowledge the participation of Francisco Alvarado (University of Wisconsin, USA) as part of the organizing committee.

No humans or animals were harmed during the writing of this article.

Declarations

Conflict of interest The authors declare no competing interests.

References

- Acuña-Rodríguez JP, Mena-Vega JP, Argüello-Miranda O (2022) Live-cell fluorescence spectral imaging as a data science challenge. *Biophys Rev* 14(2). <https://doi.org/10.1007/s12551-022-00941-x>
- Brenes O (2022) Invertebrate neurons as a simple model to study the hyperexcitable state of epileptic disorders in single cells, mono-synaptic connections, and polysynaptic circuits. *Biophys Rev* 14(2). <https://doi.org/10.1007/s12551-022-00942-w>
- Carvalho-de-Souza JL, Pinto BI, Pepperberg DR, Bezanilla F (2018) Optocapacitive generation of action potentials by microsecond

laser pulses of nanojoule energy. *Biophys J* 114(2):283–288. <https://doi.org/10.1016/j.bpj.2017.11.018>

- Carvalho-de-Souza JL, Bezanilla F (2019) Noncanonical mechanism of voltage sensor coupling to pore revealed by tandem dimers of Shaker. *Nat Commun* 10(1):3584. <https://doi.org/10.1038/s41467-019-11545-7>
- Céspedes-Camacho IF, Matysik J (2022) Solid-state NMR and hyperpolarization methods for the research, development, and innovation in Costa Rican science. *Biophys Rev* 14(2). <https://doi.org/10.1007/s12551-022-00946-6>
- Pinto B, Bassetto CAZ, Latorre R, Bezanilla F (2021) Measuring temperature time course using membrane capacitance. *Biophys J* 120:240a. <https://doi.org/10.1016/j.bpj.2020.11.1579>
- Pinto BI, Bassetto CAZ, Bezanilla F (2022) Optocapacitance: physical basis and its application. *Biophys Rev* 14(2). <https://doi.org/10.1007/s12551-022-00943-9>
- Rommel A (2021) Scientists want virtual meetings to stay after the COVID pandemic. *Nature* 591:185–186. <https://doi.org/10.1038/d41586-021-00513-1>
- Solís C, Rodríguez-Corrales JÁ, Alvarado FJ (2020) Lessons learned from organizing a biophysics symposium in a developing country. *Biophysicist* 1(2):2. <https://doi.org/10.35459/tbp.2019.000144>
- Solís C, Chaves G, Rodríguez-Corrales JÁ, Alvarado FJ (2021a) Costa Rican biophysics symposium – program. <https://crbiophysics.wordpress.com/programa/>. Accessed 19 March 2022
- Solís C, Chaves G, Rodríguez-Corrales JÁ (2021b) Announcing the call for the Issue Focus on the 2nd Costa Rican Biophysics Symposium-virtual meeting, March 2021. *Biophysical reviews* 13(4):487–488. <https://doi.org/10.1007/s12551-021-00816-7>
- Wu J, Rajesh A, Huang YN et al (2022) Virtual meetings promise to eliminate geographical and administrative barriers and increase accessibility, diversity and inclusivity. *Nat Biotechnol* 40:133–137. <https://doi.org/10.1038/s41587-021-01176-z>



Gustavo Chaves, Ph.D., works as staff scientist in the laboratory of Boris Musset at Center of Physiology, Pathophysiology and Biophysics, Klinikum Nürnberg Medical School – PMU, Nuremberg. He has a Lic. degree in Industrial Chemistry at Universidad Nacional de Costa Rica (UNA) and a M.Sc. degree in Biotechnological Engineering at BarcelonaTECH - Polytechnic University of Catalonia (UPC), Barcelona, Spain. He completed a doctoral degree (Dr.rer.nat.) in Biophysics under mentorship of Christoph Fahlke at Institute of Complex Systems - Cellular Biophysics, Helmholtz Forschungszentrum Jülich, Germany. His investigations focus on structural determinants and biophysical properties of voltage-gated proton channels, HV1. He is an active member of the Biophysical Society (USA), the German Biophysical Society (DGfB), Austrian Physiological Society (APS), the German Young Physiologists (Board member) and the Society for Latinoamerican Biophysicists (SOBLA). He joined the organizing committee of the Costa Rica Biophysics Symposium in 2020.



José Ángel Rodríguez Corrales, Ph.D., is an Assistant Professor at Universidad Nacional de Costa Rica. He obtained a B.Sc. in Industrial Chemistry at Universidad Nacional de Costa Rica and a Ph.D. in Chemistry at Virginia Tech (USA) with Brenda Winkel and Jatinder Josan. His research involves the development and miniaturization of spectrophotometric and electrochemical methods to evaluate biological activity in model systems, such as biomolecules and cell lines. He also man-

ages a laboratory that specializes in industry outreach, including biomedical, food and chemical companies, among others. Furthermore, he serves as Undergraduate Program Coordinator for Industrial Chemistry and develops green chemistry experiments for the analytical and general chemistry curriculum.



Christopher Solís, Ph.D., is a post-doctoral researcher at the University of Illinois at Chicago (UIC) in the College of Medicine working in the laboratory of Dr. Brenda Russell. Before his current appointment, Dr. Solís earned a Ph.D. in Biochemistry at South Dakota State University with Dr. John Robinson and Dr. Adam Hoppe. He obtained a B.Sc. in Industrial Chemistry at Universidad Nacional de Costa Rica. His research is centered in understanding how mechanical forces control the assembly of the cytoskeleton in cardiac muscle cells and how cells can read these mechanical signals.

Past research work has been devoted to understanding the biophysics of cardiac thin filament activation and assembly in response to calcium and myosin. In addition to research, Dr. Solís has supported early career scientists by being appointed President of the UIC Postdoctoral Association during the 2020–2021 period and by being selected to be part of the Early Career Committee of the Cardiac Muscle Society. Dr. Solís has supported efforts in science communication and outreach by co-funding the Costa Rica Biophysics Symposium in 2019.