Essraa A. Hussein Khalil

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EDUCATION

University of Cincinnati, Cincinnati, OH *2019 - 2023*
Ph.D. in Chemistry, Fall 2023
Thesis Advisor: Prof. Ryan J. White

Qatar University, Doha, Qatar *2016 - 2018*
M.Sc. in Materials Science and Technology

Beni-Suef University, Beni-Suef, Egypt *2010 - 2015*
M.Sc. in Analytical Chemistry- College of Pharmacy

Beni-Suef University, Beni-Suef, Egypt *2004 - 2009*
B.Sc. in Pharmaceutical Sciences- College of Pharmacy

RESEARCH INTERESTS AND EXPERIENCES

Texas A&M University/ Chemistry Department *July 2025- present*

Postdoctoral research associate with Prof. Lane Baker

"Pressure-regulated scanning ion conductance microscopy to probe the mechanical properties at cellular interfaces"

- Use of nanoscale imaging based on pressure regulated scanning ion conductance microscopy to perform noncontact measurement of local membrane stiffness at special scales on the order of 100 nm.
- Study the effect of chemical treatment on the deformability and stiffness of red blood cells (RBCs).
- Determination of a single cell pharmacodynamic property of RBCs from people with multiple sclerosis and controls.

"Investigation of protein-lipid interactions and the role of ions on their modulation using electrophysiological measurement"

- Employ patch clamp technique to study potassium-selective ion channels and their mutants.
- Develop a method for incorporating ion channels into artificial lipid membranes to study the effect of different membrane composition on ion channels activity under different conditions.
- Assess the effect of different lipid environments on the activity of biologically relevant mechanosensitive ion channels.

- Mentoring two graduate students, collaborating with other project teams at Texas A&M and Michigan State University, and helping with scanning probe instrumentation.

University of Tennessee, Knoxville/ Mechanical, Aerospace and Biomedical Engineering (MABE) Department: *Oct 2023- June 2025*

Postdoctoral research associate with Prof. Andy Sarles

"Hybrid biomolecular synapses for multifunctional sensing and neuromorphic computing at the edge of biology"

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- Designed hybrid biomolecular synapses, capable of selective ionic and biochemical sensing, and memory retention to function as neuromorphic devices.
- Developed a hybrid organic electrochemical transistor (OECT)-biomembrane interface for effective transduction and membrane stability.
- Experimentally characterized OECT-membrane interface using electrochemical techniques such as EIS as well as electrophysiology measurement.
- Assessed integration, activity, and functionality of transmembrane proteins, ion channels, and selective ionophores in the hybrid OECT-membrane platform.
- Trained at Center for Nanophase Materials Sciences (CNMS), Oak Ridge National Laboratory (as a one-year CNMS user, training on Nanoscribe 3D Direct-Write System, Parylene coating, and SEM).
- Worked in collaboration with other project teams at Northwestern University and University of California, Los Angeles.
- Guest lecturing in Bio-transport processes (Biomedical Engineering, BME 511 graduate course).
- Mentored two students (graduate and undergraduate) and helped with proposals development.

University of Cincinnati/ Department of Chemistry: *Aug 2019 - Oct 2023*

Graduate assistant (Ph.D.) with Prof. Ryan White

"Development of nanoscale ion channel probes, well-suited for translatable use in a broad range of analytical applications and dynamic measurements with high spatial resolution"

- Fabricated metal nanoneedles (Au & Ag) to support lipid bilayer and ion channel recordings and employed these probes for nanopore sensing.
- Investigated the effect of different probe materials and geometries to develop ion channel probe suitable for long-term measurements and applications.
- Developed current feedback mechanism to control the protein insertion and maintain single channel recordings.
- Investigated the effect of different phospholipids on the resulted lipid membrane characteristics and how this would affect the application of metal nanoneedles.
- Utilized electrophoretic deposition to silver nanoneedles to optimize the probe geometry.
- Trained in Fluorescence microscopy and Astrocytes cell culture.
- Experienced in; electrochemical techniques such as voltammetry, potentiometry and electrical measurements such as electrophysiology and capacitance measurements.
- Experienced in electrochemical etching as well as fabrication and characterization of nanoelectrodes, mainly Au &Ag.

Qatar University/ Materials Science and Technology *Sept 2016 - Aug 2019*

Graduate research assistant (M.Sc.) with Prof. Ahmed Elzatahry

"Bio-nanotechnology: design & development of nanomaterials for biomedical applications"

- Experienced in the synthesis and characterization of 2D metal carbide materials (MXenes), gold nanoparticles, and magnetic nanoparticles for cancer photothermal therapy applications.

- Designed new MXenes composites with Au and magnetic nanoparticles and investigated its toxic effects in areas such as embryonic cytotoxicity, angiogenesis, besides its activity as laser-based antitumor therapy when applied to human breast cancer cells.
- Helped to develop a method to study the effect of physiological flow-induced shear stress in nanomaterial uptake by cells.
- Synthesis of MXene/Chitosan composites for environmental applications
- Participating (as a research assistant) in a Collaborative project (GCC-2017-001) between Qatar University and Fudan University, China.

Beni-Suef University/ Department of Analytical Chemistry/ College of Pharmacy

May 2010 - Aug 2016

Graduate assistant (M.Sc.) with Prof. Hala Zaazaa (Cairo Univ) and Prof. Ibrahim Naguib (Beni-Suef Univ)

"Instrumental Analysis of pharmaceuticals and related substances in their drug mixtures"

- Developed analytical methods to selectively detect pharmaceutical compounds and impurities with high accuracy and precision using different instrumental analysis techniques such as UV/vis, HPLC, TLC-densitometry, LC-MS.
- Data processing and analysis using chemometric techniques such as multivariate calibration, partial least square (PLS), linear support vector regression (SVR), and principal component analysis (PCA) models.

RELATED PROFESSIONAL EXPERIENCE AND CONTRIBUTIONS

- Teaching General Chemistry labs & recitations at University of Cincinnati and Analytical Chemistry labs and recitations at College of Pharmacy, Beni-Suef University, Egypt.
- Mentoring three undergraduate students (Kelly Klein and Brittany Rice), White research lab at UC, and (Sai Rangoon), Sarles research group at UTK in addition to three graduate students (Beliz Utebay from NWU), Sarles research group at UTK, and (Sohini Dawn and Aswathi Sahadevan), Baker group at TAMU.
- Participating in writing grant proposals (with Dr. Ryan White) for NSF and NIH R21 grants.
- Advanced Understanding in; ion channels, electrochemical techniques, analytical chemistry, surface characterization techniques such as SEM, TEM, XPS, and XRD.
- Experience in Python, Matlab, LabVIEW, BioRender, Origin, and Microsoft office.
- Extensive leadership and team building skills gained through mentoring undergraduates and graduate students, assisting new graduate students with fellowship proposal writing and professional development, collaborations and participating in the Society for Electroanalytical Chemistry (SEAC) student session v3, 2023.
- Well-developed science communication skills through presentations, posters, and reports/proposals.

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MENTORSHIP/ LEADERSHIP EXPERIENCE

Postdoc Mentor to Sohini Dawn and Aswathi Sahadevan	*2025- present*
Postdoc Mentor to Beliz Utebay and Sai Rangoon	*2024-2025*
Graduate Student Safety Leader	*2021- 2023*
BioRender Ambassador	*2022- 2024*
Graduate Mentor with Chemistry Graduate School Association	*2022*
Graduate Mentor to Kelly Klein and Brittany Rice, Undergraduate Researchers	*2020-2022*

ACADEMIC HONORS AND AWARDS

- Outstanding Future Faculty Promise Award, University of Tennessee, Knoxville. ***Spring 2025***
- Schubert Fellowship Award, Department of Chemistry, University of Cincinnati. ***Fall 2022***
- Midwestern University Analytical Chemistry Conference (MUACC) Poster Award ***Fall 2022***
- University Research Council (URC) Graduate Student Stipend and Research Cost Program for Faculty—Student Collaboration Awardee, University of Cincinnati. ***Summer 2021***
- Graduate Assistant Scholarship (GAS) and University Graduate Assistantship (UGA), Chemistry Department, University of Cincinnati. ***Aug 2019- Oct 2023***
- Orchin Milton Research Associates Award, University of Cincinnati. ***Aug 2019- July 2021***
- Qatar University, Materials Science and Technology Master Program, Research/Teaching Assistantship. ***Sept 2016 –Aug 2018***
- Beni-Suef University, College of Pharmacy, Analytical Chemistry Department, Research/Teaching Assistantship. ***April 2010–Dec 2015***

CONFERENCE PRESENTATIONS

• Essraa A. Hussein and Ryan J. White, Maintaining Single-Channel Recordings on a Silver Nanoneedle Through Probe Design and Feedback Tip Positioning Control, **Pittcon** - Philadelphia 3/2023, Oral presentation.

• Essraa A. Hussein and Ryan J. White, Silver Nanoneedle Ion Channel Probe to Maintain Single-Channel Recordings: Probe Design and Tip Positioning Control, **MUACC** - Cincinnati 10/2022, Poster.

• Essraa A. Hussein and Ryan J. White, Silver Nanoneedle Ion Channel Probe to Maintain Single-Channel Recordings: Probe Design and Tip Positioning Control, **Oesper** Symposium – Cincinnati 10/2022, Poster.

• Essraa A. Hussein and Ryan J. White, Silver Nanoneedle Ion Channel Probe to Maintain Single-Channel Recordings: Probe Design and Tip Positioning Control, **ACS Fall**- Chicago 8/2022, Oral.

• Essraa A. Hussein and Ryan J. White, Silver Nanoneedle Probes Enable Sustained DC Current, Single-Channel Resistive Pulse Nanopore Sensing, **Oesper** Symposium – Cincinnati 10/2021, Poster.

• Essraa A. Hussein and Ryan J. White, Nanoneedle Probe for Sustained, Single Channel Resistive Pulse Sensing, **Pittcon** - Online 3/2021, Oral presentation.

SCIENTIFIC PUBLICATIONS

(23 Pubs, total citations of 889 & *h*- index of 11 according to Google scholar)

1. Nawara Tanzee Minim, **Essraa A. Hussein**, Beliz Utebay, Jonathan Rivnay, Neha Kamat, and Stephen A. Sarles, A Biomimetic Ion-Selective Transistor-Coupled Droplet Bilayer for Integrated Chemical Sensing, Synaptic Plasticity, and Associative Learning, *ACS Applied Materials and Interfaces*, Under revision.

2. Hiromu Akai, Audrey Pumford, **Essraa A. Hussein**, Ryan J. White, and Kan Shoji, Ag/AgCl Needle Electrode-Based DNA Nanopore Probe Technique for Sustained Ion Current Measurements, *Small Methods*, Under revision.

3. **Essraa A. Hussein**, Beliz Utebay, Emily A. Schafer, Neha P. Kamat, Jonathan Rivnay, Nickolay Lavrik, and Stephen A. Sarles, Microbarrier-confined droplet bilayers on PEDOT:PSS enable high-resistance, dynamically addressable bioelectronic interfaces, *Analyst* 2026, 151 (19), 5634-5641.

4. **Essraa A. Hussein**, Yunong Wang, and Lane A. Baker, Correlative Multimode Electrochemical Imaging of Biological Interfaces, *Proc. SPIE, Advanced Chemical Mircorscopy for Life Science and Translational Medicine* 2026, 1386406. *(invited)*
5. **Essraa A. Hussein** and Stephen A. Sarles, Spontaneous Depletion of Valinomycin-Mediated Ion Current in Droplet Interface Bilayers, *Langmuir* 2025, 41(39), 26697-26704.

6. **Essraa A. Hussein** and Stephen A. Sarles, Stimuli-Responsive Biomimetic Membranes Inspired by Nature's First Multifunctional Composite Material, *Journal of Intelligent Material Systems and Structures*, 2025, 36 (18-19),1247-1250.

7. Joshua J. Maraj, Emily A. Schafer, Michelle M. Mansour, **Essraa A. Hussein**, Joseph Berryman, Elizabeth Klavon, Jonathan Rivnay, and Stephen A. Sarles, Highly resistive biomembranes coupled to organic transistors enable ion-channel mediated neuromorphic synapses, *Advanced Electronic Materials*, 2025, 11 (4), 2400526.

8. **Essraa A. Hussein**, Brittany Rice, and Ryan J. White, Tuning the Probe–Bilayer Architecture of Silver Nanoneedle-based Ion Channel Probes, *Langmuir*, 2024, 40, 13, 7234–7241.

9. **Essraa A. Hussein** and Ryan J. White, Maintaining Single-Channel Recordings on a Silver Nanoneedle through Probe Design and Feedback Tip Positioning Control, *The Journal of Physical Chemistry B,* 2022, 126 (48), 10111-10119.

10. **Essraa A. Hussein**, Brittany Rice, and Ryan J. White, Recent advances in ion-channel probes for nanopore sensing: Insights into the probe architectures, *Analytica Chimica Acta*, 2022, 1224, 340162.

11. **Essraa A. Hussein** and Ryan J. White, Silver Nanoneedle Probes Enable Sustained DC Current, Single-Channel Resistive Pulse Nanopore Sensing, *Analytical Chemistry*, 2021, 93 (33), 11568-11575.

12. Atiah H. Almalki, **Essraa A. Hussein**, Ibrahim A. Naguib, Eglal A. Abdelaleem, Hala E. Zaazaa, Fatma F. Abdallah, Development and Validation of Ecofriendly HPLC-MS Method for Quantitative Assay of Amoxicillin, Dicloxacillin, and Their Official Impurity in Pure and Dosage Forms, *Journal of Analytical Methods in Chemistry*, vol. 2021, Article ID 5570938.

13. Samar Shurbaji, Gulsen G. Anlar, **Essraa A. Hussein**, Ahmed Elzatahry, Huseyin C Yalcin, Effect of flow-induced shear stress in nanomaterial uptake by cells: focus on targeted anti-cancer therapy, *Cancers*, 2020,12 (7), 1916-1932.

14. Hashim Alhussain, Robin Augustine, **Essraa A. Hussein**, Ishita Gupta, Anwarul Hasan, Ala-Eddin Al Moustafa, Ahmed Elzatahry, MXene Nanosheets May Induce Toxic Effect on the Early Stage of Embryogenesis, *Journal of Biomedical Nanotechnology*, 2020, 16 (3), 364-372.

15. **Essraa A. Hussein**, Moustafa M. Zagho, Balsam R. Rizeq, Nadin N. Younes, Gianfranco Pintus, Khaled A. Mahmoud, Gheyath K. Nasrallah, Ahmed A. Elzatahry, Plasmonic MXene-based nanocomposites exhibiting photothermal therapeutic effects with lower acute toxicity than pure MXene, *International Journal of Nanomedicine*, 2019, 14, 4529-4539.

16. Yasseen S. Ibrahim, **Essraa A. Hussein**, Moustafa M. Zagho, Ghada G. Abdo, Ahmed A. Elzatahry, Melt Electrospinning Designs for Nanofiber Fabrication for Different Applications, *International Journal of Molecular Sciences,* 2019, 20 (10), 2455-2472.

17. Ibrahim A. Naguib, Eglal A. Abdelaleem, Hala E. Zaazaa, **Essraa A. Hussein**, Izzeddin Alsalahat, Development and Validation of Spectrophotometric Methods for the Determination of Amoxicillin trihydrate and Dicloxacillin sodium in Their Binary Mixture, *Analytical Chemistry Letters,* 2018, 8(6), 844-861.

18. Moustafa M. Zagho, **Essraa A. Hussein**, Ahmed A. Elzatahry, Recent overviews in functional polymer composites for biomedical applications, *Polymers,* 2018, 10 (7), 739-760.

19. **Essraa A. Hussein**, Moustafa M. Zagho, Gheyath K. Nasrallah, Ahmed A. Elzatahry, Recent advances in functional nanostructures as cancer photothermal therapy, *international journal of nanomedicine*, 2018, 13, 2897-2906.

20. Ibrahim A. Naguib, Eglal A. Abdelaleem, Hala E. Zaazaa, **Essraa A. Hussein**, Partial Least-Squares and Linear Support Vector Regression Chemometric Methods for Simultaneous Determination of Amoxicillin Trihydrate and Dicloxacillin Sodium in the Presence of Their Common Impurity, *Journal of AOAC International,* 2016, 99(4), 972-979.

21. Eglal A. Abdelaleem, Ibrahim A. Naguib, Hala E. Zaazaa, **Essraa A. Hussein**, Development and validation of HPLC and HPTLC methods for determination of cefoperazone and its related impurities, *Journal of chromatographic science*, 2016, 54 (2), 179-186.

22. Ibrahim A. Naguib, Eglal A. Abdelaleem, Hala E. Zaazaa, **Essraa A. Hussein**, Determination of cefoperazone sodium in presence of related impurities by linear support vector regression and partial least squares chemometric models, *Journal of analytical methods in chemistry*, 2015, Article ID 593892.

23. Ibrahim A. Naguib, Eglal A. Abdelaleem, Hala E. Zaazaa, **Essraa A. Hussein**, Development and validation of stability indicating spectrophotometric and HPTLC methods for determination of acemetacin, *European Journal of Chemistry,* 2014, 5 (2), 219-226.

Patents

1. “Silver Nanoneedles for Sustained DC Current Single Nanopore Measurements”. Essraa A. Hussein Khalil, Ryan J. White - US Patent App. 17/852,315, 2022