

ZINA FREDJ, Ph.D.
Assistant Professor (RTD-A)
Free University of Bozen-Bolzano

EDUCATION

[2016 – 2020] **PhD in Physics Engineering**

Higher School of Science and Technology (ESSTHS), Tunisia

[2013 – 2015] **Master's degree in micro-systems and embedded electronic systems**

Higher Institute of Applied Sciences and Technology of Sousse (ISSAT), Tunisia

[2010 – 2013] **Bachelor degree in electronics, electrical engineering, and automatics**

Higher Institute of Applied Sciences and Technology of Sousse (ISSAT), Tunisia

[2005 – 2010] **High School degree in experimental sciences**

Secondary School of Manzel Hayet_Monastir, Tunisia

RESEARCH EXPERIENCE

[Sep 2024 – Oct 2025] **Research Assistant Professor**

CenBRAIN Neurotech Center of Excellence, Westlake University, China

Main activities and responsibilities:

Design and implementation of a wearable, self-powered biosensor for real-time monitoring of neurotransmitters.

[Sep 2022 – Sep 2024] **Postdoctoral fellowship**

CenBRAIN Neurotech Center of Excellence, Westlake University, China

Main activities and responsibilities:

Designing, implementing, and testing structures for neural cells and various neurotransmitters manipulation and biosensing.

[Jul 2020 – Jun 2021] **Postdoctoral fellowship**

Research center in microelectronics & nanotechnology, University of Sousse, Tunisia

Main activities and responsibilities:

Study and development of smart nanobioplatfroms for the rapid diagnosis of SARS-CoV2 (SmartBioSens).

[Sep 2020 – Jun 2021] **Lecturer, Digital electronics**

Higher Institute of Applied Sciences and Technology of Sousse (ISSAT), Tunisia

LANGUAGE SKILLS

Arabic: (Mother Tongue)

English: Fluent in both speaking and writing;

French: Fluent in both speaking and writing

Oral Communications

- [1] **Z. Fredj**, A. Baraket, M. Ben Ali, and A. Errachid, "Thickness Effects on pH Response of HfO₂ Sensing substrates grown by atomic layer deposition" Colloque MADICA November 8, 2018, Mahdia-TUNISIA.
- [2] **Z. Fredj**, M. Ben Ali, B. Singh, E. Dempsey "Electrochemical Sensors Based Electropolymerised Glassy carbon transducer modified with Platinionsed carbon nanofibres for Simultaneous Determination of 5-hydroxyindole acetic acid and 5-hydroxytryptamine" Conference for Analytical Sciences, May 16-17, 2018, IRELAND.
- [3] **Z. Fredj**, M. Ben Ali, M.N. Abbas, E. Dempsey, A. P. F.Turner "Early stage detection of cancer biomarkers using Nano-materials based electrochemical biosensor" International Conference on Bioanalyses: Health And Environment, December 4, 2017, Mahdia-TUNISIA
- [4] **Z. Fredj**, M. Ben Ali, M.N. Abbas, E. Dempsey, A. P. F.Turner "Nano-materials based electrochemical sensing platform for early stage detection of cancer biomarker" colloque Humboldt Kolleg on Nanoscale Science and Technology, 27-29 Octobre 2017, TUNISIA.
- [5] **Z. Fredj**, N. M. Nooredeen, M. Ben Ali, M. N. Abbas and E. Dempsey" Contribution to the development of biosensor based on copper phthalocyanine Nanomaterials for the early diagnosis of prostate cancer biomarker", International conference on nanomaterials and applications "nanoMAT2017", April 29- May 01, 2017 Hammamet, TUNISIA.
- [6] **Z. Fredj**, S. Azzouzi, M. Wing Cheung, M. Ben Ali, P.F. Turner Anthony, "A sensitive electrochemical biosensor for microRNA-21 detection based on combination of neutravidin and the dual-functional AuNP-MB-biotin" International conference of bioanalysis Health and environment April 25, 2017, Mahdia–TUNISIA.
- [7] **Z. Fredj**, N. M. Nooredeen, S. Azzouzi, M. Ben Ali, M.N. Abbas, A. Errachid "Novel strategies in phosphate sensors microsystems development based on copper phthalocyanine derivative Nonmaterial's modified gold transducers: Environmental and Biomedical Applications" 2nd Workshop on Nanostructured Materials and Nanotechnology May 24, 2016, Sousse- TUNISIA.

Poster Communications

- [1] **Z. Fredj**, Mounir Ben Ali, Abdelhamid. Errachid, Mohamed N. Abbas, Eithne Dempsey, Anthony Turner Early-stage detection of cancer biomarkers using Nanomaterials based sensors 10th International workshop on impedance spectroscopy, September 27-29, 2019, Chemnitz, GERMANY (**get the best poster award**)
- [2] **Z. Fredj**, N.M. Nooredeen, S.Azzouzi, M. Ben Ali, M. N.Abbas "Phosphate sensitive impedimetric sensors based on a novel copper phthalocyanine derivative modified gold structures: Application for environmental monitoring", 10th International workshop on impedance spectroscopy, September 27-29, 2017, Chemnitz, GERMANY (**get the best poster award**).
- [3] **Z. Fredj**, N. M. Nooredeen, S. Azzouzi, M. Ben Ali, M.N. Abbas, A. Errachid, D. Eithne, intitulée "Acid phosphatase activity monitoring for the early-stage detection of prostate cancer" Colloque MADICA November 8 ,2016, Mahdia TUNISIA.

- [1] **Z. Fredj**, F. Marvi, F. Ullah, and M. Sawan, "A wearable electrochemical aptasensor based MOF on MOF heterostructure for multi-neurotransmitters monitoring," *Microchim. Acta*, vol. 192, no. 6, p. 384, May **2025**, doi: 10.1007/s00604-025-07219-5.
- [2] **Z. Fredj**, G. Rong, and M. Sawan, "Recent Advances in Enzymatic Biofuel Cells to Power Up Wearable and Implantable Biosensors," *Biosensors*, vol. 15, no. 4, p. 218, Apr. **2025**, doi: 10.3390/bios15040218.
- [3] F. Ullah, **Z. Fredj**, and M. Sawan, "Perovskite Quantum Dot-Based Memory Technologies: Insights from Emerging Trends," *Nanomaterials*, vol. 15, no. 11, p. 873, Jan. **2025**, doi: 10.3390/nano15110873.
- [4] A. Ghezal, **Z. Fredj et al.**, "Electrochemical Detection of Nitrite Based on Iron Oxide–Reduced Graphene Oxide Nanocomposite Modified Electrode in Real Water," *Adv. Sens. Res.*, vol. 4, no. 8, p. e00021, **2025**, doi: 10.1002/adsr.202500021.
- [5] M. Jebali, **Z. Fredj**, S. Daboussi, M. Ben Ali, and M. Hassen, "Silicon Nanowires Sensor Modified with Cu (II) Phthalocyanine Derivative for Phosphate Monitoring," *Chemosensors*, vol. 13, no. 8, p. 297, Aug. **2025**, doi: 10.3390/chemosensors13080297.
- [6] P. Wang, **Z. Fredj**, H. Zhang, G. Rong, S. Bian, M. Sawan, "Blocking Superantigen-mediated Diseases: Challenges and Future Trends" *Journal of Immunology Research*, vol. 2024, p. e2313062, Jan. **2024**, doi: 10.1155/2024/2313062.
- [7] M. Bahri, **Z. Fredj**, P. Qin, and M. Sawan, "DNA-Coupled AuNPs@CuMOF for Sensitive Electrochemical Detection of Carcinoembryonic Antigen," *ACS Appl. Nano Mater.*, vol. 7, no. 10, pp. 11921–11930, May **2024**, doi: 10.1021/acsanm.4c01473.
- [8] S. Jebril, **Z. Fredj***, et al., "Nanomaterial-based electrochemical chemo(bio)sensors for the detection of nanoplastic residues: trends and future prospects," *RSC Sustain.*, Feb. **2024**, doi: 10.1039/D3SU00471F.
- [9] **Z. Fredj**, P. Wang, F. Ullah, and M. Sawan, "A nanoplatform-based aptasensor to electrochemically detect epinephrine produced by living cells," *Mikrochim Acta*, vol. 190, no. 9, p. 343, Aug. **2023**, doi: 10.1007/s00604-023-05902-z.
- [10] **Z. Fredj**, B. Singh, M. Bahri, P. Qin, and M. Sawan, "Enzymatic Electrochemical Biosensors for Neurotransmitters Detection: Recent Achievements and Trends," *Chemosensors*, vol. 11, no. 7, Art. no. 7, Jul. **2023**, doi: 10.3390/chemosensors11070388.
- [11] **Z. Fredj** and M. Sawan, "Advanced Nanomaterials-Based Electrochemical Biosensors for Catecholamines Detection: Challenges and Trends," *Biosensors*, vol. 13, no. 2, Art. no. 2, Feb. **2023**, doi: 10.3390/bios13020211.
- [12] X. Song, **Z. Fredj**, Y. Zheng, H. Zhang, Guoguang Rong S. Bian, and M. Sawan., "Biosensors for Waterborne Virus Detection: Challenges and Strategies," *Journal of Pharmaceutical Analysis*, Aug. **2023**, doi: 10.1016/j.jpha.2023.08.020.
- [13] Y. Zheng, X. Song, **Z. Fredj**, S. Bian, and M. Sawan, "Challenges and perspectives of multi-virus biosensing techniques: A review," *Anal Chim Acta*, vol. 1244, p. 340860, Mar. **2023**, doi: 10.1016/j.aca.2023.340860.
- [14] F. Ullah, M. Tarkhan, **Z. Fredj**, Y. Su, T. Wang, and M. Sawan "A Stable Undoped Low-voltage Memristor Cell Based on Titania (TiO_x)", *Nano Ex.*, vol. 5, no. 1, p. 015003, Dec. **2023**, doi: 10.1088/2632-959X/ad1413.
- [15] M. Moslah, **Z. Fredj**, and C. Dridi, "Development of a new highly sensitive serotonin sensor based on green synthesized silver nanoparticle decorated reduced graphene oxide," *Anal. Methods*, vol. 13, no. 43, pp. 5187–5194, Nov. **2021**, doi: 10.1039/D1AY01532J.
- [16] **Z. Fredj et al.**, "Capacitance Electrochemical pH Sensor Based on Different Hafnium Dioxide (HfO₂) Thicknesses," *Chemosensors*, vol. 9, no. 1, Art. no. 1, Jan. **2021**, doi: 10.3390/chemosensors9010013.

- [17] **Z. Fredj**, M. B. Ali, M. N. Abbas, and E. Dempsey, "Simultaneous determination of ascorbic acid, uric acid and dopamine using silver nanoparticles and copper monoamino-phthalocyanine functionalised acrylate polymer," *Anal. Methods*, vol. 12, no. 31, pp. 3883–3891, Aug. **2020**, doi: 10.1039/D0AY01183E.
- [18] S. Azzouzi, **Z. Fredj**, A. P. F. Turner, M. B. Ali, and W. C. Mak, "Generic Neutravidin Biosensor for Simultaneous Multiplex Detection of MicroRNAs via Electrochemically Encoded Responsive Nanolabels," *ACS Sens.*, vol. 4, no. 2, pp. 326–334, Feb. 2019, doi: 10.1021/acssensors.8b00942.
- [19] **Z. Fredj**, M. Ben Ali, M. N. Abbas, and E. Dempsey, "Determination of prostate cancer biomarker acid phosphatase at a copper phthalocyanine-modified screen-printed gold transducer," *Analytica Chimica Acta*, vol. 1057, pp. 98–105, May **2019**, doi: 10.1016/j.aca.2018.12.058.
- [20] **Z. Fredj**, M. Ali, B. Singh, and E. Dempsey, "Simultaneous voltammetric detection of 5-hydroxyindole-3-acetic acid and 5-hydroxytryptamine using a glassy carbon electrode modified with conducting polymer and platinised carbon nanofibers," *Mikrochim Acta*, vol. 185, no. 9, p. 412, Aug. **2018**, doi: 10.1007/s00604-018-2949-5.
- [21] **Z. Fredj**, S. Azzouzi, A. P. F. Turner, M. B. Ali, and W. C. Mak, "Neutravidin biosensor for direct capture of dual-functional biotin-molecular beacon-AuNP probe for sensitive voltammetric detection of microRNA," *Sensors and Actuators B: Chemical*, vol. 248, pp. 77–84, Sep. **2018**, doi: 10.1016/j.snb.2017.03.160.
- [22] **Z. Fredj**, N. M. Nooredeen, S. Azzouzi, M. B. Ali, M. N. Abbas, and A. Errachid, "Novel Sensitive Impedimetric Microsensor for Phosphate Detection Based on a Novel Copper Phthalocyanine Derivative," *Analytical Letters*, vol. 51, no. 3, pp. 371–386, Feb. 2018, doi: 10.1080/00032719.2017.1322096.

BOOK CHAPTERS

- [1] **Z. Fredj** and D. Saadi, "Utility of MXenes and Its Hybrid Materials for Batteries," in *MXenes: Expanding the Frontiers of Energy Applications*, J. Singh, K. R. Singh, R. Verma, and R. P. Singh, Eds., Singapore: Springer Nature, 2025, pp. 119–154. doi: 10.1007/978-981-96-0491-3_6.
- [2] **Z. Fredj** and M. Bahri, "Chapter 14 - Green nanomaterials for advanced biosensors development," in *Sustainable Nanomaterials*, M. Rani and U. Shanker, Eds., in *Micro and Nano Technologies*, Elsevier, 2025, pp. 479–500. doi: 10.1016/B978-0-443-21855-2.00009-X.
- [3] **Z. Fredj** and M. Sawan, "2D-non-layered materials: Advancement and application in biosensors, memristors, and energy storage," in *Semiconductors and Semimetals*, Elsevier, 2023. doi: 10.1016/bs.semsem.2023.09.007.

HONOURS AND AWARDS

- Best Postdoctoral Award:** CenBrain Neurotech Center of excellence, China, 2023
- First Award Certificate Awarding institution:** Technische Universität Chemnitz, Germany
Pitch your research topic in 5 min during the the International School on Smart Materials for Energy Conversion (ASMEC).
- Award Best poster:** Best poster award "Early-stage detection of cancer biomarkers using

Nanomaterials based sensors"on the 12th International workshop on impedance spectroscopy, September 27- 29, 2019, Chemnitz, GERMANY.

4. **Awarded fellowship:** DAAD (German Academic Exchange Service) for internships at the University of Technology of Chemnitz, GERMANY (September15, 2019 - December 15, 2019).
5. **Awarded fellowship:** From the NanoMISENE laboratory (Nanomaterials and MicroSystems for Health, Environment and Energy), belong to the Center for Research in Microelectronics and Nanotechnology of Sousse, TUNISIA, for internships at the Institute of Analytical Sciences, University Claude Bernard Lyon 1, Lyon FRANCE (June 3, 2018 – July 30, 2018).
6. **Awarded fellowship:** From the Ministry of Higher Education and Scientific Research in TUNISIA, for internships at the Institute of Technology Tallaght Dublin IRELAND (May 1, 2017 – July 30, 2017).
7. **Award Best poster:** "Phosphate sensitive impedimetric sensors based on a novel copper phthalocyanine derivative modified gold structure: Application for environmental monitoring" on the 10th International workshop on impedance spectroscopy, September 27- 29, 2017, Chemnitz, GERMANY.