

### INFORMATION ON DOCTORAL THESIS

1. Full name : Tran Nhu Chi
2. Sex: Male
3. Date of birth: 25/11/1993
4. Place of birth: Bac Giang
5. Admission decision number: 25/QĐ-CTSV Dated 14/01/2022
6. Changes in academic process: .....  
*(List the forms of change and corresponding times)*
7. Official thesis title: Development of a protein detection system for point-of-care testing (POCT) in biomedical diagnostics
8. Major: Electronic Engineering
9. Code: 9510302.01
10. Supervisors: Associate Professor, PhD Bui Thanh Tung  
*(Full name, academic title and degree)*
11. Summary of the **new findings** of the thesis: .....
  - Research Objectives and Scope: The dissertation focuses on developing an integrated microfluidic system for protein enrichment and detection, enabling efficient concentration and detection of proteins with minimal sample volume and reduced experimental time. The primary goal is to design, implement, and evaluate a microfluidic chip based on the principles of electrochemical immunosensors. The proposed chip is capable of detecting target proteins in solutions by recording changes in fluorescence and electrical signals. These signals are subsequently captured, processed, and displayed, offering a comprehensive and efficient solution for protein detection and analysis.
  - Research Methods: Literature review, design, modeling, principle analysis, fabrication and testing, data analysis, and comparative studies.
  - Key Results and Conclusions:
    - + Successfully developed and tested a protein concentrator using a dual-gate electrode structure and nano-selective membranes to control and enrich proteins within a specific region of the microchannel, enhancing detection and analysis capabilities for biomedical testing applications.

- + Established protocols for functionalizing gold and carbon electrode surfaces and developed immunosensors for protein detection. The sensor performance was evaluated on real proteins using fluorescence and electrochemical measurements.
- + Developed an integrated microfluidic chip combining preconcentration structures and immunosensors within a microchannel for protein preconcentration and detection.
- + Built an automated system enabling protein preconcentration control and conducting electrochemical and impedance measurements for protein detection.
- + The results of the dissertation provide a foundation for developing point-of-care testing systems, offering significant potential for future medical applications, including protein detection, quantification, and disease diagnosis through electrochemical and impedance measurement methods.

12. Practical applicability, if any: The results of this dissertation have practical applicability and lay the foundation for the development of future point-of-care protein testing systems.

13. Further research directions, if any: .....

14. Thesis-related publications: .....

*(List them in chronological order)*

1. **Chi Tran Nhu**, Phu Nguyen Dang, Hang Tran Thanh, Thom Vu Thi, Loc Do Quang, Tung Bui Thanh, “*A protein preconcentration platform utilizing dual gate structure and ion-selective membrane*”, (2022), in 2022 IEEE Ninth International Conference on Communications and Electronics (ICCE), pp. 195-198.
2. **Chi Tran Nhu**, Phu Nguyen Dang, Loc Do Quang, Trinh Chu Duc, Chun-Ping Jen, Tung Bui Thanh, “*Development of a microfluidic chip for protein preconcentration using dual gate structure and nanomembrane*”, (2023), *Microsystem Technologies* vol. 29, no. 12, pp. 1757-1767 (WoS).
3. **Chi Tran Nhu**, Do Quang Loc, Jen Chung Ping, Chu Duc Trinh, Bui Thanh Tung, “*Research and Detection of Bovine Serum Albumin using the Screen Printed Gold Electrode*”, (2023), in *The 4th International Workshop on Advanced Materials and Devices (IWAMD 2023)*, pp. 52-55.
4. **Chi Tran Nhu**, Do Quang Loc, Nguyen Dang Phu, Nguyen Cong Huu, Nguyen Tran Thuy, Chu Duc Trinh, Bui Thanh Tung, “*A novel surface functionalization process for carbon electrodes based on the combination of conducting polymer and gold nanoparticles for protein detection*”, (2023), in *The 8th International Workshop on Nanotechnology and Application (IWNA 2023)*, pp. 258-261.
5. **Chi Tran Nhu**, Huynh Thi Thuy Linh, Nguyen Canh Viet, Do Quang Loc, Le Van Chieu, Vu Ngoc Trung, Jen Chung Ping, Chu Duc Trinh, Bui Thanh Tung, “*Detection and quantification of bovine serum albumin using screenprinted gold*”

- electrodes and electrochemical measurements*”, (2023), in The 8th International Workshop on Nanotechnology and Application (IWNA 2023), pp. 254-257.
6. **Chi Tran Nhu**, Loc Do Quang, Chun-Ping Jen, Thuy Nguyen Tran, Huu Nguyen Cong, Trinh Chu Duc, Tung Thanh Bui, “*A Novel Approach to Detect Protein Utilizing the Microfluidic Pre-Concentrator Based on The Impedance Measurement Method*”, (2023), in 2023 1st International Conference on Health Science and Technology (ICHST), pp. 1-5.
  7. **Chi Tran Nhu**, Phu Nguyen Van, Loan Do Thi, Loc Do Quang, Chun-Ping Jen, Trinh Chu Duc, Tung Bui Thanh, “*Research and Development of A Portable Impedance Measurement System Utilizing AD5941 Analog Integrated Circuit for A549 Lung Cancer Cell Detection*”, (2023), in 2023 1st International Conference on Health Science and Technology (ICHST), pp. 1-6.
  8. **Chi Tran Nhu**, Bui Thanh Tung, Chu Duc Trinh, Nguyen Dang Phu, “*Development of a Non-Enzyme Sensor to Detect Glucose Based on the Modification of Copper Electrode*”, (2023), Arabian Journal for Science and Engineering, vol. 49, pp. 9849–9858 (WoS).
  9. **Chi Tran Nhu**, Phu Nguyen Dang, Linh Huynh Thi Thuy, Loc Do Quang, Thuy Nguyen Tran, Trung Le Thanh, Thanh Le Ngoc, Trinh Chu Duc, Tung Bui Thanh, “*An evaluation of a gold surface functionalization procedure for antibody binding and protein detection using 11-mercaptopundecanoic acid (11- MUA)*”, (2024), Biomedical Engineering: Applications, Basis and Communications, vol. 36, no. 02, pp. 2450002 (WoS).
  10. **Chi Tran Nhu**, Anh Phan Hoang, Tuan Vu Quoc, Loc Do Quang, Phu Nguyen Dang, Trinh Chu Duc, Tung Bui Thanh, “*Development of a Low-Cost and Compact Medical Image Reconstruction Platform Based on EIT Technique*”, (2024), IETE Journal of Research, vol. 70, no. 08, pp. 7044–7057 (WoS).
  11. **Chi Tran Nhu**, Huynh Thi Thuy Linh, Nguyen Canh Viet, Do Quang Loc, Vu Quoc Tuan, Tran Thi Thuy Ha, Vu Ngoc Trung, Jen Chun-Ping, Chu Duc Trinh, Bui Thanh Tung, Nguyen Dang Phu, “*Development of an immunosensor based on the screen-printed gold electrodes for bovine serum albumin detection*”, (2024), International Journal of Nanotechnology (IJNT), Accepted (WoS).
  12. **Chi Tran Nhu**, Loc Do Quang, Chun-Ping Jen, Trinh Chu Duc, Tung Bui Thanh, “*Development of a Protein Enrichment and Detection Microfluidic Platform based on Ion Concentration Polarization (ICP) and Electrochemical Impedance Spectroscopy (EIS) Techniques*”, (2024), IEEE Sensors Letters vol. 8, no. 9, pp. 1-4 (WoS).
  13. **Chi Tran Nhu**, Tuan Vu Quoc, Loc Do Quang, Phu Nguyen Dang, Jen ChunPing, Trinh Chu Duc, Tung Bui Thanh, “*Comparison of faradaic and nonfaradaic impedance biosensors using 2-electrode and 3-electrode configurations for the determination of bovine serum albumin (BSA)*”, (2024), Analytical Letters vol. 57, no. 17, pp. 2959–2971 (WoS).

14. **Chi Tran Nhu**, Phu Nguyen Dang, Manh Pham Tien, Trinh Chu Duc, Tung Bui Thanh, Loc Do Quang, “*Functionalization of Carbon Electrode Surface Using Polyaniline and Gold Nanoparticles for Protein Immobilization*”, (2024), Analytical Letters, pp. 1–15 (WoS).
15. **Chi Tran Nhu**, Nguyen Tran Thuy, Nguyen Cong Huu, Le Thanh Trung, Do Quang Loc, Bui Thanh Tung, “*Development of a Compact System Integrating Pre-Concentrator and Electrochemical Measurements for Protein PreConcentration and Detection*”, (2024), in The 10th IEEE International Conference on Communications and Electronics - IEEE ICCE 2024, pp. 178-183.
16. **Chi Tran Nhu**, Loc Do Quang, Chun-Ping Jen, Trinh Chu Duc, Tung Bui Thanh, Trung Vu Ngoc, “*NSE Protein Detection in a Microfluidic Channel Integrated an Electrochemical Biosensor*”, (2024), Biomedical Physics & Engineering Express, Vol. 11, No. 01, pp. 015047.
17. **Chi Tran Nhu**, Tuan Vu Quoc, Loc Do Quang, Phu Nguyen Dang, Son Nguyen Hong, Trinh Chu Duc, Tung Bui Thanh, “*Novel, compact electrochemical and impedance instrumentation*”, (2025), Instrumentation Science and Technology, Vol. 53, No. 01, pp. 28-43 (WoS).