Anahita Izadyar

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Professor of Chemistry

Chemistry and physics department

Arkansas State University aizadyar@astate.edu

Education

Shiraz University of Iran	Chemistry	B.S. 1994
Shiraz University of Iran	Analytical Chemistry	M.S. 2000
Shiraz University of Iran	Analytical Chemistry	Ph.D. 2008

Appointments

11	
2024	Professor of Chemistry, Arkansas State University (A-State)
	Department of Chemistry and Physics
2018-2024	Associate Professor of Chemistry, Arkansas State University (A-State)
	Department of Chemistry and Physics
2012-2018	Assistant Professor of Chemistry, Arkansas State University (A-State)
	Department of Chemistry and Physics
2009-2012	Postdoctoral Fellow, The University of Pittsburgh
	Department of Chemistry, Advisor: Professor Shigeru Amemiya
2006-2008	Visiting scholar, The University of Texas at Austin Center for Electrochemistry,
	Department of Chemistry and Biochemistry, Advisor: Professor Allen J. Bard

Personal Statement

My research endeavors are dedicated to tackling major public health challenges, particularly focusing on the diagnosis of Alzheimer's, and monitoring anti-depression drugs such as fluoxetine, both significant contributors to the global burden of disease and disability. Additionally, addressing metabolic disorders, particularly those associated with inadequate insulin production by the pancreas, is a crucial aspect of my work. My primary objective is centered on developing an affordable, portable device. Creating a fast, sensitive, and reliable biosensor to detect glucose levels and monitor Amyloid beta, a key indicator in evaluating Alzheimer's disease, is of paramount importance to me. I firmly believe that the advancement of electrochemical biosensors will play an increasingly integral role in medical, industrial, and environmental applications.

My academic background is rooted in analytical chemistry with a specific emphasis on electrochemistry. Within our research group, we emphasize the exploration and discussion of industrial analytical and electrochemical processes, inclusive of sensor development such as ion-selective electrodes, amperometric (bio)sensors, nanosensors, ultramicroelectrodes, and disposable sensors tailored for biomedical applications. Our exploration extends to nanoparticles like graphene and borophene, conductive polymers, and various novel materials for sensor and biosensor development. Notably, I have contributed to multiple publications in peer-reviewed journals, including a review article. I am driven by a persistent pursuit of funding for my research and deeply recognize the significance of consistent communication among team members to establish pragmatic research plans, timelines, and budgets.

An area of our focus involves employing stripping voltammetry for analysis using screenprinted electrodes, a methodology gaining considerable attention in both medical and nanotechnological fields. Our goal is to create sensors with vast potential for applications across medical diagnostics and in numerous industries, including pharmaceuticals, environmental sectors, and various biotechnological fields. Equally important is our aim to provide employment and research opportunities for aspiring students and enthusiasts in the scientific domain.

Based on my years of study and hands-on experience, I am confident in my expertise, leadership, training, and motivation to successfully execute the proposed research project. Over time, I have supervised nineteen undergraduate research students, three of whom have completed their master's degrees. The active involvement of undergraduate students in my research program has been a significant aspect, and I am committed to continuing this mentorship throughout the proposed research program. My collaborative efforts with students have led to several co-authored articles, with ongoing work toward the submission of another article.

This personal statement encapsulates my dedication to addressing critical health issues, the depth of my research expertise, and my commitment to mentoring the next generation of scientific minds.

Institutional Responsibilities

- o Teaching duties at the undergraduate and graduate levels.
- o Supervising undergraduate and graduate student's research/thesis projects.
- o Leading an independent research group.
- o Service duties at the department, college, and university level.

Teaching Activities

General chemistry I: bachelor freshman level course, 3 credits per semester.

General chemistry II: bachelor freshman level course, 3 credits per semester.

Quantitative Analysis: bachelor junior and senior level course 3 credits lecture and one credit laboratory per semester.

Instrumentation: Senior level course and master's level course, 3 credits lecture and one credit laboratory per semester.

Advanced Analytical Chemistry: master's level course, 3 credits per semester.

Green Chemistry: Ph.D. and master's level course, semester, 3 credits per semester. I developed Green Chemistry (ESCI 6343) as a new course, a graduate course for the Environmental Science Ph.D. (EVS) program. The interdisciplinary nature of this course helps students recognize how to apply principles and methods from one field to another. Moreover, students understand how the future can be different by identifying the appropriate reagents, reactions, and technologies that should be and realistically could be replaced by green alternatives.

Complete list of Publications (*corresponding author) Patents

Izadyar*, **A.**; Electrochemical Sensor for The Measurement of Glucose Concentration. **United States Patent** May 19, 2022, application number PCT/US2022/030096

Peer- Reviewed Publications

- (1) **Izadyar A,** Van MV, Miranda M, Weatherford S, Hood EE. (2022) Electrocatalytic Effect of Recombinant Mn Peroxidase from Corn on Microbiosensors to Detect Glucose. Biocatal. Agric. Biotechnol.43:102445.
- (2) **Izadyar A**, Van MV, Miranda M, Weatherford S, Hood EE. (2022) Development of a Highly Sensitive Glucose Nanocomposite Biosensor Based on Recombinant Enzyme from Corn. J. Sci. Food Agric. 102: 6530-6538.
- (3) **Izadyar A**, Rodriguez KA, Van MN, Tran U, Hood EE. (2021) A bienzymatic amperometric glucose biosensor based on using a novel recombinant Mn peroxidase from corn and glucose oxidase with a Nafion membrane. J. Electroanal. Chem.895:115387.
- (4) **Izadyar A**, Tran U, Hood EE. (2019) Recombinant Mn Peroxidase from Corn Grain Has an Excellent Electrocatalytic Effect in a Designed Amperometric Biosensor to Detect Hydrogen Peroxide at Low Concentrations. ACS Sustainable Chem. Eng. 7: 19434–19441.
- (5) **Izadyar A,** Hershberger JC, Robert R. (2018) Voltammetric Assessment of Ions Transfer at Ionophore-Graphene Based Polymeric Membranes. Electroanalysis. 30(11):2580-2583.
- (6) **Izadyar A.** (2018) Stripping Voltammetry at the Interface between Two Immiscible Electrolyte Solutions: A Review Paper. Electroanalysis.30(10): 2210-2221.
- (7) Guzinski M., Jarvis J. M. D'Orazio P., **Izadyar A.**, Pendley B. D., Lindner E. "Solid Contact pH Sensor without CO₂ Interference with a Super Hydrophobic PEDOT-C14 as Solid Contact: the Ultimate "Water Layer" Test". *Analytical Chemistry*, **2017**, 89 (16), 8468–8475.
- (8) **Izadyar A,** Al-Amoody F, Ranawaka Arachchige D. (2016) Ion transfer stripping voltammetry to detect Nanomolar concentrations of Cr (VI) in drinking water. J. Electroanalytical. Chemistry. 782: 43–49.
- (9) **Izadyar A,** Ranawaka Arachchige D, Cornwell H, Hershberger JL. (2016) Ion Transfer Stripping Voltammetry for the Detection of Nanomolar Levels of Fluoxetine, Citalopram, and Sertraline in Tap and River Water Samples. Sensors and Actuators B: Chemical. 223:226-233.
- (10) Kim J, **Izadyar A**, Shen M, Ishimatsu R, Amemiya S. (2014) Ion Permeability of the Nuclear Pore Complex and Ion-Induced Macromolecular Permeation as Studied by Scanning Electrochemical and Fluorescence Microscopy. Analytical Chemistry. 86: 2090–2098.
- (11) Amemiya S, Kim J, **Izadyar A**. (2013) Kabagambe B., Shen M., Ishimatsu R. "Electrochemical Sensing and Imaging Based on Ion Transfer at Liquid/Liquid Interfaces. Electrochimica Acta. 110: 836-845.
- (12) Kim J, **Izadyar A**, Nioradze N, Amemiya S. (2013) Nanoscale Mechanism of Molecular Transport through the Nuclear Pore Complex as Studied by Scanning Electrochemical Microscopy. Journal of the American Chemical Society.135: 2321–2329.
- (13) Kabagambe B, **Izadyar A**, Amemiya S. (2012) Stripping voltammetry of nanomolar potassium and ammonium ions using a valinomycin-doped double-polymer electrode. Analytical Chemistry. 84:7979-86.
- (14) **Izadyar A**, Kim Y, Ward Muscatello MM, Amemiya S. (2012) Double-Polymer- Modified Pencil Lead for Stripping Voltammetry of Perchlorate in Drinking Water. Journal of Chemical Education. 89:1323–1326.
- (15) Ishimatsu R, Izadyar A, Kabagambe B, Kim Y, Kim J, Amemiya S. (2011)

- Electrochemical Mechanism of Ion–Ionophore Recognition at Plasticized Polymer Membrane / Water Interfaces. Journal of the American Chemical Society.133:16300–16308.
- (16) **Izadyar A**, Liu ST, Chou PT, Bard AJ. (2009) Electrogenerated Chemiluminescence (ECL) of 2-Oxa-bicyclo [3.3.0] octa-4,8-diene-3,6-dione (OBDD). J. Electroanalytical. Chemistry. 635: 7–12.
- (17) **Izadyar A**, Omer KM, Liu Y, Chen S, Xu X, Bard AJ. (2008) Electrochemistry and Electrogenerated Chemiluminescence of Quinoxaline Derivatives. Journal of Physical Chemistry C. 112: 20027–20032.
- (18) Abbaspour A, **Izadyar A**. (2007) Platinum Coated Electrode Based on Bentonite Carbon Composite for Lead Detection as an Environmental Sensor. Talanta. 71: 887–892.
- (19) Abbaspour A, **Izadyar A**. (2006) Multi Wall Carbon Nanotube Composite Coated Platinum Electrode as a Sensitive Sensor for Detection of Cr (III) in Natural Waters. Analytical and Bioanalytical Chemistry. 386:1559–1565.
- (20) Abbaspour A, **Izadyar A**, Shargei H. (2004) Carbon Composition PVC Based Membrane in a Highly Selective and Sensitive Coated Wire Electrode for Silver Ion. Analytica Chimica Acta. 525: 91–96.
- (21) Abbaspour A, **Izadyar A**. (2001) Chromium (III) Ion Selective Electrode Based on Dimethylamin Azobenzene. Talanta. 53: 1009–1013.
- (22) Abbaspour A, **Izadyar A**. (2001) Highly Selective Electrode for Nickel (II) Ion Based on 1-5 Diphenylthiocarbazon. Microchemical Journal. 69:7–11.

Synergistic Activities (Memberships on panels, boards, and individual scientific reviewing activities)

- Textbook Manuscript Reviewer "Introduction to Green Chemistry, Third Edition, by Albert Matlack and John Andraos, 2020, CRC Press Taylor & Francis group.
- o Editorial Board member of the MDPI ((Multidisciplinary Digital Publishing Institute)) journals. (2019-)
 - https://www.mdpi.com/journal/chemistry/submission reviewers
- Editorial Board member of Frontiers in Chemistry for the Analytical Chemistry section (2023- 2025).
- Proposal review for the 2023 NSF Graduate Research Fellowship Program (GRFP) (total 11)
- Proposal review for the 2024 NSF Graduate Research Fellowship Program (GRFP)
- o Article Reviewer for the Journal of Applied Electrochemistry (spring 2024)
- o Article Reviewer for the Journal of Physical Chemistry (fall 2023)
- o Article Reviewer for the *Chemical Record* journal (fall 2020)
- o Article Reviewer for *Journal of Analytical chemistry* (spring 2020)
- o Article Reviewer for *Journal of Pharmaceuticals* (spring 2020)
- o Article Reviewer for *Journal of Crystals* (spring 2021)
- o Article Reviewer for materials chemistry and physics (fall 2019)
- o Article Reviewer for *International Journal of Molecular Sciences* (spring 2019)
- o Article Reviewer for *Journal of Nanomaterials* (spring 2019, spring 2020)
- O Article Reviewer for the *Journal of Sensors* (fall 2018, spring 2019, fall 2019, summer 2020)
- o Article Reviewer for the *Journal of Electroanalytical Chemistry* (fall 2017, fall 2018, spring 2019)
- o Article Reviewer for the *Journal of Electrochimica Acta* (total 14 across fall 2017, spring 2018, fall 2018, spring 2019, fall 2019, spring 2020, summer 2020, fall 2020)

- o Article Reviewer for the *Journal of Molecules* (fall 2018)
- o Article Reviewer for the *Journal of Bioelectrochemistry* (fall 2018, fall 2019)
- o Article Reviewer for the Food Analytical Methods Journal (2015)
- o Article Reviewer for the Journal of *ChemElectroChem* (fall 2021)
- o Article Reviewer for the Journal of *Nanostructure in chemistry* (spring 2021)
- o Article Reviewer for the National Conference on Undergraduate Research (NCUR; 2017)
- o Article Reviewer for the *Electrochemistry Communications* journal (2022)
- Article Reviewer for the *biosensors* journal (spring 2022, summer 2022, fall 2022, summer 2023, fall 2023)
- o Article Reviewer for the *Chemosensors* journal (2022)
- o Proposal Reviewer for the Student Undergraduate Research Fellowship (SURF) program (total 21; 2017, 2018, 2019)
- o Proposal Reviewer for the *Swiss National Science Foundation* (SNSF; total 2 across fall 2017; fall 2021)
- o Thesis Chair for two Graduate Students (A-State; 2016)
- o Thesis Chair, Honor Undergraduate Student (A-State; 2015)
- o Judge at Symposium of Research, Scholarship and Creativity (A-State; 2016)
- o Member of A-State Shared Governance Committee (2015–present)
- o Member of A-State Faculty Achievement Awards Committee (2020–present)
- o Member of Department graduate students review committee (2018–present)
- o Member of various university committees at A-State (Graduate Program in Environmental Sciences, 2012–present; Analytical Chemistry Curriculum Committee, 2012–present; General Chemistry Committee, 2012–present; Materials Sciences Group, 2013–2015; two Comprehensive Examination Committees, 2013).
- o Member of A-State College Diversity Plan Committee (2022-presnet)
- Hiring Committee Member for various positions at Arkansas State University (Organic Faculty Search Committee, 2012; Organic Chemistry Instructor Search, 2013)
- o Summer Institute for Research Development (SIRD) workshop (A-State, June 2014)
- o Summer Institute for Teaching and Learning for Innovation, Inspiration and Creativity workshop (A-State, June 2019)
- o A-State Proposal Writing Workshop (Spring 2020)
- LEARN@STATE workshop (Spring 2020), Get students to focus on learning instead of grades: Metacognition is the key!
- o Grant Writing Workshop sponsored by Arkansas IDeA Network of Biomedical Research Excellence (Arkansas INBRE) (June 2019)
- o The General Education Program workshop (A-State, July 2019)
- o Arkansas Bioscience Institute (ABI) Undergraduate Research Scholar Program Mentor (2019-2020).
- Reviewer of six abstracts for Create @ State (spring (2021), is important for co-curricular student-learning assessment reporting to the Higher Learning Commission at A-State.
- O Reviewer of four abstracts for Create @ State (spring (2022), is important for co-curricular student-learning assessment reporting to the Higher Learning Commission at A-State.
- o Member, American Chemical Society (2007–present)
- o Member, Arkansas Academy of Science (2013–present)
- o Project director, as a graduate student, at the Shiraz oil refinery (2004–2006)
- Clinical Laboratory research, as a graduate student, on HbA1c testing methodology (2002–2004)
- Collaboration with Water Analytics Inc on fabrication of a commercial sensor. (2017–2019)

Awards and Grant

- O SBIR Phase I: Develop a Novel Ion-selective Microelectrode for the Diagnosis of Dry Eye Diseases(pending) .\$304,605.
- The Arkansas IDeA Network of Biomedical Research Excellence grant (Arkansas INBRE) 2024Using Corn to Develop a Disposable Electrochemical Sensor for Glucose Detection in Diabetic Patient, pending \$50,000.
- The Arkansas IDeA Network of Biomedical Research Excellence grant (Arkansas INBRE) 2024.
- o FRAC: Faculty Research Fund 2024.
- o College of Science and Mathematics (COSM) seed grant 2024.
- o NSF I-Corps fund 2024.
- o Arkansas Biosciences Institute grant (2020-2022)
- National Institute of Food and Agriculture (USDA\NIFA) grant as external funding, (2021-2024)
- o Nathan Deutsch Faculty Development awards (A-State, 2018)
- GRADES-SR Award from the College of Science and Mathematics Dean's office (A-State, 2014 and 2016)
- o Provost Scholar Award (A-State, 2014)
- o The Arkansas Science & Technology Authority Grant (2014)
- o Faculty Research Award (A-State, 2013)
- o Shiraz University Scholarship for Top Graduate Student (2006–2008)

Supervision of Undergraduate and Graduate Researchers

Graduate Student Research and Thesis Advisors

- o Dinusha Ranawaka Arachchige (MSc), current position (PhD student)
- Fatma Al-Amoody (MSc), current position (chemistry instructor at A-State)
- o Amanda Pillow (MSc), current position (High school teacher)

Honors Thesis Advisor (Undergraduate)

Hayden Cornwell

Research Advisor (Undergraduate)

- (1) Tanner Horton (Technical Support Engineer at Play On Sports)
- (2) Hayden Cornwell (Recognized as an outstanding undergraduate student in the College of Sciences and Mathematics at A-State, graduated Magna Cum Laude)(Process Scientist at AMPAC Fine Chemicals)
- (3) Cody Anderson (Recognized as an outstanding graduate student in the College of Sciences and Mathematics at A-State, Doctor of Osteopathic Medicine from New York Institute of Technology.
- (4) Anna Pittman (undergraduate)
- (5) Giang Truong Hoang (A-State Student Research Ambassador for 2017–2018, undergraduate)
- (6) Anaiya Lowe (undergraduate)
- (7) Robert Rogers (First-place winner, undergraduate poster presentation)
- (8) Uyen Tran (undergraduate)

- (9) Kayleigh Amber Rodriguez (PhD Candidate at University of Arkansas for Medical Sciences)
- (10) Erin Nicholas (College outstanding student award recipients, PhD student in Chemistry (U. Illinois))
- (11) My Ni Thi Van (Student employee of the year, undergraduate, accepted in optometry school)
- (12) Marcela Miranda (Student employee of the year, accepted in MS program, international undergraduate)
- (13) Sindhuja Vemireddy (undergraduate)
- (14) Clay Aureli (undergraduate)
- (15) James Andrew Goode (undergraduate)
- (16) Scout Weatherford (College outstanding student award recipients, Student employee of the year,)
- (17) Yarelhy Paola Gutierrez Salinas (Current international undergraduate)
- (18) Nathan Lamb (Research assistant)
- (19) Brandon Elston (Current undergraduate)
- (20) Priscilla Brown (Current undergraduate)
- (21) Ezekiel McCaine (Current undergraduate)

Research Collaborators

Research collaborators: Professor Alireza Abbaspourrad, (Department of Food Science, Cornell University); Aquametrix Water Analytics, Inc.; Professor Hassan Beyzavi, (Department of Chemistry and Biochemistry, University of Arkansas); Professor Alexander Biris (Center for Integrative Nanotechnology, University of Arkansas); Samuel Dagogo-Jack, MD, DSc, A. C. Mullins Professor of Medicine, Director, Division of Endocrinology, Diabetes & Metabolism; Professor Elizabeth E. Hood (Department of Agriculture, Arkansas State University); Dr. John C. Hershberger (Department of Chemistry and Physics, Arkansas State University); Dr. Jeffrey T. La Belle; Professor Erno Lindner (Department of Biomedical Engineering, University of Memphis); Professor Tanja McKay (Director of Environmental Sciences, Professor of Entomology, Arkansas State University); Professor Shanlin Pan (University of Alabama); Dr. Mark Spencer (President of Water Analytics, Inc.). David B. Warner, M.D, Professor of Ophthalmology, Medical Director of Arkansas.

Conferences

Presentation (oral) #1 Ultrasensitive Electrochemical Sensors for Trace Ions:

Environmental Analysis and Beyond Learned Forum: Science Departmental Seminar April 10, 2013, Arkansas State University, AR

Presentation(oral) #2 Discovering new ion selectivity using pencil lead electrodes to enable detection of various pharmaceutical drugs as environmental contaminants Learned Forum:
 34th annual undergraduate research conference 22 February, 2014, University of Memphis, Memphis, TN

Presentation (poster) #3 Pencil lead ion selective electrode to detect fluoxetine drug as pharmaceutical environmental contaminant (poster presentation)

Learned Forum: 4 April 2014, 98th annual meeting Arkansas Academy of Science, Harding University, University of Central Arkansas, AR

Presentation (oral) #4 Ion transfer stripping voltammetry for detection of drugs in real samples. Dinusha U. Ranawaka Arachchige. The Memphis section of the American Chemical will host the 2015 Combined Southwest Region Meeting and the **Southeastern**

- Regional Meeting of the American Chemical Society.
- Presentation (poster) #5, "Ion Selective Electrodes to Detection Water Contaminants" Dinusha U. Ranawaka Arachchige, spring 2016, Arkansas Soil & Water Conference Student Poster Competition.
- Presentation(oral) #6 Sensitive Electrochemical Sensor to Detect Fluoxetine, Sertraline, and Citalopram in Environmental Samples, Hayden Cornwell, spring 2016, Symposium of research, scholarship &creativity at A-state.
- **Presentation (oral)** #7 Ultra-sensitive electrochemical detection of Cr (VI) using double polymer membrane and Beyond, **The 68th Southeastern American Chemical Society**, Columbia, SC, 2017
- Presentation (poster) #8 Development Electrochemical Sensors using Graphene Based Ionophore-doped Double Polymeric Membrane to Monitoring Heavy Metals, Hoang, Giang Truong, spring 2017, National Conference on Undergraduate Research (NCUR) at the University of Memphis.
- Presentation (poster) #9 Applying Nano Sensors Using Reduced Graphene Oxide to Detect Phosphate, fall 2017, by Robert Rogers, Arkansas STEM Posters at the Capitol Instructions for Presenters at the Little Rock, AR
- Presentation (poster) #10 Nano Sensors modification for phosphate ion detection, spring 2018, by Robert Rogers, Symposium of research, scholarship &creativity at A-state, Arkansas state university, AR, 1st place winner undergraduate poster presentation.
- **Attendance conference Selected** as a Judge in the IDeA Network of Biomedical Research Excellence (INBRE) Conference, fall 2019, Fayetteville, Ar.
- **Presentation (oral) #11** An Amperometric Glucose Sensor Using Recombinant Mn Peroxidase and Glucose Oxidase, spring (2021), by Kayleigh Rodríguez, and My Ni Thi Van, Create @ State, A-State.
- **Presentation (oral) #12** Amperometric Biosensor for Glucose Determination Based on a Novel Recombinant Mn Peroxidase from Corn Cross-Linked to a Gold Electrode, International Conference on Applied Chemistry, May 13-14, 2021, in Amsterdam, Netherlands.
- **Presentation (oral) #13** Electrochemical Technique to Fabricate Glucose Biosensor Using Enzyme Extract from Corn, spring (2021), by Kayleigh Rodríguez, Arkansas Academy of Science 2021 Meeting, April 2021.
- Presentation (oral) #14 Biosensor for Glucose Determination Based on a Novel Recombinant Mn Peroxidase (PPMP) from Corn Cross-linked to a modified Gold Electrode, fall (2021), by Anahita Izadyar, American Chemical Society, Southwest Regional Meeting (SWRM), Austin, TX, 2021
- **Presentation (oral) #15** Electrochemical Glucose Biosensor, spring (2022), by Marcela Miranda, Create @ State, A-State..
- Presentation (poster) #16 Bienzymatic Nanocomposites Biosensors to Measure Glucose
- , spring (2022), by, My Ni Van, Marcela Miranda, Scout Weatherford, Create @ State, A-State ,it won Dean's Award for Undergraduate Poster Presentation.
- **Presentation (oral) #17** Electrochemical study of Recombinant Mn Peroxidase from Corn on Disposable Screen-Printed biosensor to Detect Glucose, fall (2022), by Scout Weatherford, INBRE Research Conference.
- **Presentation (poster) #18** Electrochemical Microsensors Using Recombinant Manganese Peroxidase from Maize Along with Nanocomposite Materials Used to Detect Glucose. Spring (2023), by Scout Weatherford, Create@State 2023, A-State.
- Presentation (oral) #19 Electrochemical study of recombinant manganese peroxidase from maize along with nanocomposite materials for glucose detection. by Anahita Izadyar Euroanalysis, Congress, Geneva, Switzerland, August, 2023

- **Presentation (poster) #20** Square Wave Electrochemical Voltammetry Study Using Disposable Screen-Printed Electrodes to Detect Glucose., Fall (2023), By Nathan Lamb, INBRE Research Conference.
- **Presentation (poster) #21,** Electrochemical Environmental Sensors for Phosphate Detection, Summer(2024) Ezekiel McCain, 11th Arkansas Undergraduate Summer Research Symposium.