IGEM Grant Report

☐ Progress (due January 1) ☐ Annual (due July 31) ■ Final (due August 31)

IGEM Grant # : IGEM25-001 Principal Investigator: Daniel Fologea, PhD

Submission Date: 08/29/2025 Primary Institution: Boise State University

*Instructions: Complete each section of this report directly on this template. Completed reports must be limited to **1 page for Progress Reports and 2 pages for Annual or Final Reports in 12 pt Arial or similar font**, excluding the expenditure report. Simple and concise answers will be appreciated, and even bullet lists of information will be sufficient. Reports that do not follow these requirements will be returned for revision. Submit reports by the appropriate due date to HERC@edu.idaho.gov.*

Section 1: Summary of project accomplishments for the reporting period and plans for the upcoming reporting period.

- We demonstrated the successful use of KinExA technology in conjunction with aptamers for direct determination of Polychlorinated Biphenyls (PCB) in water samples. The estimated sensitivity of the developed method for PCB72 is less than 1 ppt, which surpasses by 2 orders the EPA's maximum contaminant level in water (i.e., 0.5 ppb).
- We identified functional anti-PFAS antibodies in eggs, extracted and purified the mRNA pool, and selected the most potent antibodies by employing the phage display method.
- The Boise State University team developed a novel method for rapid concentration of small, organic pollutants in water samples. A single, 15-minute concentration step provides a ~20-fold increase in the concentration of organic pollutants; therefore, a thousand-fold concentration increase may be attained in less than one hour.
- Two polyclonal antibodies for polycyclic aromatic hydrocarbons (PAHs) have been produced and purified from eggs; both have been successfully tested with the KinExA technology for PAH measurements in water.
- We developed a procedure for covalent binding of PCB aptamers to glass beads and used them as capture elements for KinExA; the beads maintained full functionality for over 8 months at room temperature.
- We finalized and tested the portable KinExA instrument for PCB quantification in water in a bench setup; in the same line, we determined the temperature-correction factors for using the portable instrument to determine PCB in water in a temperature interval ranging from 5 ^{0}C to 45 ^{0}C.
- We collected water samples from wells, rivers, lakes, and household sources in the region. From those, over 50 have been already tested for PCB 72 and further spiked for PCB quantification in true environmental conditions. The determined confidence interval of the measurements was greater than 96% for all samples.

Section 2: High-level summary of budget expenditures for the period just completed.

The total budgeted cost of the project was $187,100; we spent $186,060, which led to an unspent amount of $1,040. The expenditures include salaries ($109,362.97), fringe benefits ($10,868), OE ($64,682), and travel ($1,146). A detailed expenditure report is provided in section 6, presented in a separate document included with this submission. The 0.6% underspending occurred because of the billing cycles; the remaining funds may be used for additional sample measurements or may be returned to the sponsor.

Section 3: Demonstration of economic development/impact, including the following as applicable: patents, copyrights, plant variety protection certificates received or pending; technology licenses signed, start-up businesses created, and industry involvement; private sector engagement; jobs created; external funding; any other pertinent information.

- The project benefited from a significant involvement of the commercial partner, Sapidyne Instruments. Their engagement in this project led to 12 new jobs. Up to date, Sapidyne hired 1 PhD student, 1 MSc student, 5 undergraduate students, 3 high school students, and provided 2 internships.
- The PI Fologea also created 8 research technician/research assistant positions for undergraduate and graduate students during the academic year, and 11 internship positions for high school students during the summers. The PI Fologea initiated the preparation of documents required for IP on the newly developed method of concentrating organic pollutants in water and works closely with Sapidyne for licensing.
- An external solicitation for funding was prepared and sent to the Department of Defense in 2025; this proposal was not selected for funding but the new experimental data are anticipated to lead to a new application in the spring of 2026.
- The PI and two students successfully completed the NSF ICorps program.
- The results were disseminated at two national conferences, and one of the presentations was selected for press release.

Section 4: Number of faculty and student participants as a result of funding, and brief description of student efforts.

Besides the 12 new hires at Sapidyne, this project involved three faculty members, 8 high school students, 10 undergraduate students, and 4 graduate students for the entire project duration. The student efforts consisted of sample preparation, experimental setup, sample running, and data analysis with the KinExA instrument, environmental sample collection in standardized conditions, sample concentration and purification, and pollutant quantification in pristine and spiked environmental samples. One of the graduate students included all these efforts in their PhD thesis. Three undergraduate students participated in this project as volunteers, and 4 of the hires made by Sapidyne were for students trained in the PI's lab at Boise State University. Six of the trained undergraduate students that worked with the PI were selected to continue working at Boise State University on distinct research projects that require using the KinExA technology.

Section 5: Updated details and/or progress on the long-term sustainability plan for the project and description of future plans for project continuation or expansion.

The project ran for one year and this is the final report. The efforts for the next year will be led by the industrial/commercial partner, Sapidyne Instruments in collaboration with Boise State University. It is anticipated that the PCB and PFAS kits will be fully validated and become commercially available within 16 months. Sapidyne Instruments started the commercialization of functionalized glass beads to be used with the KinExA technology. We also plan on requesting federal funds from DOE and NSF for further technology development together with Sapidyne and other commercial partners.

Section 6: Expenditure report – is attached as a separate document in the submission.

IGEM Grant Report

☐ Progress (due January 1) ☐ Annual (due July 31) ■ Final (due August 31)

IGEM Grant # : IGEM25-001 Principal Investigator: Daniel Fologea, PhD

Submission Date: 08/29/2025 Primary Institution: Boise State University

Section 6: Expenditure Report – Attach an expenditure report as a separate document showing expenses toward the original budget submitted for this project. The expenditure report does not count toward the page limit. A written summary of budget expenditures should be provided in section 2 of this report.

The original budget of the project totaled $187,100 and included salaries, fringes, and OE (Materials and Supplies). However, we requested and received approval from the Board to reallocate ~$18k from OE to a subcontract to Creative Biolabs. The budget adjustment did not impact the scope of the project and did not exceed 10% of the annual award amount. The adjustment was needed due to problems with the availability of materials and supplies needed to construct and characterize the mRNA library. This not only expedited the process, but also eliminated the need for additional time-consuming and costly tasks initially intended to be carried out locally. This facilitated an early sample collection and characterization, and provided more opportunities for students to participate at the research tasks presented by this proposal, and present the findings at national conferences.

The expenditures toward the original budget are detailed next.

PI salary: we budgeted $27,300 to partially cover the PI's summer salaries for a total period of 10 weeks spread over the summers of 2024 and 2025 (the PI is on a 9-month contract). We spent $26,910 for this category.

Fringe PI salary: we budgeted $9,300 for fringe benefits, and we spent $5,036.

OE: we budgeted $92,200 and spent $64,682. This underspending occurred because of task subcontracting to Creative Biolabs. Besides subcontracting, the funds were spent on materials and supplies (analytical standards, lipids, airfuge supplies for sample concentration, consumables for KinExA experiments, chemicals of analytical purity, pristine capture beads, extruders, filters, microcontrollers, accessories for rotary evaporation, environmental vials, and personal protective equipment). The phage display analysis, which we developed and carried out within this project, comprised of materials and supplies that were not included as a distinct sub-category in the initial OE budget. However, the surplus funds have been used for student salaries and travel.

Other salaries and fringes: The initial budget included $55,100 for other salaries (including students and Research Technicians), and we spent $82,453. We also included $3,200 for other fringes in the original budget and spent $5,833. As we

explained, the contracting of mRNA library led to a significant cost reduction, and the surplus funds have been used for student support, which also added to the fringe benefits category.

Travel: The original budget did not include travel funds; however, we utilized the available funds to support the dissemination of the results at two national conferences. The travel funds provided from this grant amounted for $1,147; this represents only ~30% of the total funding needed for travel. The additional funding was provided by the institution from other available sources.

Budget balance: The total budget of $187,100 was spent at a 99.4% rate ($186,040), with a remaining balance of $1,040. This occurred because of the billing cycles, some expenses contracted during the project were billed beyond project's duration. These remaining funds may be used to support a student to expand the measurements on environmental samples, or they may be returned to the sponsor.