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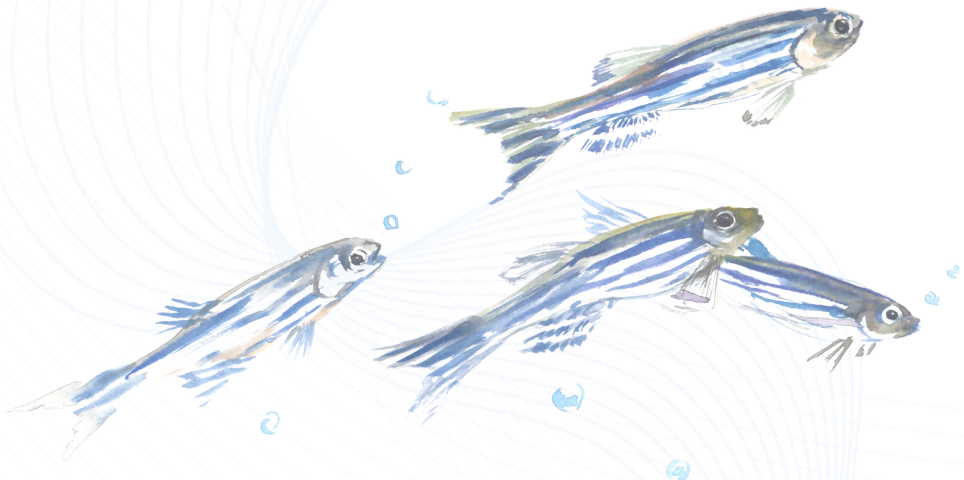
Client: UMassAmherst

Project: Energy Efficiency



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Case Study:
UMass Amherst
School of Public Health & Health Sciences
Environmental Health Sciences Department

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Image (above): UMass Amherst, one of Danio Lab's clients that have received aquatic system service, support, and guidance over the years

Background

Dr. Timme-Laragy's Research Lab

Our major project was in Dr. Timme-Laragy's research lab, who is a Professor and Principal Investigator focused on developmental toxicology in the Environmental Health Sciences Department in the School of Public Health and Health Sciences. "TeamTL" is a large lab with post-docs, multiple graduate students, and anywhere from 10-15 undergraduates.

They are a developmental toxicology lab using zebrafish to understand how embryonic exposure to pollutants affects embryonic development and later-life health outcomes. This includes ongoing projects examining the effects of perfluorinated compounds and PCBs on pancreas and liver development - and investigating toxicant effects of later-life metabolic diseases. They anchor these morphometric and metabolic outcomes with experiments probing the antioxidant defense system and the Nrf2 signaling pathway.

Sarah Conlin - Zebrafish Lab Manager

"I have been Alicia Timme-Laragy's lab manager since June 2017, and I've been working with zebrafish for over 12 years. I started as a summer fish feeder during high school in the Department of Molecular and Cellular Biology's zebrafish facility at Harvard University. This led me to work as an undergraduate research assistant at the University of Maine's zebrafish facility, and I continued to use the model during my graduate career there as well."

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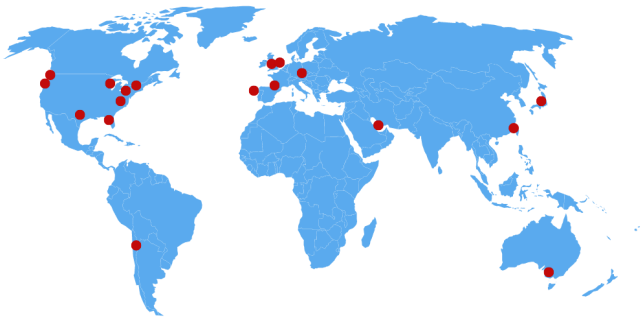
Danio Lab specializes in providing the scientific zebrafish community (laboratories, institutions, and other facilities) with superior services and products to increase efficiency & production, streamline operations and accelerate research.

- Our attention to detail and superior customer service guarantees your research continues seamlessly.
- We work with institutions and facilities across the globe to help them solve their zebrafish husbandry operations - from a product, service, design, and technology perspective
- We have over 20+ years of experience that in developing solutions and designing the most optimal system for your needs
- Contact us for assistance in solving your facility's short and long-term needs



Danio Care

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Zebrafish IVT Rack & Tank Systems

Danio Nutrition

Diets & Dispensing

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UMass Case Study

- We started working with UMass in 2017, where we began troubleshooting and servicing their pre-existing zebrafish systems. During this time, we solved some pump pressure issues, provided service & technical support for their stand-alone rack systems, and provided consumable items (including filter bags, pH supplies, etc.) for their operations.

- As the lab grew, more housing space for Zebrafish was required. Several old stand-alone Zebrafish systems were pulled from storage that UMass provided for refurbishment to use. While the system was operational, its efficiency was low. We developed a solution to improve their energy efficiency by redesigning their overall filtration system.

- In summary, we interconnected their individualized filtration units into a single, centralized filtration skid. In doing so, we significantly reduced their annual energy costs, decreased maintenance, and increased their overall operational efficiencies, production, and ease of use.

Read our case study here for more info on how we optimized their fish room:

CHALLENGE

- **Running a zebrafish facility, especially if not set up and designed correctly, can entail expensive annual costs - including water, electricity, maintenance, etc.**

OBJECTIVE

- **Develop a practical solution for our client in order to significantly lower the pre-existing system's annual energy consumption by increasing operational efficiency via filtration design.**

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Plan of Action

Proposal to Increase Energy Efficiency and Workflow:

After providing continued service, support, and consulting, we proposed an idea to optimize their zebrafish facility that would:

- Reduce weekly/monthly maintenance tasks
- Lower operating costs and energy consumption
- Increase overall energy efficiency
- Provide a more long-term cost-effective, sustainable solution
- Create an easier, more intuitive system for all users

Optimization

Our proposal was to re-design and transform 4 stand-alone racks (plus 5 more refurbished racks) which were transformed into a centralized system. Previously each rack had its own individual filtration unit. This setup was very high maintenance that required excessive electricity usage and entailed higher all-around costs - not only regarding electricity bills but also more funds spent on monthly/yearly consumables.

Solution - Simplify with a Centralized Filtration System:

We proposed designing and building a single centralized filtration skid, where all the zebrafish racks are interconnected to one main life support system. All factors considered made this the optimal choice, both from a financial perspective and an overall maintenance standpoint.

Energy Justification Assessment

UMass' Old System - Power Consumption & Cost

Power Consumption	Circuits required	Volts	Amps	Watts/Hour	kWh	kWh/Year	Annual Cost
AHAB Rack 1	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AHAB Rack 2	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AHAB Rack 3	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AHAB Rack 4	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AQ Rack Single	1	120	15.00	1800	1.8	15768	$ 1,655.64
AQ Rack Double	1	120	16.00	1920	1.92	16819.2	$ 1,766.02
Monitor and Dosing 1	1	120	10.00	1200	1.2	10512	$ 1,103.76
Monitor and Dosing 2	1	120	10.00	1200	1.2	10512	$ 1,103.76
Monitor and Dosing 3	1	120	10.00	1200	1.2	10512	$ 1,103.76
AHAB Rack 5*	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AHAB Rack 6*	1	120	12.00	1440	1.44	12614.4	$ 1,324.51
AHAB Rack 7*	1	120	12.00	1440	1.44	12614.4	$ 1,324.51

Total Circuits	Total Amps	Total Annual Energy Cost
12	145	$16,004.52

UMass' New System (via Danio Lab)

Power Consumption	Circuits required	Volts	Amps	Watts/Hour	kWh	kWh/Year	Annual Cost
DL ZFS-010	3	120	24	2880	2.88	25228.8	$ 2,649.02

Total Circuits	Total Amps	Total Annual Energy Cost
3	24	$2,649.02

Summary of Savings:

- Annual Energy Cost (Old System) = $16,004
- Annual Energy Cost (Danio System) = $2,649

Total Savings (After Danio Lab's Redesign):

- 1-year savings = $13,335.50
- 5-year savings = $66,777.48

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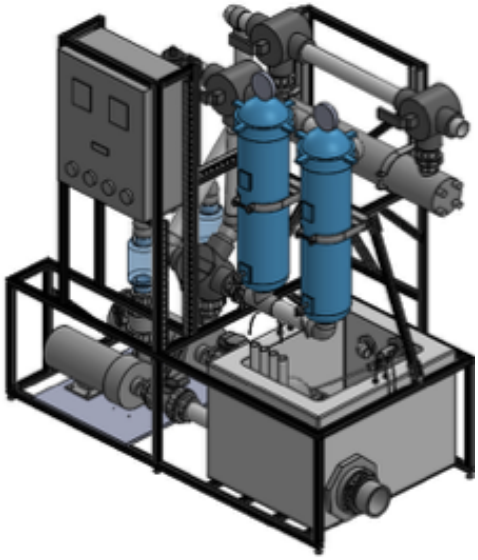
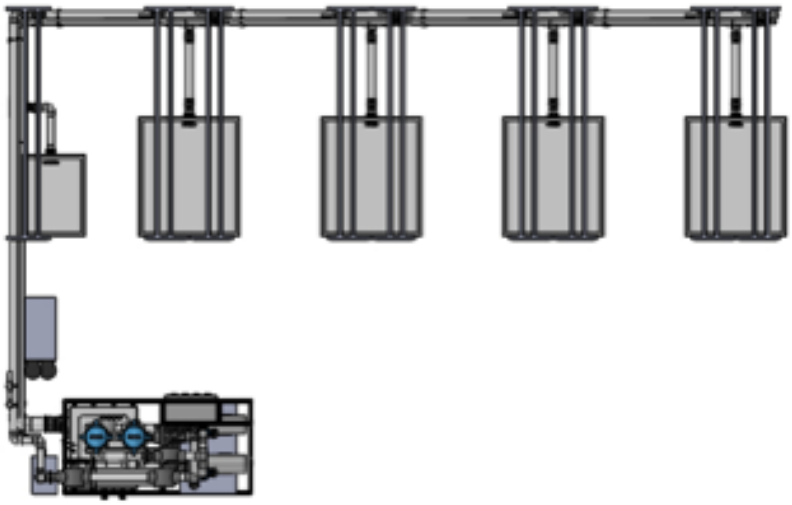
Project Design & Construction

At Danio Lab, we aim to customize and personalize our services to your needs. Pictured here is our initial filtration skid frame used to house all aquatic life support components in a single, organized, clean unit that is designed to streamline your everyday operational workflow and weekly/monthly tasks.





Once all of the computer-generated engineering renders are finalized, the life support system/filtration unit is framed and constructed out of high-quality, long-lasting aluminum. Once the framework is complete, the structure is transferred to its designated lab. Following that, the rest of the aquatic life support system is installed including all plumbing, electrical, probes, and monitoring system.

System components: 2 water pumps (one backup, in case of emergencies), bead/drum filters, UV sterilization, control panel for (pH, conductivity, DO, temperature), dosing system, and other components as needed.

Project Design & Construction

- Pictured: All life support system components together in a centralized location. All of the system water, from all the room's Zebrafish racks, is now pumped through this centralized filtration system; as opposed to having individual filtration systems for each rack, which translates into higher energy consumption, higher costs, and higher maintenance.

- With a centralized filtration skid, not only is it more energy efficient (saving money on operating costs), users can also take advantage of a more organized system, with the ability to control and maintain all of the major system components in one location (for all their zebrafish racks & tanks).

RESULTS

- Significantly reduced energy consumption & operating costs
- Lower maintenance tasks
- Increased facility's fish capacity
- Higher operational efficiency, overall work-flow, and ease of use
- Updated monitoring system & control panel to easily & precisely track, calibrate, and control water quality parameters such as pH, DO, conductivity, & temperature
- Refined system plumbing - such as the addition of a backup pump in case of emergencies

> The efficiency and practicality of our day-to-day operations have improved significantly since working with Danio Lab
>
> **Sarah Conlin**
> Zebrafish Laboratory Manager

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Testimonial

Sarah Conlin | Laboratory Manager, UMass Amherst

How long have you been working with Danio Lab? If any, what were your issues/challenges with your system/operation before calling us? Why did you end up choosing Danio Lab?

- We heard about Danio Lab from our neighboring fish facilities and reached out in late summer 2017. We were having water pressure issues with our three daisy-chained seven-row stand-alone racks, and adjusting individual tank flows would not fix the issue. I heard back from Rory within the hour, and he was able to come for a site visit within the week. It took him less than 10 minutes to diagnosis the issue, noting that the pumps we were supplied with were not meant to service seven-row racks. It was very easy to choose Danio Lab to be our service provider given Rory's responsiveness, vast knowledge of the field, and proximity to our campus.

Are you happy with the results? If any, what differences have you noticed (compared to your old, pre-existing setup)?

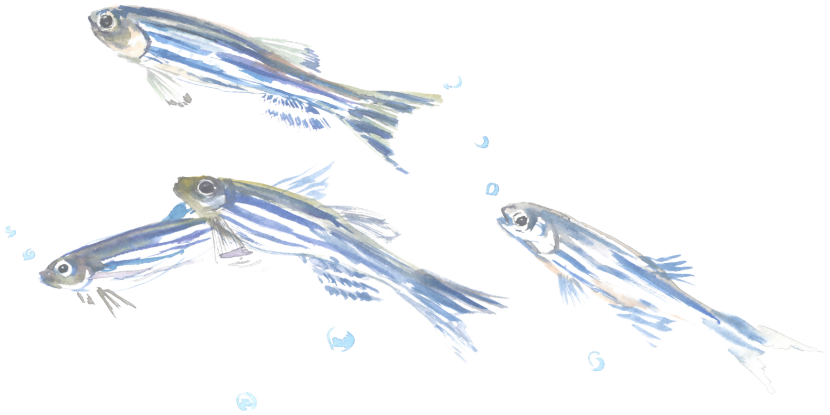
- We are very happy with the results of working with Danio Lab. Since our first meeting, we've gone to Rory for any and all zebrafish services, including regular maintenance and new facility design and assembly. The efficiency and practicality of our day-to-day operations have improved significantly since working with Danio Lab. The noticeable differences between past and present facility additions are our increased fish capacity, new and improved pump and filtration skid, and updated monitoring system. The improvements implemented by Danio Lab give us the confidence that our fish are well cared for from a plumbing and filtration perspective.

Would you recommend Danio Lab to others?

- I would most definitely recommend Danio Lab to those looking for zebrafish service and support.

If any - other comments, feedback, or criticism (we're always looking to get better!):

- Not only is Danio Lab an excellent service provider, but Rory is very personable and easy to work with! I always look forward to chatting with him about his creative designs and look forward to seeing them in action.



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