



# Thinking Microscopically

Suffolk's experience in vivarium construction—where even the tiniest detail makes a huge impact—has developed a variety of solutions in these specialty spaces.

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WHITEPAPER

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# Challenge

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To preserve years of delicate scientific research and set the stage for future lifesaving medicine, vivariums require a large catalogue of specialized construction elements. Utilities that are twice as large and complex as in typical buildings, sensitive lighting controls, protocols and finishes that keep air and floors pristine, and top-notch building specialists are all essential to successful vivarium construction.

## The Team

### SUFFOLK

- **Jason Seaburg, Chief Operating Officer**
- **Jason Lansberry, Project Executive**
- **Paul LeBlanc, Senior Superintendent**
- **Kevin Malenchini, Director of MEP Engineering**

### THE PROJECTS

- **Beth Israel Deaconess Medical Center**
- **Brigham and Women's Hospital**
- **Boston Children's Hospital—Karp Research Building**
- **Harvard Medical School**
- **UMass Medical School—Sherman Center**
- **Broad Institute**
- **Vertex Pharmaceuticals Fan Pier Annex cGMP Facility**
- **Momenta Pharmaceuticals**

# Solutions

On various projects throughout greater Boston, Suffolk has honed several solutions to handle the complex and specialized requirements of vivarium construction. All the solutions come down to one major concept: extensive, diligent, painstaking preparation.

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## Attention to detail, before work even begins

To deliver an unparalleled construction experience throughout the project lifecycle, the Suffolk team prioritizes early, close collaboration with the project's design team and the researchers, who will be the end users of the space. Since design and construction will directly impact the quality of their scientific research, robust communication on layouts, equipment, and process is key.

For example, the owner typically supplies the cage and rack system for the facility. Suffolk's life sciences

team works with the owner to determine which system will be in the facility, then coordinates the layout for air drops—which need to be right over the rack—and the watering system in a 3D virtual model. At Boston Children's Hospital, the Suffolk team had to pay extra attention to coordination as they worked to expand an existing vivarium. Piping had to take place above existing animal habitats and procedure rooms. To address that challenge, the team met with individual researchers three months before the project started and developed a protocol for working the ceiling above each of their rooms.

Pools to house research subjects at Harvard Medical School.



### A technology-forward approach

Technology plays a critical role in managing the complex coordination of vivarium construction. Once the Suffolk team has the proper information from the design team and end users, they build virtual mockups of holding rooms and the attached procedure rooms. With that model, designers, clients, and builders can spot and correct any errors before they reach the field, avoiding costly rework and scheduling delays. On Suffolk's vivarium project at Brigham and Women's Hospital, a researcher pointed out in the virtual model that an outlet should be on the right, not the left. One outlet may seem like a minute detail, but if it had been installed in the field, the issue would have resulted in a change to the concrete masonry unit (CMU) wall. Changes to

the CMU wall could cause small cracks in the wall's epoxy finish, which could then become homes for microbes, which could then infect a colony and destroy years of careful research. Thanks to this early collaboration and the virtual model, the team caught the error and relocated it to the proper location before work even began.

At the Brigham, the team also did a physical mockup of the floor, a surface that had to reach a Goldilocks balance of grit: not enough could cause slips in the room, too much could cause cleaning supplies to tear and create space for microbes. By having the end users mop the floor mockup, the Suffolk team determined the correct amount of grit for the entire surface prior to full installation.

The rack system at UMass Medical School's Sherman Center.



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### Experience and creativity lead to a safe, clean site—and space

Suffolk’s deep experience in the healthcare and life sciences sector has set up our teams for success to manage the sensitive requirements of vivariums. In these spaces, utilities must be twice the size to handle twice as much airflow as a typical lab building. All utilities must also be on backup power so HVAC systems can operate seamlessly in the event of an outage, ensuring no changes in temperature, humidity, and other conditions that could adversely affect the animals.

Rooms are also specially pressurized to prevent the potential spread of disease between rooms.

The pressure relationships between rooms are specific to the research and species in each space—another reason for upfront coordination and collaboration. Plus, these spaces must be antiseptic ecosystems for the animals, where pathogens can’t be introduced or have a chance to thrive. Our teams undergo training with researchers and clients to make sure they follow their protocols, clean their tools, and caulk every opening in a room to control the proper airflow and pressure specific to that room. That caulking is completed before air balancing and commissioning since caulking after that process would change the requirements. Given these factors, air balancing and commissioning can take up to three times as long as a typical lab.

The sterilization room at Beth Israel Deaconess Medical Center.





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To ensure a clean site at the Harvard Medical School vivarium, the Suffolk team engineered walkable ceilings in lieu of a catwalk system during construction. With engineered metal studs, plywood, and a hatch to enter the ceiling, workers could walk in the space above the ceiling—instead disturbing the antiseptic environment—to get where they needed to go. Those walkable ceilings were rigid so a person's weight wouldn't create cracks, since the patches on those cracks could be difficult to clean. At other projects, the team used a similar concept of walking space above animal holding rooms so workers could easily complete maintenance and repairs without disturbing the clean room atmosphere.

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The mechanical room at Beth Israel Deaconess Medical Center.



Interstitial space to house mechanical systems at Brigham and Women's Hospital.

Interstitial space to house mechanical systems at UMass Medical School's Sherman Center.



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## Respect and courtesy rules in occupied buildings

At the Boston Children's Hospital vivarium, the Suffolk team was working in an occupied space. In those cases, vibration is a real concern, as it greatly disturbs the animals' circadian rhythms, reproductive cycles, and general well-being. To accomplish the drilling necessary to install anchors into the slab, the team met with each researcher for the nearly 20 rooms to determine an individual work plan for each space. The team went over what work needed to happen, when it could happen, and how long it would likely take. Based on input from the researchers, drilling only occurred for 10 minutes at a time during an eight-hour period. As Senior

Superintendent Paul LeBlanc said, "When you had a researcher saying something was taking too long, you had to pivot. If they come up and say you have to stop, you have to stop. You regroup and you wait, and you figure out a plan."

If it was possible to move cages out of the room, the team did so, but otherwise built a containment system around the existing cages. That secure containment system was supplemented with HEPA filters to keep dust out of the room. The team took additional cleanliness measures for vermin control, such as sealing and gasketing any fixtures or conduits that they had to remove or install over the course of work.

A finished room at Boston Children's Hospital's Karp Building.



## Strong relationships with trade partners

Just as collaboration with the design team and end users is crucial to the success of vivarium projects, the relationships that Suffolk has forged with qualified trade partners are key in this arena. The exacting standards of vivarium construction require the upper echelon of trades for technical

installations, such as the stainless-steel watering systems needed for cage wash areas. Suffolk's strong presence in the Boston market, in addition to the company's national resources, has made it possible to build connections with these top tier trade partners and leverage their expertise on vivarium projects.

# Conclusion

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Each vivarium project has its own unique challenges, depending on the location, research, species, and plenty of other factors. Suffolk's experience over the years and the company's emphasis on collaboration have created a toolbox of solutions to tackle each one with precision, care, and personalization—no matter how impossible those challenges may seem.

**Here's how you can connect  
with our life science experts:**

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