

Merck Opens New Research Center in Boston

Built to Establish Stronger Links to Academic Research Community

The new 12-story, 600,000-sf Merck Research Laboratory (MRL Boston), which opened in August of 2004, is currently devoted to the development of therapies for the treatment of cancer and neurodegenerative disorders such as Alzheimer's disease.

"Although Merck already has thriving research centers in New Jersey, Washington, and Pennsylvania, as well as other international locations, we wanted to establish a presence in Boston to recruit top academic researchers and to develop synergies with established institutions," says Annette Nichols, associate director for Site Services and Engineering at Merck.

Located in the heart of Boston's Longwood Medical Area, Merck's new facility is literally surrounded by many of the world's leading academic research centers and hospitals, including Harvard Medical School, Beth Israel Deaconess Medical Center, Dana-Farber Cancer Institute, Brigham & Women's Hospital, and Children's Hospital Boston. The facility is sited on the Emmanuel College campus. Merck's long narrow footprint, 425-ft long and 110-ft wide, brings three of the building's sides to within inches of the property lines of neighboring facilities.

Urban Challenges

"In order to fit everything within our tight footprint we built vertically, which is very different from the layout of our other research centers," says Nichols. "This led us to incorporate creative space planning solutions such as internal loading docks, and a semi-enclosed bulk nitrogen storage tank on the ground floor."

Nichols adds that the vertical approach required all of the laboratories to follow the same 22-ft grid lengthwise throughout the building. The close proximity of neighboring institutions forced the architectural/engineering team to complete an extensive wind analysis of the site and surrounding facilities prior to final design approval to assure that air intakes and discharges of all facilities would not be adversely impacted.

"Along with some built-in challenges, our urban setting also offers unique public relations opportunities," says Nichols. "To capitalize on this, we added a demonstration lab that can be used for educational programs that promote science as a vocation and used by vendors who want to present new equipment or products."

She explains that the demonstration lab, which can be viewed by the public from the street level, provides a fully functional space where vendors can show their products without entering into Merck's proprietary lab space or without disrupting actual research.

Laboratory Spaces

The MRL Boston site includes three floors devoted to chemistry labs and four floors of biology lab space. Each floor is approximately 30,000 sf, with three 22-ft long lab modules designed to accommodate 12 chemistry researchers and up to 18 biology researchers. There are 12 horizontal sliding sash 8-ft fume hoods in each chemistry lab. Most biology labs include one 8-ft fume hood to be shared by all researchers working within that lab. Specialty chemistry labs in the new facility include an Analytical Support Lab, complete with multiple mass spectrometers. The chemistry facility can house up to four 600-megahertz NMR instruments. It has a Low-level Hydrogenation Lab that includes explosive-rated light fixtures and electrical equipment.

The facility also has a separate Scale-up Chemistry Prep Lab that includes an epoxy floor with both walk-in and vertical fume hoods and large open spaces designed for conducting robotic-based experiments and research requiring additional distillation space or elevation.

The biology labs use a combination of fixed and flexible casework to create an open/modular layout, with each lab based on the same 22-ft module as the chemistry labs. Each biology lab includes numerous biosafety tissue culture suites and equipment support spaces which vary according to the needs of the researchers.

The facility's vivarium is designed with all mechanical systems on the outside perimeter to minimize any maintenance or mechanical disruption. The vivarium supports basic research steps in the drug discovery process.

"Our vivarium has heat recovery and its own dedicated air handlers that are cross-tied both hydronically and on the air side between the two floors so that three out of four air handling units will always operate in the event of a mechanical failure," says Nichols.

Building Amenities

The four-story portion of the facility, known within Merck as the "Head Block," contains administrative offices and building amenities that include a full-service cafeteria.

"Visitors to the Head Block enter into four-story atrium that includes a coffee bar and open access spaces with groups of seating and tables to encourage interaction among the researchers as well as visitors to the building," says Nichols. "The atrium also includes a view of the dramatic four-story spiral stairwell that connects the Head Block floors of offices."

Nichols adds that access to this stairwell is only available to building occupants, and that it was created as another informal meeting spot to encourage and enhance communication among employees.

The Head Block also includes a 280-seat auditorium with an expandable stage that is used as a site for events ranging in scope from concerts, to academic symposiums, to Merck's own in-house talks and training programs.

Centralized Systems

Nichols explains that the vivarium contains an area for centralized cage washing. This area is fed by a distribution network that pumps detergents up from the bulk detergent system located at the ground floor. This same system feeds a centralized glasswash facility.

"We determined that we are able to use the same detergents, just mixed in different concentrations, for washing both cage racks and scientific glassware," says Nichols. "This allows us to have bulk quantities of the detergent delivered to both areas.

She adds that using a centralized glass wash facility eliminates the need to have separate wash stations within each lab. All glass is labeled and manually picked up and delivered to and from the centralized glass wash facility.

The facility also houses a horizontal bulk nitrogen tank, including oxygen monitoring, numerous exhaust fans, and exterior venting.

Utility Systems

According to Nichols, the MRL Boston facility presented numerous HVAC challenges. To address some of these challenges, Merck combined both lab supply and lab exhaust air as a manifolded system.

"Using a manifolded system allows the office exhaust to become part of the lab supply make-up air," says Nichols. "This leads to energy savings since the office air is almost free because it is part of the makeup air to the lab. The energy consumed to heat or cool the office space is relatively small compared to what the cost would have been if it was run as its own separate system."

She adds that all of the chemistry general labs are tied into a common manifolded exhaust, with fire dampers in each of these branch connections. In addition, the vivarium has its own separate dedicated exhaust ducts, while the biology floors are manifolded separately to minimize vertical ductwork requirements.

"Booster fans have been added wherever it makes sense to minimize the whole HVAC energy usage or where fans are needed for terminal filtration or supplemental cooling," says Nichols.

Nichols explains that from an HVAC perspective, both the cagewash and glasswash areas produce very wet exhaust streams. She recommends using ductwork that leads to the manifolded general lab exhaust rather than adding a separate fan for redundancy.

“Our new Boston facility includes a large central chiller plant that is very flexible and extremely efficient,” says Nichols. “It uses a primary-only VFD pumping system, which from an energy perspective, is the most efficient system for a conventional chilled water system.”

In addition, the chiller plant is a hybrid design, with both steam turbine and VFD electric drives to maximize flexibility and reliability.

According to Nichols, the facility’s chilled water capacity is not redundant and she recommends this type of set-up particularly for northern climates. Merck also capitalized on the opportunity for free cooling with a plate and frame heat exchanger against chilled water to take advantage of the winter climate.

“This set-up is highly efficient from both a reliability standpoint and operating cost standpoint,” says Nichols. “It provides the flexibility to switch between electric and steam depending on cost and availability.”

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Biography: **Annette Nichols** is associate director for Site Services and Engineering at Merck where she is responsible for Merck’s new Boston research laboratory. In this capacity she is in charge of all site facility operations and site engineering issues. Prior to her Merck-Boston assignment, Nichols was the corporation’s senior mechanical utility specialist for strategic planning, trouble-shooting, and energy management. In that position, she managed the front-end design of major capital-project utility systems for new grass-roots research and manufacturing facilities. Nichols has been working in industry for 29 years, 17 years of which have been with Merck. She has also worked for Exxon Research and Engineering and Union Carbide.

This article is based on Nichols’ presentation at the Tradeline *Research Buildings 2006* conference held in May.

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The new 12-story, 600,000-sf Merck Research Laboratory (MRL-Boston) is located in the heart of Boston's Longwood Medical Area. (Photo courtesy of Merck & Co., Inc.)



To create a light and open feel, Merck's chemistry labs include design elements such as exterior windows, flexible casework, and clear glass drying racks located above the sinks. (Photo courtesy of Kling, Paul Warchol Photography.)