Delicate Balance

Columbia Univ.'s Gary C. Comer Geochemistry Building achieves harmony with its dramatic surroundings while giving its researchers both form and function.

This special issue of *R&D Magazine* highlights the four winners of the 43rd annual Laboratory of the Year competition, co-sponsored by *R&D Magazine* and SEFA, the Scientific Equipment and Furniture Assn. Applicants were new or renovated labs first occupied between Aug. 1, 2007, and Dec. 31, 2008, and were carefully evaluated by research laboratory specialists.

The West Entrance to the Gary C. Comer Geochemistry Building clearly show the demarcation between the lab wing (on left) and the office wing (on right). The dividing line is a split atrium that allows for a unique "skip-step" stairway design. Image: Warren Jagger Photography

The judging criteria is intense, and an overall winner is not necessarily named each year. This year, however, the **Gary C. Comer Geochemistry Building**, Palisades, N.Y., impressed the judges and was named 2009 *R&D Magazine* Lab of the Year for excellence in design,

The new home for the Columbia Univ. Lamont-Doherty Earth Observatory's Geochemistry Division is situated on the site of a scenic former estate overlooking the Hudson River. Well respected for earth science R&D, the building is home to 70-some geochemists who study the many of the world's non-renewable resources. Their lab needs are significant. Highly-sensitive mass spectrometers, corrosive acid compounds, and extremely high pressures are common research requirements.

This work, in part, helped pave the way for a brand-new lab. Gary C. Comer, founder of the Lands' End catalog company, became interested in the earth sciences after he learned he was able to navigate through the Northwest Passage in his yacht, doing in a single summer what took explorers centuries to accomplish. His subsequent discussions with leading scientists, including **Columbia Univ.** professor Wally Broecker, led to a plan improve on 1950s-era buildings. Construction began just a week before the death of Comer in 2006 and was dedicated in November 2007.

Satisfying multiple missions

With the Comer Building, Columbia Univ. wanted to maintain a high level of harmony with natural environment. To minimize the building's visual impact, **Payette Associates,** Boston, Mass., chose to use an existing parking lot in a shallow depression. The deep soil base removed the need for expensive rock excavation and allowed air-handling and mechanical equipment to be housed underground. Victoria David, AIA, Lab of the Year judge and VP/director laboratory design **Leo A Daly Architects**, Denver, Colo., liked the strategy.

"This is really a handsome building, and the design team made the effort to optimize its location and minimize its visibility on a lovely site," she says.

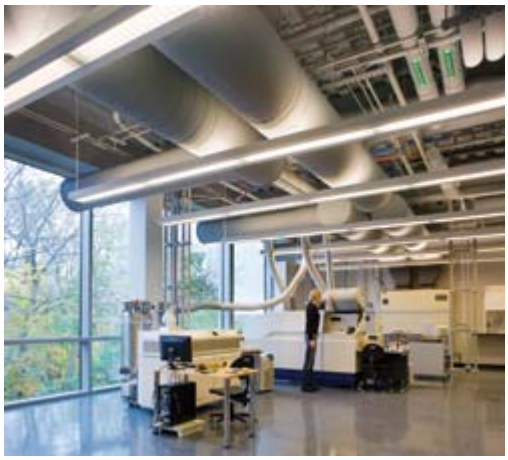
The new building would feature a 2.5-to-1 ratio of offices to labs, so architects were faced with the common but crucial challenge of clean integration. Using the difference in ceiling height to their advantage, they positioned a three-story wing of 10-foot-high offices opposite a two-story wing of 15-foot-high labs. These were connected with half-story staircases in a "skip-stop" fashion that saved designers 19% in building footprint and 13% in envelope.

To mediate the wings, the team designed two separate clerestory-lit atria to emphasis space and light. The two-wing strategy also cut energy use. Offices, which don't need high-flow air solutions, have

individual fan coil units that sense occupancy and shut down to save costs. All mechanical ductwork was kept on the lab wing, allowing designers to reduce air needs 36% under all-VAV baseline projections.

"The separation of the two zones, office from lab, completely addressed the engineering issue of separating low-energy zones from high-energy zones and in turn reducing the annual operating costs," says Richard Johnson, Lab of the Year judge and director, strategic marketing, corporate alliances, **Thermo Fisher Scientific**, Two Rivers, Wis.

Other "green" features include low-emitting construction materials, low-flow plumbing, efficient thermal design and ventilation, and daylighting. The project is being considered for LEED silver certification from the U.S. Green Building Council.



The inductively-coupled plasma mass spectrometry lab is just one of 26 core laboratories in the Comer building. Despite the specialized nature of many of these labs, they must be flexible enough to accommodate changing research needs. Image: Warren Jagger Photography

Getting the research done

The Comer Building has 26 active core labs, which fall into four general categories—mass spectrometry, instrumentation, wet chemistry, and specialty labs. Each lab area is individually customized. For example, three mass spectrometers in the building use noble gases, such as helium, argon, and krypton, in analysis of geological samples. Applications may range from evaluating stardust to conducting hydrology work.

Grouping is important at a lab like the Comer Building, where core labs are shared by multiple researchers. Only one researcher might make use of the paleoceanography lab, but at least five are using the inductively coupled plasma mass spectrometry (ICPMS) lab on a regular basis.

"The organization of the various labs is based on their functional requirements, and the individual labs aren't proprietary to one investigator," says David. "The designers used the landscape to locate instrumentation labs on the ground floor, and incompatible labs are distant from one another."

The sensitivity of the instruments, however, means that some labs have to be separated. The ICPMS lab, for example, uses argon and so had to be positioned well away from the noble gas mass spectrometry area to prevent contamination.

Despite well-outlined core functions, Comer Building labs have flexibility. Metal channel supports and reconfigurable service drops support a wide range of instrumentation. Mechanical ductwork, lighting, and other systems are left exposed to facilitate maintenance.

"The module isn't hard and fast, but the space is wide open to accommodate changing instrumentation. HVAC shafts are tucked into the corridor ends of the labs to allow as much free headroom within the working areas as possible," says David.

Solving acids, dampening vibrations

The design of the wet chemistry labs was particularly challenging for designers. Unlike most chemistry labs that use solvents, the processing of marine sediments and other samples involves the use of strong acids. Researchers measure stable isotope ratios and concentrations of naturally-occurring radionuclides such as carbon-14 and other isotopes. Even small quantities of the airborne acids can oxidize ferrous metals on contact.

The need for a non-metallic lab environment led to the use of polypropylene casework and fume hoods. Ductwork, which is commonly metallic, presented a challenge. In the end, a number of different materials were used, including CPVC for perchloric hood exhausts, fiber-reinforced plastic for conventional hood exhausts, and high-performance epoxy-coated galvanized steel for supply ductwork.

Mass spectrometers are crucial for characterizing molecular structures but are also highly sensitive to vibration. To help guarantee the value of the measurements, specialized and innovative small steel "link-columns" were embedded with the walls of the appropriate labs, allowing the mass of the second floor in the lab wing to dampen the movement of the first floor. This solution was effective without appreciably increasing the building's mass.

The basement laboratories benefit from this vibration damping approach. Yet, they are not entombed in darkness thanks to daylighting from celerestory windows near ceiling height.

Office space

The sad fact is that many researchers are forced to spend as much or more time behind a computer screen in their office than in the lab performing hands-on work. Designers mitigated the burden of a modest 120- to 180-square-foot office size limit by installing floor-to-glass windows along the entirety of the office wing as well as the lab wing. The view, situated against the surrounding deciduous forest, is likely appreciated by the researchers. Roller shades control solar input.

In seeking freedom from the confines of the old office buildings, researchers were often seen using outdoor areas for lunch, group discussions or solo laptop work, even in the dead of winter. Upon learning this, the lab's designers created a spacious videoconferencing room that provided access to a large outdoor patio overlooking the Hudson River Valley. The patio is readily accessible via a large, automatic bi-parting door.

Despite the grand view from the patio, and abundant light throughout, the building is cleverly camouflaged. Perhaps the best evaluation of the laboratory's success in topping the judge's list is the summary given by Julie Higginbotham, Lab of the Year judge and editor of *Laboratory Design* newsletter, which organized the roundtable judging process. She says the lab emerged from a strong field by excelling in multiple areas: siting, space efficiency, energy use, and the technical quality of the labs.

"The facility also creates many opportunities for informal interaction, both indoors and outdoors, and maximizes the opportunity to create a focal point not only for building occupants but also for others who work on the campus. All in all, a beautiful, functional building and a very impressive achievement."

—Paul Livingstone