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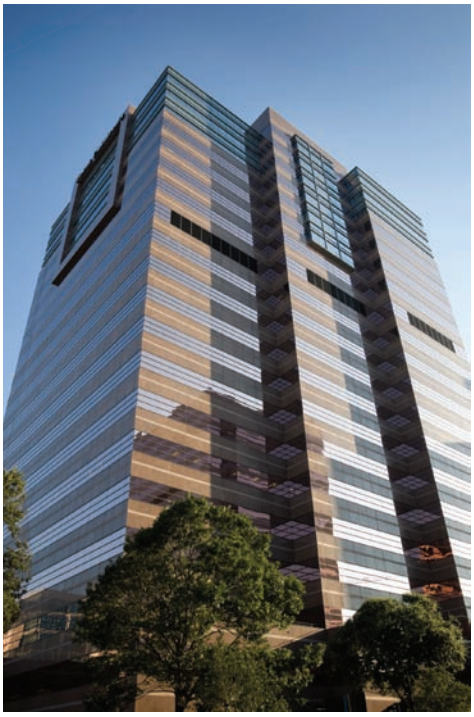
2010 Laboratory of the Year

Honorable Mention

Raise the Roof

Vertical expansion elevates the translational research program at Texas Children's Hospital.

Floor to floor vision glass offers expansive views from the labs. Photo: Aker/Zvonkovic Photography



In 2008, the City of Houston code would not allow for any H occupancy within 1000 feet of schools, hospitals or residences. With help from the project team, the code was revised to allow for up to 10% H occupancy per floor. Photo: Aker/Zvonkovic Photography

Need new lab space? Find a parking lot and build. Or, tear down the old lab and start from scratch. Or, you can "go vertical".

That was the strategy for **Texas Children's Hospital** (TCH) in Houston, the pediatric teaching hospital of Baylor College of Medicine and one of the largest pediatric institutions in the United States. In 2006, TCH introduced Vision 2010 Excellence to Eminence initiative—the largest expansion ever by a single children's hospital. A major component was the extension of the hospital's translational research program with a complex vertical expansion of the 12-story **Feigin**

Center. The resulting 20-story structure was designed to facilitate the sharing of knowledge between basic research and clinical care, improve disease research and treatment, and to attract leading physicians and scientists.

For its innovative approach to renovating and expanding a limited space—while the facility remained operational—Texas Children's Hospital Feigin Center is the recipient of an *R&D Magazine* 2010 Lab of the Year Honorable Mention.

"It was a very creative and effective renovation of an impossibly complex building; given this was the second renovation, it created a third life on this tight site in a dense medical center," says Erik Mollo-Christensen, AIA, principal at **TSOI/Koubus & Associates** (Cambridge, Mass.) and 2010 Laboratory of the Year (LOY) judge. "The addition improved the function of the existing portions as well as creating new space."

With no open land available, the Feigin Center had nowhere to go but up. Fortunately, the building's original design and construction—a simple floor plate, 14-foot floor-to-floor heights, and a robust foundation—allowed for future vertical expansion. In 1991, the center opened as a clinical care center. In 2002, it was adapted to a 12-story research building. The award-winning 2009 expansion converted the center to a 20-story tower with enhanced vistas and collaborative space. **FKP Architects**, Houston, managed all phases of the expansion.

"The idea of adding on versus just tearing something down and starting from scratch is great," states Victoria David, AIA, VP director laboratory design, **Leo A Daly,** Denver, Colo., and LOY judge. "The foresight used in the original construction has been honored and the result is a seamless evolution."

With the Feigin Center's vertical expansion, the facility added more than 200,000 ft^2 of space for research labs, clinical research offices, good manufacturing practice (GMP) space for gene therapies, a simulation center, an expanded vivarium, and a new animal imaging center. The facility now houses more than 120 investigators involved in 800 basic research and clinical studies in genetics, cancer, neurology, cardiology, neonatology, diabetes, asthma, and infectious diseases.

Laboratories are designed on a generic footprint and incorporate a movable laboratory wall system and a flexible casework system to give users the capability of reconfiguration as technology or staff changes. Photo: Aker/Zvonkovic Photography

Building vertically presented some unique challenges. Existing **City of Houston** building codes did not allow for any Hazardous occupancy (H-occupancy) space within 1,000 feet of schools, hospitals, or residences—a potential roadblock to the vertical expansion plan. The project team formed a task force of representatives from FKP Architects, code consultants, the City of Houston Fire Marshall, and the City of Houston legal department. The task force revised the code to allow for up to 10% H-occupancy zoned space per floor of combined spaces of no more than 500 ft^2 per H-occupancy room, paving the way for the vertical expansion of the Feigin Center and other Houston high-rise medical and research institutions.

Feigin's existing roof was riddled with small fans from original lab exhaust. The project team was faced with the relocation of existing exhausts, affecting a total of 125 hoods within the building. Photo: FKP Architects

Lessons Learned

"Texas Children's Hospital is one of the first owners I have seen that actually re-evaluates and refurbishes its lab buildings on a time frame consistent with the program turnover in a modern lab environment (~3-5 years). More owners should be following their example."

–Richard R. Reitz, LOY judge

"Success is more likely with a team than a fee-competitive separate selection of architects and contractors. It is clear that collaboration with the users throughout the planning and design gave the team the confidence the project would work, and that operations would continue."

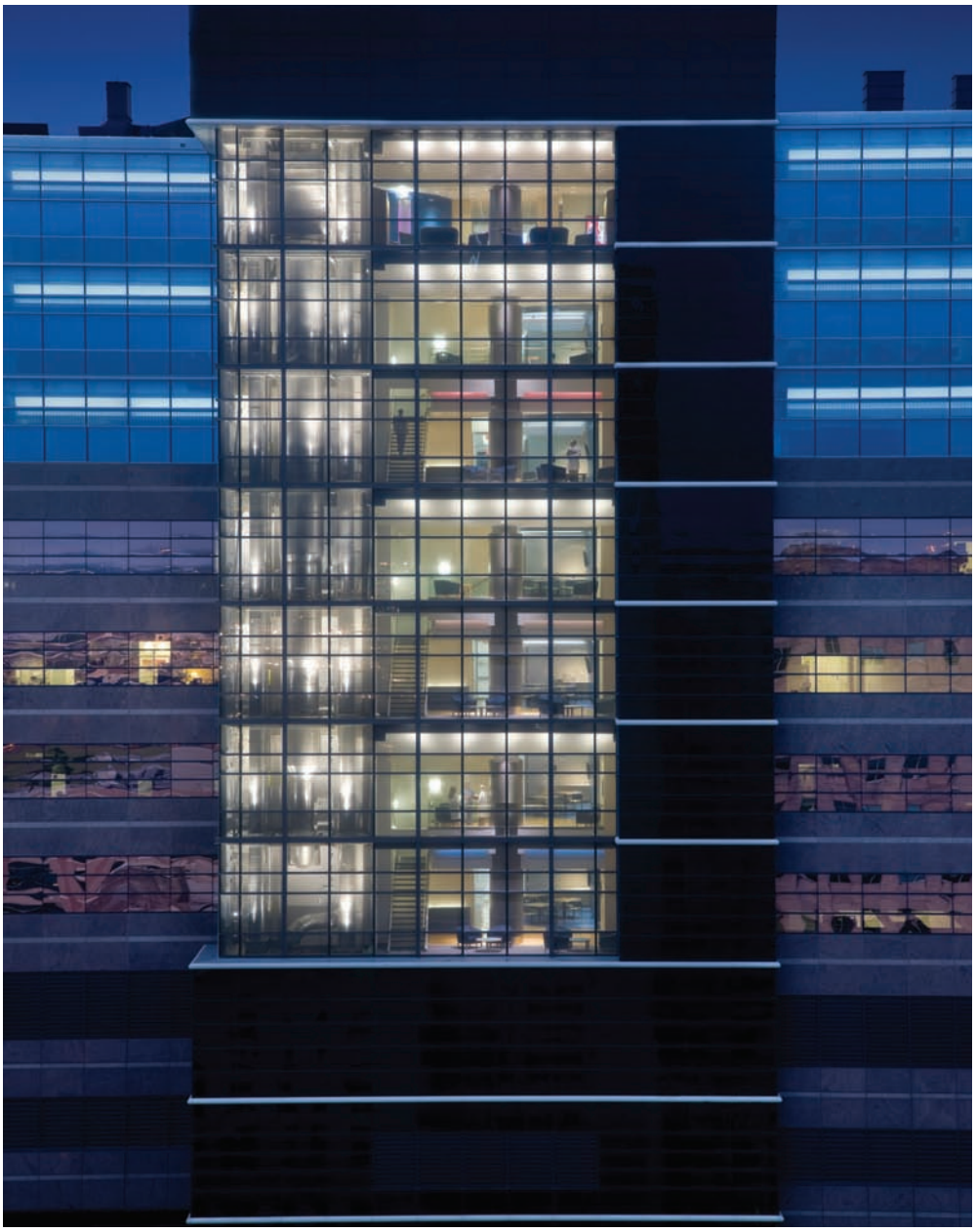
–Erik Mollo-Christensen, LOY judge

"Rethink the idea of how to improve existing buildings and extend their life,"

–Victoria David, LOY judge

Going up

The roof of the 12-floor Feigin Center was a maze of exhausts from 125 fume hoods. Contractor **W.S. Bellows Construction**, Houston, worked with hospital operations, maintenance, and research personnel to evaluate the potential



The building's transparency brings it alive at night and offers a glimpse of the activity inside. Portions of the structural skeleton, stainless steel wrapped ducts, exhaust systems and piping are visible through the glass. Photo: Aker/Zvonkovic Photography

impact on ongoing research projects and developed shutdown schedules During construction, upblast fans allowed the contractor to add vertical stacks at each new floor to discharge the fumes at least 15 feet above the workers.

The new 13th floor became an interstitial mechanical level built over the manifold serving the original 12 floors. It houses exhaust manifolds and the primary outside air pretreatment handling units for the new seven floors of laboratory space. The original building had units on each floor; consolidated units serve the expansion from a single floor.

Separate air systems were designed for each quadrant of the new floors, each comprised of two side-by-side air handling units capable of supplying 100% of the make-up air for the laboratory exhaust system. Outside air, return air, and exhaust air are tracked on a per-floor basis to maintain the desired pressure. Emergency generators serve the chilled water pumps, air handling units, exhaust fans, lighting, control systems, and the data center.

Air chases were moved into the interior of the building, opening views to the south for the building's two-story collaboration spaces. The air distribution system on each floor was designed to minimize crossing of primary supply and exhaust air ducts. The supply air emanates from the core, while the exhaust is collected to two main ducts at the perimeter and routed vertically to the roof manifold on the south side of the building.

The design team installed **Aircuity,** Newton, Mass., systems on two existing floors to measure volatiles and particulates in the air and evaluate adjustments in makeup air and exhaust rates. The results showed that the air was clean 99% of the time; air changes could be reduced from 15 to 4 changes per hour but can be increased if contamination is detected.

David says, "The new design also benefitted the existing floors, taking the opportunity to update vertical circulation, update lab module configurations to reflect the changing nature of research, and reduce energy consumption of outside air quantities given new control system technologies."

In planning for the laboratory space and layout, the designers surveyed the existing lab users to see what they would change. The users were happy overall; they asked only for more collaboration space.

The designers extended their investigations, following the daily work of researchers, then analyzing the workflows with time-study software.

Based on this analysis, the designers not only increased collaboration space, but also standardized furnishings to a six-foot movable bench for more efficiency, created central storage rooms with high-density storage systems, and increased the ratio of office and support space to labs. Reconfiguring the laboratories to remove non-lab functions reduced operational and construction costs and energy consumption, and provided more efficient space for users.

"The TCH/FKP approach of analyzing their existing labs and questioning what works and what could be done better is atypical on lab projects, particularly where an existing building is involved," said LOY Judge Richard R. Reiz, PhD, Helena, Mont. "Actually studying the work habits in the labs is above-and-beyond the norm for lab planning work. And studying the actual air quality in the existing labs allowed TCH to reduce the HVAC demand on the lab floors, both new and old."

For example, with a full building and vivarium, ensuring that the construction activities would not adversely affect the breeding patterns of the mice colony in the vivarium was a top priority. In order to provide this data, TCH used vibration monitoring equipment, placing accelerometers in the vivarium, as well as on the 12th floor, to collect readings and spikes of vibration. The data showed that most spikes occurred within normal business hours and were primarily caused by TCH's own facility equipment and operations, especially when the cage washing machine was operating, when the air handlers would turn off and on, and the doors opened and closed. The data did not indicate any impact from construction activities.

The laboratories are designed on a generic footprint with a flexible casework system; lab

assignments can fluctuate without movement of walls. The six-inch technical laboratory wall system, Hamilton MAXWall, from **Thermo Fisher Scientific, Inc.**, Two Rivers, Wis., features piped services, data, and power. Adjustable shelving hangs from the wall, and adjustable height tables allow users to reconfigure the lab themselves.

The lab can be reconfigured without drywall de-construction, which allowed for the building of additional tissue culture rooms as the construction started and user requirements changed.

"Not only did Texas Children's Hospital refurbish, add to and extend the life of a still-viable research building, they also used the opportunity to change the image of their laboratories by making the new floors day-lit with large expanses of glass," says Reitz.

Floor-to-floor vision glass provides expansive views from the labs. Color visually organizes the open labs; bright yellow swoops indicate the lab exits where handwashing, safety shower, and other safety equipment can be found.

A signature beacon

To create a beacon effect and allow the building to "change expression" throughout the day, the designers selected high-performance radiant glass with ceramic frit glare control for energy efficiency that is transparent in direct sun and reflective when skies are cloudy. Using cold cathode, incandescent, and LED lighting, the building appears to emit a glow at night. The glass extends the building's signature horizontal banding, connecting the new section with the existing structure and enhancing visual interest. Several vertical stainless steel ducts can be seen from the exterior, adding to the visual effect.

To match the existing building's signature Sunset Red granite cladding, the contractor shipped granite clad precast panels salvaged from the 2002 project to a granite quarry, where quarry engineers found matching samples. Other panels salvaged from the building's previous conversion were used in the 2009 expansion—conserving new granite and cutting project costs.

"This was a challenging assignment to expand this facility vertically with all the fixed constraints of a floor plate size, perimeter, central core and structural grid to accommodate a highly diverse program," says Andy Vazzano, FAIA, LEED AP, Science and Technology practice leader, office director, **SmithGroup,** a LOY judge. "What set this project apart was the design and systems and constructability approach to expand this facility vertically while keeping all the lower floors in operation in minimal disruption."

—Lindsay Hock

VITAL STATS

Project: Texas Children's Hospital, Feigin Center vertical expansion

Size: 200,000 ft²

Cost: $80.4 million (includes shell & core, build-out, and renovations).

Architect, lab planner:
FKP Architects, Houston

MEP engineer:
Burns Delatte McCoy Inc., Houston

Structural/civil engineer:
Walter P. Moore, Houston

Interiors: Inventure Design, Houston

Landscape architect:
White Oak Studio, Houston

Contractor:
W.S. Bellows Construction, Houston