Article Reprint
Tradeline Inc.
Leading-Edge Resources for Facilities Planning and Management
TRADELINE

New Labs of the Decade

Themes, teams, and tools drive diversity

If there's a hallmark trait distinguishing the latest lab facilities, it would have to be diversity. Each new building is a one-off design that, while borrowing heavily from its predecessors, is custom-configured to meet specific occupant needs, according to Richard Rietz, Ph.D., a long-time lab consultant based in northern California.

The labs that came on line toward the end of the last century lent themselves much more readily to characterization, observes Rietz. The 1980s were marked by the rise of the biological sciences. The following decade saw a burgeoning increase in analytical instrumentation in all laboratory types. But today, five years into the new millennium, it's hard to capture the essence of contemporary research facilities--either recently completed or underway--in just a few a words.

The closest Rietz gets to an overarching generality is the observation that labs are moving in three directions: incorporating some combination of themes, teams, or tools; brimming with feature creep; and exhibiting a much greater degree of specificity.

"Ten or fifteen years ago, you could look at the next biomedical building or the next biotechnology laboratory and they would be very similar," he says. "You could take the program from one building and put it in the other, and the researchers could work fine. Now when I go on a building tour, every building I have seen in the last several years is different.

"I think that is the big trend going forward. Lab buildings are unique. Every one has its own program, its own drivers, and its own set of features to be optimized. Both consultants and owners have to be exactly on target for each project."

New Directions

In addition to this complex diversity, what Rietz had originally expected to happen in the lab arena in this new era didn't materialize. More than 20 years of involvement in laboratory planning had led him to believe that in this decade lab design would move forward incorporating incremental improvements at an evolutionary pace. Instead, the path branched off in multiple directions.

"The three general things flavoring lab buildings today are themes, teams, and tools, the Three Ts," he explains. "Many buildings are taking an overall approach, such as targeting brain function or cancer. Another prong is the team-oriented building, which has to accommodate groups of people working together productively in a particular way. Then there is the development of incredible tools, like high resolution microscopy, nanofabrication, or the barrier animal facility, where the whole building is a research tool."

In various permutations, these drivers have produced a plethora of innovative facilities and a long list of building types.

“The individual combination of themes, teams, and tools will determine how a particular building gets put together, but you can come up with very different answers, even when two institutions have the same Three Ts,” notes Rietz. “There are many different interpretations of scientific themes and different definitions of specialty spaces. The big message is the prevalence of uniqueness today.”

To understand the full extent of his observations, Rietz offers an armchair tour through some of the most prominent examples of new building types.

Mingled Disciplines

The first category Rietz focuses on is the latest iteration of the multidisciplinary building, now referred to as **trans-disciplinary**, reflecting the overlapping boundaries of so many areas of science. A welcome haven for academics who don’t fit into traditional university departments, trans-disciplinary facilities are springing up on campuses from Baylor to Berkeley--and multiplying courtesy of the NIH, whose Roadmap for Science not only identifies the need for these kinds of buildings but also provides funding.

One noteworthy example is Stanford’s Clark Center, whose aptly named Bio-X science program targets the intersection of biology with other sciences. Open labs of 4,000 sf can be reconfigured to house physics or robotics investigations as well as biology or chemistry. Utilities, carried on hooks and rails in the exposed ceiling, can be moved around as needed. The arrangement of ancillary space is an experiment in flexibility, with offices, conference rooms, and student areas out in the lab zone in configurations that can be shifted at will.

Nanotechnology

Category number two, **nanotechnology**, owes its proliferation, in large part, to the federal initiative signed by President Clinton in the spring of 2000. Early facilities harboring work on the submicron level showed up as sections or suites of other buildings, but now funding has spurred construction of several full-on nanotech centers, of which Cornell’s Duffield Hall is the first such example.

Most nanotech structures going up on American campuses have similar features: nanofabrication on the ground level with either a bay and chase or modified bay and chase design. The dry labs are on the upper floors. High-performance subspaces include high-resolution electron microscopy and other atomic level observational techniques. These specialized spaces impose heavy demands on the infrastructure, for example, the need for electromagnetic, radio frequency, and vibration shielding. Duffield Hall, a shared facility, lacks faculty offices, so the building is riddled with collision areas--either along the atria or in little alcoves or at the ends of the laboratory zone--meant to foster interaction between faculty and students.

Rietz figures that between university nanotech facilities, either stand-alone or as parts of other buildings, and the six nanolabs the federal Department of Energy is adding to the National Laboratories, approximately one and one-half million sf of nanotech space will be brought on line in the U.S. by 2008.

Scientific Themes

The third type is the **scientific-theme** building, which collects everything necessary to do a particular science in one centralized location, so researchers have all the tools they need without leaving the premises. A prime example is the Broad Center at CalTech, devoted to the study of human consciousness--whether through primate or human models or on a molecular biology level. The building brings together the biology labs, human and primate imaging, electron microscopy, a mouse vivarium, and a full primate vivarium.

The building footprint is a cube, with three floors of laboratories above ground and two floors below ground. These accommodate the imaging suites and the vivaria, along with an interstitial level that serves them both.

“The laboratories are fairly standard and people are tightly mingled,” comments Rietz. The Broad Center is rich in community spaces: embedded food service; a family room combining a library, interaction area, and coffee area; and lounges for individual research groups.

Of the other research-themed buildings, probably the boldest experiment is the one launched by Howard Hughes Medical Institute (HHMI) as it morphs from a virtual organization to one offering a bricks-and-mortar collaborative laboratory for its members.

The idea behind the new building, slated for occupancy sometime next year, is to bring visiting HHMI fellows to a centralized facility that affords access to the cutting-edge tools their home universities do not have. Stays can range from two months to two years. The Loudon County, Va., facility incorporates scientific themes focusing on brain imaging, function, and control.

Rietz points out two HHMI features reminiscent of other facilities: “pods of researchers getting together, as in the Salk Institute, and long corridors like the IBM or Bell laboratories.”

Private Institute on Campus

Type number four is the **private research institute**, examples of which are the Lee Moffitt building, a cancer institute at the University of South Florida; the Gladstone Institutes at the University of California, San Francisco (UCSF); and the Kansas City-based Stowers Institute.

"These buildings really optimize two specific lab features: the re-assignable open laboratory and the linear equipment room," Rietz observes. "They all have various themes, and many of them are funded by different mechanisms, often by a mix of state and private sources. The way they are run varies, too," he continues, noting, "Some have mixed agreements with the universities on whose campuses they reside."

A notable aspect of the Stowers Institute, a major cancer research center created from scratch, is the effort expended on the mouse barrier vivarium, including the incorporation of a full interstitial level and all the infrastructure required for fault-free operation. Multiple levels of isolation assure the effectiveness of quarantine areas, with micro-isolators and isolation suites in their own zones closed off by special isolation doors. Air flow controls allow for pressurization changes throughout, including the ratio of isolation to regular space in the facility.

To speed up recruiting, the facility has numerous amenities, ranging from 400-sf principal investigator offices to shared PI libraries to an on-site hotel for guests.

Group Productivity

The fifth category, the **productivity** building, consolidates multiple user groups in need of similar capabilities. One of the largest such facilities is the Queensland Bioscience Precinct (QBP) in Brisbane, Australia, completed about 18 months ago. QBP represents the pooled resources of five research groups, government and private, all of which wanted updated quarters. Working together, they contracted for a 375,000-sf joint tenant structure with flexible utilities and furniture systems. Utility taps are in a network above the ceiling, easily accessed through droppers and turrets, or closed off with ceiling tiles if unneeded. Pieces of furniture come in metric units that require little time to reassemble.

Other features include glass walls into the labs for safety and visual interaction; open laboratories with multi-use corridors separating labs and lab support; linear equipment and material corridors;
huddle areas right at the research group; food service and community spaces, and a link to the main campus. QBP also created shared core resources consisting of high field NMR and electron microscopy.

More productivity buildings are appearing. The Bayer High Tech Center in West Haven, Conn., brought to the forefront the combination of overhead wings and turrets, along with carts that allow laboratory equipment to be moved around and reconfigured. The FDA Western Regional Labs now house testing personnel formerly scattered all across the Los Angeles basin. The University of California, San Francisco, is relocating medical center researchers to new buildings that feature group social areas and a reconfigurable laboratory zone that can house chemistry, biology, or computational science.

Urban Scientists

Another category coming on strong is the **urban-oriented** laboratory building, whose main challenge is making good use of the high-priced land underneath. The answer appears to be the high rise, such as the Millennium Pharmaceuticals complex in Cambridge, Mass., near MIT.

"The solution here was elegant and simple," reports Rietz. "All the community spaces are on level one, such as the cafeteria and lecture hall. The laboratory floors above are optimized for either chemistry or biology. Interspersed with the labs are little pods of offices, while equipment rooms are clustered towards the center of the building. The lab floors have limited common spaces, just small analytical equipment rooms, safety stations, and breakout areas."

As for the rationale behind this new trend, Rietz points to Novartis trading its 10-year-old, Lab of the Year in suburban New Jersey for a renovated building in Boston, an admittedly expensive move. Rather than putting up a new building, Novartis turned a 75-year-old candy factory into a modern, 500,000-sf biomedical research institute.

"The company's new head of research explained the move by saying, 'That is where the talent is, the people whom I want to hire, and where the ideas are that I want in our science,'" he relates.

Three More

Although not new, **advanced chemistry** facilities continue to undergo refinement, with the addition of more efficient fume hoods, lower conditioned air usage, advanced instrument areas, and sophisticated waste disposal systems. **Biodefense** represents "a big expenditure of people, time, money, and resources in this country at the moment," Rietz says, referring to planned spending of $1 billion to $2 billion for between 20 and 30 bio-safety level 3 and 4 lab buildings. **Economic development facilities** have the mission of drawing targeted enterprises to a specific geographic area. Arizona's Biodesign Institute Phase One, on the Arizona State campus in Tempe, includes interior spaces that look like a private medical research institute, which Rietz says is an intentional decision designed to attract just that level of personnel.

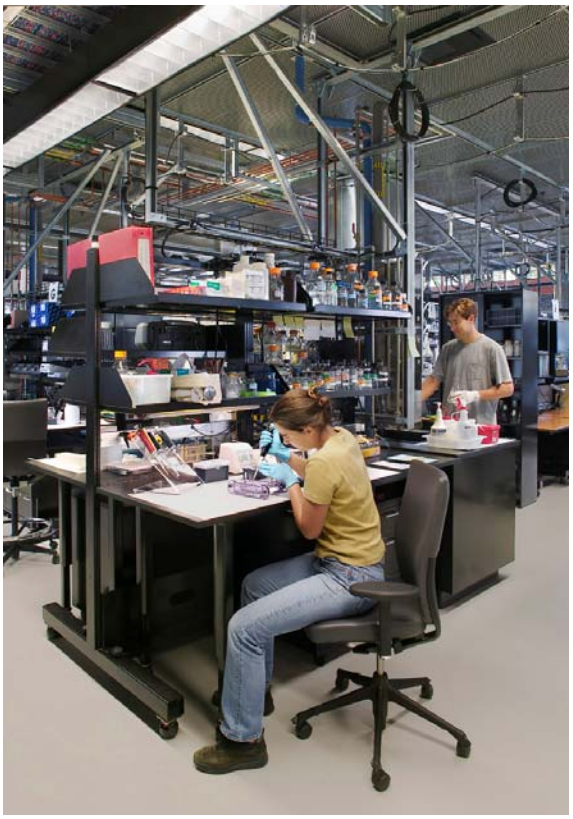
For more information
Richard Rietz, Ph.D.
Independent Strategic Lab Planner
629 Bridgeport Lane
Foster City, CA 94404-3605
(650) 572-0418
rrrietz@earthlink.net
laboratorystrategicplanning.com

Biography: As an independent lab consultant, **Richard Rietz**, Ph.D., prepares laboratory facility programs and capital plans for both corporate and academic organizations. He also studies how labs are planned, managed, and used, and what makes some more successful than others. Rietz's recent assignments have included projects for Allergan Pharmaceuticals, Alza, Gilead Sciences, Protein Design Labs, Sanofi-Pasteur, the University of Nebraska, The University of Oklahoma Health Sciences Center, the University of Alberta, and the National Research Council of Canada.

This report is based on a presentation Rietz gave at the Tradeline *Research Buildings 2005* conference in April 2005.

Collecting all the tools necessary for the study of human consciousness, the scientifically themed Broad Center at CalTech is rich in community spaces, including a family room that combines a library and interaction and coffee areas. (*The Caltech Broad Center for Biological Sciences, Architects: SmithGroup/Pei Cobb Freed and Partners. Image copyright Timothy Hursley*.)

A private research center, the Gladstone Institutes at the University of California, San Francisco has been designed to optimize two specific lab features: the re-assignable open laboratory and the linear equipment room. (*Photo courtesy of Richard Rietz.*)



Stanford University's Clark Center houses the trans-disciplinary Bio-X science program in open labs that can be reconfigured to house physics or robotics investigations, along with biology or chemistry research. The arrangement of ancillary space is an experiment in flexibility. (*Photo by Robert Canfield courtesy of MBT Architecture/Foster & Partners.*)