

LABORATORY Design

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Designing for collaboration: The stakeholders' perspective

By G. Michael Chippendale, PhD

In recent years, the design of science buildings has focused on enhancing collaboration both inside and outside the laboratory. A landmark workshop sponsored by the New York Academy of Sciences in 1993 (*Ann. N.Y. Acad. Sci. vol. 735, 1994*) explored new designs for research facilities for the future. The workshop brought together different viewpoints, including those of scientists, research managers, architects, engineers, and construction personnel from universities, corporations, and government agencies. Their collective expertise brought into focus the need to design research buildings that foster collaboration during a

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Fig. 1. A 5,000-ft² atrium in the Bond Life Sciences Center provides interaction space that is easily reconfigured for different group activities. Illustrated is the atrium being used for a vendor show and displays of scientific posters.



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time when the frontiers of science and technology are progressing rapidly. The past 20 years have seen major changes in the way science is conducted away from single-investigator laboratories towards interdisciplinary teams working together in shared laboratories.

Buildings that support collaboration are designed to create an environment where faculty, students, and staff can rub shoulders with their colleagues in other disciplines, thereby promoting an exchange of ideas that encourages interdisciplinary work. The inclusion of collaborative space in science buildings designed for single or multiple disciplines creates a desirable environment for research and education. Collaborative space provides a friendly, welcoming, and interactive workplace for all who use the building.

Recognizing that the Baby Boomer generation is starting to leave the workforce and that buildings currently under design will not be occupied until around 2010, architects and engineers need to focus on meeting the workplace needs of generations X and Y. Unlike their elders,

these generations tend to put work-life balance and personal satisfaction over job permanence. To recruit and retain personnel, special emphasis should be put on creating modern science buildings that are functional and attractive. Building designs should create a sense of community and provide attractive work space and

public areas, as well as offer amenities, such as a café and child care facilities.

This article describes the features that stakeholders and users seek in the design of new or renovated life sciences buildings. The term “life sciences” refers to the current scientific revolution that integrates knowledge across life forms: micro-organisms, plants, animals, and humans. The convergence of advances in molecular biology, information and computer technology, and robotics is allowing scientists and technologists to achieve previously unreachable levels of scientific integration.

The information presented is based on my experiences in running a research laboratory, teaching graduate students, and later being intimately involved (from 1994 to 2006) with architects and engineers in the planning, design, construction, and operation of the Christopher S. Bond Life Sciences Center at the Univ. of Missouri-Columbia. This center opened in 2004; it was designed by BNIM Architects of Kansas City; Anshen + Allen Architects, San Francisco; and RFD, San Diego; and constructed by River City Construction, Peoria, Ill., as the general contractor. All

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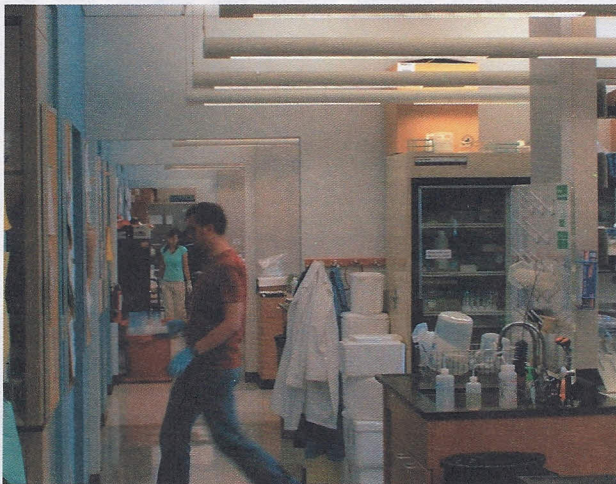


Fig. 2. Research laboratories in the center, each about 1,000 ft², are connected with a ghost corridor that allows for the easy movement of personnel between labs to facilitate collaboration.

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photos in this article were taken by the author at the Bond Life Sciences Center.

Campus academic administration Universities operate in a highly competitive environment, striving to secure the best talent and maximum funds to run research and educational programs. Campus administrators recognize that modern facilities for research and teaching are vital for maintaining and enhancing a university's academic credentials. State-of-the-art science buildings enhance the reputation of a university because they:

- Provide top-quality research lab space that attracts and retains faculty.
- Provide an environment that increases the success rate of securing federal grants that are increasingly being directed to interdisciplinary research.
- Enhance the reputation of the institution by providing public

facilities (e.g. auditoriums, conference rooms, and atriums) to attract national and international symposia and workshops and to serve as a hub for conferences and workshops. (Fig.1, page 1).



Fig. 3. A 3,000-ft² space immediately outside the auditorium in the center allows for the mingling of attendees before or after presentations to encourage interaction.

- Show that the institution is responsive to modern sustainability initiatives by using sustainable design methods and construction materials.

Campus facilities and management

This stakeholder group is concerned primarily with the functionality of the building and how well it will hold up over time under heavy use. Special attention is placed on what sustainable design features are incorporated into the building that might reduce life-cycle costs for utilities and maintenance. Critical design features should:

- Provide good traffic patterns and signage inside and outside the building and good zoning in the building, thereby contributing to public safety.
- Provide energy-conserving measures, such as high-performance fume hoods and motion detectors that prevent the illumination of unoccupied space.
- Provide convenient access to mechanical and electrical systems for ease of maintenance.

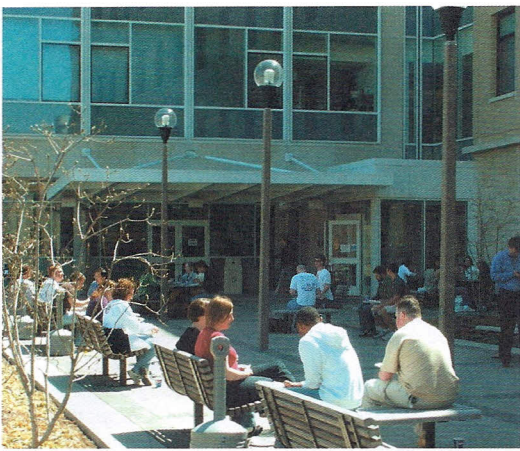


Fig. 4. A well-landscaped terrace allows center occupants and visitors to enjoy an extended indoor-outdoor feel and a place for informal interactions.

- Provide adequately for custodial services in terms of staff workstations, equipment storage, and durable floors and walls.

- Incorporate design features that allow for the ease of adapting laboratories to new uses.

Colleges/schools/divisions/departments To attract and keep outstanding faculty, a university must be able to offer state-of-the-art labs equipped for cutting-edge research. Such facilities and equipment go a long way toward enabling faculty members to recruit the highly qualified staff and students needed to maintain competitive research programs. This leads to outstanding research being conducted and to the enhanced prestige of the college, school, division, and department. Collaborative facilities benefit this group of stakeholders because they:

- Provide research space for existing faculty designed to foster interactions and, therefore, provide new opportunities to expand research into new areas. (Fig. 2, page 2).

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- Provide an environment with research facilities and equipment that is attractive for recruiting and retaining faculty.

- Provide enhanced public facilities (e.g. atrium, auditorium, café) for professional and social events that can lead to improved morale and productivity within the campus community (Fig. 3, page 4).

- Provide opportunities to expand and enhance disciplinary programming through interactions across disciplines and access to specialized equipment.

- Provide new state-of-the-art teaching laboratories.

- Generate laboratory and office space from faculty and staff vacating existing facilities to move into new facilities.

Faculty Principal investigators funded by grants are especially concerned about having facilities that streamline all aspects of their research program while they multitask in such areas as student advising, grant and manuscript writing, and teaching. Some critical design features are those that provide:

- Adequate amount and layout of lab and office space with attractive and functional furniture; retain flexibility to adapt laboratories to different uses.

- Easy access from office to lab, to lab personnel, to shared equipment, and to conference rooms for lab meetings.

- Emergency backup power for samples, key instruments, and computer equipment.

- Natural lighting, welcoming public areas, and attractive landscaping (Fig. 4, above, left).

- Adequate hazard management and security for laboratory zones.

Administrative staff, technical staff, students, and postdocs These user groups interact most closely with all design features of the building. They quickly become aware of any design features that delay or complicate their activities in the building. For this reason, it is most important for designers to get input from representatives of these groups of occupants early in the design process. Some examples of critical design features are those that provide:

- Adequate, quiet, and well-lighted workstation and/or office space.

- Sufficient personal space and adequate informal interaction space.

- Adequate kitchen, break, and lunch space (Fig. 5, above, right).

- Isolation of noisy equipment.

- Convenient traffic patterns and elevator locations in the building.

- Adequate shelving and storage space.

- Sufficient wall space in labs to accommodate free-standing equipment.



Fig. 5. A 1,400-ft² café is an amenity for faculty, staff, and students, as well as a gathering place to hold informal meetings.

- Adequate special-use rooms, such as tissue culture and cold rooms.

- Faculty offices close to labs.

- Corridor doors and doors into labs sufficiently wide and high (42 × 90 in.) to allow for the ease of movement of large pieces of equipment within the building.

- Accessible voice/data ports (i.e. not blocked by furniture).

- Lactation station for nursing mothers.

Considerations concerning scientific equipment The design of modern collaborative science buildings provides opportunities for cost savings in equipment purchases because of increased opportunities to share expensive equipment. This requires designing sufficient support space adjacent to the research laboratories to accommodate the various instruments needed to conduct modern life sciences research. An additional benefit is that the maximum amount of bench and wall space in the research labs can be made available for work space rather than for placing equipment.

The sharing of equipment is associated with

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Correction

An incorrect phone number was provided at the end of the article "Redefining Construction Management" (December 2007, page 9). The correct number for Jim Contratto, McCarthy, is 314-919-2343; jcontratto@mccarthy.com.

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some problems about the proper use and care of multi-user equipment. However, these concerns can be minimized by putting appropriate oversight systems in place.

Another important way to conserve space in research labs and support space is to designate a separate room or “farm” for the ultra-low-temperature freezers that are indispensable for long-term storage of samples for life sciences researchers (Fig.6, right). A freezer farm with electrical power backed up to an emergency generator provides reassurance of safe storage to investigators, and also simplifies the oversight and maintenance of the freezers by the service staff.

Core facilities are becoming increasingly important as centralized laboratories set up to provide and run expensive and sophisticated modern research equipment, such as mass spectrometers, X-ray diffraction apparatus, NMR machines, and DNA sequencers. They are staffed with technical support personnel who are knowledgeable about operating and maintaining the instruments. Core facilities may be available on a fee-for-service basis or be embedded into

particular research programs; either way, they are indispensable for research advances in the life sciences.

Economies of scale can be accomplished for equipment maintenance and fabrication in



Fig. 6. A 650-ft² freezer farm provides an excellent service to investigators for the long-term storage of samples. All freezers in the farm are connected to an emergency generator.

modern science buildings that are designed with an adequate service facility for repair and fabrication. On-site maintenance staff can provide immediate and personal attention to equipment breakdowns thereby facilitating research, and can often accomplish the work more quickly and at less expense than if an outside technical representative were to be called in on a service contract.

In conclusion, a successful outcome of planning for new and renovated science buildings depends on developing and maintaining a meaningful dialogue that involves the architects, engineers, stakeholders, and users during programming and design.

In January 2007, G. Michael Chippendale, professor emeritus at the Univ. of Missouri-Columbia, launched Chippendale Consulting LLC in Columbia, to provide expertise for planning and designing life sciences research and education facilities that maximize interdisciplinary interactions and support the implementation of sustainable technologies for food, health, and the environment (www.chippendaleconsulting.com). For this article, he is indebted to his former colleagues at the Bond Life Sciences Center, Univ. of Missouri, for their input (<http://BondLSC.missouri.edu>).