Breaking down barriers: Facilitating interdisciplinary research and teaching

Paul Cornell
VP, Product Marketing

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VECTA

Robert Luchetti Associates, Inc.

Topics

- Introduction
- The nature of ISC's
- Leading examples
- Architectural Design Guidelines
- Furniture Design Guidelines
- Conclusion

Who are we?

- Robert Luchetti
- Paul Cornell

Topics

- Introduction
- The nature of ISC's
- Leading examples
- Architectural Design Guidelines
- Furniture Design Guidelines
- Conclusion

What is an ISC?

- Interdisciplinary science centers (ISC) are facilities designed to bring different scientific disciplines together under one roof
- Typically, this includes chemistry, physics, biology, earth sciences and/or mathematics

Why interdisciplinary study?

- Major breakthroughs will come at the boundaries between disciplines
- Wilson's notion of "consilience"—the 'jumping together' of knowledge by linking facts and theory across disciplines
- "Real world" problems exist across disciplines
- They cannot be addressed without integrating across domains

Why interdisciplinary study?

- Benefits derive from exposure to alternate paradigms, methods and points of view
- Faculty are asking for it
- Grant submissions increasingly demand it
- Industry sponsorship requires it
- Recruiting and retaining faculty, students and funding

Why an ISC?

- The facility provides a means to achieving the vision of interdisciplinary endeavors
- Pedagogy is changing, requiring new kinds of facilities
- Multiuse space makes economic sense, especially for smaller schools
- Combined facilities provide greater critical mass, more exposure for programs

How does the facility help?

- A variety of organizational and financial incentives encourage collaboration
- However, the facility also helps by:
  - Increasing the likelihood of interaction between scientists
  - Sharing resources
  - “Situating” collaborative behavior
  - Making communication more frequent, less formal and ad hoc
  - Contributing to a sense of community

What are the benefits of collocation?

- Cognition
- Access to tools and materials
- Communication
- Social capital

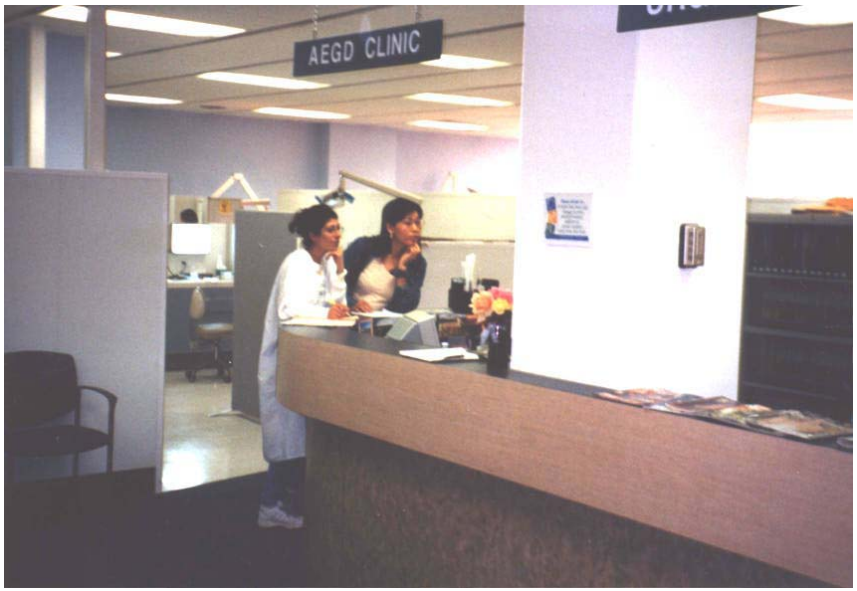
Collocation's cognitive benefit

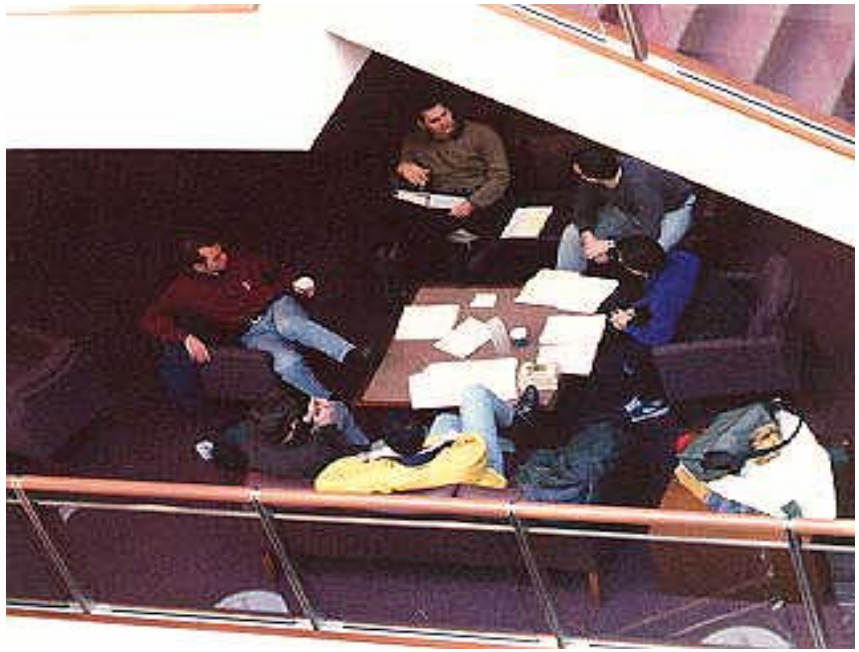
- Context for action—"set the stage"
- Cues for memory—persistent information
- Aids intuition—more and better info
- Fosters spatial memory—memory is a many-factored thing
- Learning aid—juxtaposed info
  - What's the best way to learn German?
- "Team immersion"

Paying attention

- Can humans multitask?
- “single piece flow” and switching costs
- Consider the time it takes you computer to start or switch applications
- Amount “attended to” is much smaller than what is available
- The subconscious is involved in learning
- The subconscious constantly influences our thinking

Cognitive benefit

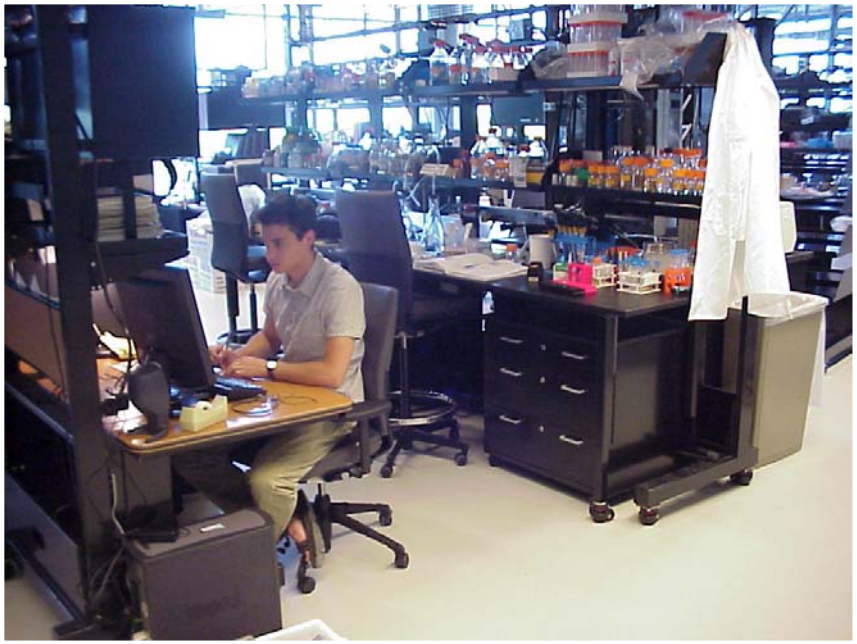




Tools and materials

- Every researcher wants to be collocated with their lab and their materials
- Quick and easy access to other labs makes interaction less formal, more frequent and more impactful
- “Let me show you” vs. “Let me tell you”
- The tools and materials we have available *mediate* what we do and how we behave
- Processes are “embedded” in our tools
  - “When you only have a hammer, every problem looks like…”

Tools and materials



Impact on communication

- Speed
- Accuracy
- Bandwidth
- Feedback
- Relevancy
- The “social life” of information

Communication

Social capital

- Capital is a resource for action, for getting things done
- Physical capital
- Human capital
- Structural capital
- Social capital

Impact on social capital

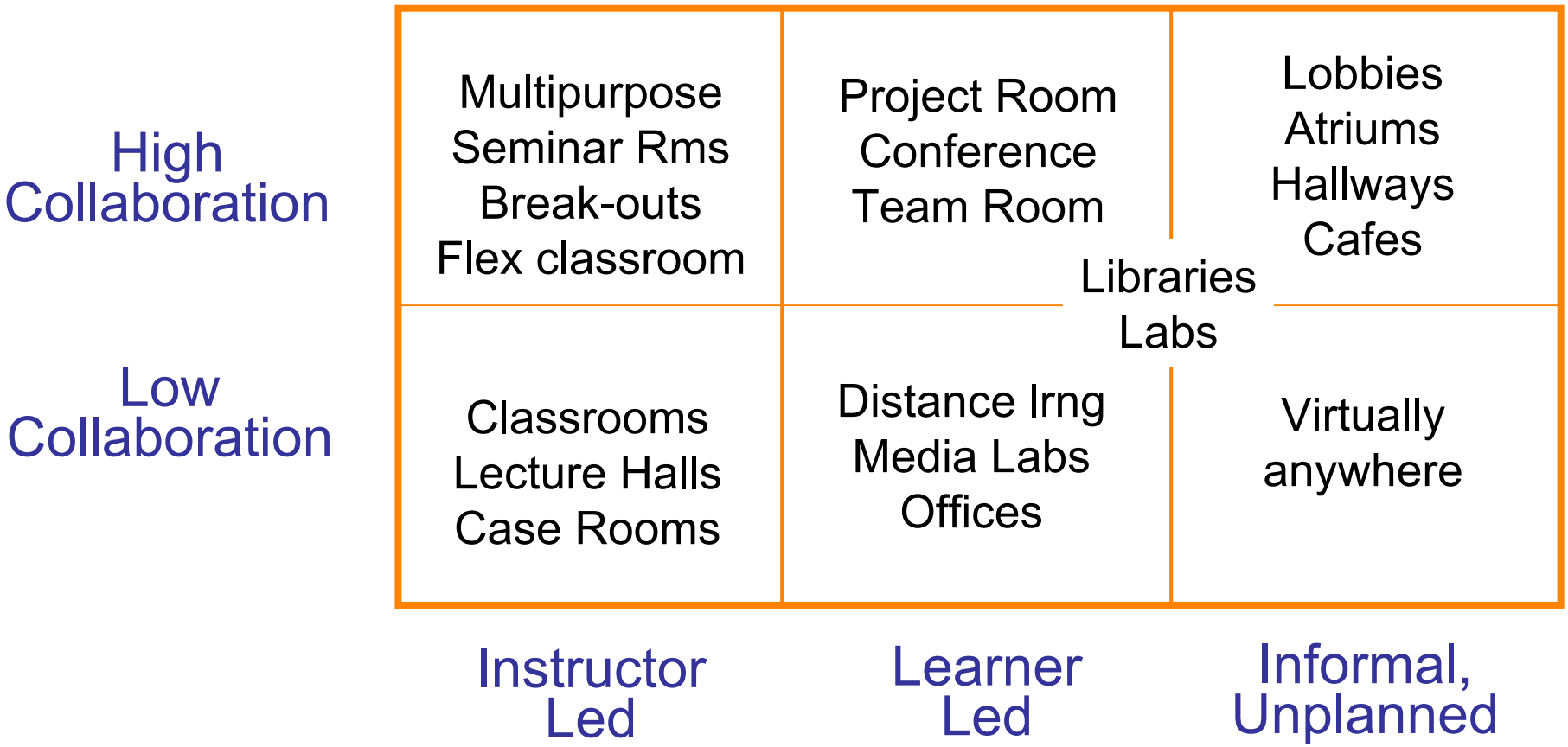
- The cognitive and communication benefits over time lead to familiarity and relationships
- This promotes a common context, even a shared language and culture
- Trust and reciprocity emerge
- Without collocation and face-to-face contact, social capital takes much longer to develop

Social capital

What are the benefits of collocation?

- Cognition—Memory, information processing, subconscious functioning
- Access to tools and materials—Location, resources, embedded processes
- Communication—Bandwidth, speed, accuracy, relevancy
- Social capital—Networking, sharing, trust building, reciprocity

What kinds of spaces are in ISC's?



Space attributes

1. Size	Small Group	⟷	Large Group
2. Enclosure	Open	⟷	Closed
3. Duration	Short	⟷	Long
4. Formality	Informal	⟷	Formal
5. Flexibility	Flex./Active	⟷	Fixed/Passive
6. Scheduling	Ad Hoc	⟷	Planned
7. Ownership	Shared	⟷	Dedicated
8. Functionality	Multi-purpose	⟷	Specialized

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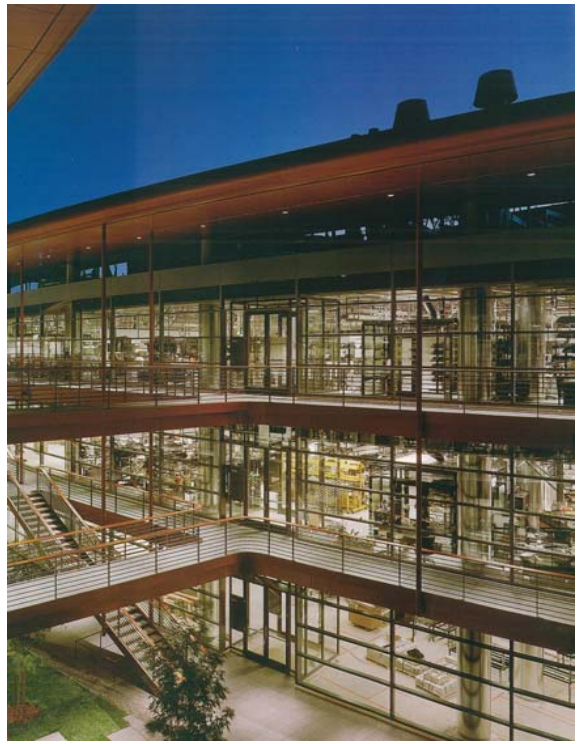
Just coming on-line

MIT Stata Center

Stanford
Clark Center



MIT Stata Center

Ray and Maria Stata Center

The new home of the Institute's Computer Science and Artificial Intelligence Laboratory (CSAIL) and the Department of Linguistics and Philosophy.

Soon the Brain and Cognitive Sciences building (right) will stand next door, but it is currently under construction.

The Stata Center features extensive community space intended for informal intellectual development

MIT Stata Center

Inspiration and Motivation

Bring current departments from rented off campus buildings back onto the MIT campus.

MIT was instituting a campus wide effort to “nurture community, socialization, and even amusement…comfort, communication, connectivity and a sense of place.”

To serve as a hub for student activity; a model for innovative, technologically-supported education; and a modern incubator for new ideas and technology, providing significant flexibility for multiple use.”

MIT Stata Center

Program

The 713,000 sf Stata center houses :

Student shopping, child care, food services, AV systems, museum space, various reading rooms, various classrooms, various labs, two-story parking garage, lounges, and outdoor terraces.

Contains the following departments: electrical engineering, computer science, artificial intelligence, linguistics, and philosophy.

MIT Stata Center

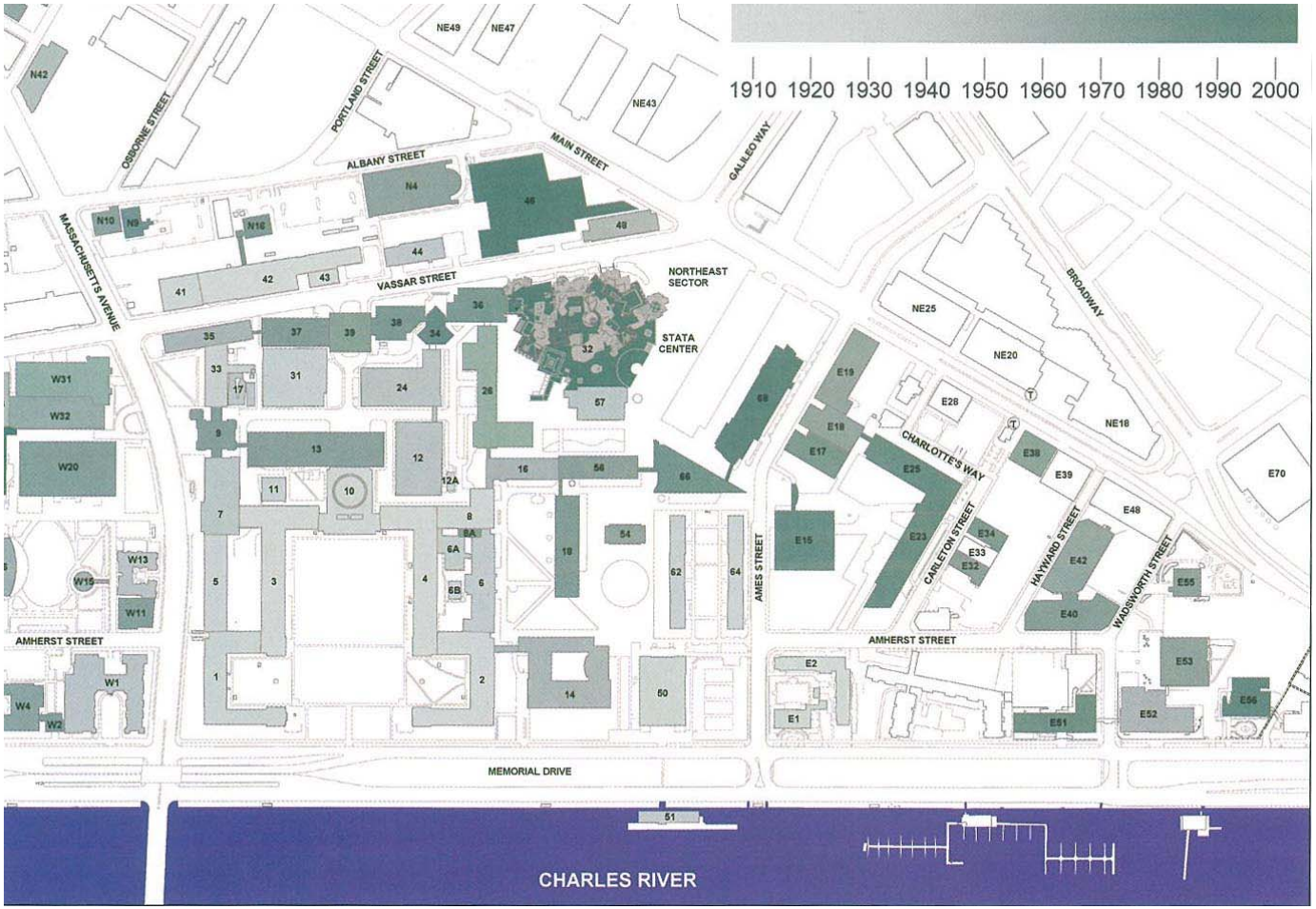
Community

Student Street creates a community creating a mini-mall within the building … students will be drawn to this commerce district and hold informal discussions.

There are large glass facades with the intent of increasing visibility/decreasing privacy and thus bringing the entire building “closer.”

Infinite Corridor System – is meant to open to the pedestrian as well as transform the northeast sector of MIT’s campus into a pedestrian zone.

MIT Stata Center



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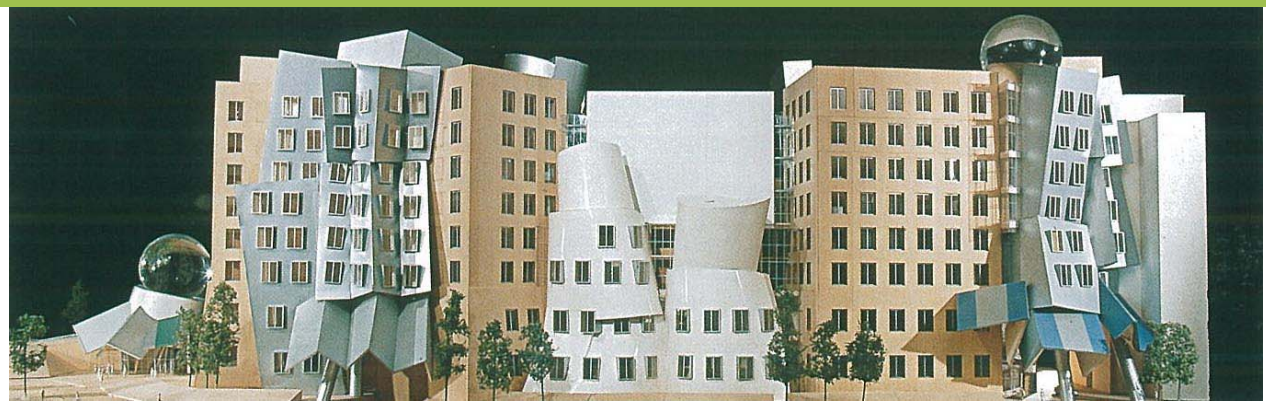
MIT Stata Center



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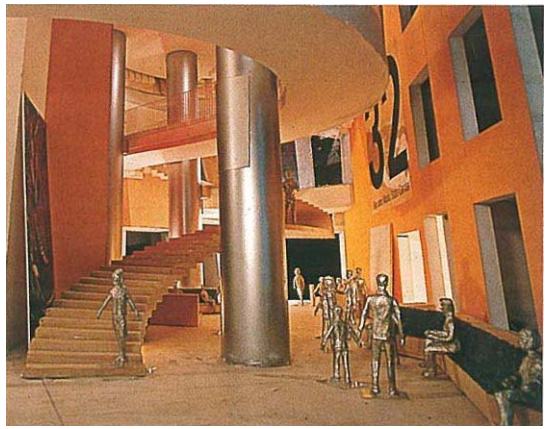

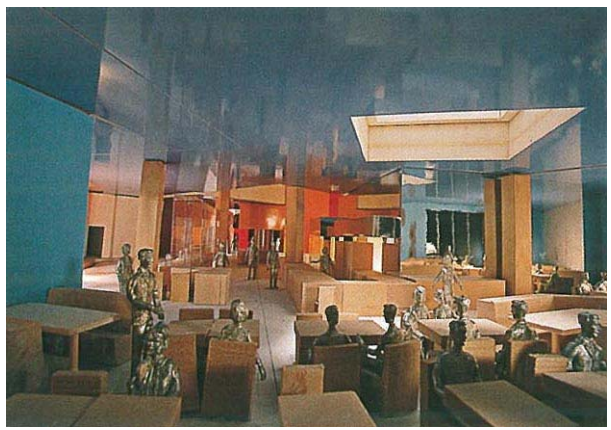

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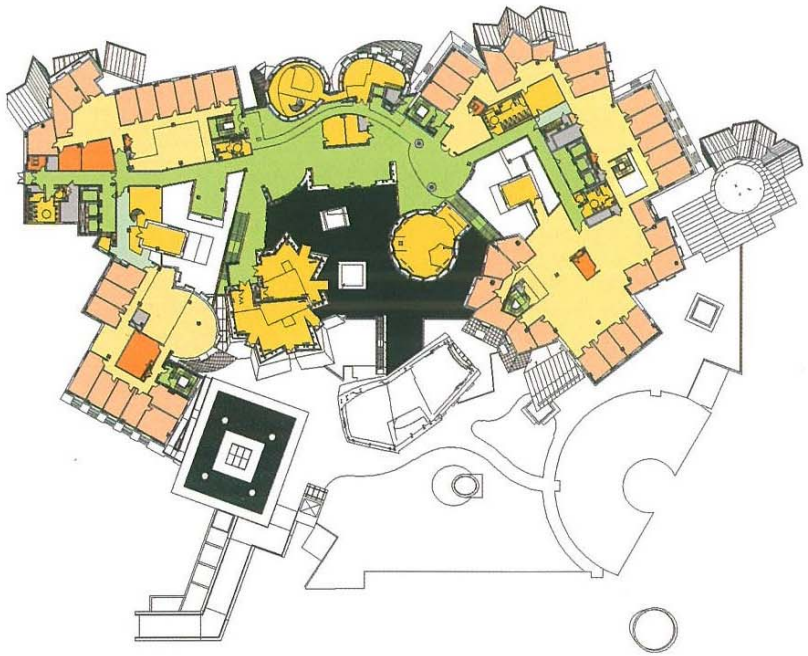

Office
Open-Plan
Segregated Lab
Common
Client Circulation
Public Circulation

Level 4

Level 5

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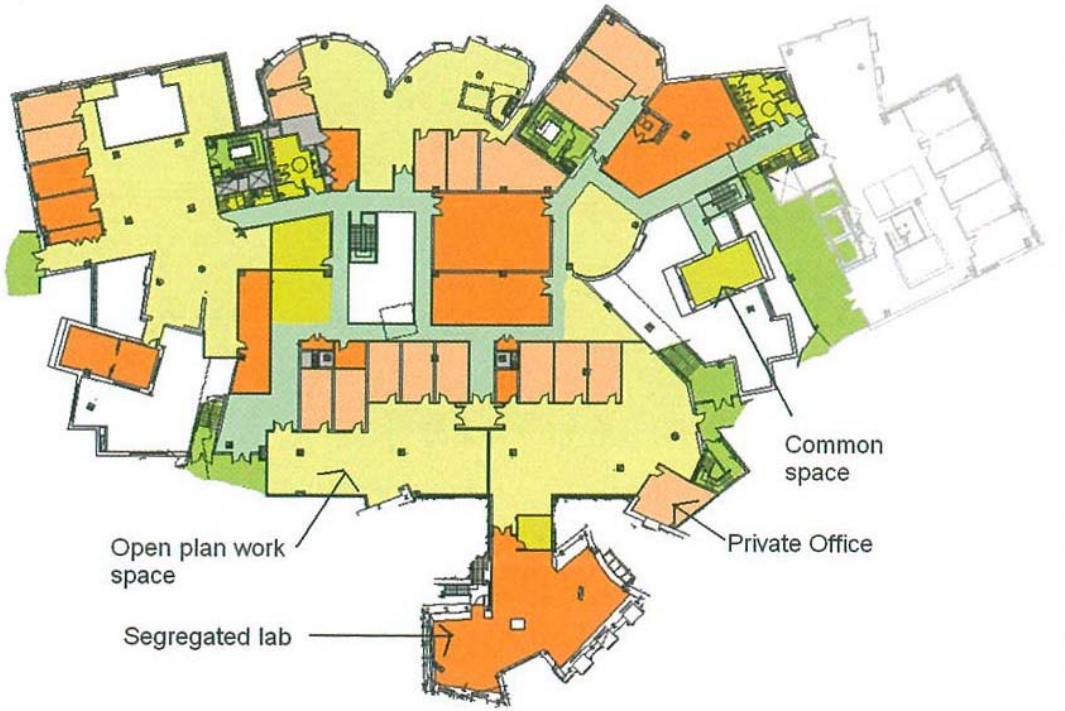
MIT Stata Center



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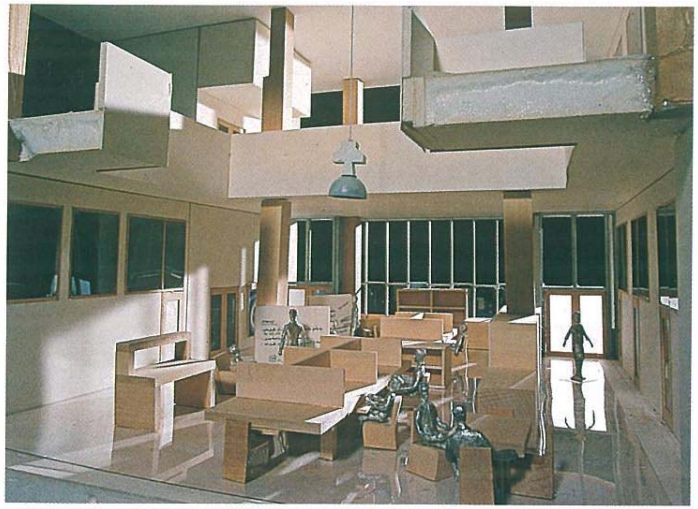

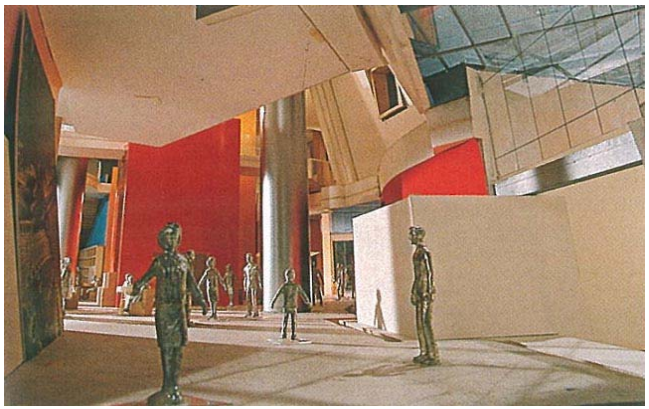

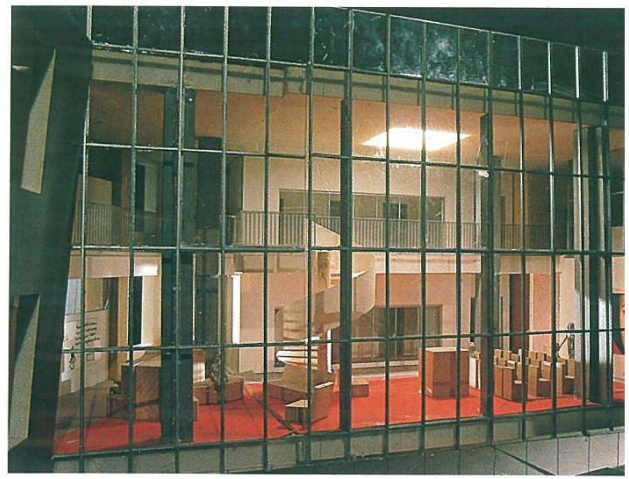

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Stanford's Clarke Center

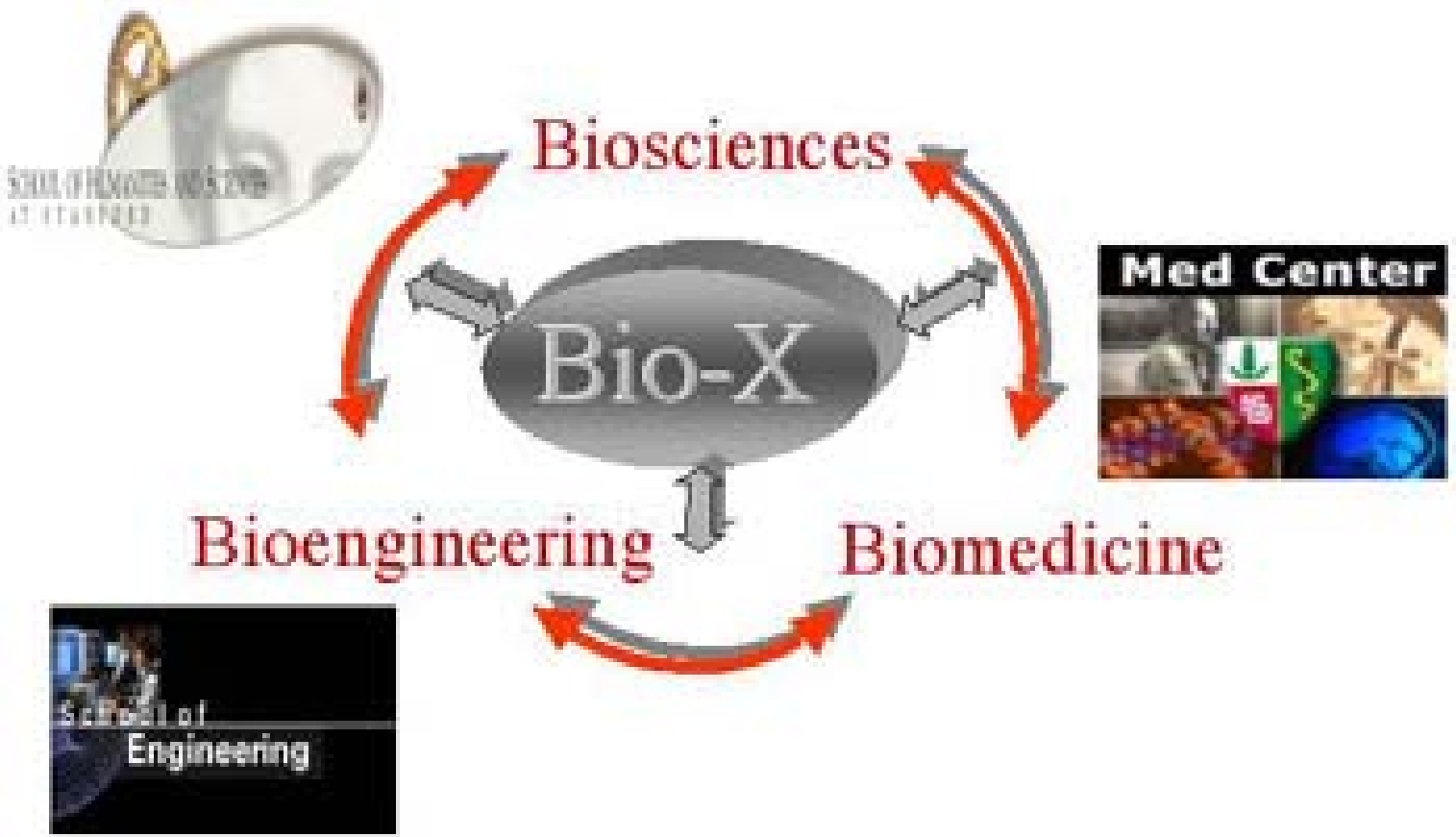
The James H. Clark Center

The Center is the hub for the Bio-X program, one of the most radical experiments in scientific research in the world.

The building provides facilities for 700 academics from 23 different University departments working within dynamic teams.

A critical mass of ~40 faculty from various disciplines will occupy the Center.

Stanford's Clarke Center



Stanford's Clarke Center

Inspiration and Motivation

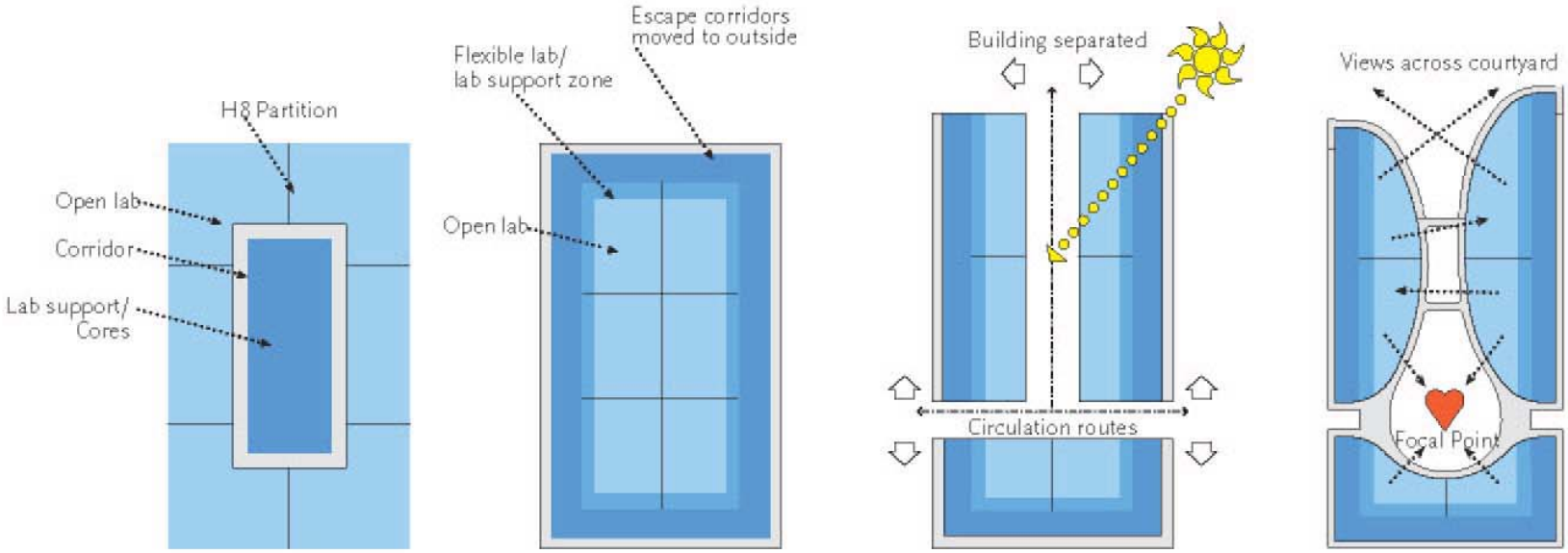
The intent is to foster an unprecedented degree of collaboration between scientists from different disciplines in order to meet some of the most pressing scientific and medical challenges of the coming decades.

It was created to "support a new paradigm for scientific discovery and teaching based on cross discipline interaction and collaboration."

It is a building, which was meant to draw people through it instead of around it.

Vision

Innovation—Collaboration—Interaction



1. Typical lab building

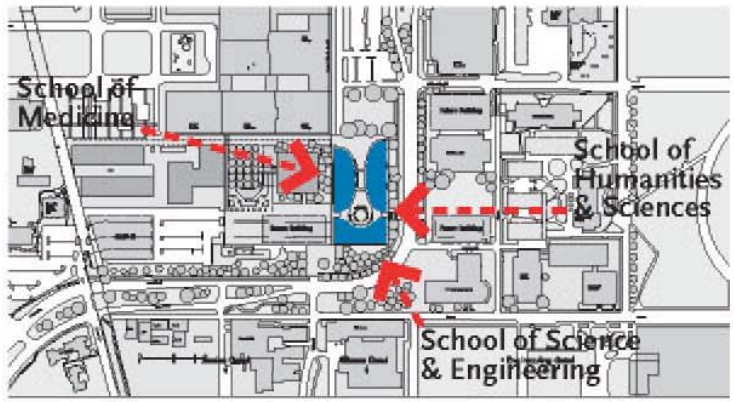
2. Move lab support to outside

3. Introduce light

4. Introduce space

Building concept: campus hub

The Bio-X program fosters the coming together of leading-edge research in basic, applied and clinical sciences to enable tomorrow's discoveries and technological advances across the full spectrum from molecules to organisms. It is through innovation, collaboration and interaction this goal is achieved.



Interdisciplinary hub for Stanford

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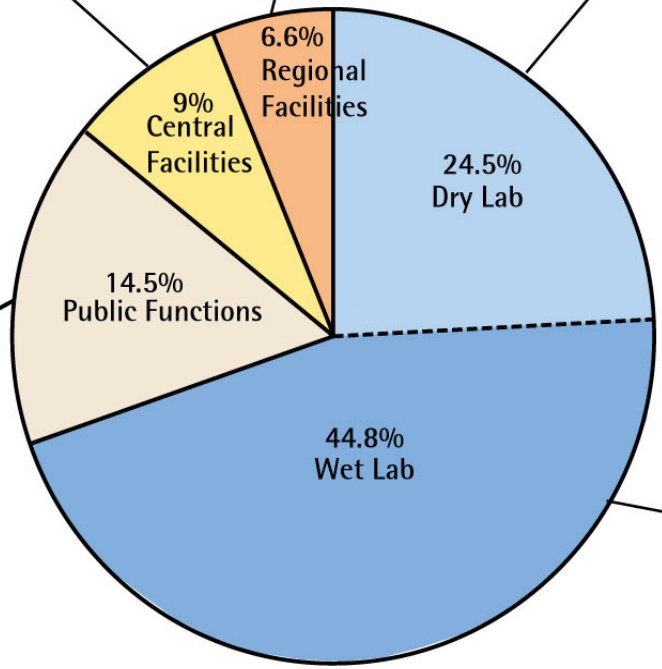
Stanford's Clarke Center

Program:

- Open Labs: Equipped with wheeled furniture and all infrastucture is dropped from the ceilings.
- Enclosed Labs: Like open but environmentally controlled
- Meeting/Presentation Rooms: includes 150 person auditorium
- Demountable Offices: For highest level researcher and can be moved
- Food Services: Coffee bar and restaurant/cafeteria
- Open Exterior Corridors: Meant to put the activity inside the building on display for all to see and "get excited about."

Stanford's Clarke Center



Regional Shared Facilities:
Functions:
Small Animal Imaging
Bio Comp/
Imaging Users Space

Central Facilities:
Functions:
Administrative Space
Stockrooms
Emergency Response
Media Prep
Governance/Facilities Management
Surge Vivarium
Glassware Processing

Open Dry Laboratory Zone:
Functions:
PI Work Space (office)
PI Hotel Space
Graduate Student Work
Staff Work Space
Shared Admin Area
Wet Lab Bench Space
Dry Lab Bench Space

Public Functions:
Functions:
Conference Rooms (14 person)
Auditorium (150 seats)
Rear Screen Projection Room
Classrooms (varying sizes)
Classroom Prep Area
Cafeteria & Espresso Bar

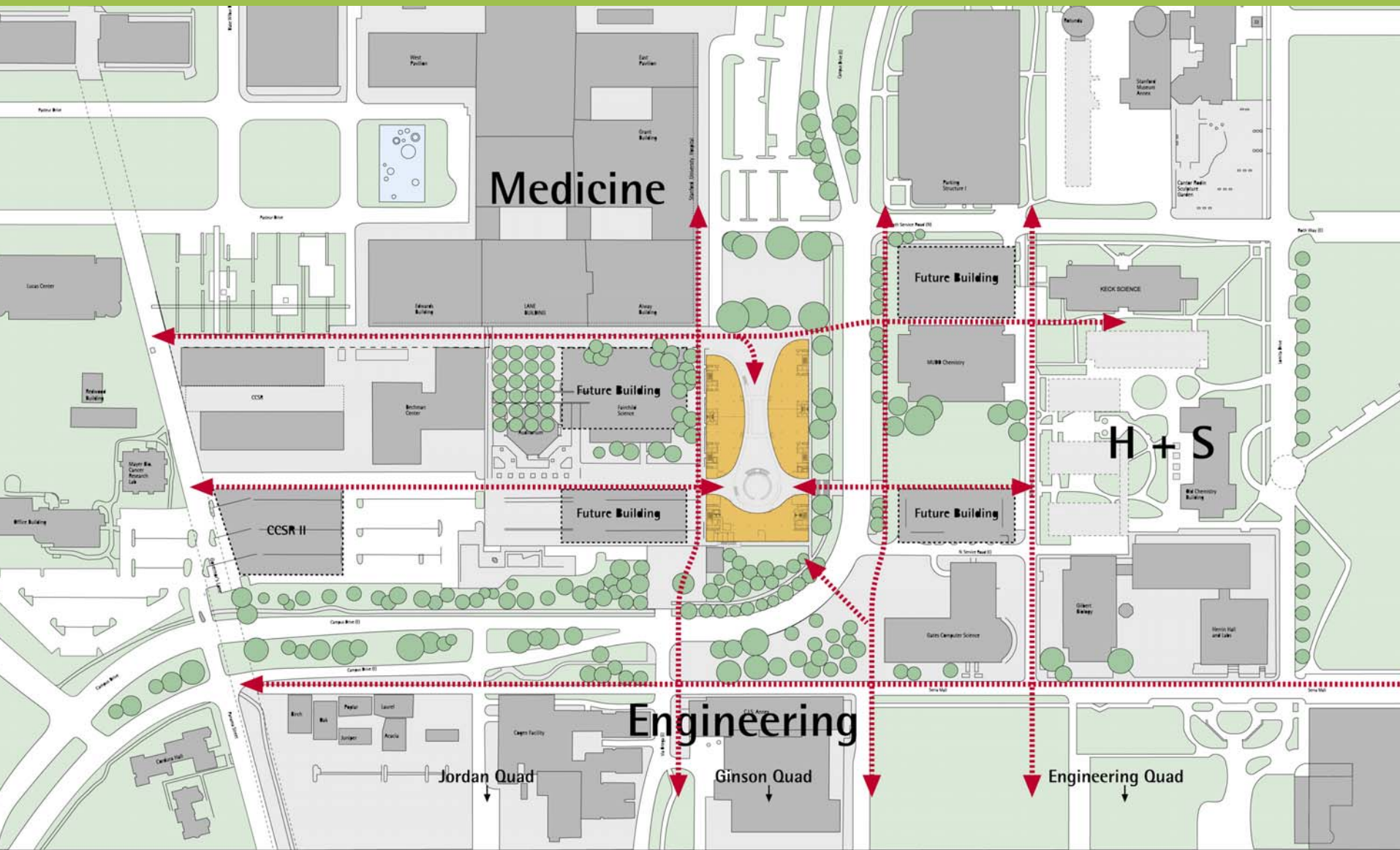
Open Wet Laboratory Zone:
Functions:
PI Work Space (office)
PI Hotel Space
Graduate Student Work Space
Shared Admin Area
Dry Lab Bench Space
Wet Lab Bench Space

Stanford's Clarke Center

Community

- U-shaped with three wings surrounding an open courtyard – the overall design concept was to facilitate interaction among the researchers.
- Coffee Bar – meant to create a space where various researchers can interact and hold informal discussions.
- Restaurant/cafeteria: meant to serve as a space for students, professors, and administrators to congregate.
- Open exterior corridors: When people move throughout the building they are able to view the different experiments underway. Used to draw "outside" students passing by to go through the building so they can see what is occurring inside
- Closed Labs: Even though they are enclosed, they are enclosed in clear glass to allow the activities within to be viewed.

Stanford's Clarke Center



Stanford's Clarke Center

Departments feed the Clark Center from paths (site plan and opposite, bottom) that meet in its court (this page and opposite, top). Balconies and bridges offer additional meeting places.

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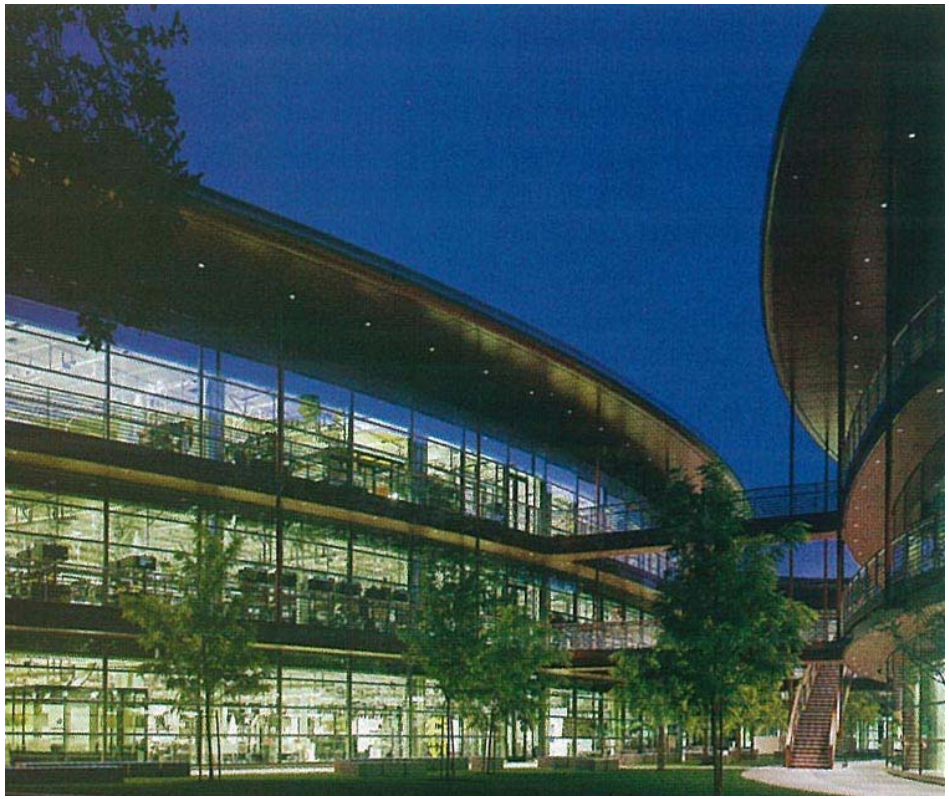
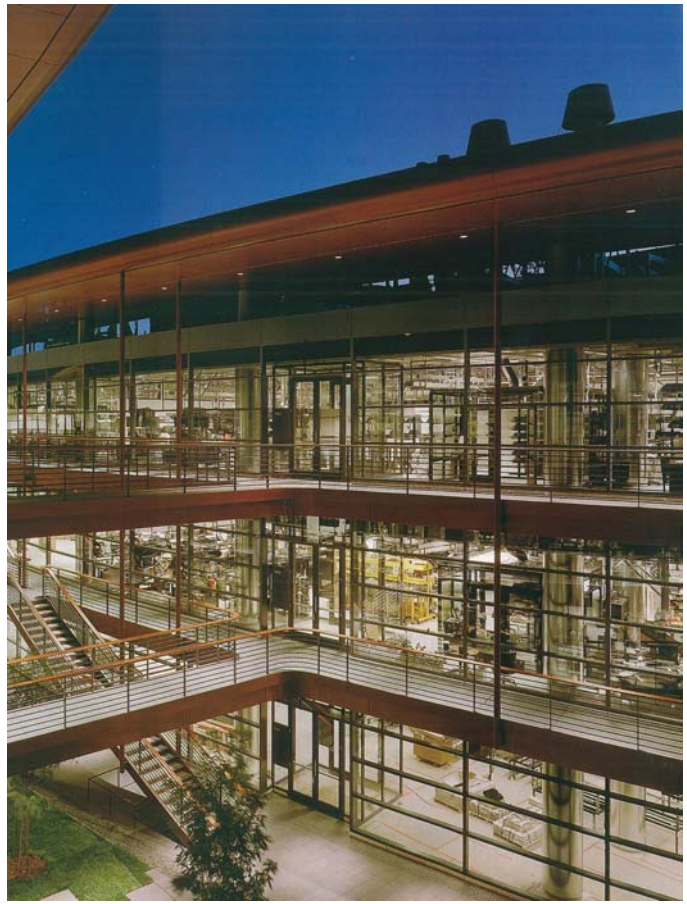
Stanford's Clarke Center





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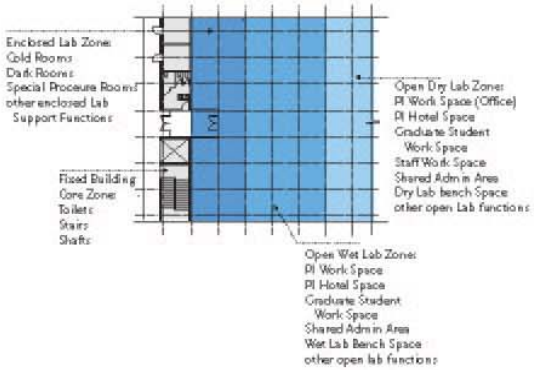
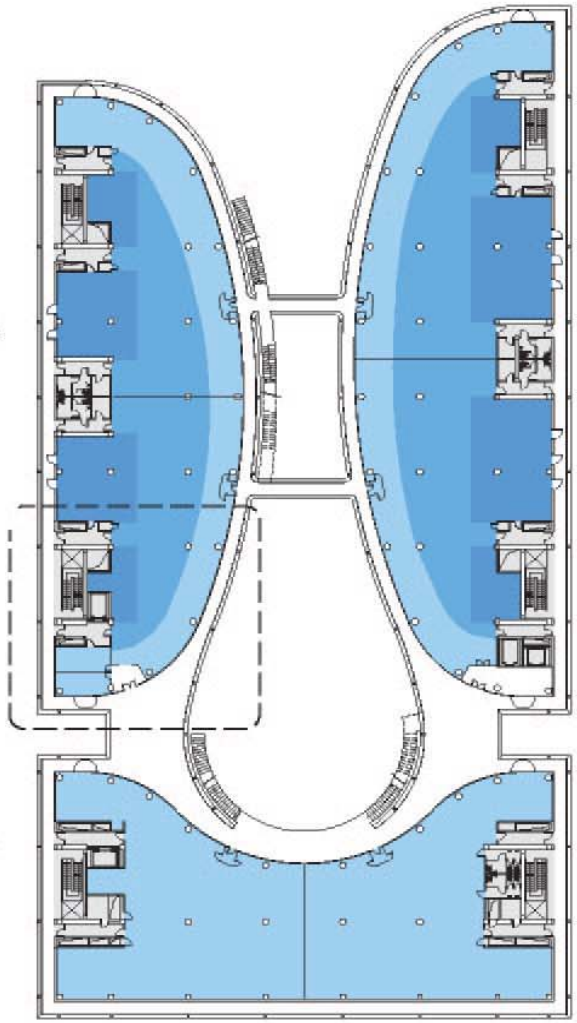
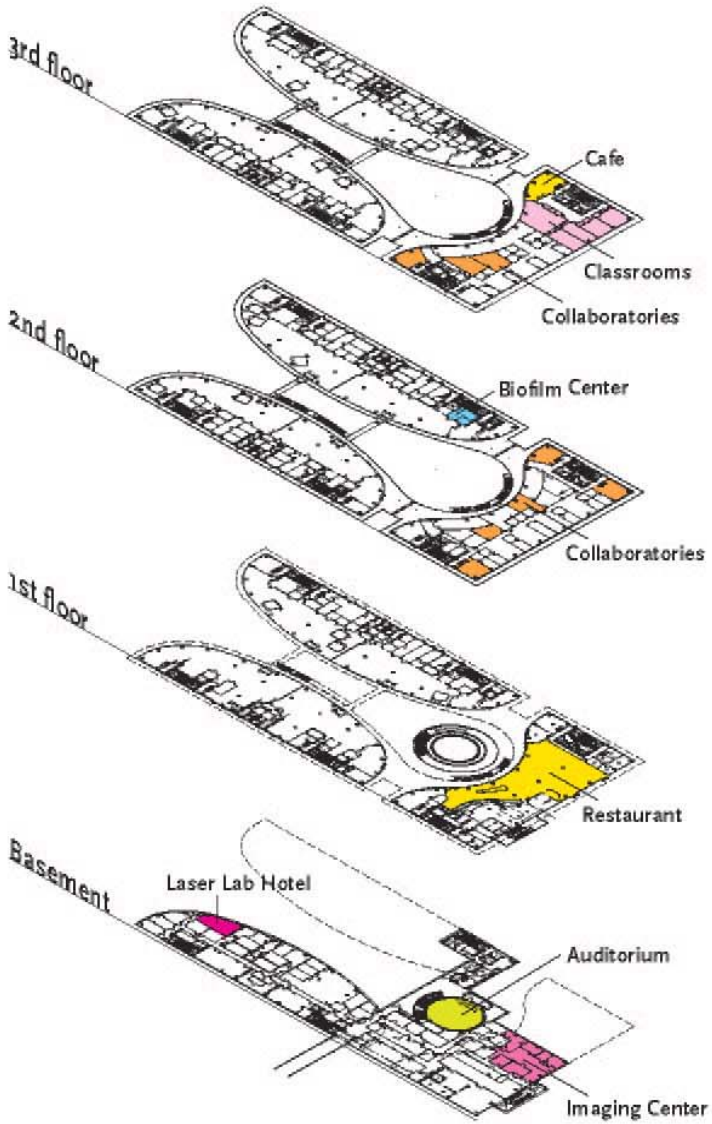
Building Concept

Multiple Hubs of Interaction







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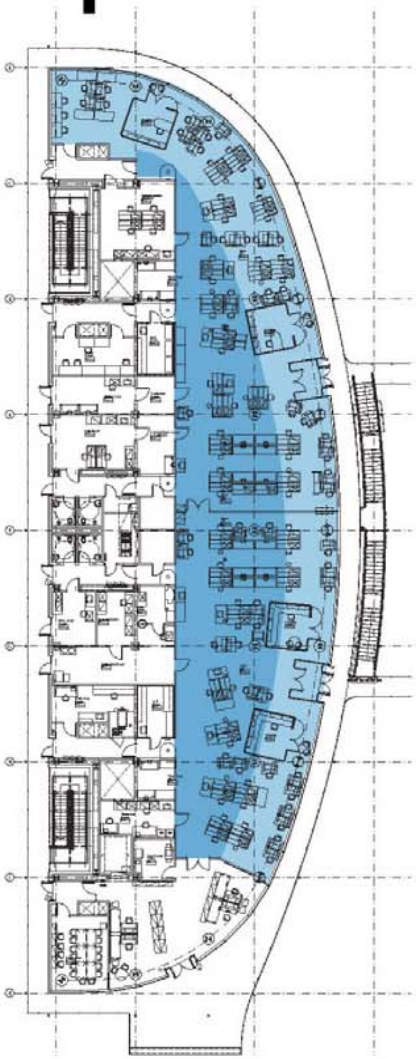
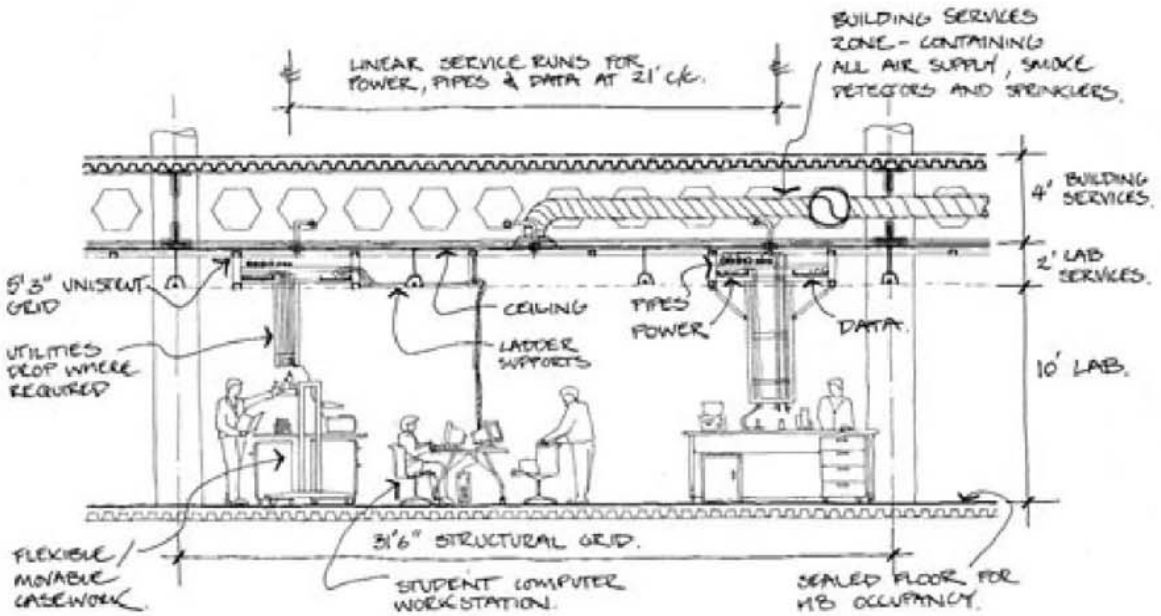
Open Lab

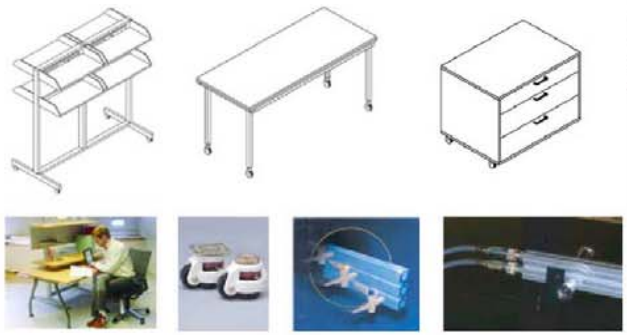
Flexibility—Benches on Wheels



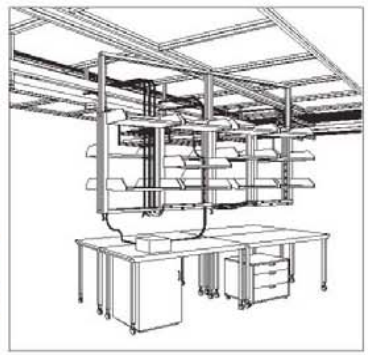
Floor plan

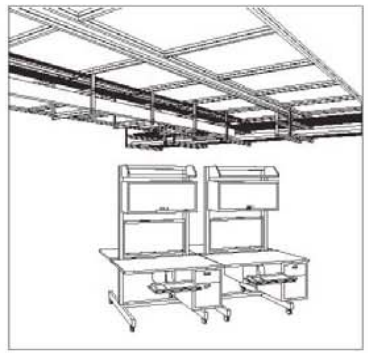


Laboratory section



Kit of parts





Casework concept

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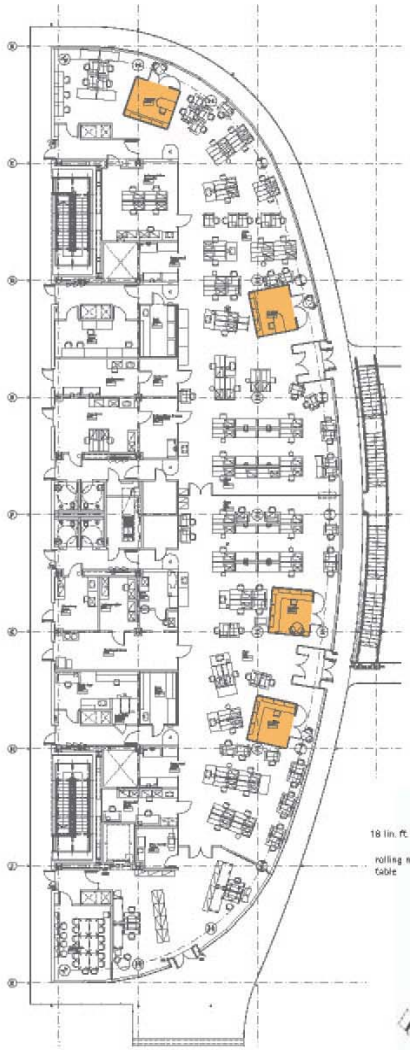
Offices

Flexible Location



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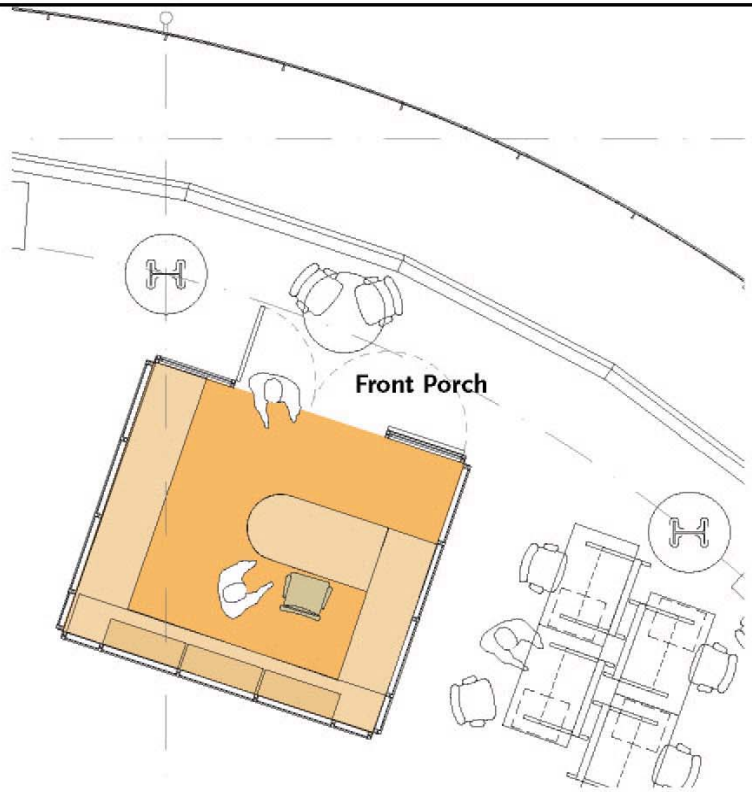

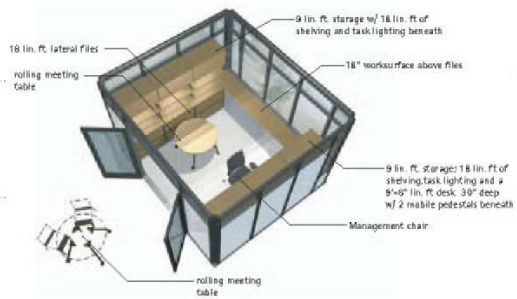

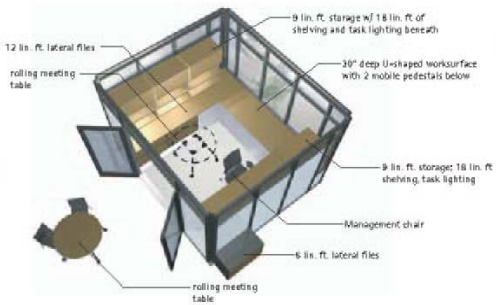

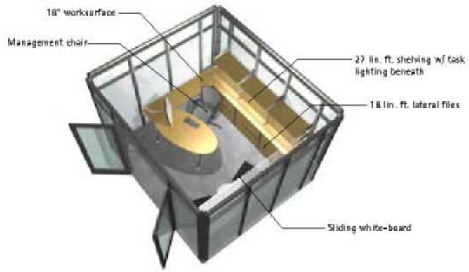

Office configuration options

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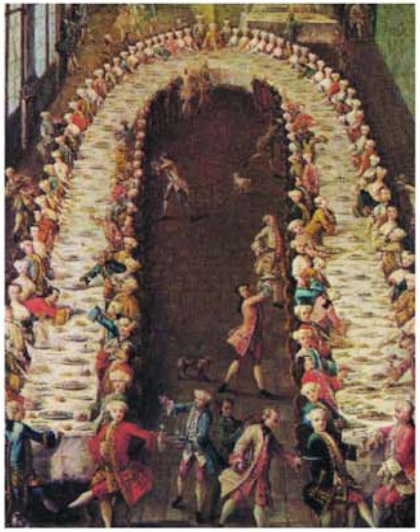
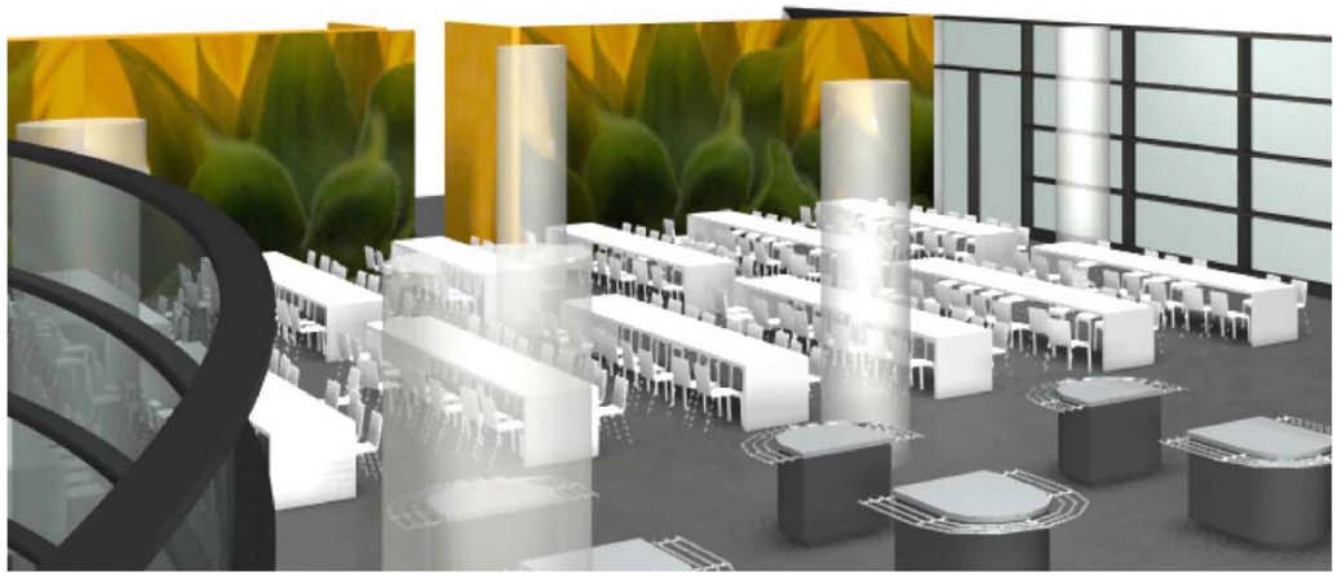
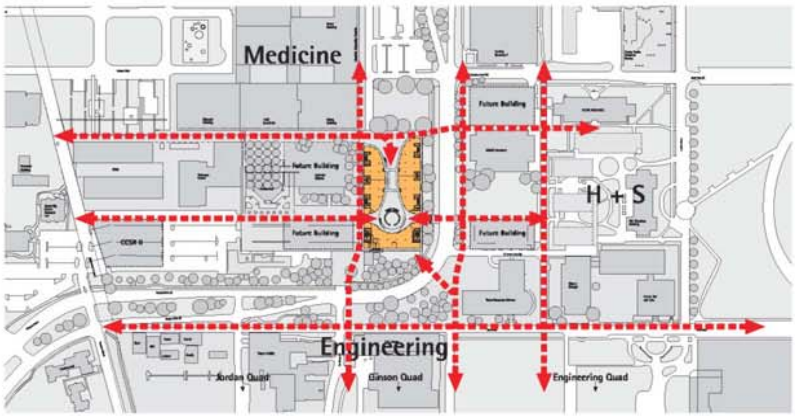
Restaurant

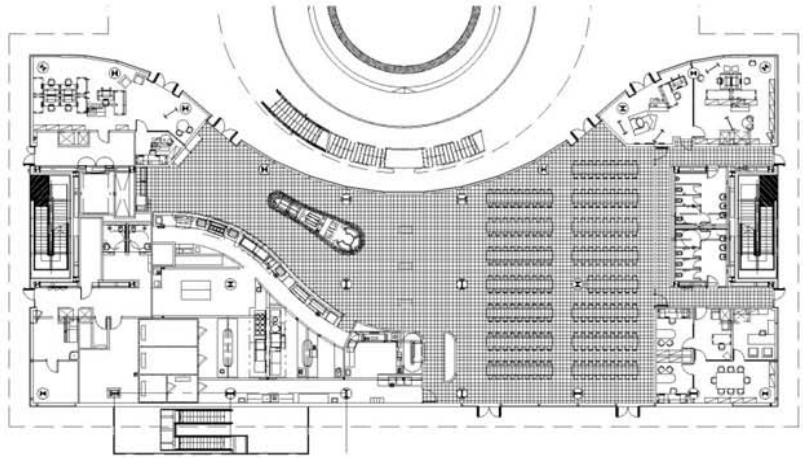
Family Style Dining, Scientific Interaction







Campus Magnet



Floor plan

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Architectural guidelines

…the architect's point of view

- Flexibility
- Utilities
- Visibility
- Efficiency
- Space Design
- Wayfinding
- Department Identity

Flexibility

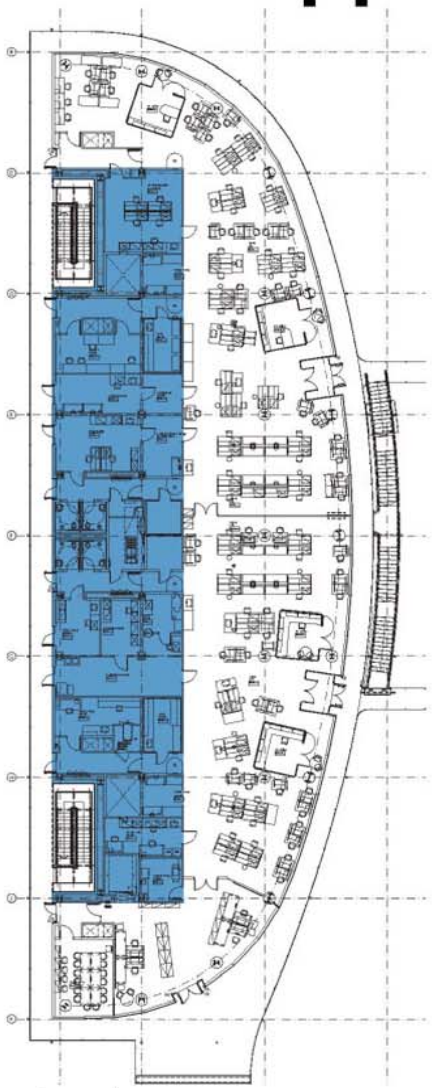
- Flexibility is the most important aspect of interdisciplinary space design
- Levels of Flexibility
  - Fixed – elements are not re-arrangable without demolition and new construction.
  - Flexible – elements can be reconfigured by facilities staff responsible for the space.
  - Fluid –elements can be reconfigured by the users of the space.

Architectural guidelines
Flexibility

Daylight filters through the ceiling-mounted Unistrut grid that supports readily changed utility drops.

Lab Support

Flexible and Interchangeable Kit of Parts



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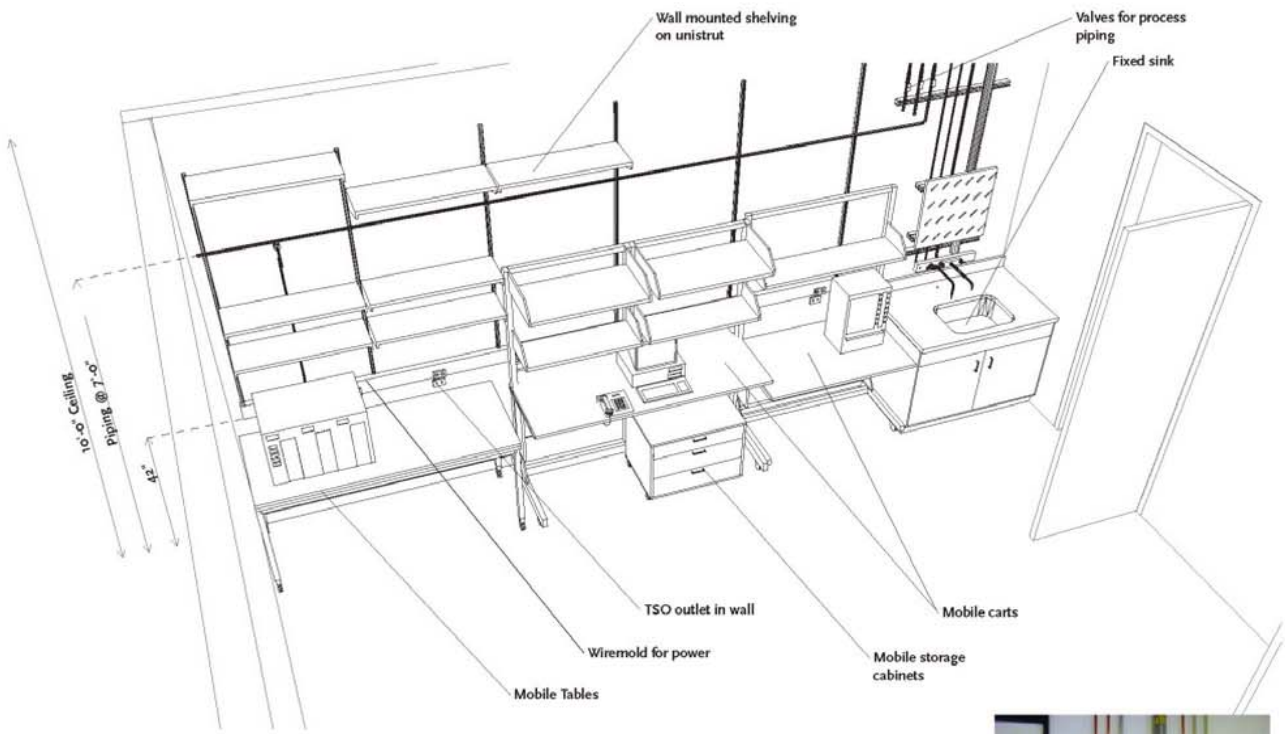
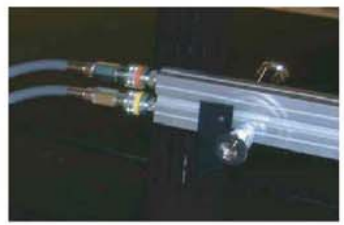


Casework concept



Kit of parts

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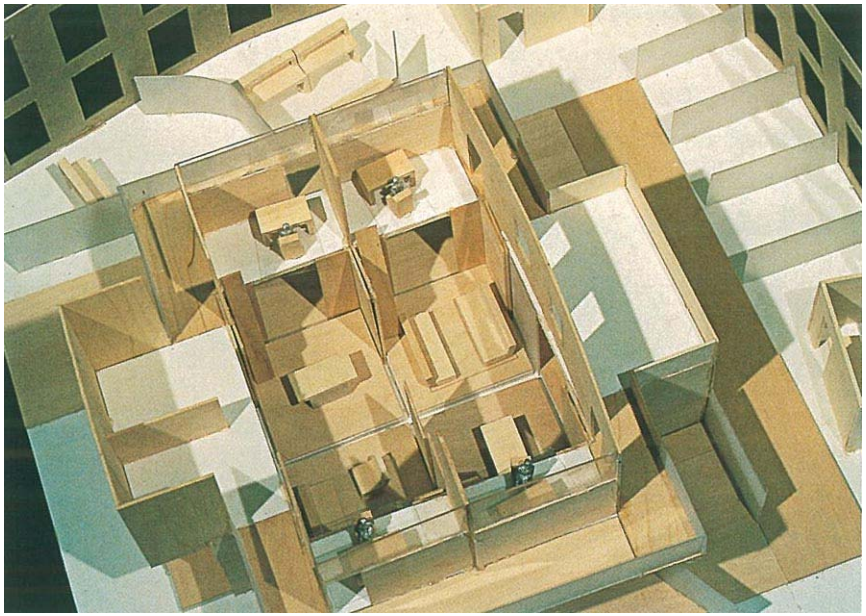
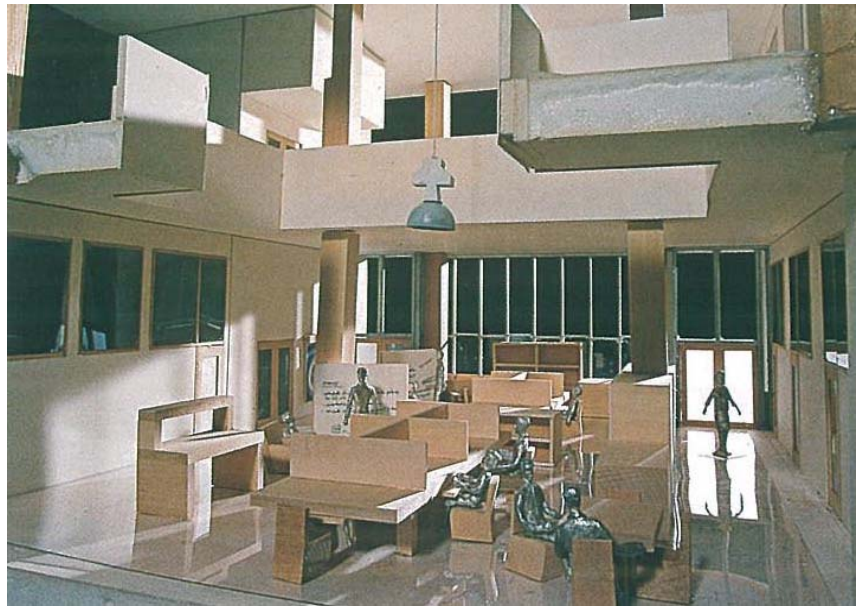
Architectural guidelines

Flexibility





Architectural guidelines
Utilities

Movable PI Office

Flexible lab support

Dry bench, kit of parts

Docking station, kit of parts

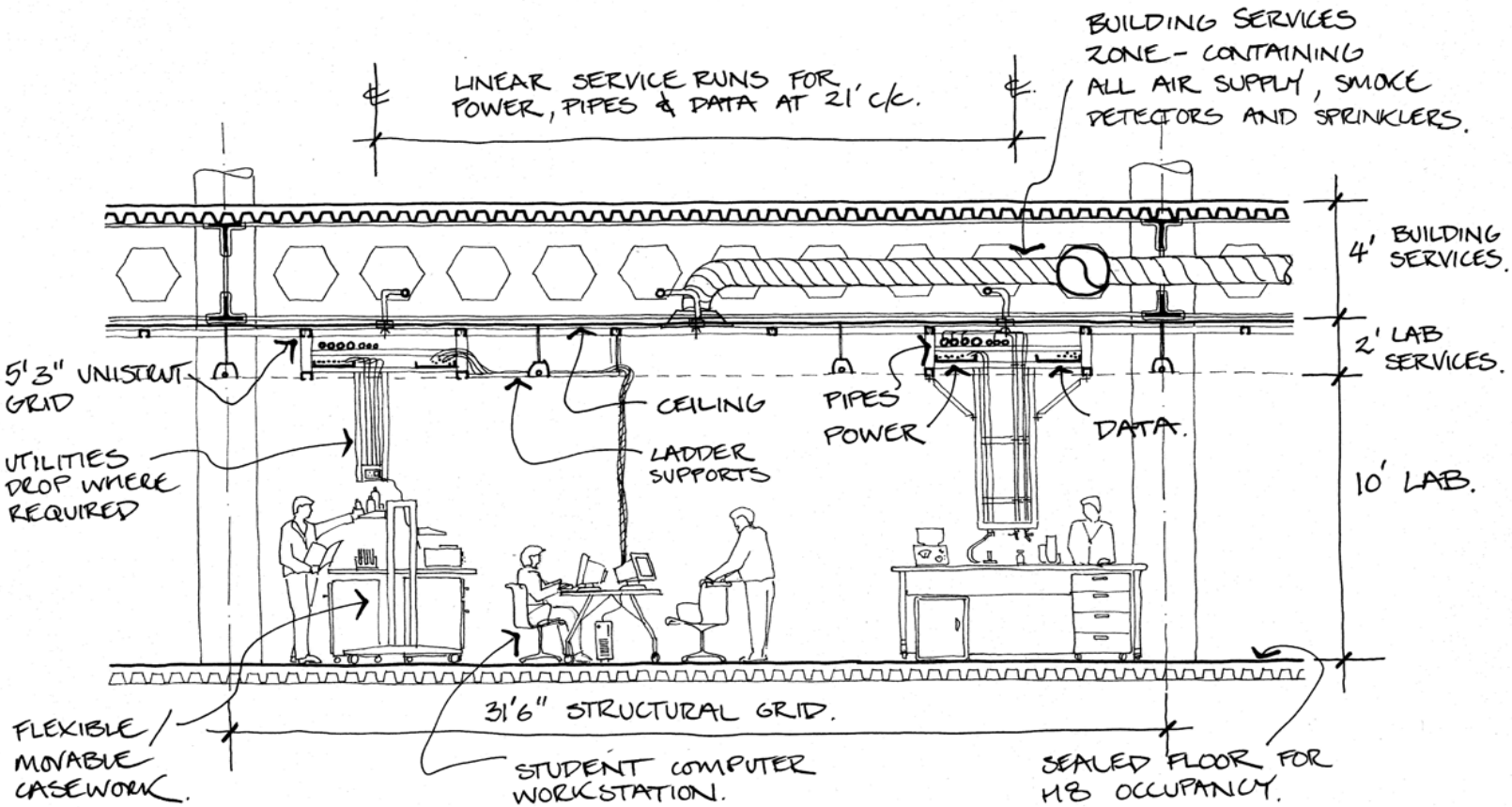
Accessible ceiling system and utilities,

Ceiling cable tray

Manifold quick connect/disconnect

Testing finishes systems

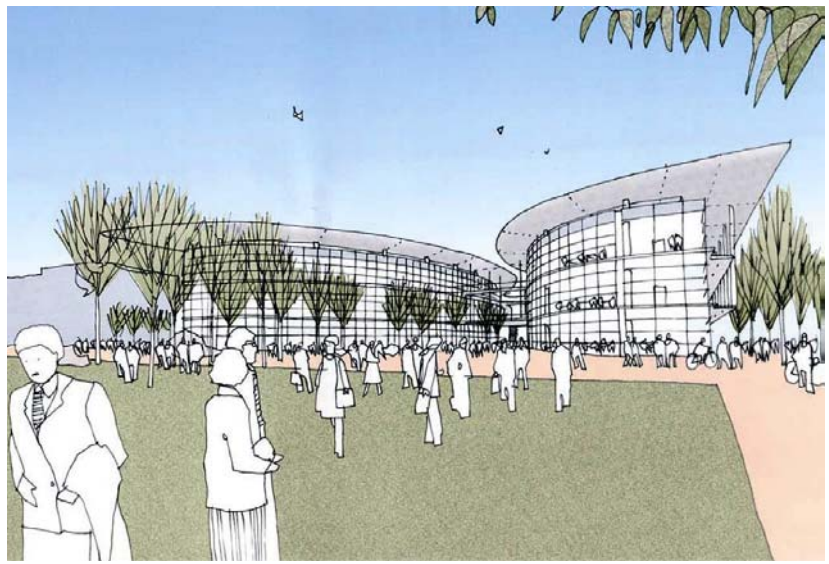
Architectural guidelines
Utilities



Architectural guidelines

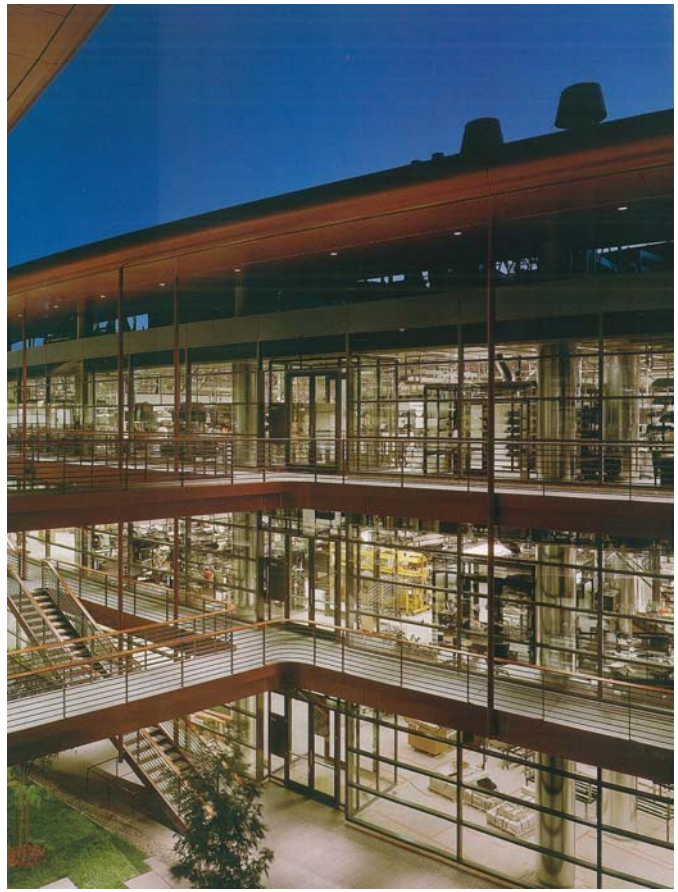
Visibility

- The ability to see what activities are occurring in the facility
- The buildings prominence and visibility on campus



Architectural guidelines

Visibility



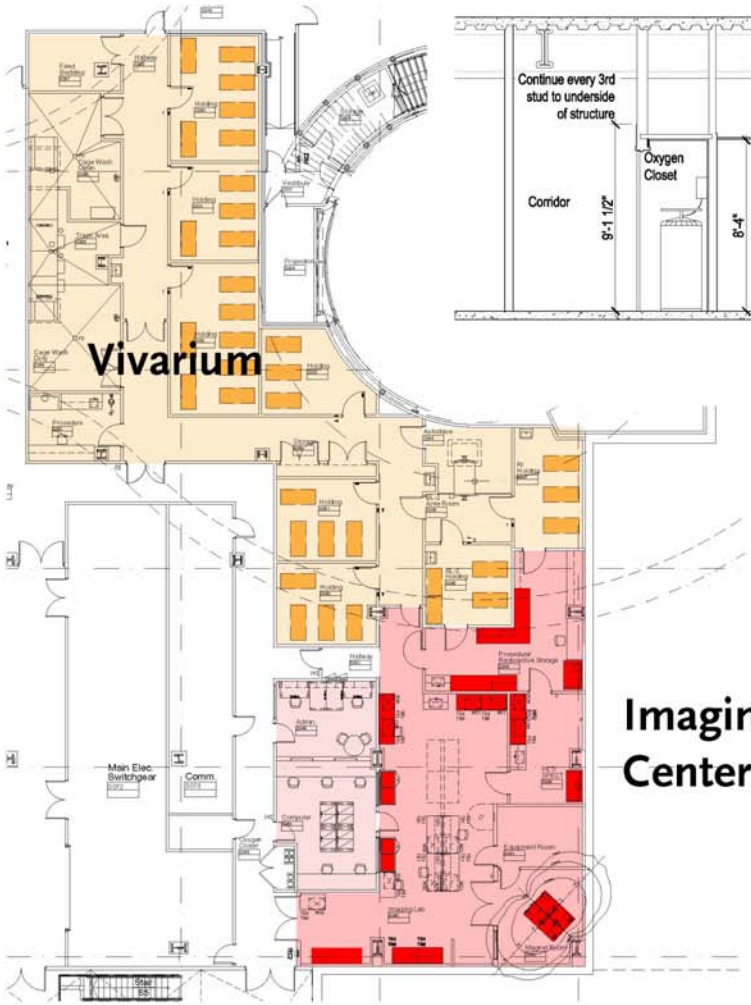
Architectural guidelines

Efficiency

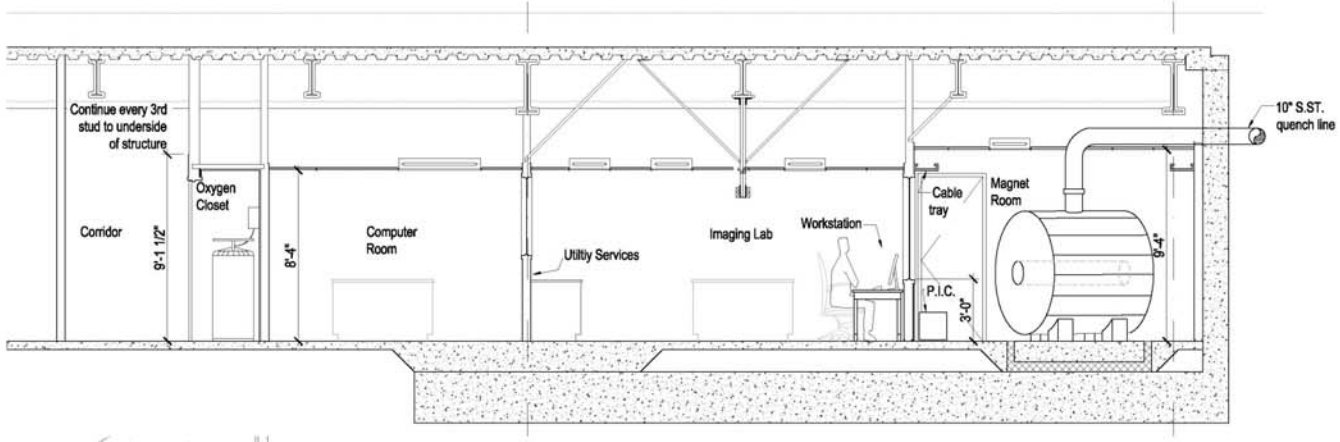
- Numerous formerly discrete departments can now share resources and infrastructure
- Leverage specialized equipment
- Reduce travel and coordination time
- Simplify adaptation to regulatory requirements

Imaging Center

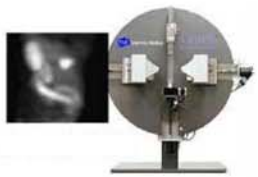
Scientific Hub



Floor plan



Section

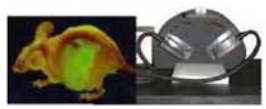


microSPECT

microCT

Animal MRI

microPET



Fluorescence

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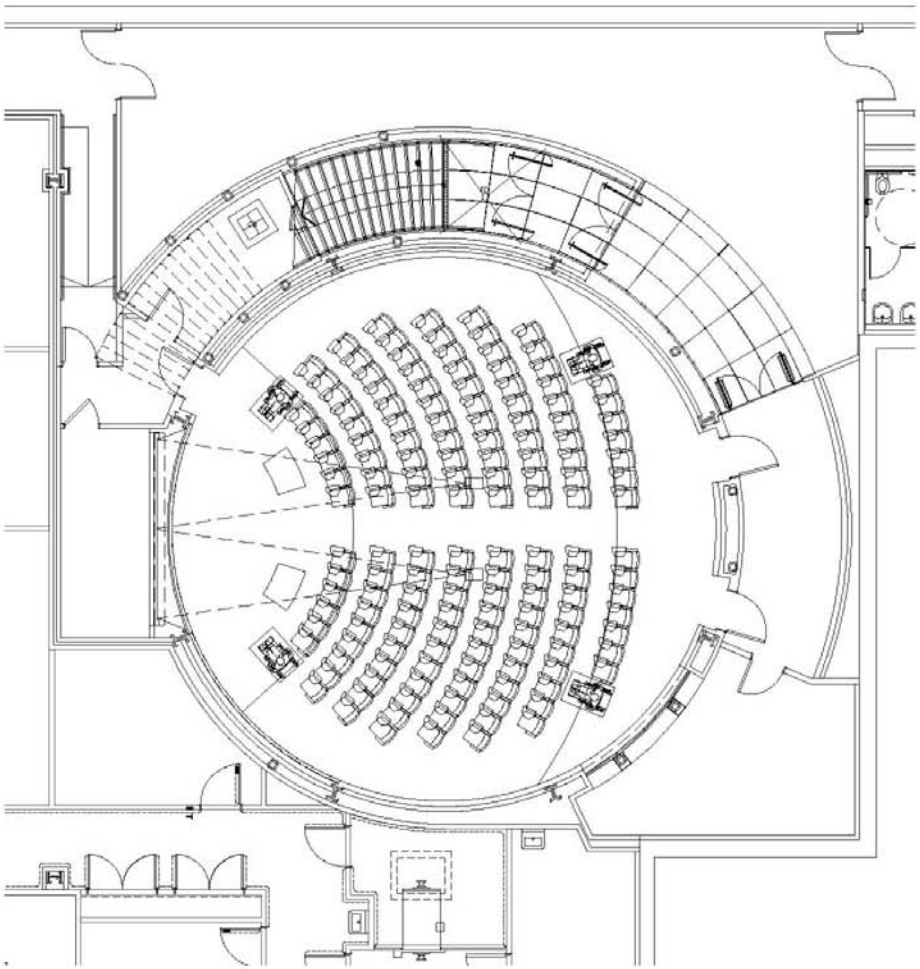
Auditorium

Scientific Hub, Distance Learning, Interdisciplinary Presentation

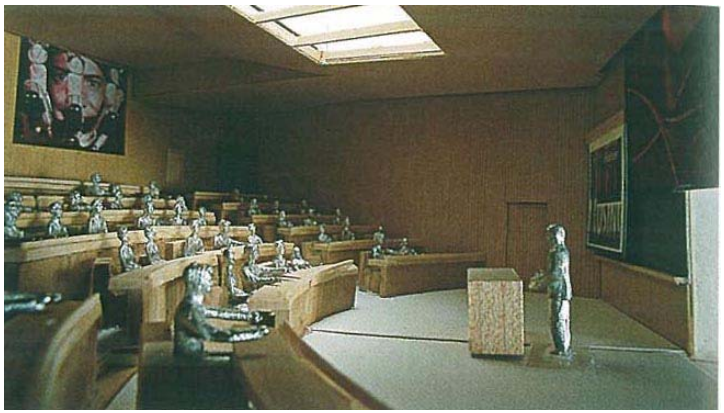


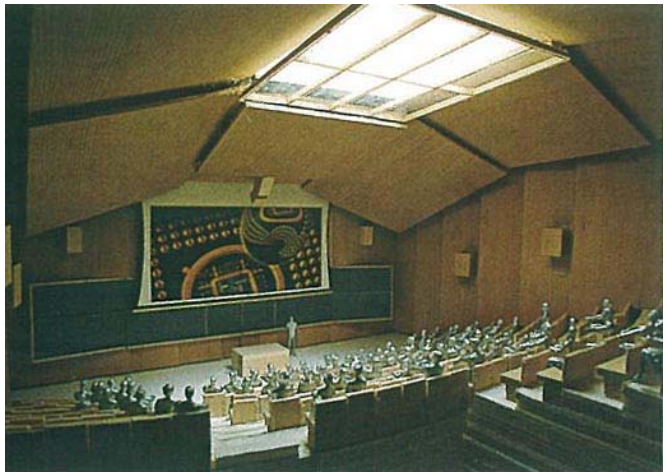
Floor plan

Stowers Institute Auditorium

UW Harborview Auditorium

Architectural guidelines
Efficiency

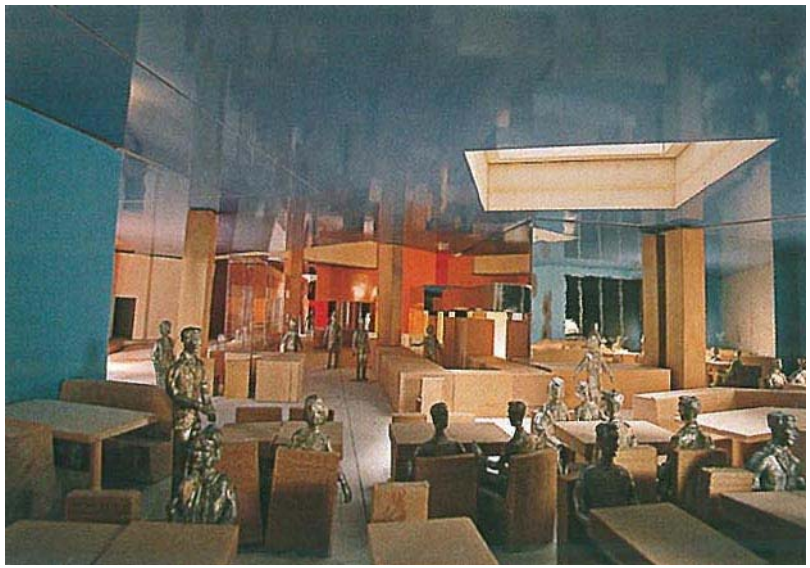


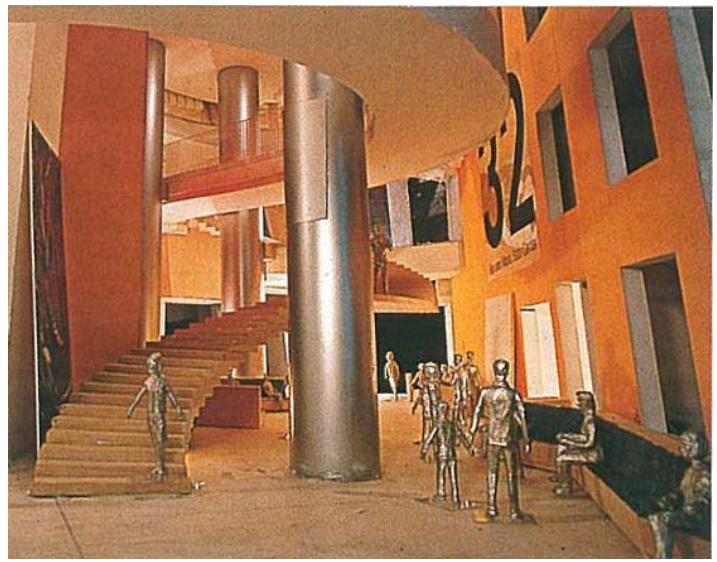


Architectural guidelines

Space Design

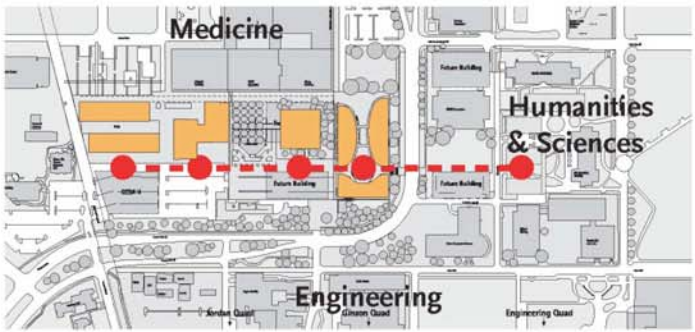
- Design for interaction
- Design for informal meeting
- Design for undedicated interaction



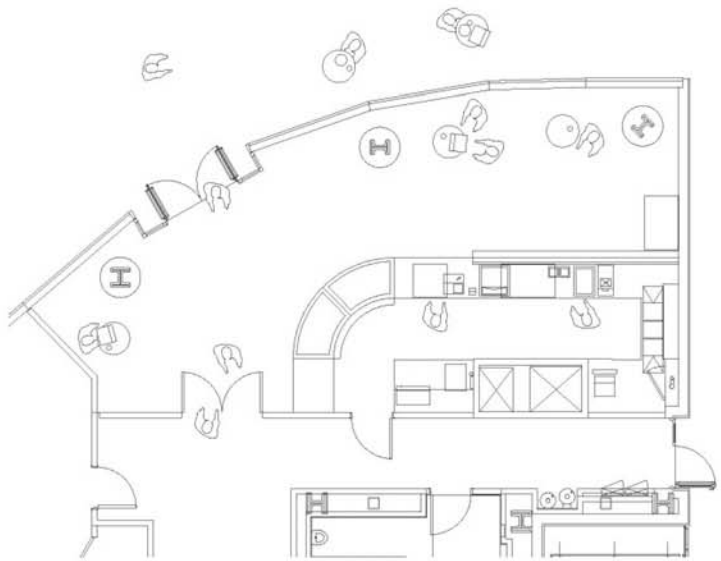


Coffee Bar

Campus Magnet, Informal Interaction



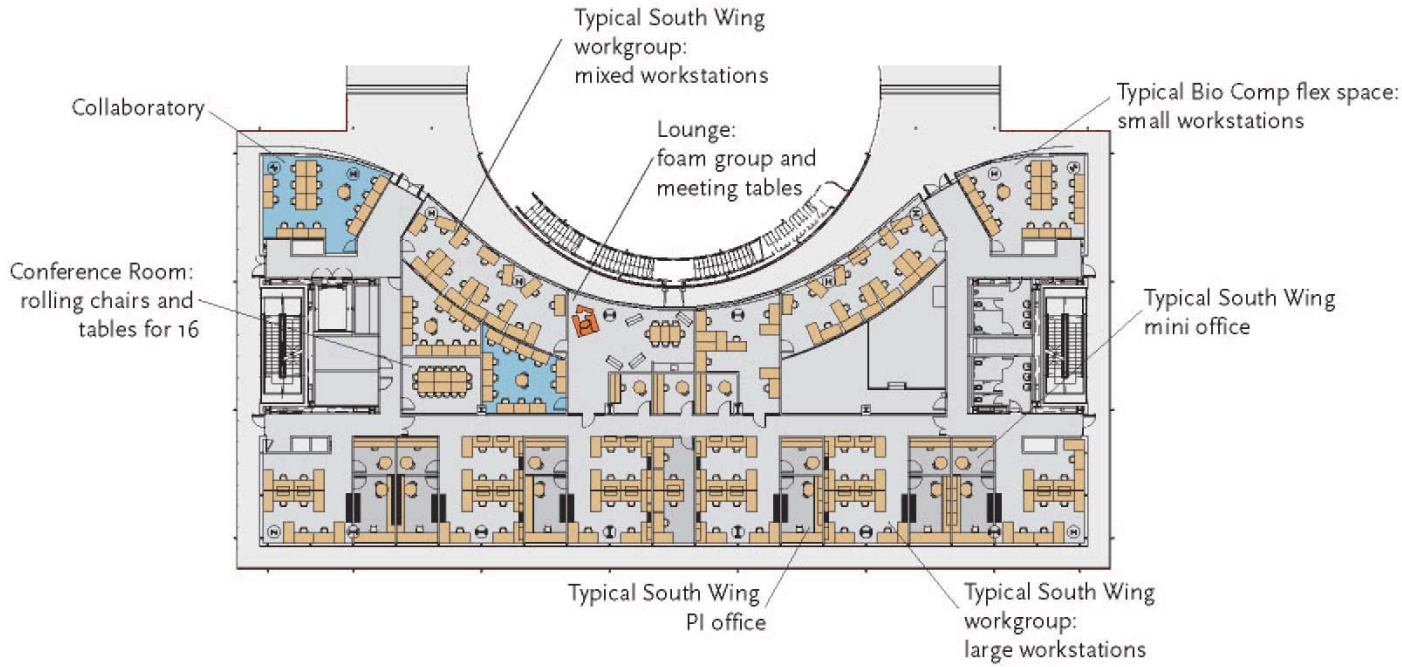
Science corridor

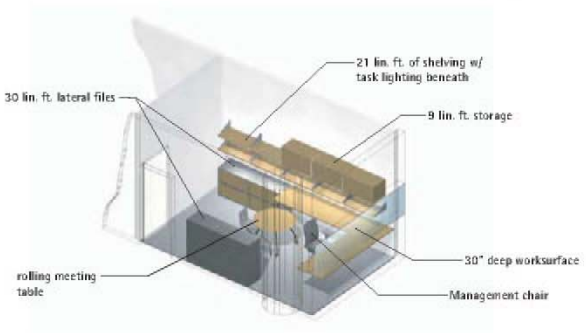


Floor plan

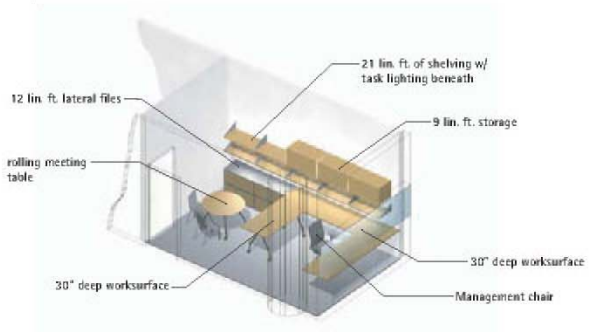
Informatics

Collaboratories, Hotel Space

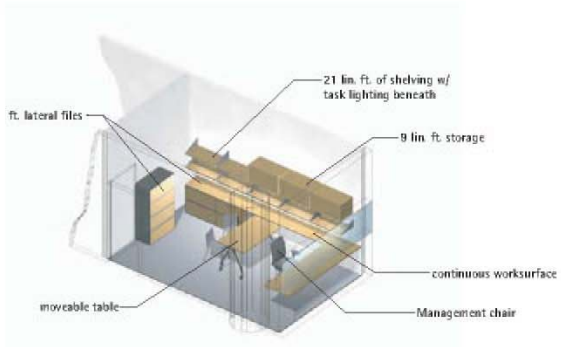




South Wing Layout Option 1
L Shaped Desk



South Wing Layout Option 3
U Shaped Desk



South Wing Layout Option 4
Continuous Worksurface with Movable table

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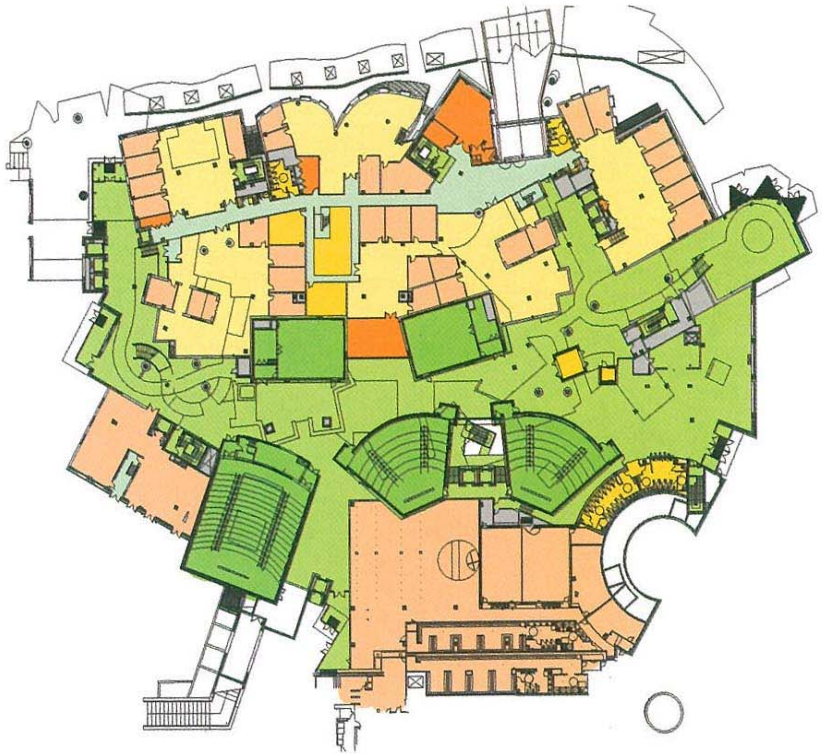
Architectural guidelines

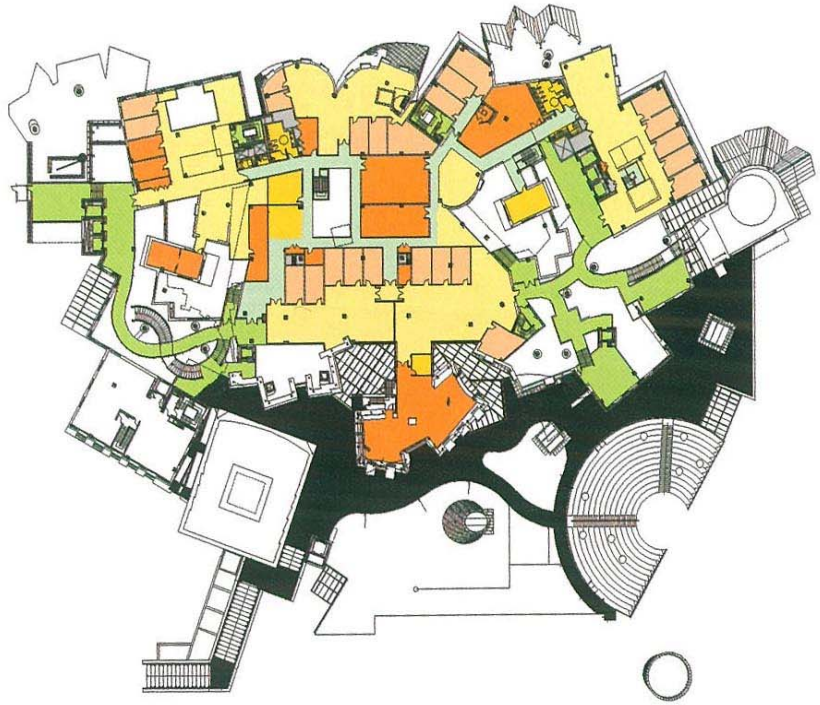
Wayfinding

- Visual navigation clues
- User orientation
- Clarke Center
  - Channel people in
  - Turn building inside out with circulation on the outside
- Stata Center
  - “Infinite Corridor System” – a system of access paths that permeate the building

Architectural guidelines
Wayfinding

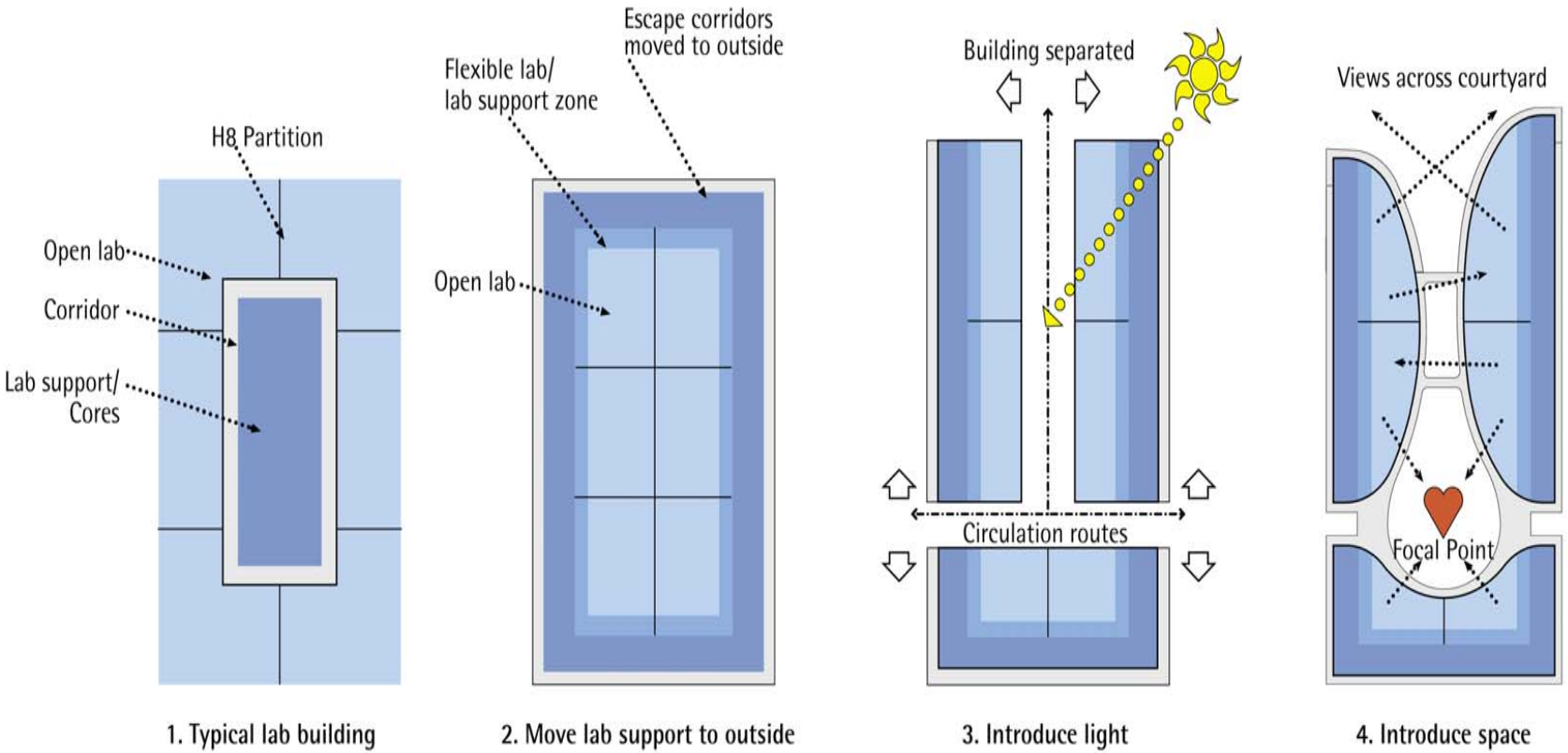


Levels 1 and 2



Level 3

Architectural guidelines
Wayfinding



Architectural guidelines

Department Identity

- Should “departments” be identified or is it more important for the interdisciplinary community to identify itself?
- “Communities of Practice” – communities of engineers, researchers, students, biologists, teachers, scientists….
- Interdisciplinary identity is primary but departmental/disciplinary identities should remain intact.

Topics

- Introduction
- The nature of ISC's
- Leading examples
- Architectural Design Guidelines
- Furniture Design Guidelines
- Conclusion

Furniture guidelines

…the furniture guy's point of view

- User reconfigurability of space
- Minimization of unused equipment
- Unencumbered access to electronic data
- Display, record and recall information
- Support collaboration and concentration
- Inspiring spaces

Furniture Guidelines:

User Flexibility

- Flexibility is often desired, but what is it?
- Frequency may be once a year, semester, weekly, daily or during class!
- Users are faculty and students
- Consider…
  - Ergonomics
  - Task performance
  - Teaching and learning
  - Collaboration
  - Personalization

Furniture Guidelines:

User Flexibility

Furniture Guidelines:

User Flexibility

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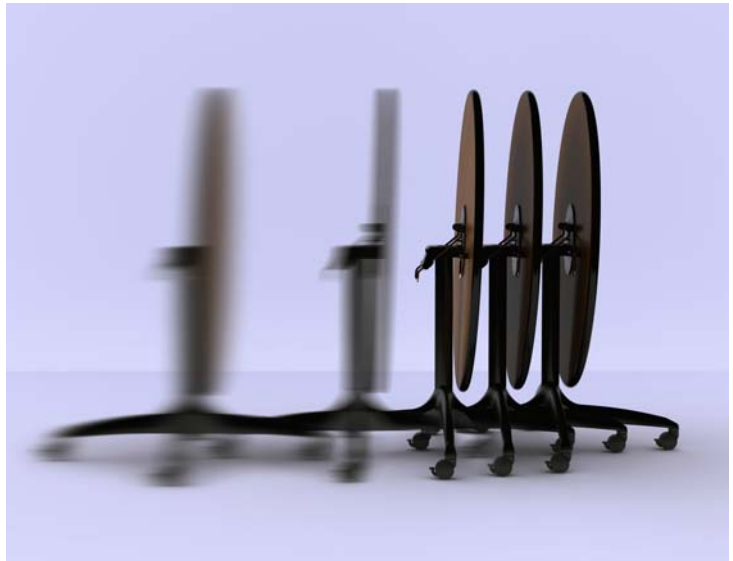
Furniture Guidelines:

Getting it out of the way

- Flexibility may lead to chaos
- Need to get rid of or store furniture you're not using
- Just pushing it to the side creates clutter and doesn't allow full use of the space
- Strategies include storage spaces, folding, nesting/stacking

Furniture Guidelines:

Getting it out of the way



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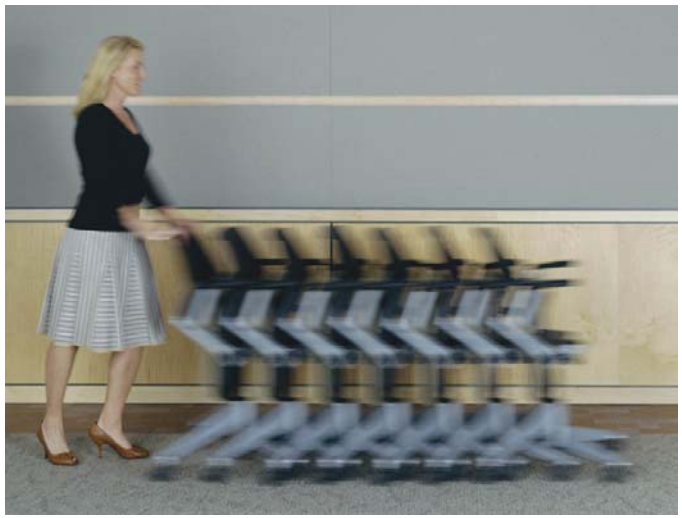
Furniture Guidelines:

Getting it out of the way



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Furniture Guidelines:

Getting it out of the way

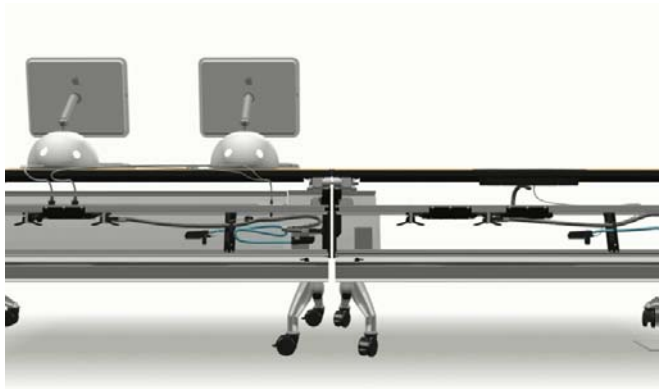
Furniture Guidelines:

Unencumbered access

- Used to “go to” a place to get access to electronic information
- This would force you to leave, disrupting “situated action”
- “all the world’s information” needs to be available when and where you need it
- Increased plug-n-play opportunities and wireless are making this possible

Furniture Guidelines:

Unencumbered access



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Furniture Guidelines:

Display, record and recall

- Chalkboards have been around forever
- Markerboards are a step up
- Technology exists to capture what's written
- And to bring back what was written, recreating the context of previous activity
- Make efforts to insure
  - Ease of use
  - Connectivity
  - Support of existing practice

Furniture Guidelines:

Display, record and recall

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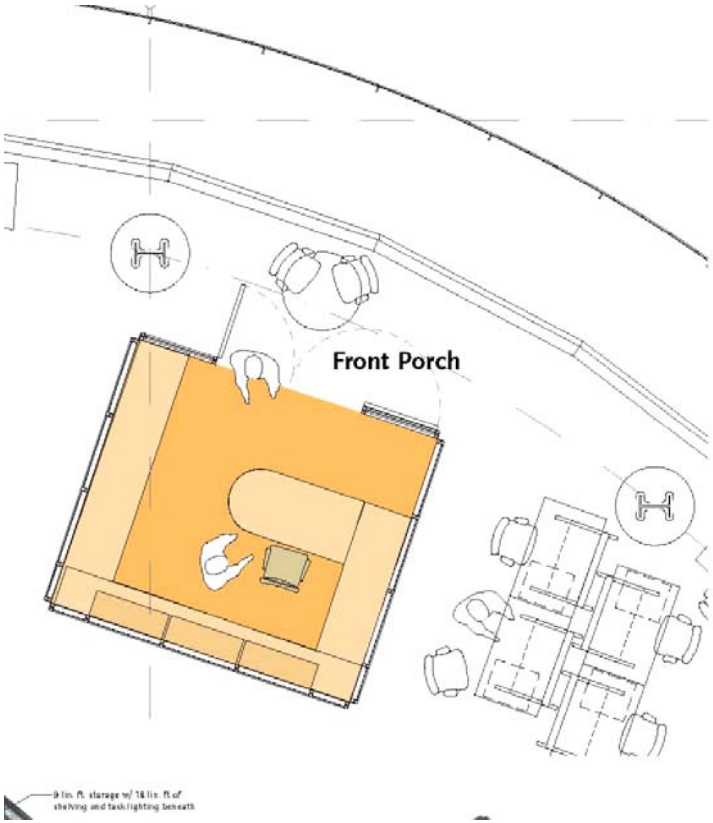
Furniture Guidelines:

Collaboration and concentration

- ISC's are all about promoting collaboration
- But we mustn't forget the need to draw back, reflect, ponder…
- Recognize individual differences in learning style
- Recognize generational differences in processing information

Furniture Guidelines:

Collaboration and concentration



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Furniture Guidelines:

Inspiration

- More important than ever to show up—“snooze ya lose”
- Showing up is discretionary
- Want this to be a cool happening place for everyone—faculty, staff, student, collaborator
- Motivate, please and comfort users
- Strange attractor
- Think Starbucks or the cushy chairs at Barnes & Noble

Furniture Guidelines:

Inspiration

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Furniture Guidelines:

The role of technology

- Technology is an enabler
- Speed of change
  - Infrastructure changes slowly
  - Appliances change quickly
- A change in either may produce sudden changes in behavior…or…more gradual changes

Furniture Guidelines:

Technology integration

Furniture Guidelines:

Emerging technology

- Tagging
- Ubiquity
- Miniaturization
- “agents” and “bots”
- Small scale power
- Smart materials
- Displays
- Sensors

Furniture Guidelines:

Technology and behavior

Adobe ad

Topics

- Introduction
- The nature of ISC's
- Leading examples
- Architectural Design Guidelines
- Furniture Design Guidelines
- Conclusion

Conclusion

- Many universities have built, are building or are planning ISC's, and for good reason
- They…
  - facilitate communication and collaboration,
  - foster scientific breakthroughs,
  - enhance funding opportunities,
  - aid in recruiting,
  - attract partners and sponsors.

Conclusion

- To realize these benefits, however, the interior architecture must support these objectives
  - Longevity of a building that is flexible,
  - Increased visibility and image for the institution,
  - Efficiency of common facilities and shared equipment,
  - Space supports accessibility, community and interaction – breaks down traditional interdisciplinary barriers.

Conclusion

- The furniture plays a role too by…
  - Enabling user reconfigurability
  - Reducing clutter
  - Supporting access to power and data
  - Facilitating info display
  - Supporting collaboration and concentration
  - Enhancing the overall experience, attracting and inspiring users

Again, what's different about an ISC?

- In doing this, the environment becomes more than just a comfortable place to sit and work
- It becomes an asset in accomplishing the strategic goals of the institution by promoting the behaviors and activities crucial to the advancement of knowledge!!

Thank you for your time!

Breaking down barriers:
Facilitating interdisciplinary research and teaching

Paul Cornell
VP, Product Marketing

Robert Luchetti
President

VECTA

Robert Luchetti Associates, Inc.

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