



UNIVERSITY OF HAWAI'I AT MĀNOA | DESIGN GUIDELINES

Research Labs

-
- 4 INTRODUCTION
 - 5 OCCUPANCY
 - 9 UTILIZATION GUIDELINES
 - 21 LAYOUTS
 - 34 RELEVANT POLICIES
 - 34 REFERENCES



PREPARED BY
THINK^{MK}

REVISED 06/13/2022

Version 2.0 updated May 2021

Prepared By University of Hawai'i & MKThink

Project Team

Daniel S. Friedman, PhD, FAIA, Campus Architect
Chad Walton, PhD, Interim Assistant Vice Chancellor of Research
Nate Goore, AIA, Principal-in-Charge
Odile Schlossberg, Project Designer

Direct Contact

Nate Goore, AIA
808.800.0888
735 Bishop Street, Suite 230
Honolulu, HI 96813

Table of contents

1

Introduction

2

Occupancy

2-1 Consideration
2-2 Calculations

3

Utilization guidelines

3-1 General requirements
3-2 Theory lab utilization
3-3 Benchtop lab utilization

4

Layouts

4-1 Layouts

5

Relevant policies

6

References

1 Introduction

These research lab space guidelines describe how to strategically allocate campus space and support decision-making that maximizes the availability and efficiency of research labs. Research lab design guidelines shall serve as a resource for faculty, staff, and designers during the planning and design phases of a project.

Special-purpose equipment and room configuration characterize typical laboratory facilities and connect research activities to a particular discipline or a closely related group of disciplines. These activities may support individual or group work with or without supervision.

The university will review research space allocation at least every three years and, if indicated by metrics, adjust assigned lab space to ensure adequate and efficient use on an ongoing basis. Space can be reassigned at the discretion of the Vice President for Administration (VPA), in consultation with the UHM Space Recommendation Committee.

The move toward large shared laboratory space is one we support and encourage for all scientific research at UH Mānoa. Infrastructure, space flexibility, and the waxing and waning of grant activity, etc., influence efficiency and therefore allocation.

These research lab design guidelines aim to complement the designer's knowledge in the field; they do not cover all regulatory issues nor all design situations. It is the designer's responsibility to understand criteria essential to the development of the specific lab type for each project. These guidelines and recommendations aim to support the design process on a case-by-case basis and provide sustainable and energy-efficient laboratory facilities. References to codes and regulations in these guidelines are not comprehensive. All project designers shall consult with appropriate health, safety, and environmental codes in conformance with all applicable local, state, and national standards and regulations.

2 Occupancy

2-1 Considerations

2-2 Calculations

2-1 Considerations

For calculation of assignable square feet

Wet lab space, support space, and dry lab space dedicated solely to one Principal Investigator (PI) counts toward a PI's assignable research space.

Faculty offices, conference rooms, break rooms, core laboratory facilities, and administrative space do not count toward a PI's assignable research space.

General recommendations

Assignable research spaces vary by building and not all research spaces offer modular bench systems; therefore, lab borders and total square footage of assignments may vary.

Insofar as junior faculty members with start-up packages generally do not have grants that bear indirect costs, the university will allocate space based on 4 full-time equivalents (FTEs)—600 SF wet or 300 SF dry—in addition to faculty office space during their probationary period, as defined in the individual's letter of offer.

Faculty will be assigned laboratory space according to established metrics at such time as they obtain research grants and related FTEs.

As additional positions in the research group generate funding, additional working space may be allocated, if available.

Private offices will not be made available for technicians, fellows, graduate students, or undergraduate students.

Additional lab, office, and other spaces will be provided given a reasonable use plan and a compelling need for growth, provided that current space is effectively used. Effective use is a measure of productivity, which includes the consideration of extramural grant funds proportionate to the square footage involved, as well as related scholarly activities.

Special Cases

Programs that are highly instrument-intensive (e.g., genomics programs) may require more space per FTE than indicated by the metrics.

The university will allocate specialized areas (bays, clinical and behavioral space, and studios supporting the visual and performing arts) on a case-by-case basis

For multi-investigator grants, credit for FTEs and indirect costs may be split between and among investigators according to the distribution of work, upon mutual agreement of the investigators. FTEs and indirect costs will be counted only once.

Chemistry special considerations

Typically, every two laboratory personnel whose work involves hazardous chemicals should have at least one chemical hood. These hoods should be large enough to provide each person with a minimum of 3 linear feet, but it could be 8 feet or more depending on planned activities and chemistry types.



IMAGE 2-1: Research laboratory—benchtop, wet lab.

2-2 Calculations

Occupancy guidelines ensure an effective and safe laboratory environment. They help determine the minimum occupant load based on space, activity, and equipment.

Table 1 provides a range of guidelines for different types of lab spaces.

Actual space per station or seat in a lab may vary depending on existing room configurations as well as furniture types and seating. As the university increasingly outfits labs to accommodate sophisticated equipment, room capacity may decrease.

Total direct costs per square foot

Research space will be assigned at a benchmark rate of \$250 direct costs/square foot (SF).

Scholarly activity

Deans and space administrators will assess the importance, impact, and nature of research, and its relevance to the UHM academic mission. Deans will also consider scholarly activities such as publications, intellectual property, pending awards, etc., in their determination of effective use.

Funded personnel

Additional university personnel who factor in space research allocation include:

- Paid research staff
- Paid post-doctoral research scholars (fellows and research associates)
- Paid graduate research students

FTEs will be determined by UHM payroll records; direct surveys may be employed to assure accurate assignment of paid FTEs. FTEs will be calculated on an annual basis (e.g., a postdoctoral student who works at 100% effort for six months would count as 0.50 FTE). Visiting scholars and post-doctoral fellows who are paid directly by outside sources will be considered on a case-by-case basis.

Special considerations

The dean and university may determine to cap senior investigators at the equivalent of 3 X Base SF (see Table 1) to allow for the development of junior faculty and/or to support those who are changing research direction or experiencing a gap in research funding.

In the event of emergencies or urgent needs, the university may elect to adjust all of the above formulas and allocations. All departments and programs may be required to contribute proportionate shares of their space allocation to address urgent needs.

The university will allocate no more than 250 square feet of storage space to tenured faculty members with no active research grants or funded FTE's over a 3 year period.

Deans may elect to exempt young investigators from space needs evaluation during their start-up period.

Type of Research Space		Definition	Number of PIs	Base Lab SF	Faculty Office SF	Extramural Funds	per 1.0 FTE
Theory	Office-Based	Computer-based analytic research that does not require equipment with specialized power, cooling, security or lighting controls.	1	N/A	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80	\$250/SF	Staff/post-doc = 48-60 SF
	Computational Lab	Computer-based analytic research utilizing equipment with specialized power, cooling, security and/or lighting controls.	1-3	275-350	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Full-time faculty member = 140 SF Staff/post-doc = 48-60 SF Graduate Students = 36-44 SF
	Collaborative Research Cluster (Shared)	Computer-based analytic research utilizing equipment with specialized power, cooling, security and/or lighting controls. Space is assessed based on research goals for the cluster.	4+	500-600	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Full-time faculty member = 140 SF Staff/post-doc = 48-60 SF Graduate Students = 36-44 SF
Benchtop	Dry	Advanced computational or applied mathematical analysis/simulation research.	1	300-400	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Staff/post-doc = 48-60 SF
	Wet	Research requiring access to water of varying degrees of purity, laboratory exhaust and specialized plumbed utilities.	1	300-400	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Staff/post-doc = 48-60 SF
	Loft	Research requiring large open areas for individual or team-based projects.	Varies	500-600	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Full-time faculty member = 140 SF Staff/post-doc = 48-60 SF Graduate Students = 36-44 SF
	Collaborative Research Cluster (Shared)	Interdisciplinary research requiring direct proximity between computational and experimental areas conducted in a cluster or team-based environment.	2+	110-140	Faculty-T/TT = 100-120 Faculty-Adjunct/Lecturer = 80		Full-time faculty member = 140 SF Staff/post-doc = 48-60 SF Graduate Students = 36-44 SF

Table 1

3 Utilization guidelines

- 3-1 General requirements
- 3-2 Theory research lab utilization
- 3-3 Benchtop research lab utilization

3-1 General requirements

The general requirements in these guidelines include basic health and safety measures applicable to all new and remodeled laboratories.

3-1.1 Codes and regulations

All laboratories shall comply with the following regulations and standards:

- Federal Code of Regulations (CFR), Title 29, Labor
- OSHA Hawaii State Plan Standards
- California Code of Regulations (CCR), Title 24, Part 9, Uniform Fire Code
- International Building Code
- National Fire Protection Association (NFPA) Handbook 70: National Electric Code
- UH Mānoa Radiation Safety Program, Link here: <https://www.hawaii.edu/ehso/radiation-safety/>
- UH Mānoa Hazardous Material Management Program. Link here: <http://www.hawaii.edu/ehso/wp-content/uploads/2016/07/UHHMMP01-1.pdf>
- American National Standard for Laboratory Ventilation (ANSI/AIHA Z9.5-2012)
- American National Standard for Thermal Environmental Conditions for Human Occupancy (ANSI/ASHRAE 55-1992)
- State of Hawaii, Department of Health Services, Indoor and Radiologic Health Branch
- Guide for the Preparation of Applications for Medical Programs (RH 2010 4/90) (not formally adopted)
- "Safe Handling of Radioactive Materials", National Council on Radiation Protection (NBS Handbook 92)
- "Safe Handling of Radionuclides", International Atomic Energy Agency, Safety Series No. 1, (current edition) (IAEA)
- CDC-NIH Biosafety in Microbiological and Biomedical Laboratories, 5th Edition
- National Institutes of Health Design Requirements Manual, December 12, 2016
- National Research Council (2011) Prudent Practices in the Laboratory

3–1.2 Planning and building design considerations

These guidelines aim to ensure safe environments for laboratory personnel and students to carry out their work while allowing for maximum flexibility in the conduct of research.

Incorporate the following considerations when locating and designing laboratory spaces.

- Provide a minimum ceiling height of 12'-0"
- Install standard doors with vision panels
- Equip spaces with automated blackout shades
- Segregate laboratories from non-laboratory activities to reduce risk and promote safety in the academic environment.
- Locate offices and desks outside the laboratory environment; provide appropriate space for meals, quiet work, and storage.
- Locate office zones adjacent to the laboratory, providing access, visibility, and communication preferably within a line of sight, e.g., through the use of glass walls or walls with windows.
- Locate chemical intensive or other highly hazardous spaces on ground floors.
- Separate laboratories from outside areas.
- Fixed pane windows are preferable. Where operable windows are used, provide insect screens.
- Laboratory doors shall be self-closing.
- Laboratory aisles shall have a min. clearance of 24 inches; main aisles shall have a min. clearance of 36 inches or more as required per occupancy and egress loads.
- Maintain a pathway clearance of 36 inches at the face of the access/exit door.
- Specify lab carts with designated storage space to ensure 36 inch min. clearance for corridors and aisles.
- Separate workstations at intervals of 5 ft or greater to provide ease of access. Bench spacing shall depend on the subject matter and code requirements for the occupancy load.
- Design laboratories so that they can be easily cleaned.
- Special consideration should be given to the choice of fireproof construction for the buildings. Site selection shall be such to minimize the risk of landslide or flood damage.
- When possible, maximize energy and materials conservation and processes throughout every project.
- Equip laboratory areas with adequate natural or artificial illumination to ensure sufficient visibility for operational safety.

3–1.3 Breakrooms

Provide one break room per floor, and/or an individual, enclosed desk space for each occupant separate from laboratory activities.

3–1.4 Health and safety

Anticipate and evaluate all safety hazards and incorporate appropriate protective measures into each laboratory design.

- Provide a safety station area near the door for phone, fire extinguisher, safety postings, and visitor safety glasses
- Do not place chemical storage shelves above laboratory sinks.
- Use shatter-resistant glass large sections.

3–1.5 Fire sprinklers

- Include fire sprinklers under all circumstances. Automatic sprinkler systems are required during construction, alteration, and demolition operations and shall be provided in accordance with Chapter 33 of the International Fire Code.
- Place fire sprinklers according to current codes, as required.

3–1.6 Gas

- Place gas cylinders near or at fume hoods.
- Protect gas cylinders from external heat sources in dry areas with appropriate ventilation, at least 20ft from highly combustible materials.
- Provide an automatic main gas shutoff valve for the building and interior manual shutoff valves for both research and teaching areas.

3–1.7 Fume hoods

- Do not locate fume hoods adjacent to any exit; at least 10 feet should separate hoods from any door or doorway.
- Place hoods away from pedestrian traffic.
- Select the appropriate fume hood type according to the control system being used. Select the by-pass sash design required for constant air volume (CAV) systems, and hoods designed for variable air volume (VAV) systems when VAV systems drive hood ventilation.
- Require ASHRAE 110 testing for new fume hood installations and for high performance hoods as part of commissioning
- Equip all fume hoods with visible and audible alarms.
- Select hood type according to laboratory needs and space performance. These include, but are not limited to: constant volume hoods; variable air volume hoods; supply or auxiliary air hoods; ductless fume hoods; and perchloric and acid hoods. Verify hood and duct requirements for function, installation, insulation, sealants, and cleaning.
- Base hood size and type on room size, number of air changes, lab heat load, types of materials used, number of users per hood, frequency of use, and the size of apparatus used in the hood. A laboratory with intense chemical use should consider 2.5 linear feet of hood space per student.
- Construct fume hoods intended for use with radioactive materials with stainless steel or other non-corrosive material, and identify with the approved radiation hazard symbol.
- Hoods used for radioactivity must conform with required sashes and sliding glass panels as required by relevant safety protocols. Hood mounting cabinets must support shielding for any radioactive materials used in the lab.
- Label fume hoods and special exhaust ventilation systems for intended use and display information from the most recent inspection.

3–1.8 Emergency eyewash

- Provide emergency plumbed eyewash or eye/facewash equipment for all work areas, wherever eyes may come into contact with toxic substances that can cause corrosion, irritation, or permanent tissue damage. Provide a plumbed eyewash station for all work areas where researchers handle formaldehyde solutions in concentrations greater than or equal to 0.1%.
- Install an emergency eyewash/shower station within 10 seconds of each fume hood.
- Locate an ADA emergency eyewash/shower within 10 seconds of an ADA fume hood (minimally one ADA hood per laboratory floor).
- Do not locate sink-mounted eyewashes under drying racks and/or storage.
- Eyewash waste to be hard-piped or otherwise safely conducted to floor drain.
- Select fume hoods based on room size, number of air changes, lab heat load, and types of materials used.

3–1.9 Sinks

- Sink placement depends on subject matter and lab layout.
- All outlets served by non-potable water shall have prominently displayed signs stating “Non-Potable Water – Do Not Drink”.
- Equip wet labs with sinks with lips to prevent spills.

3–1.10 Freezers

- Acknowledge high heat loads generated from freezers and place them accordingly.
- Specify shared ultra-low temperature freezers with multiple, interior, insulated sub-compartments to avoid long open door periods.

3–1.11 Darkrooms

- Equip wet darkrooms with additional ventilation as required for film processing.
- Install a silver recovery system for effluent from automatic film processors.
- Comply with waste water discharge permitting requirements of Honolulu, Hawai‘i.
- Design space for waste collection containers where required.

3–1.12 Radiological laboratories

- When work involves gamma emitters, the floors and coatings must be able to support gamma shielding criteria.
- Shielding design shall be in accordance with all applicable state regulations and NCRP and ANSI standards.
- Provide areas where radioactive materials or other radiation sources are used or stored with adequate security to prevent removal or use by unauthorized personnel.
- Equip high radiation areas and very high radiation areas with a control device that energizes a visible or audible signal so that an individual entering the area and the operator of the device are made aware of approaching personnel.
- Provide adequate space for radioactive wastes generated by projects within the lab.
- Base ventilation requirements for the laboratories utilizing radioactive materials on the types of materials used.
- Depending on the type and quantities of radioactive materials or the location of the facility, fume hoods used with volatile radioactive materials shall have specific design requirements.

3–1.13 Electrical considerations

- Backup generators to follow UH standards.
- Maximize number of separate circuits to avoid overloads.
- Provide electro/magnetic field protection as required by laboratory type.
- Lighting:
 - a. Control occupancy sensors for under-counter fixtures with overhead lighting.
 - b. Provide up and down light for each fixture.
 - c. Where possible, specify recessed lighting.
 - d. Where possible, place lighting to avoid glare or screen reflection.
- Power:
 - a. Place panel locations at lab entries, either exterior (in the corridor prior to entry), or interior (immediately adjacent to entry).
 - b. A disconnect switch for each lab is required at panel/entry.

3–1.14 Telecom and data

- Equip each lab with at least one phone.
- Equip all labs with power and data. Placement of outlets depend on lab type and subject matter.

3–1.15 Laboratory ADA guidelines

The university adheres to all ADA requirements and principles in the design of its accessible laboratory spaces.

- Architectural structures and access shall be ADA compliant and shall support UH Mānoa's policies.
- At least one ADA laboratory work area, hood, and eye wash station shall be installed per floor.
- Where possible, equip labs with height variable benches and work stations.
- Safety showers, eyewash stations, fire extinguishers, and other safety-related devices shall be accessible.
- Ensure that all laboratories have accessible storage space.
- Install a minimum of one ADA accessible fume hood with appropriate surface heights and clearances per floor.

3–1.16 Mechanical considerations

- Design mechanical systems for the maximum number of fume hoods per floor or per building.
- Completely and permanently seal penetrations for electric and plumbing, etc.
- Locate GFI electrical receptacles above counter tops within 6 feet of sinks.
- Fit all labs with an adequate number of electrical outlets, that can accommodate electrical current requirements with an additional 20–40% capacity.
- Locate circuit breakers outside the lab, but not in rated corridors.

3–1.17 Plumbing

- Locate auxiliary valves for gas and vacuum lines outside the lab.
- Use flexible connections for connecting gas and other plumbed utilities to any freestanding device, including but not limited to biosafety cabinets, incubators, and liquid nitrogen freezers. Flexible connections should be appropriate for the pressure requirements and should be constructed of material compatible with the transport gas. Locate and clearly mark shutoff valves within sight of these connections.
- Separate lab waste water lines from domestic sewage and install a sampling point in an easily accessible location outside the building.
- Provide either building-wide, zone or lab backflow prevention.
- Select pipe material and insulation based on the subject matter and lab type.

3–1.18 Ventilation

Ventilation regulations and references:

- Carcinogens Code of Federal Regulation (CFR) 10, Parts 20 and 35
- National Fire Protection Association (NFPA) Handbook 45, Standard on Fire Protection for Laboratories Using Chemicals
- National Fire Protection Association (NFPA) Handbook 99 Standard for Health Care Facilities
- American National Standards Institute (ANSI), Z358.1 Emergency Eyewash and Shower Equipment
- American National Standard for Laboratory Ventilation (ANSI/AIHA Z9.5)
- American National Standard for Thermal Environmental Conditions for Human Occupancy (ANSI/ASHRAE 55-1992)
- The CalDAG – California Disabled Accessibility Guidebook
- Guide for the Preparation of Applications for Medical Programs (RH 2010 4/90) (not formally adopted) (DOHS 2010)
- "CRC Handbook of Laboratory Safety, 4th Ed." CRC Press 1995.
- "Safe Handling of Radionuclides", International Atomic Energy Agency, Safety Series No. 1, (1973 ed. is still current as of 1999) (IAEA)

General ventilation considerations:

- Equip labs with mechanically generated supply and exhaust air. Use 100% outside air and exhaust to the outside. Designs must ensure no return of fume hood and laboratory exhaust back into the building.
- Design air handling systems so that lab rooms maintain a slightly negative air pressure with respect to corridors and surrounding rooms.
- Provide mechanical climate control.
- Cabinetry or other structures or equipment must not block or reduce the effectiveness of supply or exhaust air.
- Exhaust ventilation shall be continuous.

- Equip indoor storage areas and storage buildings with mechanical exhaust ventilation or natural ventilation where natural ventilation can be shown to be acceptable for the materials as stored.
- Design general ventilation systems so that they can be shut down and isolated to contain radioactivity in the event of an accident.
- Avoid condensation by maintaining air velocity in ducts.
- Fume hoods should not be the sole means of room air exhaust. Provide general room exhaust outlets where necessary to maintain minimum air change rates and temperature control.
- Air exhausted from laboratory work areas shall not pass unducted through other areas.
- Locate an emergency exhaust button with reset capability next to the exit of all labs.
- Designate local exhaust ventilation to control the exposure of hazardous chemicals, minimizing air flow needed to contain to attain containment control.
- Label hoods to show the ventilation system to which they are connected.
- Equip laboratory ventilation systems with exterior insulation and sound insulation at the source for noise control.

Negative pressurization:

- Direct air flow from low to high hazard areas; generally ensure an adequate supply of air; supply 90% air flow to labs.
- Introduce make-up air at the opposite ends of laboratories; keep flow paths for HVAC systems away from hood locations.
- Introduce make-up air to maintain negative pressurization at all times.
- If required, include an air lock vestibule to minimize the volume of air supply required for negative pressurization control. Doors shall not open at the same time.
- Laboratories shall be maintained under negative pressure in relationship to adjacent corridors or hazardous areas. Clean rooms shall have entry vestibules with door-closing mechanisms.
- Room air currents at the fume hood should not exceed 20% of the average face velocity to ensure fume hood containment.
- Supply system air should meet the technical requirements of the laboratory work and the requirements of the latest version of ASHRAE, Standard 62, Ventilation for Acceptable Indoor Air Quality.

3-1.19 Laboratory finishes and furnishings

Select furniture to meet load requirements, and select based on the laboratory needs and subject matter.

- Avoid locating desks and study carrels in lab rooms. Include splash protection/separation from wet bench areas to reduce PPE (personal protective equipment) requirements, where necessary.
- Ensure that all lab furniture is sturdy and all work surfaces impermeable.
- Use closed and transparent storage where dust is a concern.
- When required, furniture shall comply with ESD standard requirements and ANSI S20.20 standards.
- Select floor material and finish based on lab type and subject matter. The university prohibits the use of carpeting in labs.
- Lab spaces shall not have drop ceilings. Where deemed necessary, drop ceilings shall be smooth, without texture. Ceilings are required in chemical storage rooms.
- Do not paint dampers, pumps, motors, belts, and labels.
- Paint wall surfaces with washable, hard, non-porous products.
- When possible, select benches with adjustable height.
- Select 5-leg lab chairs and non-porous fabric coverings to facilitate cleaning and prevent absorption of infectious, hazardous chemical or radioactive materials. See Furniture Design Guidelines for reference furnishing types here: [Hyperlink](#).
- Install fixed case work only when necessary. Case work varies based on the laboratory type.
- Storage:
 - a. Equip all labs with lockable storage or other means of securing regulated substances and radioactive materials. Provide sufficient storage so that incompatible chemicals/gases can be physically separated and stored.
 - b. When separate gas storage rooms are provided, they must operate at a negative pressure in relation to the surrounding area and direct the exhaust ventilation to an exhaust system.
 - c. Locate gas cabinets or exhausted enclosures in a room or area which has independent exhaust ventilation. Ventilation must operate at negative pressure in relation to the surrounding area, be connected to an exhaust system, and be internally sprinklered.
 - d. Hazardous material storage design to include spill control and secondary containment for the storage of hazardous materials liquids in accordance with the requirements of the International Building Code, Hawaii Fire Prevention Code and NFPA 45. Provide explosion control for storage.
 - e. Design flammable liquid storage such that it does not exceed 120 gallons for the combined quantity of all liquids.
 - f. When multiple flammable or hazardous liquids are present, design laboratories to address storage requirements for each material.
 - g. Design laboratories to include spill control and secondary containment for storage of hazardous material liquids in accordance to the most recent applicable Fire Code.
- Equip computer labs with movable and easy connections to systems, screens, and sound systems around the room.

3-2 Theory research lab utilization

Theory reserach labs support faculty reserach projects that require a computer or collaborative cluster to carry out work. Types of theory research labs include but are not limited to the following:

Lab: office-based

Number of Pls: 1

Target Area: N/A SF

Design intent: Research lab designed for research that does not require equipment with specialized power, cooling, security, or lighting controls. Temperature and humidity controls may be installed for office work and environmental control. Office-based layouts can vary in size to accomodate differing needs. When possible, minimize sound tranmission from adjacent spaces. Wherever possible, provide spaces with natural light.

Lab: computational

Number of Pls: 1-3

Target Area: 275–350 SF

Design intent: Equip computer-based research labs with specialized power outlets, cooling, temperature and humidity, security, and lighting controls. Minimize sound transmission from entering the computation space from adjacent spaces. Select interior colors and finishes that reduce eye strain, glare, and screen reflections.

Lab: collaborative research cluster

Number of Pls: 4+

Target area: 500–600 SF

Design intent: Equip computer-based collaborative research cluster laboratories with specialized power, cooling, temperature and humidity, security, and lighting controls. This space expressly supports collaborative work as required for research projects.

Funding influences—or, in some cases, determines—actual space assignment. Provide additional space if supported by funding. These rooms offer movable furniture specific to lab equipment, whiteboards, large display screens, HDMI connections, storage, secured entry, and additional power/cooling, if needed.

3-3 Benchtop research lab utilization

Benchtop reserach labs provide special-purpose equipment and room configurations that support faculty research projects. Types of benchtop research labs include but are not limited to the following:

Lab: dry

Number of Pls: 1

Target area: 300–400 SF

Design intent: Dry Laboratories offer space for advanced computational or applied mathematical analysis and simulated research. Equip rooms with specialized power, cooling, temperature and humidity, security, and lighting controls. Provide furniture that supports both fixed and flexible layouts. For rooms designated for human subject testing, minimize sound tranmission from an adjacent space. Programmed use determines the noise and level vibration adequate for the ongoing testing and recording activities.

Lab: wet

Number of Pls: 1

Target area: 300–400 SF

Design intent: Equip wet laboratory research spaces with access to water, exhaust systems, fume hoods and plumbing utilities, storage for chemical or biological specimens, and bio-safety cabinets. Provide furnishing that supports both fixed and flexible layouts. Follow general lab design guidelines.

Lab: loft

Number of Pls: varies

Target area: 500–600 SF

Design intent: Loft laboratories offer large open areas for individual or team-based research projects. Route all services overhead to maximize continuous open areas. Provide furnishing that supports flexible layouts. Install fume hoods as required.

Lab: hybrid cluster

Number of Pls: 2+

Target area: 110-140 SF

Design intent: The collaborative research cluster provides space for interdisciplinary research that requires direct proximity between computational and experimental areas conducted in a cluster or team-based environment.

Funding typically determines actual space assignment. These spaces require specialized engineering, mechanical and electrical equipment, infrastructure, and support for procedures associated with specified activities.

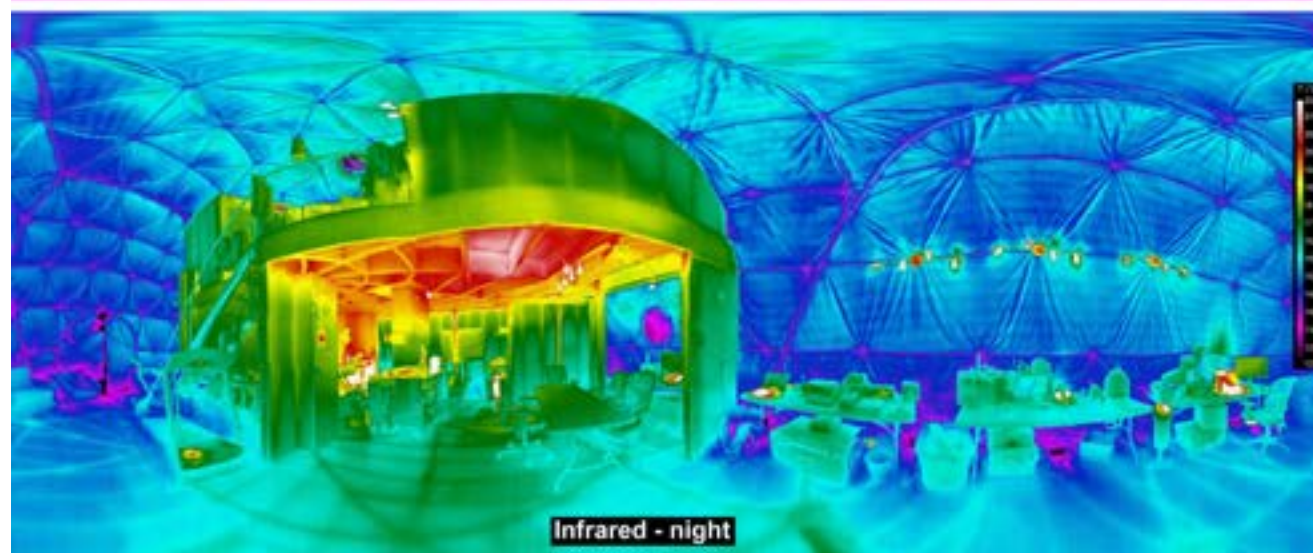
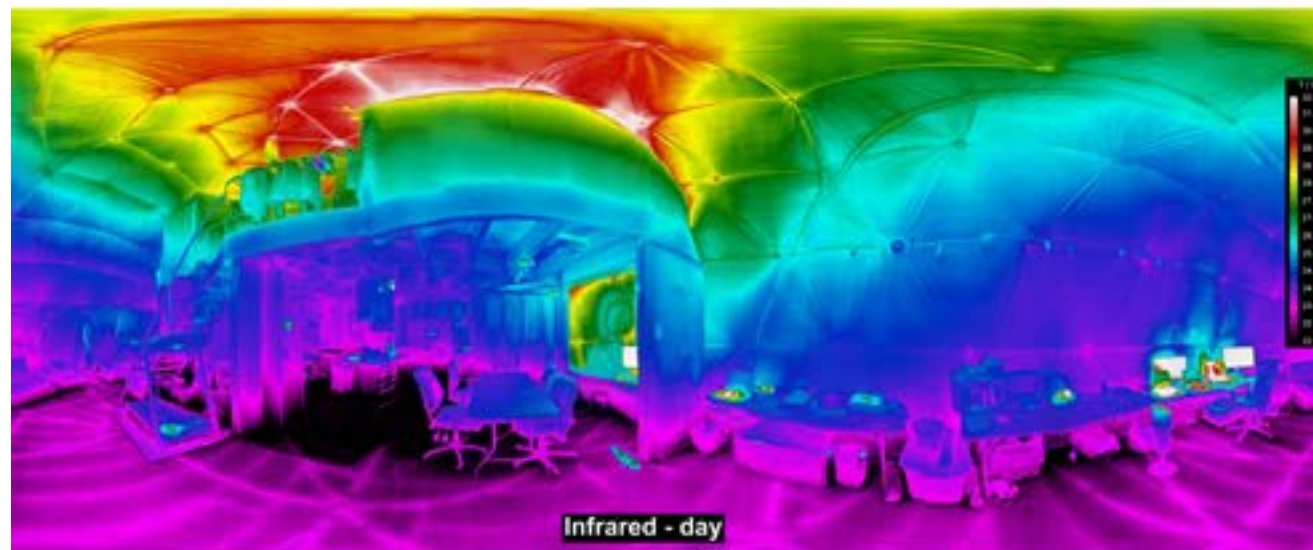


IMAGE 3-1: Interior habitat thermal analysis at HI-SEAS 2013—benchtop, dry lab.

4 Layouts

These guidelines serve to help estimate the size of research labs actually needed for new construction or to renew, improve, and modernize existing labs. They also help assess existing research lab space in alignment with more efficient university scheduling protocols. Flexibility is and will remain the sovereign criteria for room design and renovation. Therefore, wherever possible, design the configuration of rooms and furniture to adapt and change as the pedagogy and the research methods evolve.

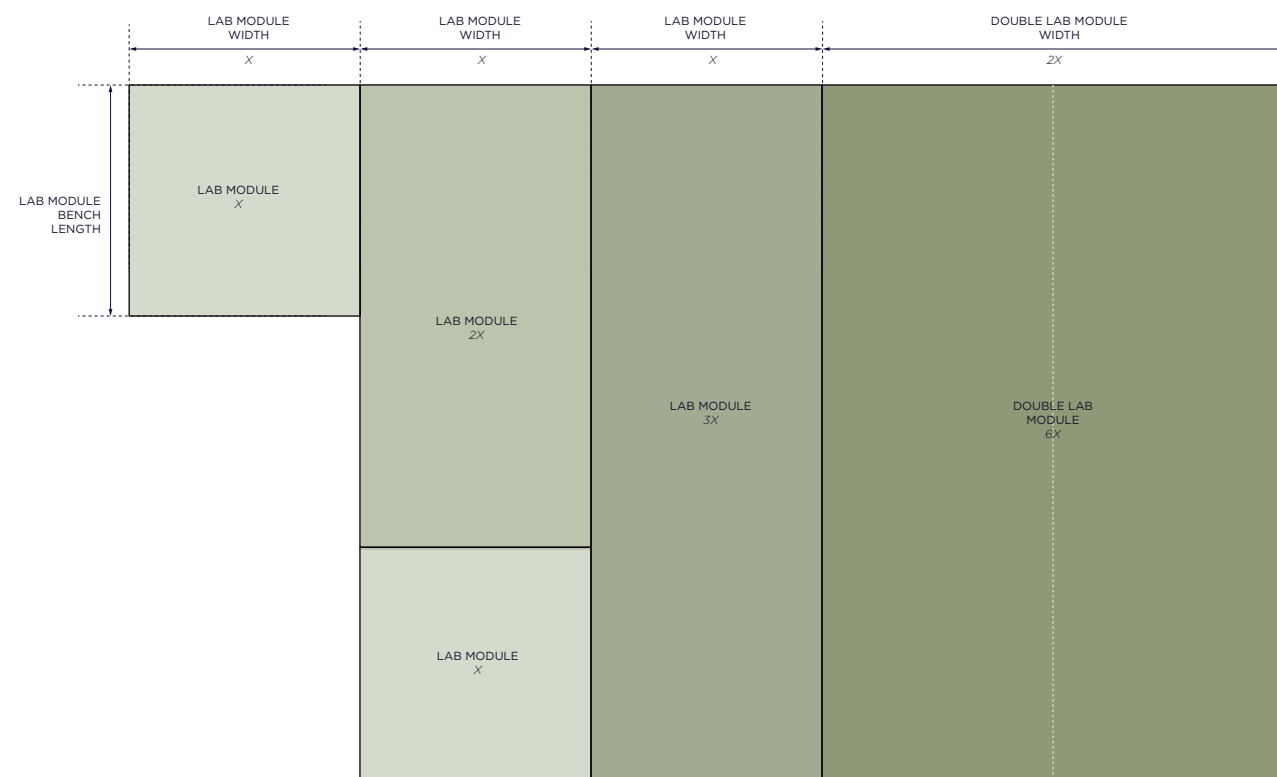
Design research labs to incorporate modular space planning, modular building systems, accessibility, and connectivity within modular building systems. These principles ensure appropriate design and construction of new and renovated laboratory space while minimizing the disruption to existing buildings and conditions.

Modular space planning aims for highly flexible space while fulfilling functional requirements. It also accounts for future renovations and mixed-use spaces, providing the ability to convert, renovate, expand, subdivide, and reconfigure rooms with minimal disruption to adjacent space. This approach also enables spatial modifications with minimal alteration or interruption of building systems.

Laboratory modules support modular space planning. Modules can be combined or subdivided to accommodate diverse programs, including core-support or office spaces, as needed. Follow space division and adjacent room requirements according to each laboratory type.

Extend modular design to building systems, where elements are organized within a repetitive modular composition with consistent points of connection to each building system recurring in positions based upon the lab modules as necessary. This enables maintenance and access with minimal disruption of building systems and adjacent spaces, supporting space reprogramming with minimal cost, effort, and inconvenience.

LABORATORY MODULE CONFIGURATIONS



LABORATORY MODULE ILLUSTRATING COMBINATIONS OF FIXED AND MOBILE FURNISHING

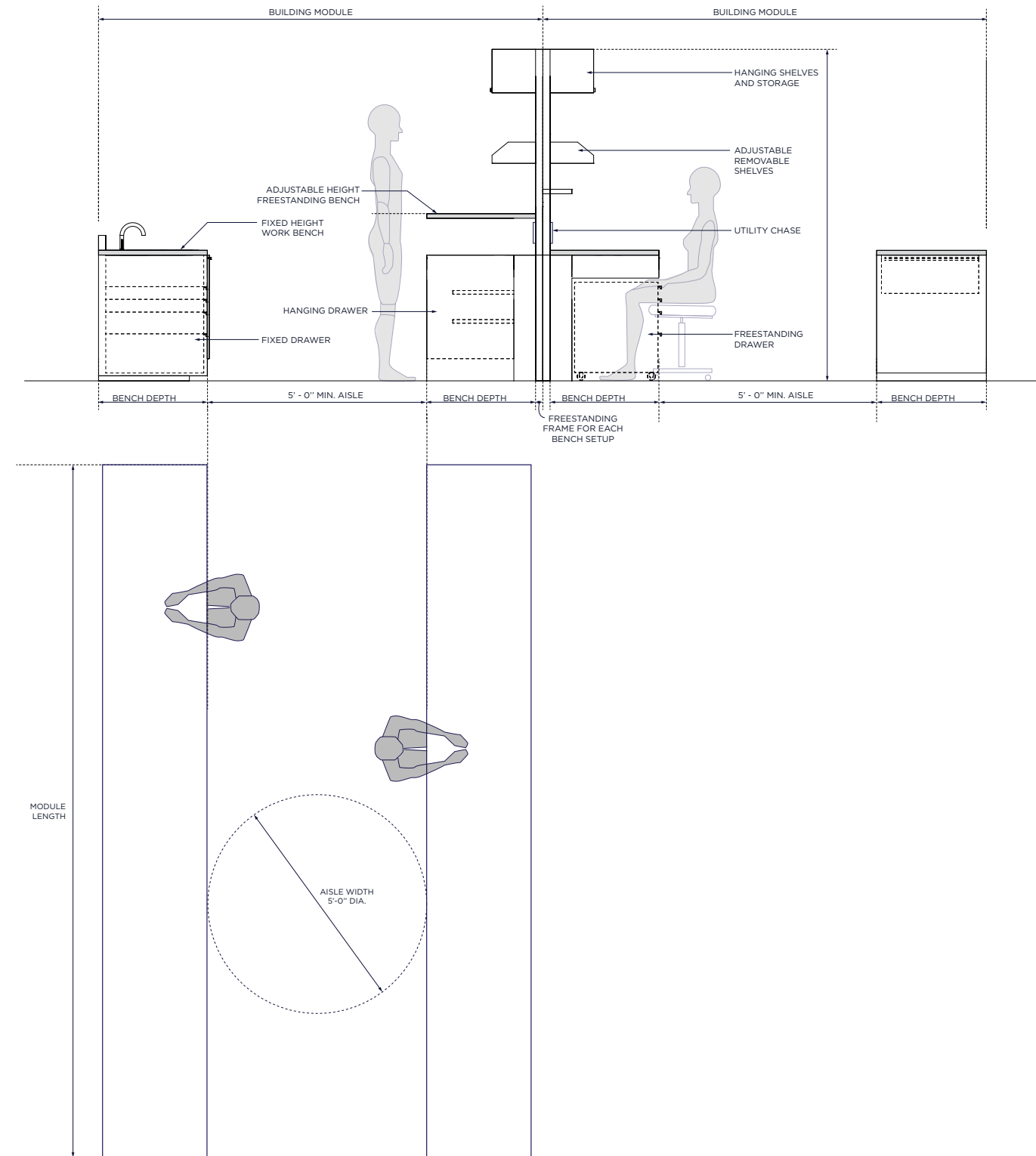




Image courtesy of the University of Boulder

IMAGE 4-1: Banich Lab for Neuroscience at the University of Boulder—theory, dry lab.



Image courtesy of Brown University

IMAGE 4-2: Digital Print Lab at the List art Building—theory, dry lab.

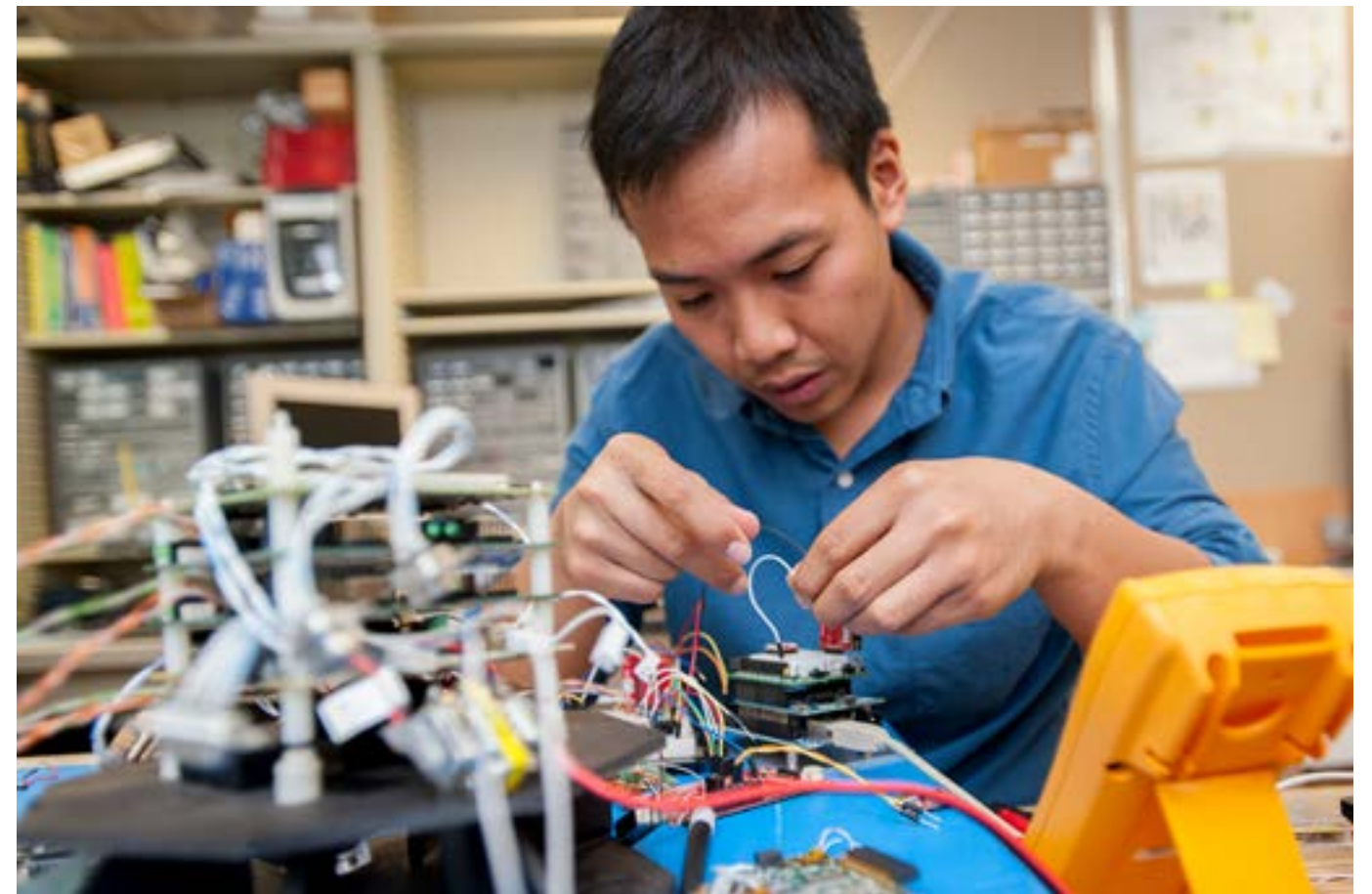


IMAGE 4-3: Flight Space Laboratory at UH Mānoa—benchtop, dry lab.

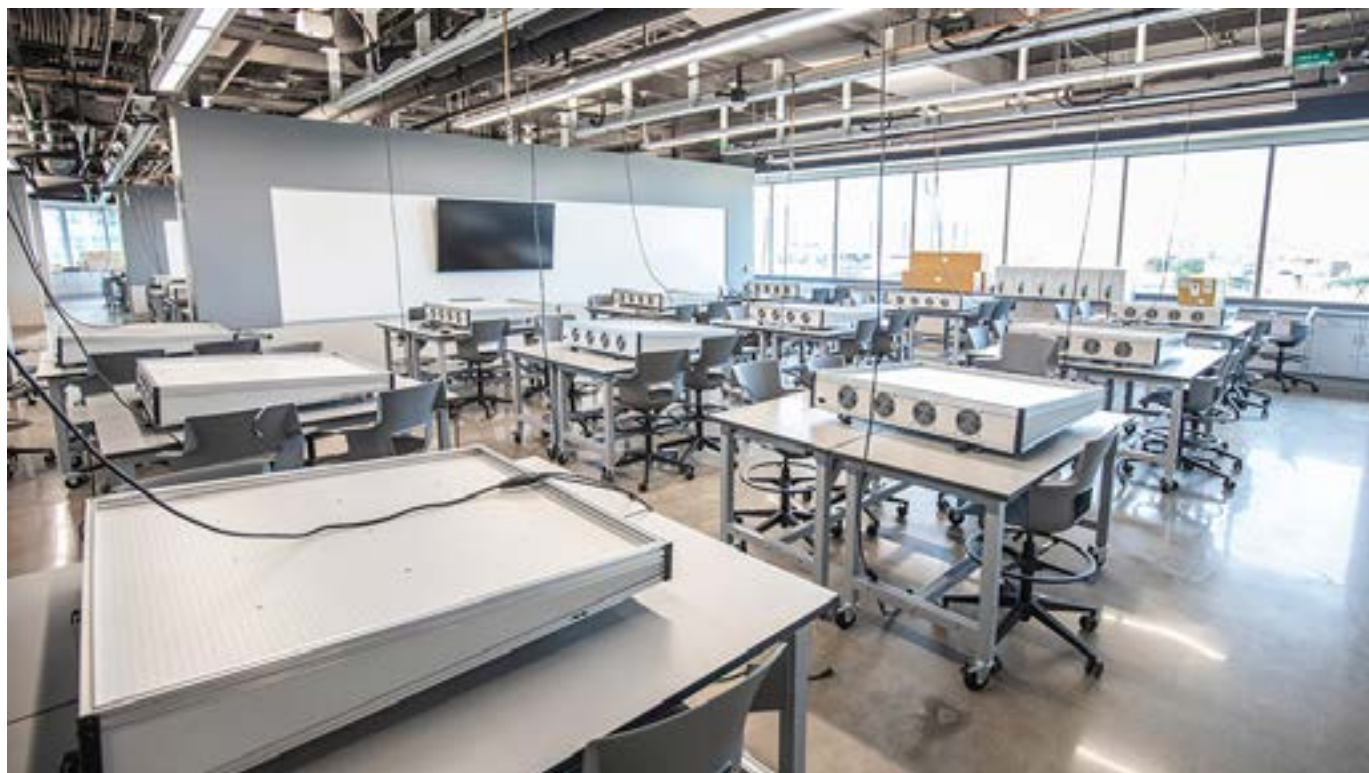


Image courtesy of Texas A & M University

IMAGE 4-4: Zachry Foundations engineering Lab—benchtop, dry lab.



Image courtesy of the University of Miami

IMAGE 4-5: Fabrication Lab at the School of Architecture at the University of Miami—benchtop, dry lab.

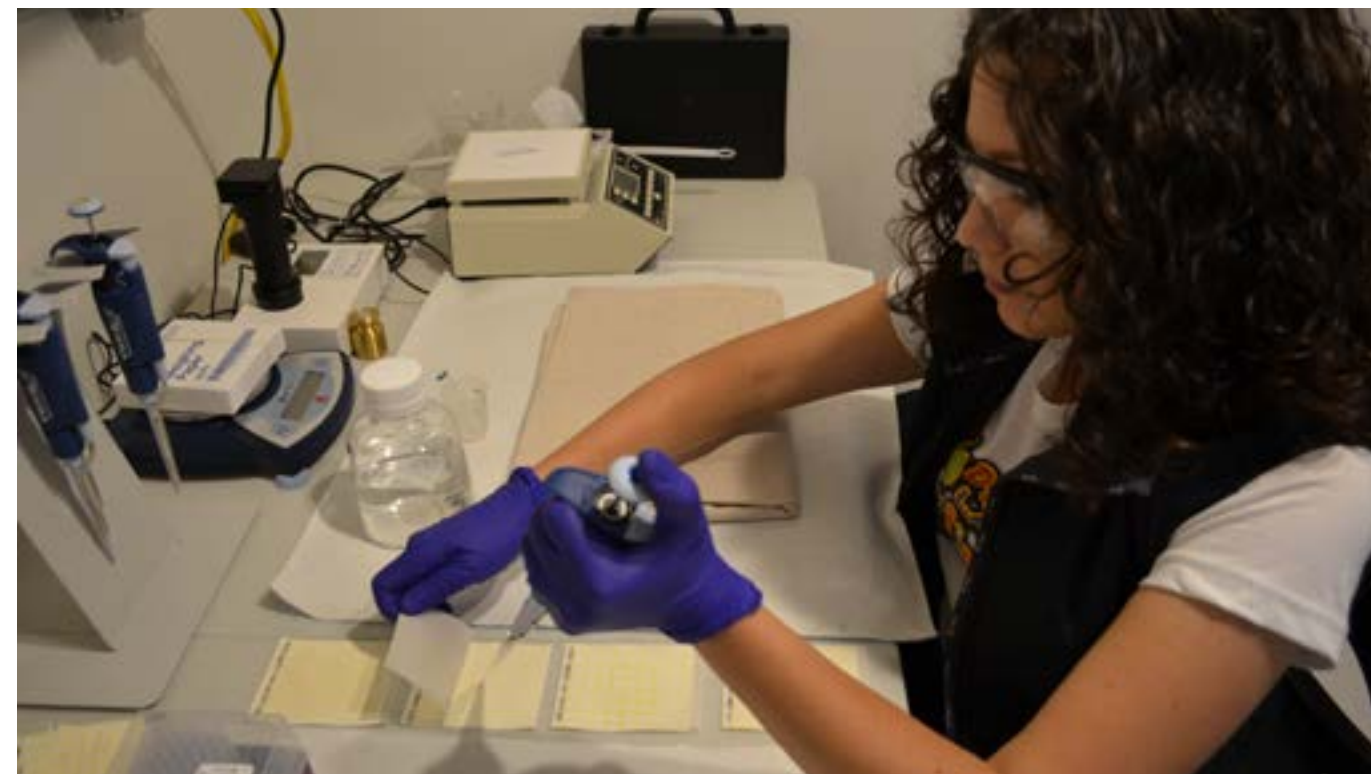


IMAGE 4-6: Microbial analysis in the lab at the HI-SEAS 2013—benchtop, wet lab.



Image courtesy of Stanford University.

IMAGE 4-7: SHRIMP-RG Lab at the Geological Survey and Stanford School of Earth, Energy & Environmental Sciences.



Image courtesy of Hilary Doyle

IMAGE 4-8: Brown University art lab at the List Art Building—benchtop, wet lab.



Image courtesy of the University of Chicago, Art

IMAGE 4-9: Dance Lab—dry lab.



IMAGE 4-10: Rare Plant Laboratory at UH Mānoa—benchtop, wet lab.



IMAGE 4-10: Drexel University Undergraduate design Labs—benchtop, dry lab.

Image courtesy of Jeffrey Totaro



IMAGE 4-11: John A. Burns School of Medicine at UH Mānoa—theory, dry lab.



IMAGE 4-12: Athletics Lab. Image courtesy of Ghent University—dry lab.

Image courtesy of Ghent University

5 Relevant policies

Draft RP 4.204 - Capital Improvement Planning
University's Administrative Practices A8.265
Executive Policy E8.202

6 References

1. JABSOM Space Request, Reassignment & Relocation Process. (2020). URL: <https://jabsom.hawaii.edu/admin/afo/space/>
2. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards: National Research Council (US) Committee on Prudent Practices in the Laboratory. (2011). Washington (DC): National Academies Press (US).
3. UHM Space Planning Guidelines (DRAFT). (2015). URL: <http://Mānoa.hawaii.edu/opf/documents/policies/UHM%20Space%20Guidelines%20-%20April%202015.pdf>
4. University of Albany: Research Space Allocation Guidelines (2016). URL: https://www.albany.edu/facilities/campusplanning/documents/RSAG_2016-10-15.pdf
5. <https://www.colorado.edu/faculty/banich/>
6. <https://www.brown.edu/academics/visual-art/facilities-equipment>
7. <https://www.sydney.edu.au/engineering/our-research/laboratories-and-facilities/electrical-engineering-and-energy-laboratories.html>
8. <https://engineering.tamu.edu/academics/labs.html>
9. <https://www.arc.miami.edu/resources/labs-and-centers/fabrication-lab/index.htm>
10. <https://www.jsums.edu/civilengineering/geotechnical-engineering-laboratory/>
11. <https://shrimprg.stanford.edu/>
12. <https://www.uchicagoartsblog.art/archive/2020/10/14/virtual-dance-lab-brings-dance-to-your-living-room-working-title>
13. <https://educationsnapshots.com/photographer/jeffrey-totaro/>
14. <https://www.victoris.be/ugent-sports-lab-unites-science-and-athletics/>
15. Stanford Design Guidelines: <https://ehs.stanford.edu/manual/laboratory-standard-design-guidelines>
16. Arizona State University guidelines: https://www.asu.edu/fm/documents/project_guidelines/Laboratory-Guidelines.pdf