

# Share the Air

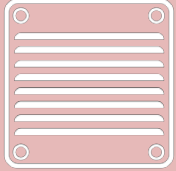
Cascading Air Strategies Using Neutral  
Temperature Dedicated Outdoor Air Systems

**Craig S. Spangler, AIA**  
Principal

**Jonathan Friedan, PE, LEED AP**  
Principal

B A L L I N G E R

## Learning Objectives



- How Neutral Supply Temperature Systems Separate Ventilation From Heating & Cooling to Re-imagine Traditional Ventilation Strategies



- Energy Savings Optimization: Sweeping Air from Dry to Wet Spaces / Compartmentalization Impacts on Air Flow & Pressures



- Understand the Integration of Critical Components & Design to Reduce First Costs, Energy Use, & Maintenance

## Speakers



Craig S. Spangler, AIA  
Principal



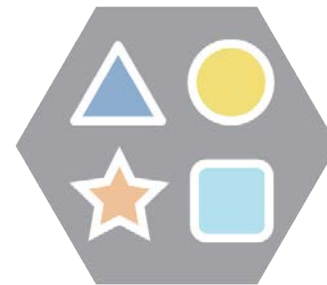
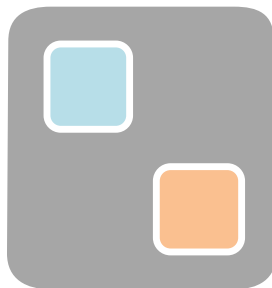
Jonathan Friedan, PE, LEED AP  
Principal





**BUY**  
ONE GET  
**ONE**  
**FREE**

# Evolution of Science: Teams & Facilities



Department  
Basic Science Labs

Colocation  
Basic Science Labs

Interdisciplinary  
Basic Science Labs  
Social Space

Convergence  
Broad Space Spectrum  
Social Continuum

ADDITIVE



SYNERGISTIC

# Convergence

Teaching  
Lab Tower

Engineering  
Teaching  
Lab

Student  
Project Space

Physics  
Teaching  
Lab

Help  
Desk

Informal  
Interaction

Biology  
Teaching  
Lab

Formal  
Interaction

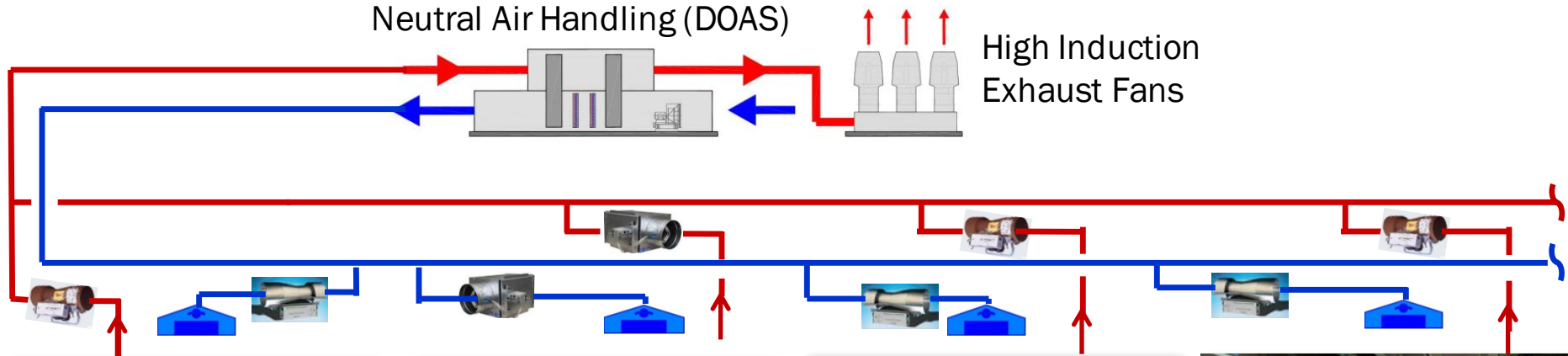
Communicating  
Stair



# | Convergent Uses/Decoupling

Neutral Air Handling (DOAS)

High Induction  
Exhaust Fans



Biology Lab



Social Space



Chemistry Lab  
(Fume Hood Intensive)



Computer Lab



# Traditional HVAC – 100% OA VAV



1,000 SF

**DRY LAB/COMPUTATIONAL/OFFICE**

Code Ventilation: **370 CFM**

Supply: Cooling Driven



1,000 SF

**WET TEACHING / RESEARCH LAB**

Code Ventilation: **430 CFM**

Supply: Cooling Driven

# Chilled Beams w/ Neutral Temperature Air

SUPPLY  
500 CFM

TOTAL  
SUPPLY:

SUPPLY  
1,000 CFM

EXHAUST  
500 CFM

1,500 CFM

EXHAUST  
1,000 CFM

45%  
REDUCTION



1,000 SF

DRY LAB/COMPUTATIONAL/OFFICE  
Code Ventilation: **370 CFM**  
Supply: Latent Load Driven



1,000 SF

WET TEACHING / RESEARCH LAB  
Code Ventilation: **430 CFM**  
Supply: Cooling/Chilled Beam Driven

# Air Transfer – Chilled Beams w/ Neutral Temperature Air + Air Share

SUPPLY  
500 CFM

TOTAL  
SUPPLY:

SUPPLY  
500 CFM

EXHAUST  
0 CFM

1,000 CFM

6 AC/HR

EXHAUST  
1,000 CFM



1,000 SF

DRY LAB/COMPUTATIONAL/OFFICE  
Code Ventilation: **370 CFM**  
Supply: Latent Load Driven

63%  
REDUCTION

Transfer  
500 CFM

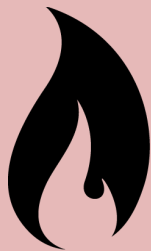


1,000 SF

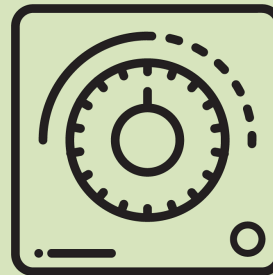
WET TEACHING / RESEARCH LAB  
Code Ventilation: **430 CFM**  
Supply: Cooling/Chilled Beam Driven

## | Issues + Challenges

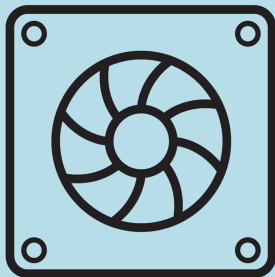
**Code**



**Control Complexity**

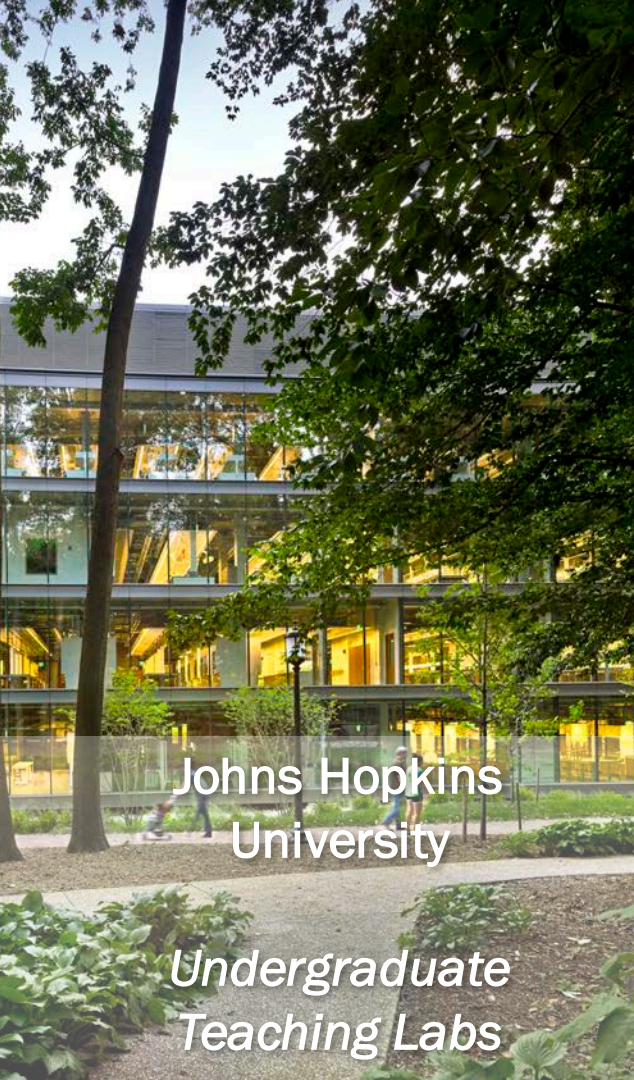


**Air Quality / Ventilation**



**Acoustics**





**Johns Hopkins  
University**

*Undergraduate  
Teaching Labs*



**University of Maryland  
Baltimore County**

*Interdisciplinary Life  
Sciences Building*



**Swarthmore  
College**

*Biology, Engineering +  
Psychology Building*



# Undergraduate Teaching Laboratories

Johns Hopkins University, Baltimore, MD



LEED  
Platinum



ASHRAE  
Technology  
Award 2017  
1st Place



JOHNS HOPKINS  
UNIVERSITY

105,000 GSF  
2013

# Program



Neuroscience



Advanced Organic

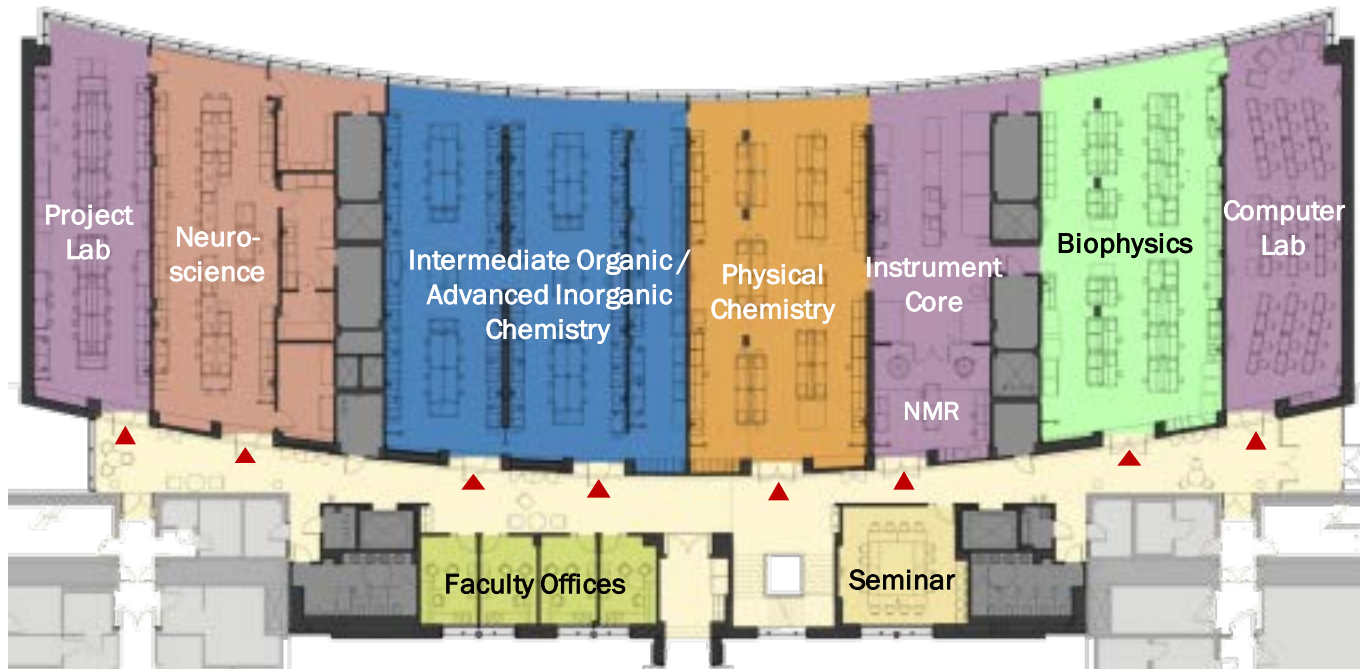


Biophysics



Computer Lab

80% Wet Lab  
20% Dry Lab



# Typical Wet Teaching Lab



Lab E: Extraction of Caffeine

The Leaves  
Cassia  
Caffeine  
Chlorophyll  
Carotenes

Extraction of Caffeine (with H<sub>2</sub>O)

H<sub>2</sub>O Soluble  
Excluded by Water  
Chlorophyll  
Carotenes

H<sub>2</sub>O Soluble  
Excluded by Water  
Chlorophyll  
Carotenes

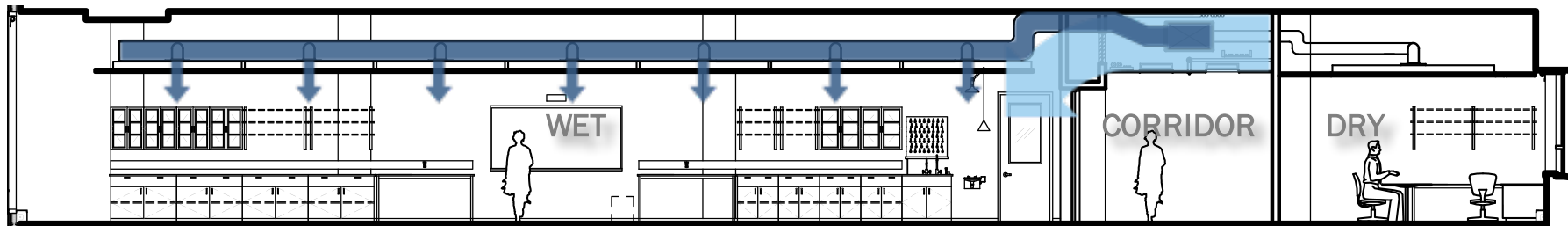
Do not  
boil  
Caffeine  
Cassia  
Caffeine  
Cassia

Do not  
boil  
Caffeine  
Cassia

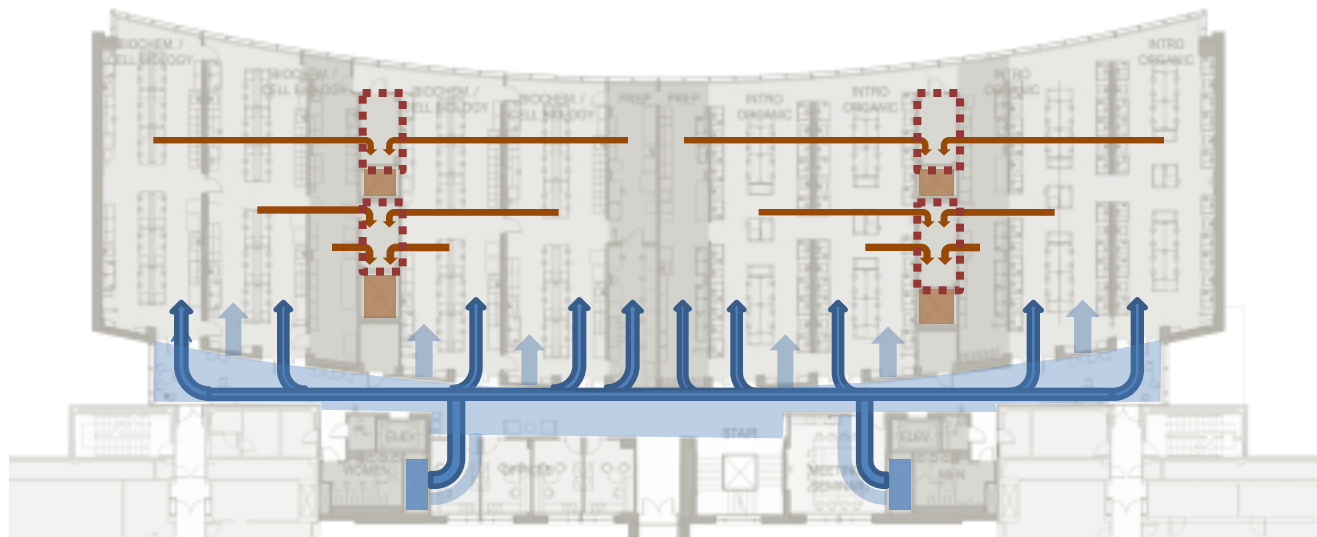
13' - 4" Floor to Floor  
9' - 4" Floor to Cloud



# Ductless Neutral Supply Air



13'- 4" Floor to Floor Height





# Interdisciplinary Life Science Building

University of Maryland Baltimore County

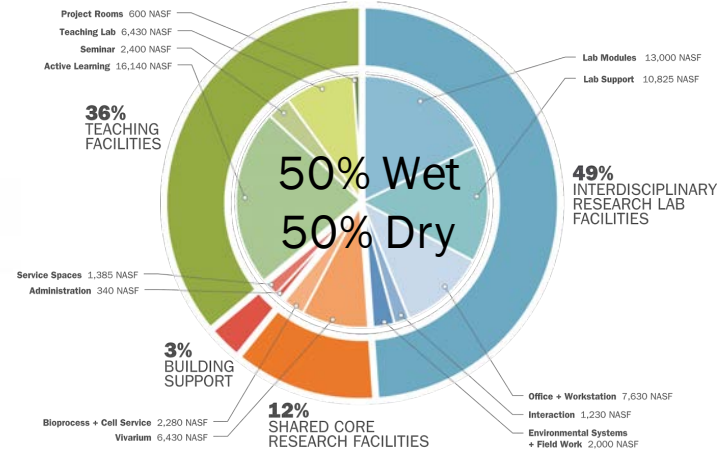


**LEED Gold  
Anticipated**



**130,000 GSF  
2019**

# First Floor Plan and Double Height Commons





Teaching and Research Labs



Commons



Active Classrooms  
450 Students

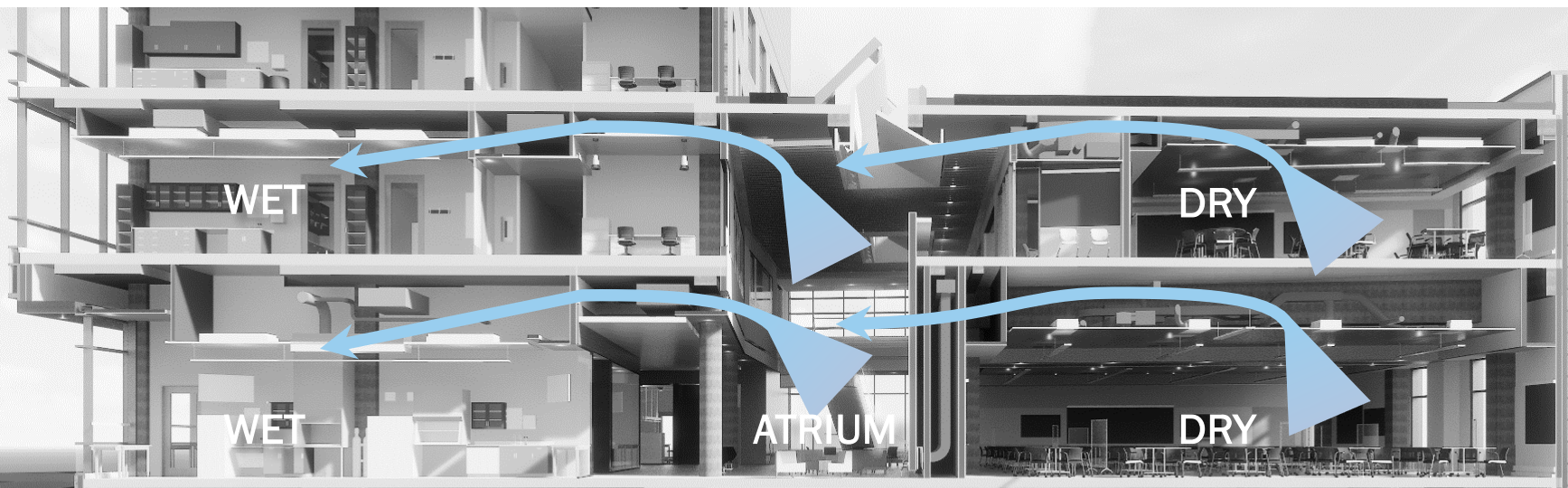
14' – 8" Floor to Floor  
10' – 0" Floor to Ceiling



Teaching and Research Labs

Commons

Active Classrooms  
450 Students



Teaching and Research Labs

Commons

Active Classrooms  
450 Students

**Swarthmore  
College  
Sustainability  
Framework  
Compliance**

**Net Zero  
Carbon  
Campus Goal**



**156,000 GSF  
/ 2020**

Science Center

**Biology, Engineering & Psychology Building**  
Swarthmore College | Swarthmore, PA

# Program



40% Wet Lab  
60% Dry Lab



Support

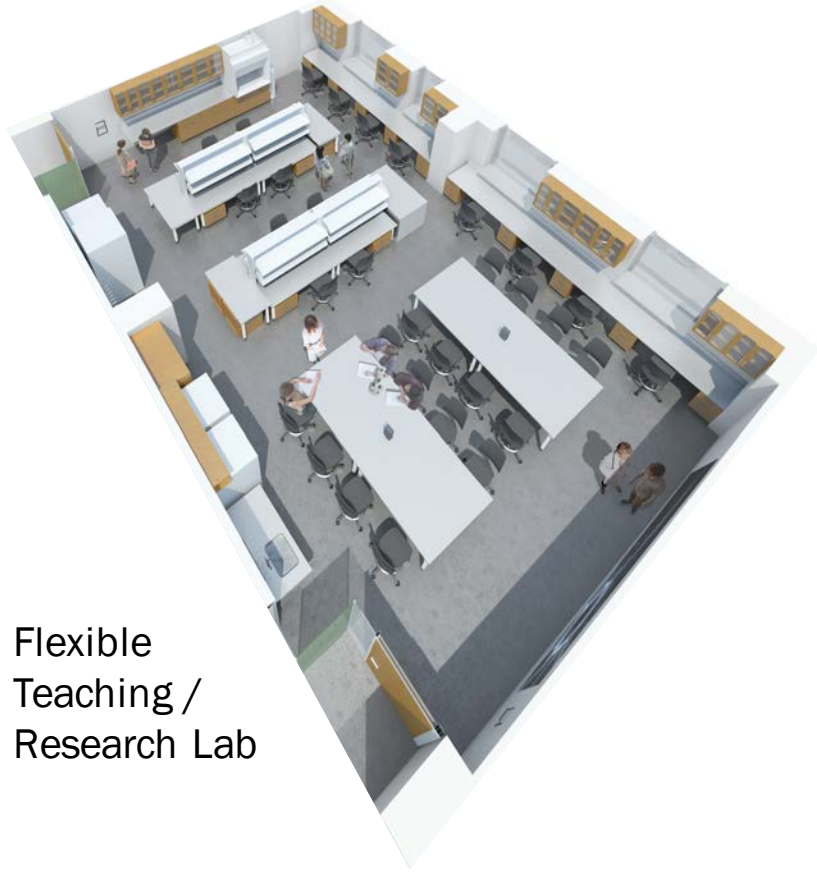
Lab

Offices

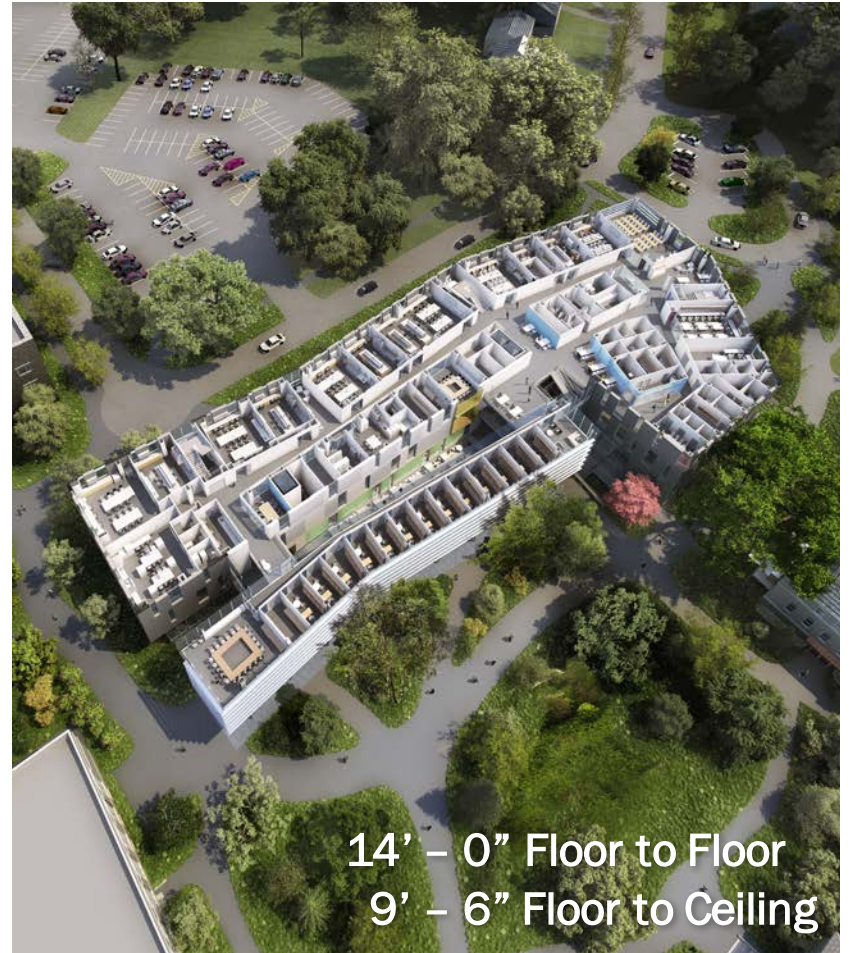
Common Spaces



# Typical Floor Plan

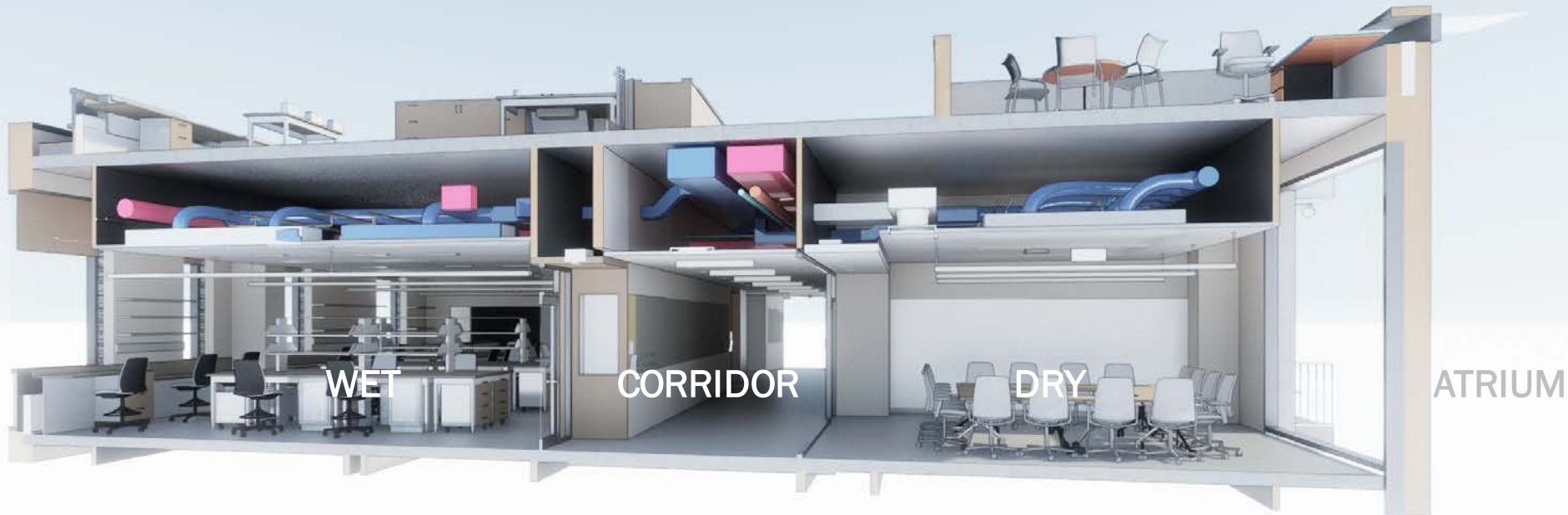


Flexible  
Teaching /  
Research Lab

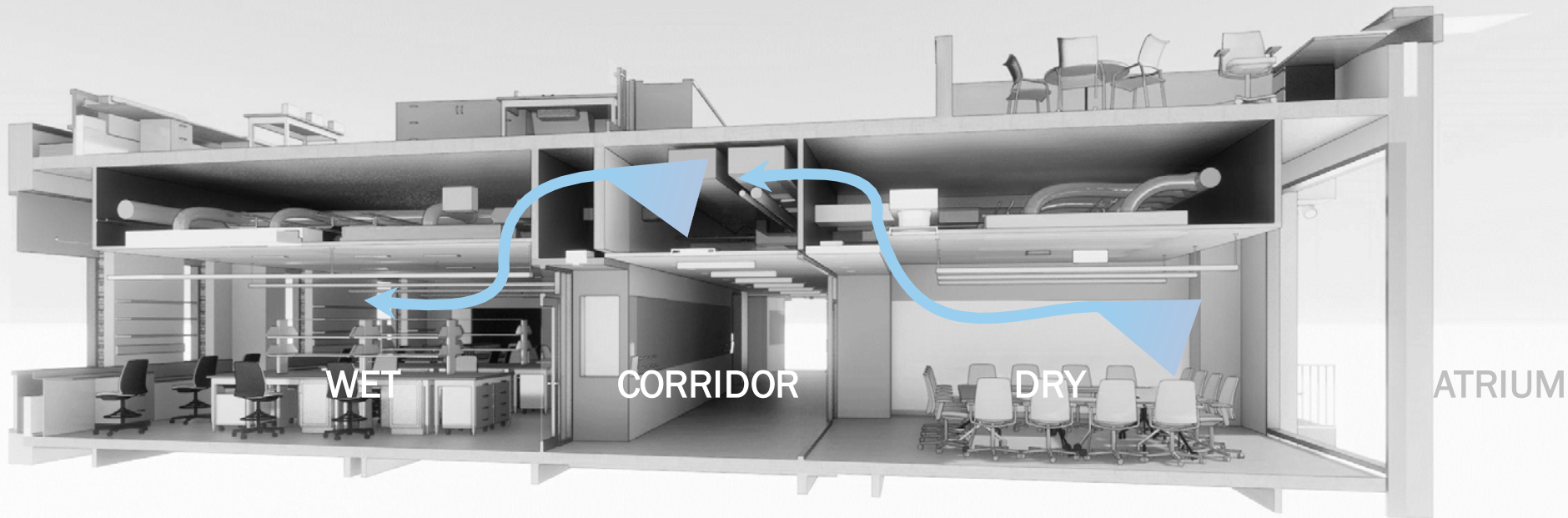


14' - 0" Floor to Floor  
9' - 6" Floor to Ceiling

# Swarthmore College: Air Share Strategy



# Swarthmore College: Air Share Strategy



# Three Case Studies Results/Energy Savings



## Johns Hopkins University

Undergraduate Teaching Labs



- Hood Makeup via Corridor Plenum
- EUI (site) – 144 kbtu/gsf
- 0.9 cfm / sq ft (Operating Peak)



## University of Maryland

Interdisciplinary Life Science Building



- Air Share via Atrium
- EUI (site) – 150 kbtu/gsf (est.)
- 0.8 cfm / sq ft (Estimated Peak)



## Swarthmore College

Biology, Engineering + Psychology Building



- Air Share via Corridor Plenum
- EUI (site) – 120 kbtu/gsf (est.)
- 0.6 cfm / sq ft (Estimated Peak)

# Questions?

BALLINGER



# Speakers



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**215.446.0700**