University of Massachusetts

Massachusetts Accelerator for Biotechnology (MAB):

"Helping Biotech Companies in Transition"

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ISPE®

MAB Facility Functions

- Biotech Companies in Transition
- Biotech Products (Pre-clinical)
- Biofuels, Biomaterials and Biochemicals
- Education: College and Public
- Research and Development

Architectural Elements

- Building shape modeled on classic enzyme-substrate "transition state"

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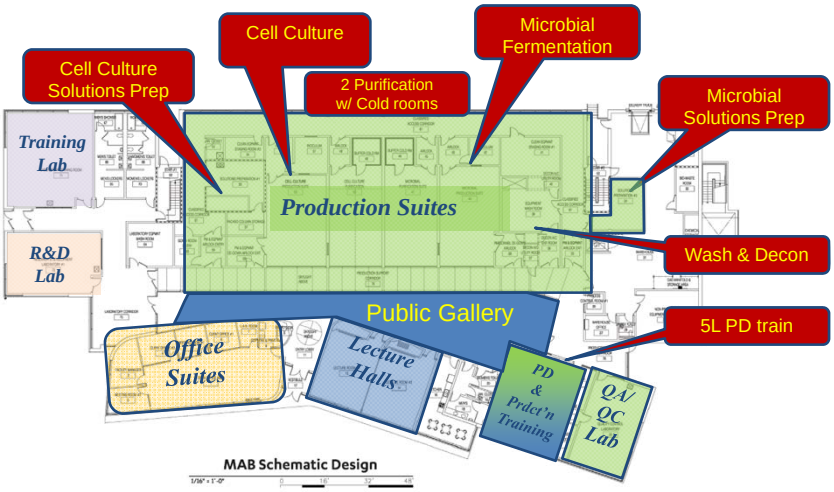
- Building shape modeled on classic enzyme-substrate "transition state"
- Close interaction between public spaces and operations suites
- Careful maintenance of confidentiality
- Multi-product operation
- "GMP-like" operation
- Building 27,745 sq. ft. designed to be expanded westwards
- LEED certified

Four Flexible Suites with Support Spaces



MAB Designed as Pilot Facility

Mammalian Suites

Microbial Suites

Public Gallery

Supporting infrastructure:

- Multiple utilities
- Equipment agnostic skid and single
- Unidirectional flow in suite
- Dedicated purification suite(s)
- Separate solutions prep room
- Multiple utility panels per suite
- Segregated HVAC for mammalian, microbial and purification

Building Systems

- Energy consumption
  - LEED certification compliance achieved
  - Energy consumption ("full tilt") 3,400 kwhr/sqm/yr (below average)
  - 20% energy recovery via RTU
- Building is ready for installation of a cogeneration unit
  - Natural gas powered
  - Alternative source of power
  - Pad and conduit already laid
- Piping quality and materials cost-effective/appropriate for duty
  - High grade 316L stainless where needed
  - Sanitary polypropylene
  - PVC where allowable
- Aqueous waste
  - Collection, pH neutralization, discharge to sewer

Process Utilities

- Utilities distributed to each operational suite via utility panels
- Circulating USP purified water (RO/DI)
- Clean steam (for humidification and SIP)
- Building hot water to solutions preparation suites
- "Grey" water
  - From RO/DI reject, USP "off-spec", USP overflow, soft water
  - Re-use for initial caustic flush for CIP
- Cleaning in Place: Mobile skids in suites
- Bio-waste collection and thermal treatment
- Clean compressed air (oil-free, dried and filtered for process)
- Medium pressure steam 100 psig electric powered for process heating and decontamination
- Gasses – oxygen, carbon dioxide and nitrogen supplied in suites
- Chilled water (glycol brine) circulated at 1 deg. C.

HVAC Design

- ISO-8 areas – 30 air changes per hour
- ISO-7 areas (purification suites) 60 air changes per hour
- Segregated air handling zones for microbial, cell culture, purification, solutions preparation and glass wash suites
- Negative Pressure for bio-containment and solvent handling rooms
- HEPA filtration at air handler (extends room envelope definition)
- Relative Humidity: 55% +/- 5%
- Clean steam humidification
- Building heating via natural gas-fired hot water heaters

Design Principles for "GMP-Like"

- "Future-proofing" a pre-IND facility for controlled production and smooth handover to CMO or transition to future GMP production;
- Present commissioning for all systems --- BUT ---- further documentation/qualification needs are:
- For HVAC and critical utility systems: USP water, clean steam, clean compressed air
  - Comprehensive, final URS for the facility
  - Gap or FMEA risk analysis for handover to and consistency with future CMO or GMP operation;
  - Base line zero-use qualification/documentation;
- Process Utilities (present and future)
  - USP produced, stored and distributed (needs C and Q)
  - Clean steam produced and distributed for equipment SIP and humidification (needs C and Q)
  - WFI initially purchased as needed (later can condense clean steam for larger volumes)
  - Grey water – operation to be qualified for CIP use and performance monitored by cleaning quals.
- Establishment of facility operational practices consistent with CMO or future clinical production
  - Maintenance re-qualification;
  - Routine QC testing of critical utilities;
  - Site change control;
  - Clean room recertification;

…Further Design Principles

- Cost-effective flexibility for different biopharmaceutical process types
  - Equipment agnostic
    - Cell culture – SUB's, S.S. Bioreactors, Incubators (tissue regeneration), DSP equipment
    - Microbial – SUB's or S.S. fermenters, DSP equipment
    - Purification suites – Chromatography, Ultrafiltration, Filtration, etc.
  - Utilities distributed to multiple utility panels in operations
  - Accommodating solvents in purification suites and solutions preparation
  - Accommodating need for cold-room operation for purification steps
  - Biofuels, biochemicals and biomaterials production
- Cost effective LEED Certification (LEED Certified)
- Process Development Labs (5 liter)
- Operations training (Lab and production scale)
- Student "On the Job" experience
- Education and Public Relations

Acknowledgements to Design Team and Management

- **Elkus Manfredi,** Architects
- **WSP Flack and Kurtz,** Building Engineers
- **JSN Associates,** Structural Engineers
- **Copley Wolfe Design Group,** Landscape
- **Sebesta Blomberg,** Commissioning
- Richard Moore, LEED Consultant