

## Instrument list for initial purchases for the CMU Academic Cloud Lab

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### Item

### Item Count

## Facilities

|                                     |     |
|-------------------------------------|-----|
| Ultrapure Water Source              | 1   |
| Industrial Dishwasher               | 3   |
| Autoclave                           | 1   |
| Fume Hood                           | 10  |
| Inert Glove Box                     | 2   |
| Biosafety Cabinet                   | 4   |
| Gas Switching Station               | 4   |
| Lab Bench                           | 114 |
| Operator Cart                       | 14  |
| Waste Bins                          | 7   |
| Health & Safety (/20 Operators)     | 1   |
| Server Infrastructure               | 1   |
| Shipping & Receiving Infrastructure | 1   |
| Machine Shop Infrastructure         | 1   |
| Waste Holding Infrastructure        | 1   |
| Lab Stools                          | 1   |
| Sample Drop Off Infrastructure      | 1   |
| Office Infrastructure               | 1   |

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## Materials Handling

StoreSamples[]

|   |    |
|---|----|
| Ambient Vertical Materials Handling Robotic System      | 2  |
| Refrigerated Vertical Materials Handling Robotic System | 2  |
| Freezer (-80°)  | 3  |
| Freezer (-20°)  | 3  |
| Cryostorage   | 2  |
| Flammable Cabinet                                       | 10 |
| Acid Cabinet  | 2  |
| Carboy Rack   | 14 |
| Environmental Stability Chamber                         | 1  |
| Desiccated Storage                                      | 2  |
| Mammalian Cell Incubator                                | 4  |
| Microbiology Solid Media Incubator                      | 2  |
| Microbiology Liquid Culture Incubator                   | 3  |

## Transport Options

|                             |   |
|-----------------------------|---|
| Chilled Sample Transporter  | 2 |
| Warmed Sample Transporter   | 2 |
| Light Protected Transporter | 2 |

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## Sample Preparation

## ExperimentLiquidHandling[]

Transfer[] Dilute[] SerialDilution[] Aliquot[]  
Consolidate[] Resuspend[] Incubate[] Mix[]  
Centrifuge[] Filter[] MagneticBeadExtraction[]  
SolidPhaseExtraction[] Pellet[]  
LiquidLiquidExtraction[] AbsorbanceSpectroscopy[]  
AbsorbanceKinetics[] FluorescenceSpectroscopy[]  
FluorescenceKinetics[] LuminescenceSpectroscopy[]  
LuminescenceKinetics[] Cover[] Uncover[]

Robotic Liquid Handler Workcell

4

## ExperimentAcousticLiquidHandling[]

Acoustic Liquid Handler

1

## ExperimentTransfer[]

Micropipettes

3

Serological Pipettes

3

Syringe Pump Dispenser

3

Graduated Cylinders

3

Volumetric Flasks

3

Ampule Handlers

1

Spatulas

1

Scoops

1

Funnels

1

Transfer Tubes

1

Pill Crushers

1

Lab Tweezers

1

Lab Scissors

1

## ExperimentIncubate[]

### ExperimentMix[]

|                         |   |
|-------------------------|---|
| Overhead Mixer / Heater | 6 |
| Overhead Mixer / Cooler | 3 |
| Heat Bath               | 5 |
| Incubator Roller        | 5 |
| Heater Shaker           | 5 |
| Heated Plate Shaker     | 5 |
| Water Bath              | 3 |
| Heated Sonicator        | 3 |
| Homogenizer             | 1 |
| Nutating mixer          | 5 |
| Cell Disruptor          | 3 |
| Plate Sonicator         | 1 |
| Vortex                  | 5 |
| Plate Vortex            | 5 |
| Wrist Action Shaker     | 2 |
| Bottle Roller           | 5 |
| Drum Roller             | 2 |

## ExperimentCentrifuge[]

|   |   |
|---|---|
| Microcentrifuge                         | 5 |
| Alternative Form Factor Microcentrifuge | 1 |
| Centrifuge                              | 5 |
| Alternative Form Factor Centrifuge      | 1 |
| Ultracentrifuge                         | 2 |
| High Speed Centrifuge                   | 2 |

## ExperimentFilter[]

|                              |   |
|------------------------------|---|
| Pump Filtration Apparatus    | 3 |
| Syringe Filtration Apparatus | 3 |

Vacuum Filtration Apparatus 2

### ExperimentEvaporate[]

Rotovap 1  
Speedvac 2  
Needle Dryer 1  
Nitrogen Evaporator 1

### ExperimentLyophilization[]

Lyophilizer 2

### ExperimentAdjustpH[]

Dead Stop Titrator 1  
Overhead Mixer 1  
pH Meter 1

### ExperimentFlashFreeze[]

Liquid Nitrogen Dispenser 1  
Dewar 1

### ExperimentDegas[]

Freeze Pump Thaw Apparatus 1  
Vacuum Sonication Apparatus 1  
Sparging Apparatus 1

### ExperimentPackColumn[]

Column Packing Apparatus 1

### ExperimentMicrowaveDigestion[]

|                                      |   |
|--------------------------------------|---|
| Automated Microwave Digestion System | 1 |
|--------------------------------------|---|

### ExperimentCover[]

|             |   |
|-------------|---|
| Heat Sealer | 1 |
|-------------|---|

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## Property Measurement

### ExperimentImageSample[]

|                        |   |
|------------------------|---|
| Automated Plate Imager | 4 |
| Large Sample Imager    | 4 |

### ExperimentMeasureVolume[]

|   |   |
|---|---|
| Plate Based Ultrasonic Volume Measurement Device  | 2 |
| Large Sample Ultrasonic Volume Measurement Device | 4 |

### ExperimentMeasureWeight[]

#### ExperimentMeasureCount[]

|                    |   |
|--------------------|---|
| Microbalance       | 1 |
| Analytical Balance | 5 |
| Balance            | 5 |
| Macrobalance       | 2 |
| Bulk Balance       | 1 |

### ExperimentMeasurepH[]

|          |   |
|----------|---|
| pH Meter | 3 |
|----------|---|

### ExperimentMeasureConductivity[]

|                    |   |
|--------------------|---|
| Conductivity Meter | 1 |
|--------------------|---|

## ExperimentMeasureDensity[]

Density Meter 1

## ExperimentMeasureDissolvedOxygen[]

Dissolved Oxygen Meter 1

## ExperimentMeasureViscosity[]

Robotic Viscosity Meter 1

## ExperimentCyclicVoltammetry[]

Electrochemical Reactor 1

## ExperimentMeasureOsmolality[]

Vapor Pressure Osmometer 1

## ExperimentMeasureRefractiveIndex[]

Refractometer 1

## ExperimentMeasureMeltingTemperature[]

Melting Point Apparatus 1

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# Cell Preparation

ExperimentCellHandling[]  
 Transfer[] Dilute[] SerialDilution[] Aliquot[]  
 Consolidate[] Resuspend[] Incubate[] Mix[]  
 Centrifuge[] Filter[] MagneticBeadExtraction[]  
 SolidPhaseExtraction[] Pellet[] LiquidLiquidExtraction[]  
 AbsorbanceSpectroscopy[] AbsorbanceKinetics[]  
 FluorescenceSpectroscopy[] FluorescenceKinetics[]  
 LuminescenceSpectroscopy[] LuminescenceKinetics[]  
 Nephelometry[] NephelometryKinetics[] ImageCells[]  
 FlowCytometry[] ElectroporateCells[] IncubateCells[]  
 Cover[] Uncover[] WashCells[] SplitCells[] QuantifyCells[]  
 TreatCells[] ChangeMedia[] AliquotCells[] FixCells[]  
 StainCells[] PermeabilizeCells[] TransformCells[]  
 TransfectCells[] TransduceCells[] LyseCells[]  
 ExtractCytolicProtein[] ExtractPlasmaMembraneProtein[]  
 ExtractNuclearProtein[] ExtractRNA[] ExtractGenomicDNA[]  
 ExtractPlasmidDNA[] ExtractOrganelle[] HarvestMedia[]  
 HarvestProtein[] HarvestVirus[] HarvestCells[]  
 HarvestExosome[] SynchronizeCells[] CocultureCells[]  
 MakeCompetent[] Inoculate[]

Robotic Cell Culture Workcell

2

## ExperimentBioreactor[]

Plate Based Parallel Bioreactor

1

Robotic Multi-Parallel Bioreactor Workcell

1

Large Lab Bioreactor

3



## ExperimentCellPicker[]

SpreadCells[] StreakCells[] PickColonies[] SpotCells[]  
RecoverCells[] ReplicatePlate[] QuantifyColonies[]  
QuantifyPlaques[] BacterialTiter[] VirallTiter[]  
PlateDiffusionDisk[]

Robotic Colony Picker / Spread Plater

1

## ExperimentElectroporation[]

Electroporator

2

## ExperimentFlowCytometry[]

Flow Cytometer

1

## ExperimentSortCells[]

Automated Fluorescence Activated Cell Sorter

1

## ExperimentFreezeCells[]

Controlled Rate Cell Freezing Apparatus

1

Freezing Container

5

## ExperimentThawCells[]

Controlled Rate Cell Thawing Apparatus

5

## ExperimentPourPlates[]

Plate Filler Robotics

1

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# Organic Synthesis

## ExperimentSynthesis[]

|   |   |
|---|---|
| Robotic Milligram Scale Parallel Reactor Workcell | 1 |
| Gram Scale Jacketed Reactor                       | 1 |
| Gram Scale Cryo Reactor                           | 1 |
| Gram Scale Pressure Reactor                       | 1 |

## ExperimentFlowSynthesis[]

|                        |   |
|------------------------|---|
| Automated Flow Reactor | 1 |
|------------------------|---|

## ExperimentElectrochemicalSynthesis[]

|                         |   |
|-------------------------|---|
| Electrochemical Reactor | 1 |
|-------------------------|---|

## ExperimentPhotochemicalSynthesis[]

|                       |   |
|-----------------------|---|
| Photochemical Reactor | 1 |
|-----------------------|---|

## ExperimentMicrowaveSynthesis[]

|                   |   |
|-------------------|---|
| Microwave Reactor | 1 |
|-------------------|---|

## ExperimentDNASynthesis[]

## ExperimentRNASynthesis[]

|                         |   |
|-------------------------|---|
| Robotic DNA Synthesizer | 1 |
|-------------------------|---|

## ExperimentPeptideSynthesis[]

## ExperimentPNASynthesis[]

|                             |   |
|-----------------------------|---|
| Robotic Peptide Synthesizer | 1 |
|-----------------------------|---|

## ExperimentSolidPhaseSynthesis[]

Solid Phase Synthesis Robotics 2

## ExperimentPCR[]

Automated Thermal Cycler 5

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# Separations

## ExperimentSolidPhaseExtraction[]

Solid Phase Extraction Robotics 2

## ExperimentLiquidLiquidExtraction[]

Liquid Liquid Extraction Apparatus 2

## ExperimentHPLC[]

Analytical HPLC with Photodiode Array and Fluorescence Detector 4

Analytical HPLC with Evaporative Light Scattering Detector 1

Semi-Preparative HPLC with UV/Vis Detector 3

Semi-Preparative HPLC with pH/Conductivity, UV/Vis, and Fluorescence Detectors 2

Semi-Preparative HPLC with MALS, DLS, and RI Detector 1

Preparative HPLC with UV/Vis Detector 1

## ExperimentFPLC[]

Fast Protein Liquid Chromatography System 2

Fast Protein Liquid Chromatography System High Flow 2

## ExperimentIonChromatography[]

|  |   |
|--|---|
| Ion Chromatography System with Suppressed Conductivity   | 1 |
| Ion Chromatography System with Electrochemical Detection | 1 |

### ExperimentFlashChromatography[]

|                             |   |
|-----------------------------|---|
| Flash Chromatography System | 3 |
|-----------------------------|---|

### ExperimentThinLayerChromatography[]

|                    |   |
|--------------------|---|
| Robotic TLC System | 1 |
|--------------------|---|

### ExperimentCapillaryElectrophoresis[]

|                                  |   |
|----------------------------------|---|
| Capillary Electrophoresis System | 2 |
|----------------------------------|---|

### ExperimentPAGE[]

#### ExperimentAgaroseGelElectrophoresis[]

|                                    |   |
|------------------------------------|---|
| Robotic Gel Electrophoresis System | 2 |
|------------------------------------|---|

### ExperimentWestern[]

#### ExperimentTotalProteinDetection[]

|                               |   |
|-------------------------------|---|
| Capillary Western Blot System | 1 |
|-------------------------------|---|

### ExperimentCapillaryIsoelectricFocusing[]

#### ExperimentCapillaryElectrophoresisSDS[]

|                                       |   |
|---------------------------------------|---|
| Capillary Isoelectric Focusing System | 1 |
|---------------------------------------|---|

### ExperimentDialysis[]

|                    |   |
|--------------------|---|
| Dialysis Apparatus | 3 |
|--------------------|---|

### ExperimentCrossFlowFiltration[]

|                                 |   |
|---------------------------------|---|
| Cross Flow Filtration Apparatus | 2 |
|---------------------------------|---|

ExperimentFieldFlowFractionation[]

Field Flow Fractionation System

1

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## Spectroscopy

ExperimentNMR[]

ExperimentNMR2D[]

500 MHz NMR

1

ExperimentAbsorbanceSpectroscopy[]

ExperimentAbsorbanceIntensity[]

Microfluidic Spectrometer

2

ExperimentAbsorbanceKinetics[]

ExperimentFluorescenceIntensity[]

ExperimentFluorescenceKinetics[]

ExperimentLuminescenceIntensity[]

ExperimentLuminescenceKinetics[]

Multimode Plate Reader w/ Injectors

1

ExperimentFluorescenceSpectroscopy[]

ExperimentLuminescenceSpectroscopy[]

Multimode Plate Reader w/ Monochromators

2

ExperimentFluorescencePolarization[]

Fluorescence Polarization Plate Reader

1

## ExperimentIR Spectroscopy[]

FTIR Spectrometer 1

## ExperimentCircular Dichroism[]

Circular Dichroism Plate Reader 1

## ExperimentDynamic Light Scattering[]

Multimode Dynamic Light Scattering and Thermal Shift Reader 1

## General Purpose Spectrometer (Experiments TBA)

Spectrofluorometer 2

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# Mass Spectrometry

## ExperimentLCMS[]

Liquid Chromatography Mass Spectrometer ESI-QToF Microflow/Nanoflow HPLC System 2

Analytical PDA HPLC System

Liquid Chromatography Mass Spectrometer ESI-QQQ 1

Liquid Chromatography Mass Spectrometer ESI-QToF Analytical PDA HPLC System 1

## ExperimentMass Spectrometry[]

MALDI-ToF Mass Spectrometer 1

Acoustic Ejection Mass Spectrometer 1

## ExperimentGCMS[]

Gas Chromatography Mass Spectrometer 1

## ExperimentCEMS[]

Capillary Electrophoresis Mass Spectrometer

1

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## Bioassays

### ExperimentqPCR[]

qPCR Thermocycler

3

### ExperimentDigitalPCR[]

Digital Droplet PCR Thermocycler

1

### ExperimentMassivelyParallelSequencing[]

Next Generation Sequencing Machine

1

### ExperimentBioanalyzer[]

Tape Station

1

### ExperimentUVMelting[]

UV/Vis Spectrometer with Thermal Controller

2

### ExperimentDifferentialScanningCalorimetry[]

Differential Scanning Calorimeter

1

### ExperimentIsothermalTitrationCalorimetry[]

Isothermal Titration Calorimeter

1

### ExperimentELISA[]

|                                     |   |
|-------------------------------------|---|
| Robotic ELISA Device                | 1 |
| Capillary ELISA Device              | 1 |
| Multiplexing ELISA Screening Device | 1 |

### ExperimentSurfacePlasmonResonance[]

|                                  |   |
|----------------------------------|---|
| Surface Plasmon Resonance System | 1 |
|----------------------------------|---|

### ExperimentBioLayerInterferometry[]

|                          |   |
|--------------------------|---|
| Bio-Layer Interferometer | 1 |
|--------------------------|---|

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## Microscopy & Crystallography

### ExperimentMicroscopy[]

#### ExperimentFISH[]

|                                     |   |
|-------------------------------------|---|
| Inverted Epifluorescence Microscope | 1 |
|-------------------------------------|---|

### ExperimentPowderXRD[]

#### ExperimentXRD[]

|                      |   |
|----------------------|---|
| X-Ray Diffractometer | 1 |
|----------------------|---|

### ExperimentNIRFluorescenceSpectroscopy[]

#### ExperimentFluorescenceLifetime[]

#### ExperimentPhotoVoltaic[]

|                 |   |
|-----------------|---|
| NIR Fluorimeter | 1 |
|-----------------|---|



ExperimentThermalImaging[]

ExperimentNIRImaging[]

ExperimentSWIRImaging[]

ExperimentIRSpectralImaging[]

FLIR Camera Thermal Sensor

1

NIR Camera/NIR Spectrometer

1

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## Polymers & Materials

ExperimentThermalGravimetricAnalysis[]

Thermogravimetric Analysis Instrument

1

ExperimentDynamicMechanicalAnalyzer[]

Dynamic Mechanical Analyzer

1

ExperimentDynamicLightScattering[]

Dynamic Light Scattering Plate Reader

1

ExperimentHPLC[]

Semi-Preparative HPLC with MALS, DLS, RI, and Differential Viscometer Detectors

1