Emerald Cloud Lab

INSTRUMENTATION CATALOG

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Advantages of a Cloud Laboratory Over Today's Laboratory

Today's Labs Present Barriers to Experimentation

Life scientists in all sectors face substantial and persistent logistical and labor barriers to running experiments

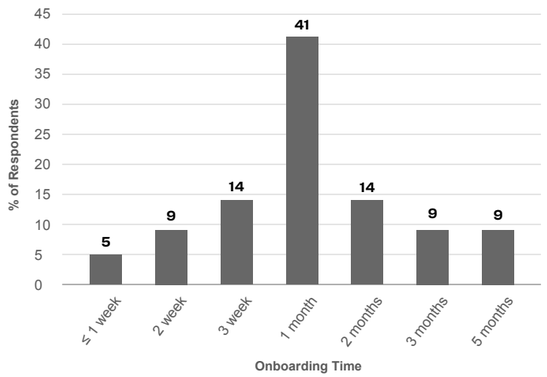
Equipment Access Problems

Most popular workaround: Personal favors to use other lab's equipment (73%)

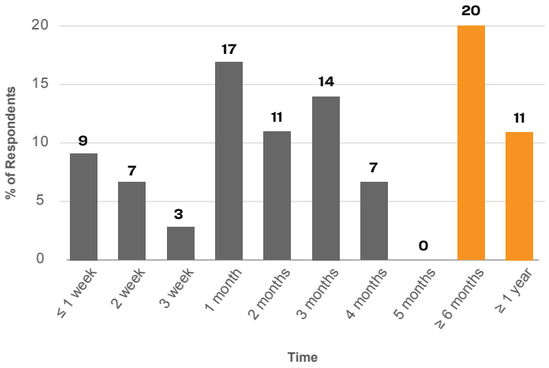
- **Over 80%** report access to instrumentation as a major impediment
  - Many labs lack full instrumentation required in their research
  - Maintenance and downtime of available instruments are additional barriers
  - Most popular work around (73% of respondents) was to request personal favors from scientists in other labs
- Average onboarding time for each new experiment type is about a month, creating barriers to conducting new or unfamiliar experiments
- Lengthy troubleshooting can stymie onboarding new experiments for months
  - Unpredictable, with a broad distribution ranging from weeks to years
  - **Over 30%** of respondents said they had suffered a delay greater than six months on a project

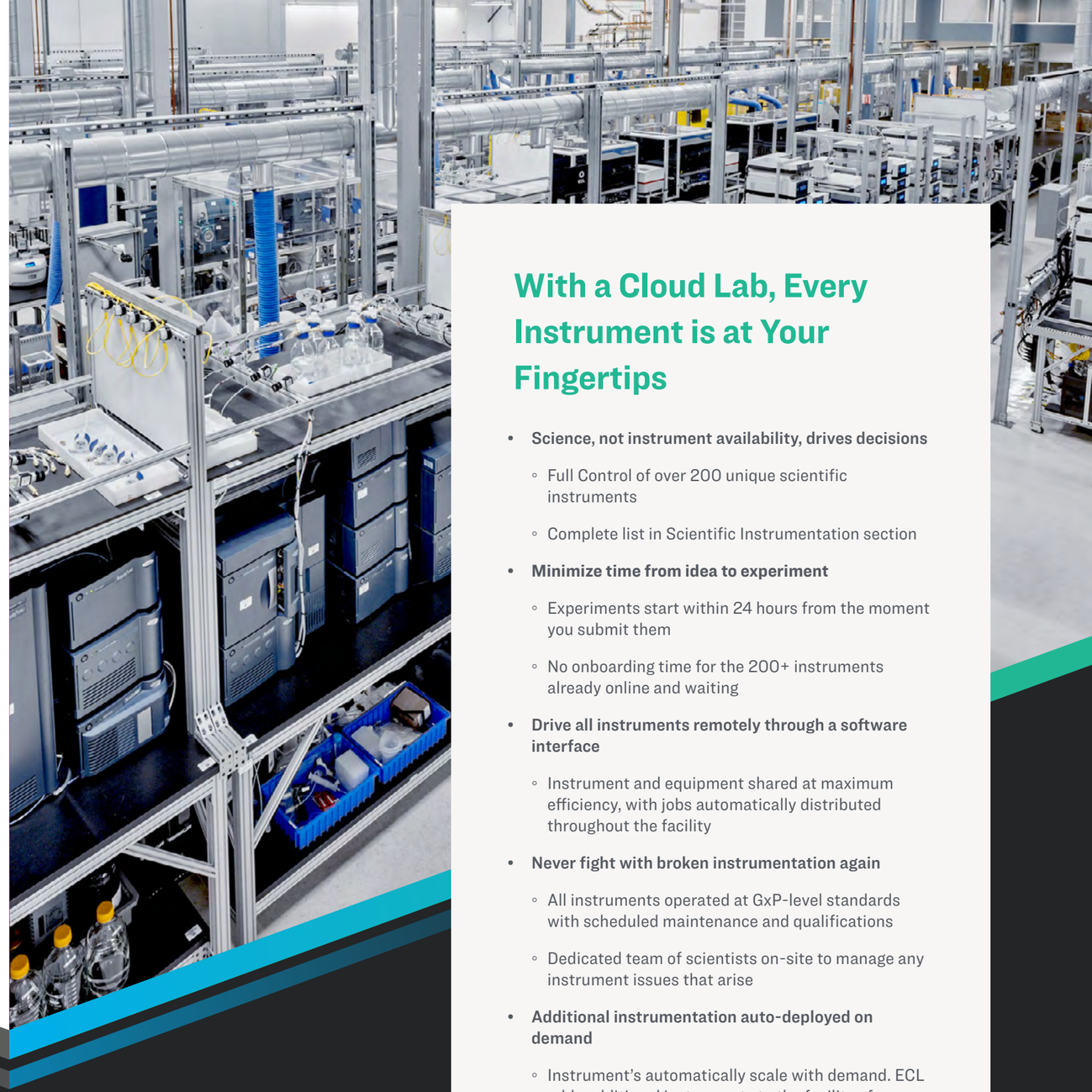
Emerald customer survey, n=130 Scientists from across the industry (mix of startups, large companies, and academia) (2013)

Average Experiment Onboarding Time



Troubleshooting Time





With a Cloud Lab, Every Instrument is at Your Fingertips

- **Science, not instrument availability, drives decisions**
  - Full Control of over 200 unique scientific instruments
  - Complete list in Scientific Instrumentation section
- **Minimize time from idea to experiment**
  - Experiments start within 24 hours from the moment you submit them
  - No onboarding time for the 200+ instruments already online and waiting
- **Drive all instruments remotely through a software interface**
  - Instrument and equipment shared at maximum efficiency, with jobs automatically distributed throughout the facility
- **Never fight with broken instrumentation again**
  - All instruments operated at GxP-level standards with scheduled maintenance and qualifications
  - Dedicated team of scientists on-site to manage any instrument issues that arise
- **Additional instrumentation auto-deployed on demand**
  - Instrument's automatically scale with demand. ECL adds additional instruments to the facility of an existing type whenever occupancy exceeds 70%
  - ~5 new unique instrument models are added to the instrumentation list per month

In Today's Labs, Science Can Take a Backseat to Labor

- More time is spent on manual labor than on all the intellectual aspects of science combined (designing experiments, developing theories, building models, analyzing data)
- Creative ideas require immense labor to execute. This favors the most well-funded teams rather than those with the most ambition
- The physical effort involved in lab work creates a barrier to scientific exploration because it is incredibly labor-intensive to pursue new research initiatives
- It is hard to incorporate new workflows as training or capital investment is often too large of a barrier

Experiment Turnaround Time for Results

70 days
Big Pharma

18 days
Biotech

R&D groups at Big Pharma and Biopharma companies self-report that results turnaround time for results takes weeks

With a Cloud Lab, Science is in the Driver's Seat

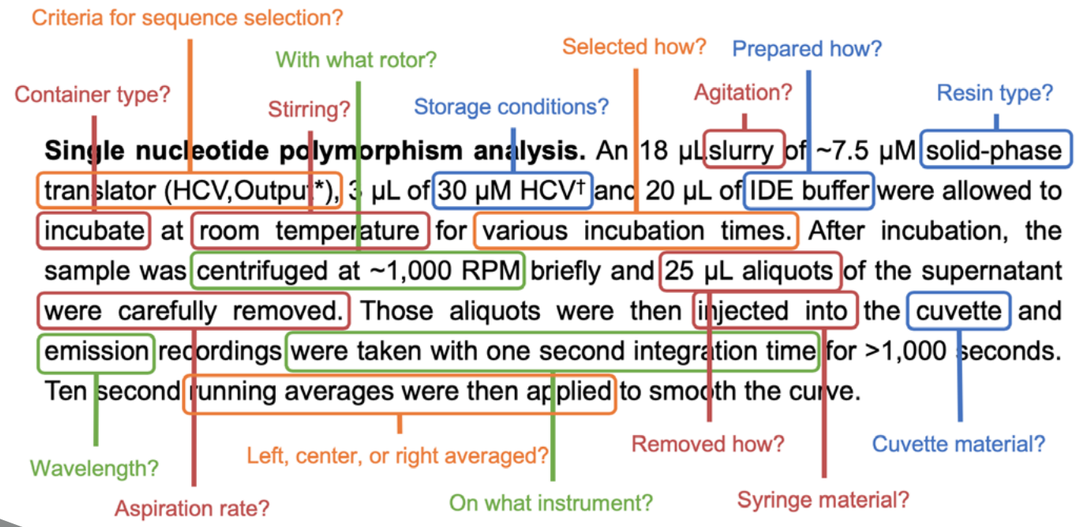
- **Focus on the science**
  - Scientists on the ECL spend their time designing experiments, analyzing and interpreting experimental results, and focusing on new ideas
  - Experiments at ECL are run automatically on-demand and are controlled entirely using software — no physical labor involved
  - Scientific talent can conceive of, execute remotely, and analyze data from more experiments (3x to 5x) than in a conventional setting.
- **Increased throughput through automation**
  - Scientists working on the ECL daily have historically processed over 50,000 samples per year per person
  - Experiments run nonstop, even while you sleep and on the weekends; facility operates 24/7/365
  - Organizations using cloud labs do more with the same, with documented productivity improvements in the 300% to 700% range
- **Greater interdisciplinary collaboration**
  - Break down barriers between disciplines by making all the instrumentation available to everyone on the system
  - Methods transfer seamlessly between groups, protocols are repeated at the push of a button
- **Inventory and resources managed automatically**
  - ECL keeps frequently used materials in stock
  - Easily place and track external orders anytime

Experiment Turnaround Time for Results

2 days
Emerald Cloud Lab

In Today's Labs, Experimental Reproducibility Presents Enormous Challenges

The image below highlights an example of the types of "missing" information from just a small portion of a method section in a paper published in the Journal of the American Chemical Society



- Results are most easily reproduced when conducted by the same scientist working in the same laboratory. Reproducibility of experiments don't transfer well to other scientists and laboratories. Why is this the case?
- Ambiguity in communication of methods and data analysis is at the core of the reproducibility problem
- With traditional method descriptions it's impossible to know a priori if the information presented is sufficient to reproduce an experiment without actually running it
- Routinely reproducing experiments is time-consuming and resource intensive and slows the overall pace of progress

Inconsistent Results

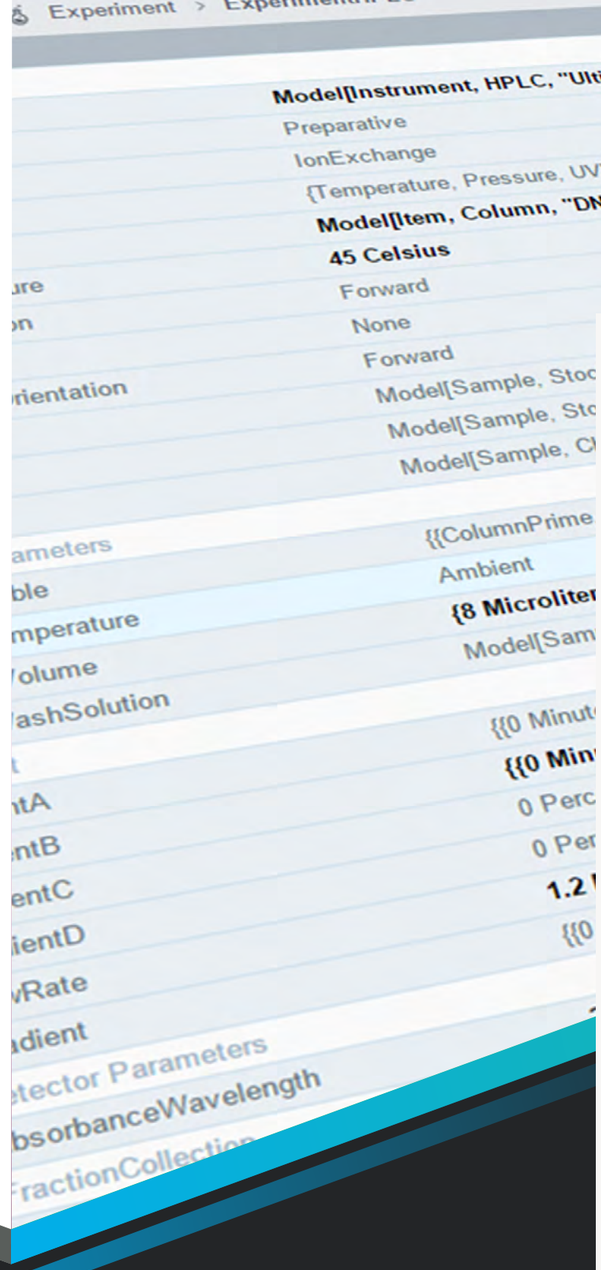
71.1%

Nature Reviews Drug Discovery 10, 712 (2011)

Inconsistent Results

88.5%

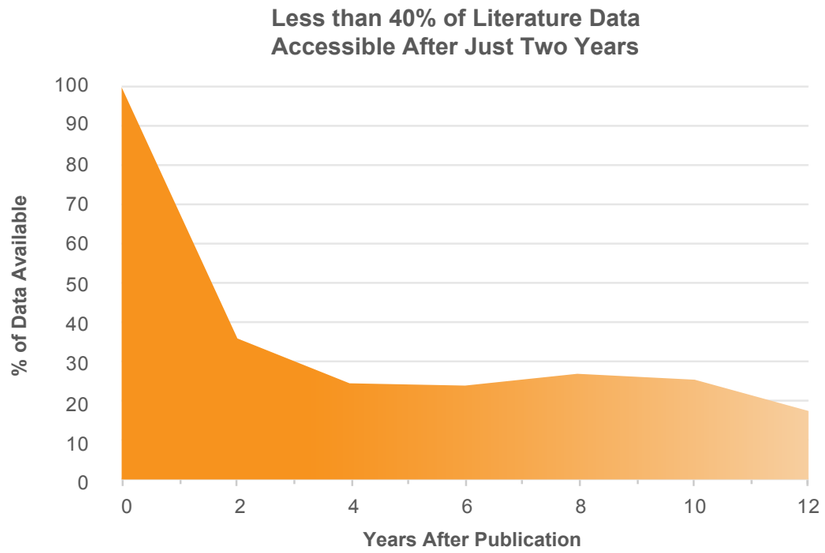
Nature 483, 531-533 (2012)



With a Cloud Lab, Experiments are Codified

- **All experiments in the ECL are driven by an enumerated instruction set, much like a microprocessor**
  - Just as a microprocessor can reproducibly execute a defined series of steps, the ECL can reproducibility conduct any experiment
- **Push-button reproducibility**
  - Any protocol run historically on the ECL can be re-rerun identically with fresh samples on demand
- **360º data capture — no data left behind**
  - ECL automatically collects all data and protocol steps that are scientifically and operationally relevant
  - In addition to primary data, ancillary data such as full sample trace history, instrumentation information (including calibrations and qualifications), and metadata captured through embedded sensors in the facility are recorded
  - The linked data network ties together all aspects of an experiment and analysis together in a scale-free network
- **Easily transfer methods between people or groups**
  - Sharing experiment IDs makes it easy to collaborate with scientists across the room or across the world
- **Codifying technique turns all errors into systematic errors**
  - Easier to identify and make systematic fixes that ensure issues do not reoccur

In Today's Labs, Availability of Primary Data Drops Off Precipitously Over Time



Current Biology 24, 94-97 (2014)

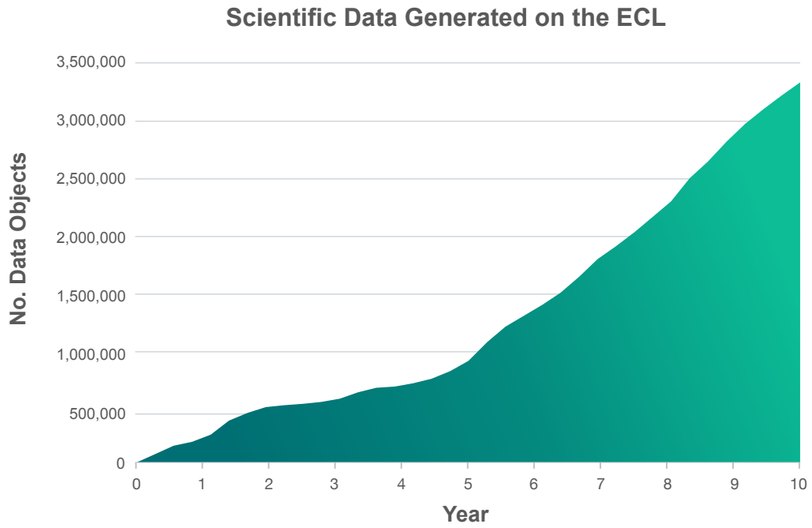
Because much of the relevant information is either uncaptured or unstructured, personal communication with the original authors vial email on phone calls is often necessary to make sense of any raw source files (if they can even be located).

- Tremendous human and societal effort goes into generating data that tragically fades rapidly over time. Data is lost in paper notebooks, hard-to-access files, and rigid data systems.
- Difficult to build on previous work, creating continuity challenges across generations of a lab
- Combining new and old data sets is difficult when primary experimental data is not available; even when available, method data is often missing or incomplete
- Machine learning is stymied by missing information or data that's not reproducible and not well-structured
- Lost opportunity for meta-analyses and other higher level conclusions

With a Cloud Lab, Data Generated Compounds in Value Over Time

A laboratory, company, or institution conducting day-to-day experimentation in this highly structured and connected system would produce a dataset with detail, sophistication, and complexity without historical precedent.

Imagine what you could do with just a year of all of your experimental data indexed and searchable on the web!



Data accumulated on the ECL always remains just milliseconds away from download on the cloud. Moreover that data is already highly structured, indexed, searchable, and, most importantly, it is connected to the experimental techniques that generated it (with push button reproducibility).

- All data captured digitally and automatically
  - Eliminates need for paper lab notebooks and printouts
  - No more efforts wasted in data transfer to ELN
- Everything accessible on the cloud to all users with valid credentials
- Methods valid and reproducible for years after initial execution
- Data is automatically structured, indexed, and made quickly searchable for instantaneous retrieval
- Standardized data ontology amenable for data mining and machine learning
- All data is traceable and linked to its source techniques and lab notebook context
- Data gathered on enterprise accounts compliant with FDA data retention and access policies

Introduction to Emerald Cloud Lab

What is Emerald Cloud Lab?

Emerald Cloud Lab® is the only remotely operated research facility that handles all aspects of daily lab work: method design, materials logistics, sample preparation, instrument operation, data acquisitions and analysis, troubleshooting, waste disposal, and everything in between - without the user ever setting foot in the lab.

Emerald Cloud Lab Mission & Vision

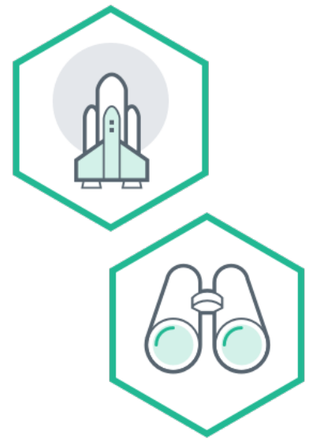
Mission

Enable scientists to transcend the laboratory by making research better, faster, and more accessible through the full digitization of science.

Vision

Empower researchers worldwide to accelerate scientific progress, break down barriers to innovation, and advance knowledge for the betterment of society.

We leverage cutting edge developments in software, AI, industrial engineering, and automation to reach this vision.



ECL Customer Value Proposition

Automation & Efficiency

Minimizes human error and accelerates QC testing with 24/7 automation

Cost Savings

Reduces lab space, maintenance, and staffing needs while simplifying method transfer

Data Integrity & Compliance

Ensures real-time, auditable data with minimal manual errors

Scalability & Consistency

Enables reproducible QC testing without extra infrastructure

Remote Access & Collaboration

Allows scientists to run and monitor experiments globally

How Cloud Labs Work

1. Command

Ship your samples to an ECL facility and design your experiments in the ECL Command Center application.

2. Run

Emerald remotely conducts your experiments in a highly automated ECL facility exactly to your specifications.

3. Explore

ECL Constellation organizes your data into a powerful knowledge graph, growing automatically over time as you conduct more experiments.

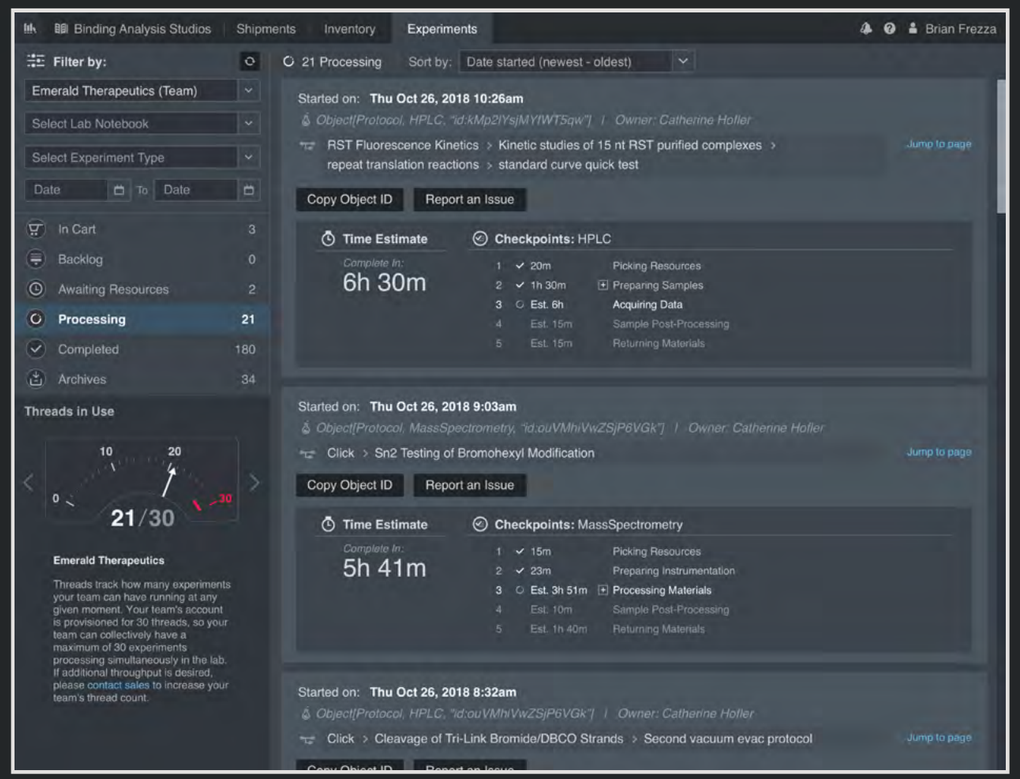
4. Analyze

ECL Command Center provides an extensive suite of tools to plot, analyze, and visualize your results.

1. Command

Transfer your samples to an ECL facility and design your experiments in the ECL Command Center application.

ECL Command Center

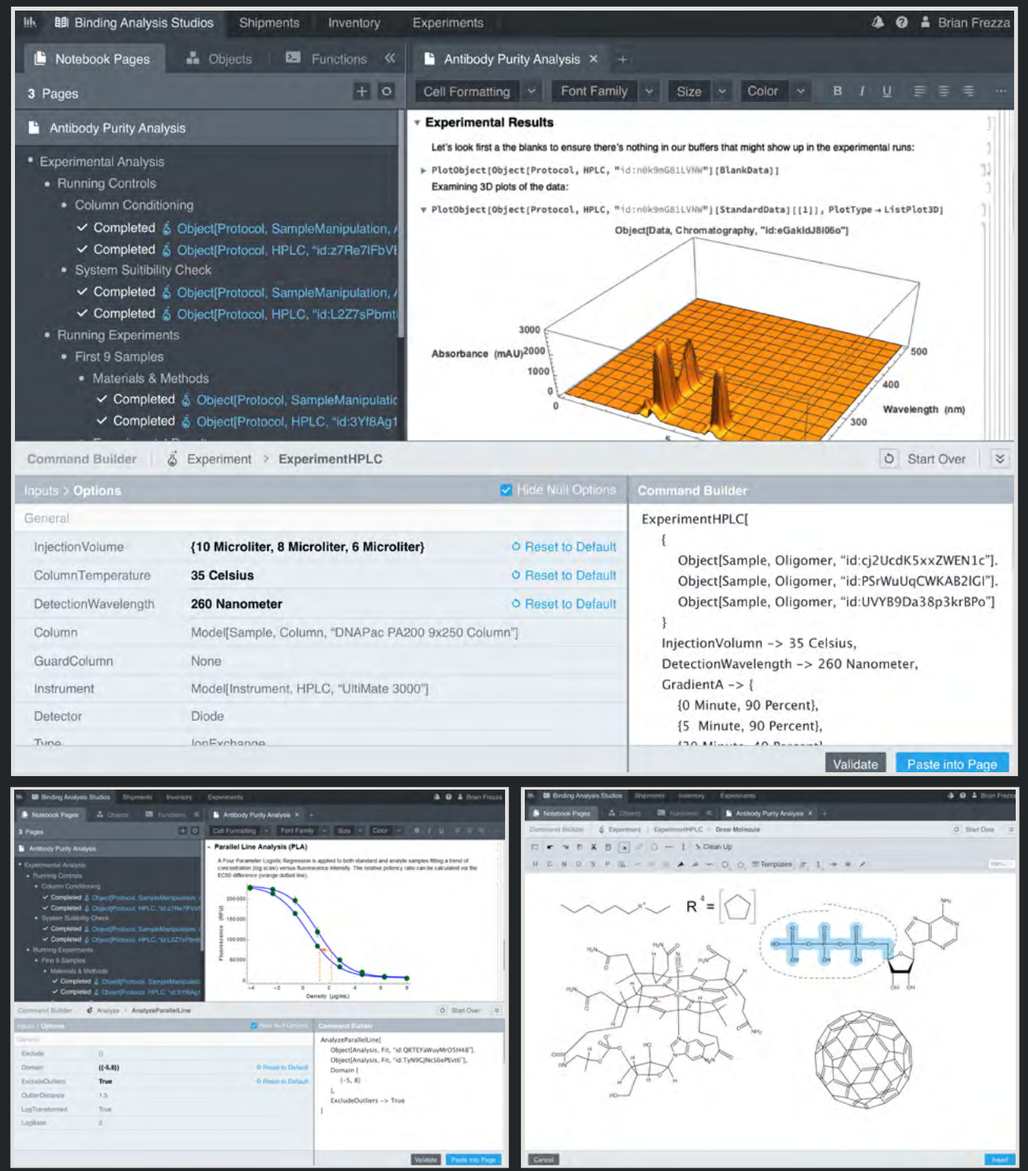


One Scientist, Infinite Hands

With an ECL account, you can execute as many experiments in parallel as you like, limited only by the rate at which you can think of them. It's not unusual for ECL users to be orchestrating dozens of protocols simultaneously, far more than one could ever manage working in a today's laboratory.

ECL facilities run your experiments on-demand, 24 hours a day, 7 days a week, 365 days a year. Leaving just hours between the moment you conceive of your experiment and the moment you receive your results.

Accounts are priced based on their bandwidth in the lab — something we call lab threads. The number of lab threads is the maximum number of simultaneous experiments you can have running in an ECL facility at any given moment during the day.



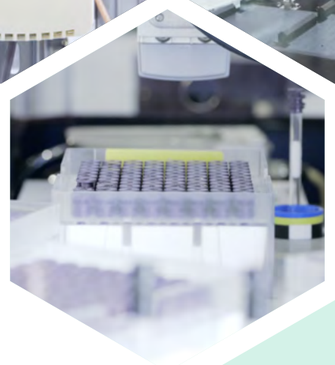
Automation Taken to its Logical Conclusion

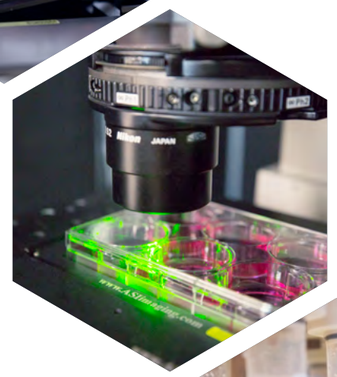
ECL Command Center is the gateway to ECL facilities and allows scientists to design and execute experiments, analyze results, and browse and search their data with zero manual labor. ECL Command Center consolidates dozens of different instrument control and analysis packages into one seamless interface.

Because the ECL is command-driven, every action taken in the lab, as well as in data processing and visualization, is fully scriptable. You can build scripts which automatically execute a series of experiments of arbitrary complexity, reproduce results, process the data, and generate reports for you to analyze.

2. Run

Emerald remotely conducts your experiments in a highly automated ECL facility exactly to your specifications.





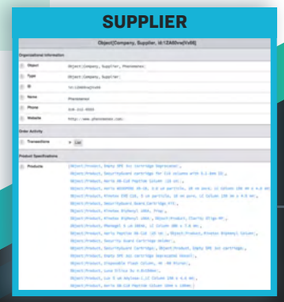
Let The Robots Do the Work

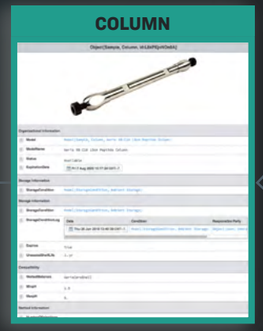
ECL allows you to remotely execute a wide array of experimental capabilities in our state-of-the-art facilities, including HPLC, Western Blot, Peptide Synthesis, Mass Spectrometry, and NMR. Experiments are conducted using automated instrumentation and robotics to carry out your instructions exactly as specified. Once you submit an experiment through ECL Command Center, the experiment is run automatically and the results and observations are added to your database in just a few days.

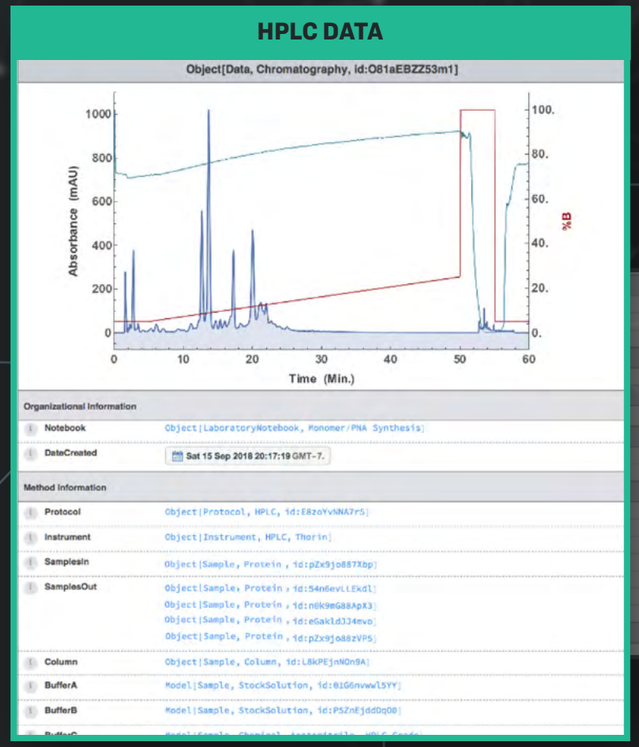
A list of the system's offerings can be found in the Scientific Instrumentation section of this document.

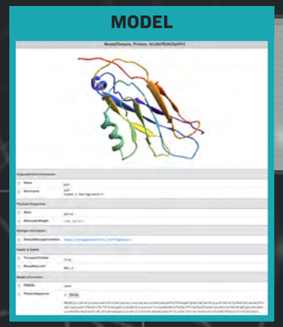
3. Explore

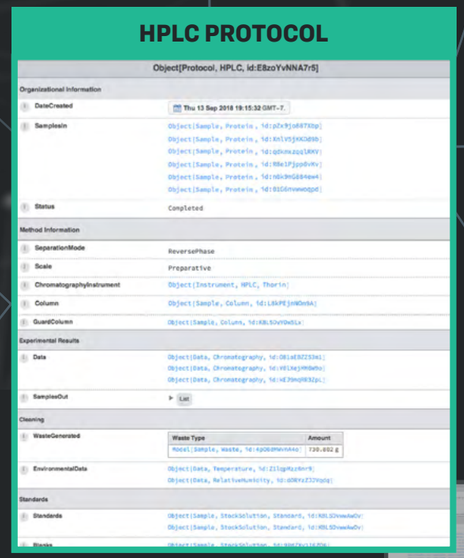
ECL Constellation organizes your data into a powerful knowledge graph, growing automatically over time as you conduct more experiments.











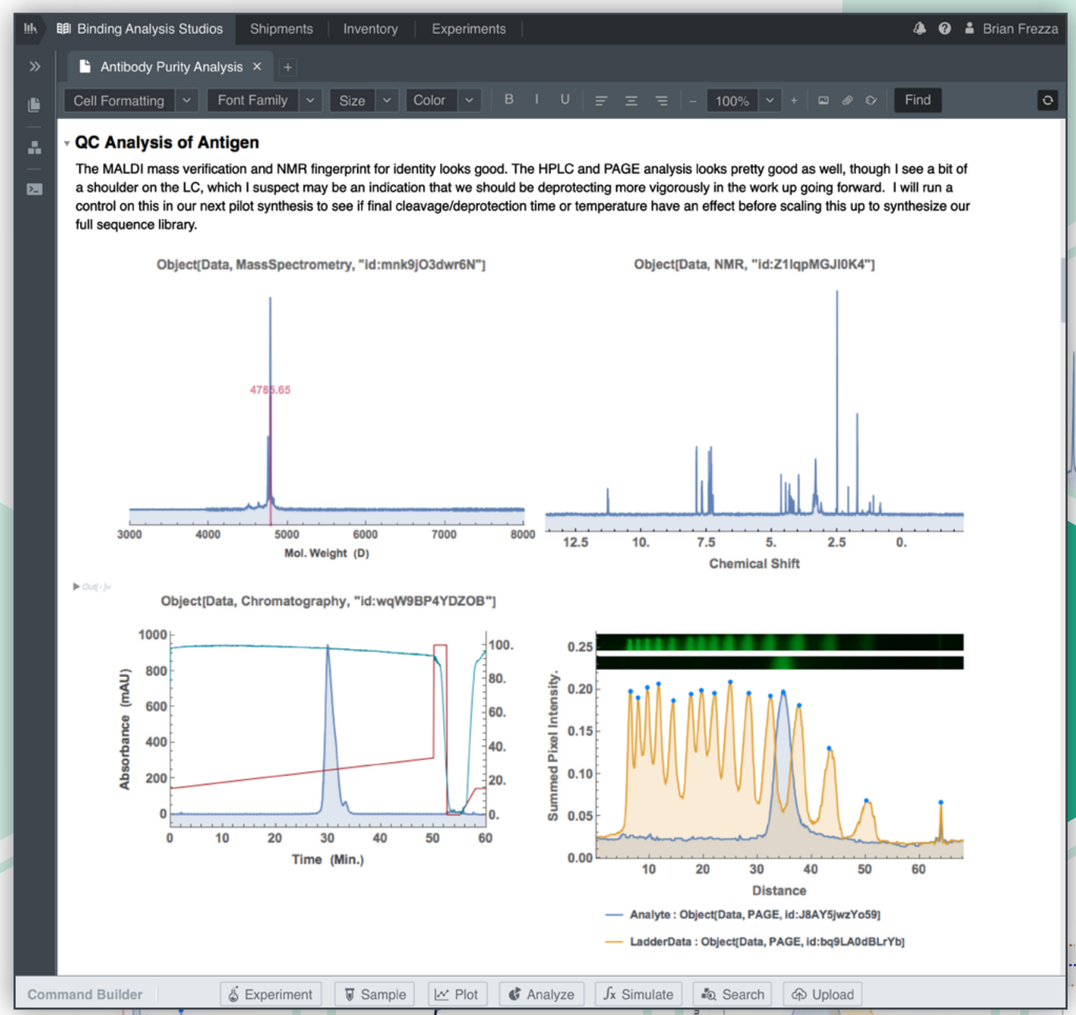
ECL Constellation

A New Model for Managing Scientific Data

ECL Constellation extends far beyond what traditional or electronic laboratory notebooks handle. In addition to storing sample information, it organizes all experimental data and data analysis, environmental data, inventory information, protocol information, and instrument diagnostics. This is all captured and linked automatically behind the scenes, building an easily surfable and searchable knowledge graph that fully encompasses a complete set of source information without any manual data entry.

4. Analyze

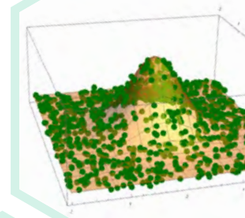
ECL Command Center provides an extensive suite of tools to plot, analyze, and visualize your results.

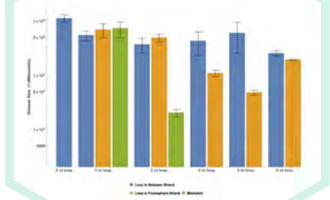


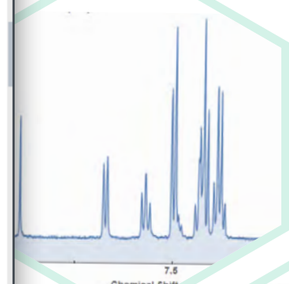
A Full Workstation for Data Analysis

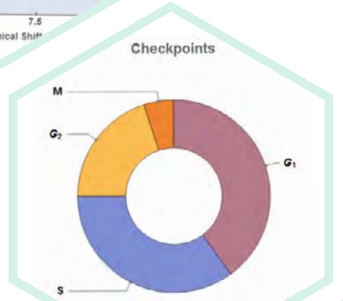
ECL Command Center provides over 4,500 powerful functions for data visualization, analysis, and simulation. The software also allows your experiments, data, analysis, results, and even scientific figures to be exported, shared, or published on the web.

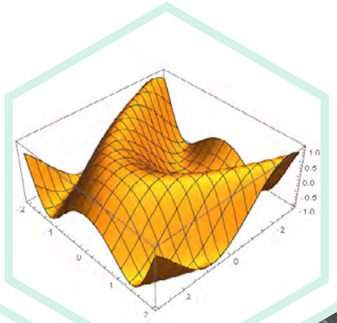
All of these tools can be accessed through both a point-and-click interface and direct entry of the commands into your lab notebook. This makes it easy to repeat or scale any analysis with a single command and to automate report generation through higher-level scripting.

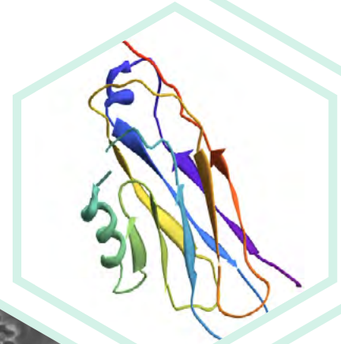


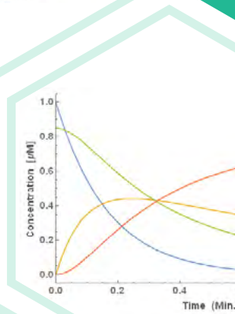


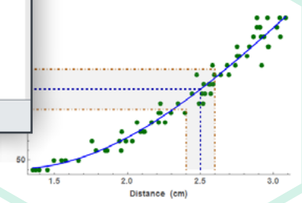


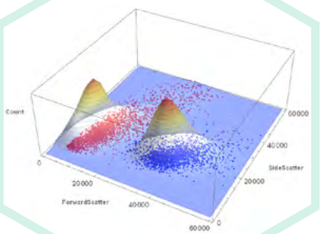


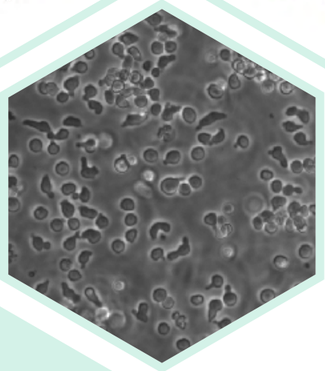


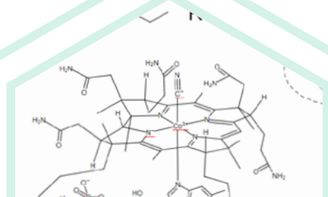












	Retention Time	Height	
Serine	12.98 (Min.)	49.62 (mAU)	4. (%)
Threonine	18.57 (Min.)	21.34 (mAU)	1.4 (%)
Asparagine	23.21 (Min.)	26.29 (mAU)	1.8 (%)
Glutamine	25.66 (Min.)	97.14 (mAU)	8.7 (%)
Proline	28.37 (Min.)	38.62 (mAU)	3.1 (%)

Additional ECL Innovations

Seamless integration with AI/ML/LLMs empowers scientists

- Asynchronous parallel Bayesian optimization for AI-driven cloud laboratories *(https://pubmed.ncbi.nlm.nih.gov/34252975/)*
- Autonomous chemical research with large language models *(https://pubmed.ncbi.nlm.nih.gov/38123806/)*
- Integration with ChatGPT via OpenAI plug-in capable of designing, refining, and submitting experiments to Cloud Lab facilities
- Featurize functions – allow scientists to define features of data within data objects to make data machine readable

Opportunity Focus

AI leverages Cloud Lab technology at multiple levels

1 Crystallize Communication

Symbolic Lab Language (SLL) API

- SLL is an open source language invented by ECL that provides an API for the laboratory.
- SLL is a requirement for all lab science AI applications. Without it, there is no way to digitally read from (analyze, compare, and mine data) and write to (design and execute new experiments) the lab.

2 Accelerate Translation

LLM-assisted experiment design

- With our collaborators, we are developing plug-ins to existing LLMs (ChatGPT, etc) to assist scientists in the translation from idea to ECL command.
- An example is giving the LLM a Methods section of a scientific paper and asking it to turn the described experiments into commands that can run within the Cloud Lab.

3 Drive Efficiency

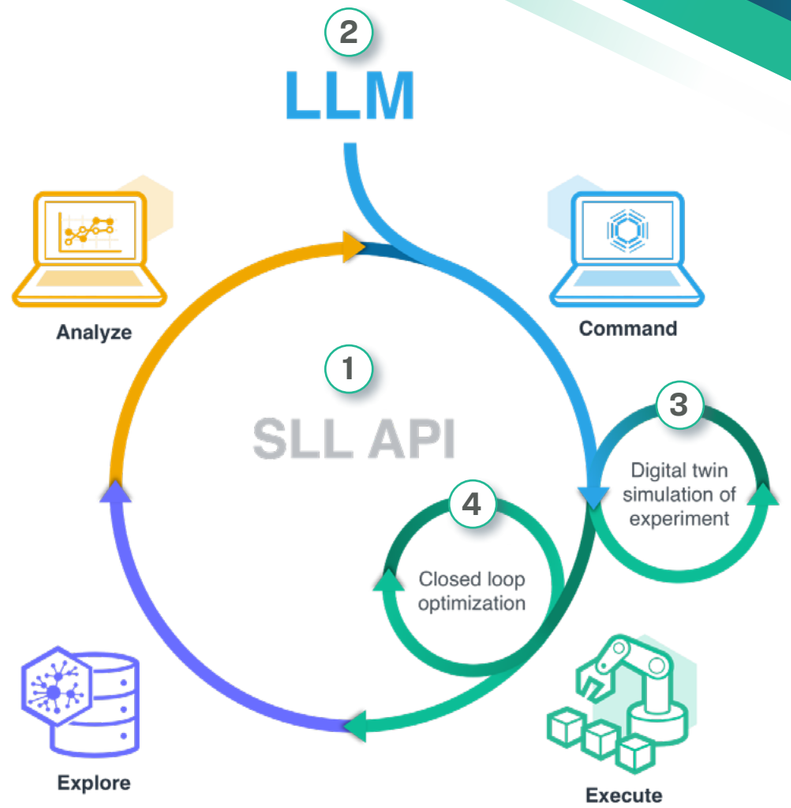
Experimental digital twins

- Use known theory and AI to generate simulated “digital twins” for every experiment run in the Cloud Lab.
- Simulations give users ability to predict experimental outcomes before actually running the experiment saving customers time and money to get to real results and drive value creation.

4 Eliminate Waste

Closed loop optimization

AI/ML algorithms designed to allow scientists to efficiently and effectively converge on the best set of experimental conditions for achieving a desired outcome.



Fully symbiotic relationship between AI and the Cloud Lab

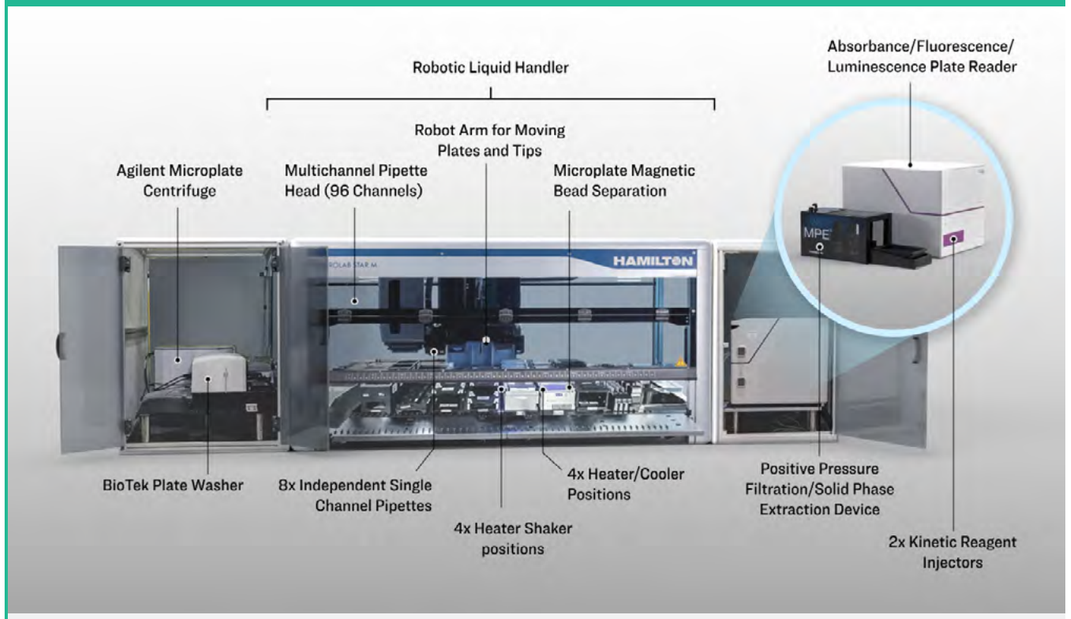
In a Cloud Lab, AI is not just a buzzword or fad

- 10+ years of software, hardware, and language development to create full digital interface to the lab ready for current and future AI applications
- Clean, digital data and metadata from Cloud Lab feeds AI learning models
- Easy connection points allow both Emerald and third parties to connect AI/ML tools at multiple places in value chain
- Short-term applications include LLM-assisted experiment design and AI-driven experiment simulation
- Not shackled to strict limitations of “self driving labs”

TRANSFERS

`ExperimentRoboticSamplePreparation[]`

Robotic Sample Preparation Workcell (Large)



UNIT OPERATIONS

Sample Preparation

Transfer
Dilute
Serial Dilution
Aliquot
Consolidate
Resuspend
Incubate
Mix
Centrifuge
Filter
Magnetic Bead Extraction
Wait
Label Sample
Label Container
Cover
Uncover
Pellet

Spectroscopy

Absorbance Spectroscopy
Absorbance Intensity
Absorbance Kinetics
Luminescence Spectroscopy
Luminescence Intensity
Luminescence Kinetics
Fluorescence Spectroscopy
Fluorescence Intensity
Fluorescence Kinetics
AlphaScreen

Workcell Integrated Micro Liquid Handler

HAMILTON
STAR

Large Capacity Deck

- 4x heater/shaker plate positions
  - heating up to 105°C
  - shaking up to 2,500 RPM
- 4x heater/cooler plate positions
  - heating up to 110°C
  - cooling down to 0°C
- 12x SBS plate positions (including any deep well or microtiter plates)
- 12x 50 mL conical tube positions
- 96x microcentrifuge tube or CE/HPLC vial positions
- Compatible with a wide variety of tubes (including opaque tubes for light sensitive samples)
- Robotic arm for movement of plates, lids, and racks around the deck and to/from integrations

8x Independent Single Channel Pipettes

- 1 µL to 1 mL volume (± 1%)
- 0.4 to 250 µL/sec aspirate/dispense rate
- 10 µL, 50 µL, 300 µL, 1,000 µL regular, wide-bore, and filtered disposable polypropylene tips
- Pre-aspiration/post-dispense mixing
- Fine-grained pipette tip aspiration and dispense position control
- Tip movement and speed control

1x Multichannel Pipette (96 Channels)

- Capable of any simultaneous rectangular pipetting up to dimensions 8x12
- 1 µL to 1 mL volume (± 2%)
- 0.4 to 250 µL/sec aspirate/dispense rate
- 10 µL, 50 µL, 300 µL, 1,000 µL regular, wide-bore, and filtered disposable polypropylene tips
- Pre-aspiration/post-dispense mixing
- Fine-grained pipette tip aspiration and dispense position control
- Tip movement and speed control

Workcell Integrated Positive Pressure Filter

- 0 to 40 PSI independent pressure sources for each well
- Filter though SBS filter plates
- Collects in SBS deep well plates

HAMILTON MPE2

Workcell Integrated Plate Reader

- Supports absorbance, fluorescence, and luminescence reads

Absorbance

- CCD detector
- 220 to 1,000 nm wavelength selection

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 320 to 740 nm excitation monochromator (8 nm bandpass)
- 680 nm laser (AlphaScreen)

Emission

- High voltage PMT detector
- 320 to 850 nm emission monochromator (8 nm bandpass)

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 96 well) per batch

Sample Injection

- 2x 500 µL injection syringes per batch
- 50 µL dead volumes, 0.5 µL precision
- 25 mL/min maximum injection speed
- 2 mL microcentrifuge tubes, 15 mL conical tubes, or 50 mL conical tube sources

CLARIOSTAR

Workcell Integrated Centrifuge

- 3,000 RPM maximum speed (1,000 x g at Rmax)
- 250 x g maximum payload per bucket
- 10 g maximum imbalance
- 2 SBS plate footprint buckets
- 48.3 mm max plate height

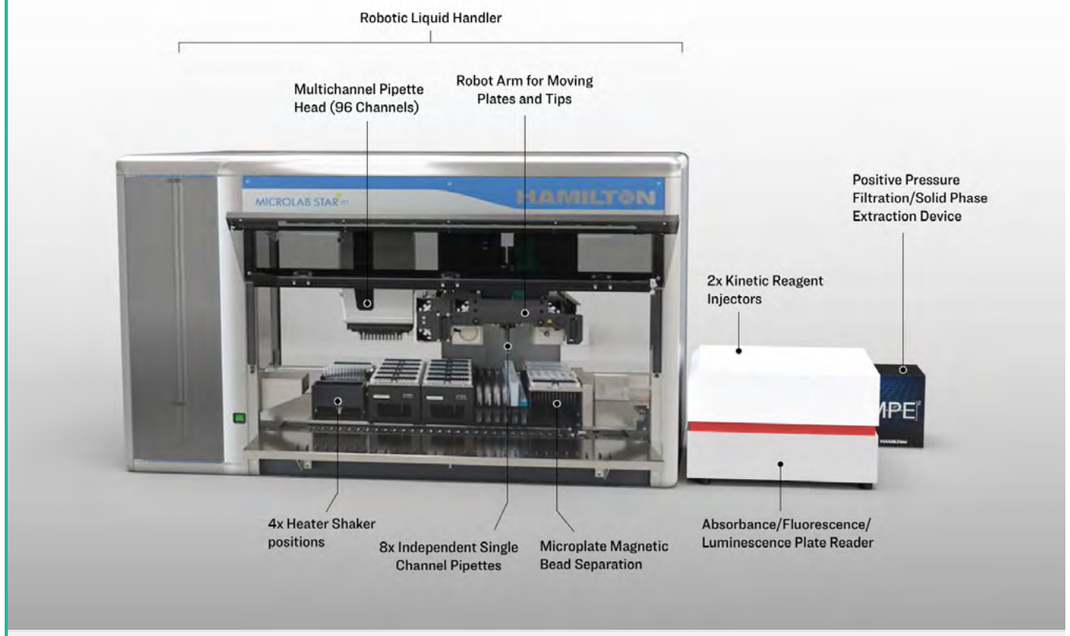
AGILENT MICROPLATE CENTRIFUGE

Workcell Integrated PlateWasher

- Up to 4 buffers switching
- 96-tube manifold is compatible with 96-well SBS plates
- Dual-action manifold allows aspirate and dispense separately for gentler and more complete washes
- Features ultrasonic cleaning manifold tubes

BIOTEK 405LS MICROPLATE WASHER

Robotic Sample Preparation Workcell (Small)



UNIT OPERATIONS

Sample Preparation

Transfer
Dilute
Serial Dilution
Aliquot
Consolidate
Resuspend
Incubate
Mix
Filter
Magnetic Bead Extraction
Wait
Label Sample
Label Container
Cover
Uncover
Pellet

Spectroscopy

Absorbance Spectroscopy
Absorbance Intensity
Absorbance Kinetics
Luminescence Spectroscopy
Luminescence Intensity
Luminescence Kinetics
Fluorescence Spectroscopy
Fluorescence Intensity
Fluorescence Kinetics

Workcell Integrated Micro Liquid Handler

HAMILTON STAR

Medium Capacity Deck

- 4x heater/shaker plate positions
  - heating up to 105°C
  - shaking up to 2,500 RPM
- 5x SBS plate positions (including any deep well or microtiter plates)
- 12x 50 mL conical tube positions
- 64x microcentrifuge tube or CE/HPLC vial positions
- Compatible with a wide variety of tubes (including opaque tubes for light sensitive samples)
- Robotic arm for movement of plates, lids, and racks around the deck and to/from integrations

8x Independent Single Channel Pipettes

- 1 µL to 1 mL volume (± 1%)
- 0.4 to 250 µL/sec aspirate/dispense rate
- 10 µL, 50 µL, 300 µL, 1,000 µL regular, widebore, and filtered disposable polypropylene tips
- Pre-aspiration/post-dispense mixing
- Fine-grained pipette tip aspiration and dispense position control
- Tip movement and speed control

1x Multichannel Pipette (96 Channels)

- Capable of any simultaneous rectangular pipetting up to dimensions 8x12
- 1 µL to 1 mL volume (± 2%)
- 0.4 to 250 µL/sec aspirate/dispense rate
- 10 µL, 50 µL, 300 µL, 1,000 µL regular, widebore, and filtered disposable polypropylene tips
- Pre-aspiration/post-dispense mixing
- Fine-grained pipette tip aspiration and dispense position control
- Tip movement and speed control

Workcell Integrated Positive Pressure Filter

- 0 to 40 PSI independent pressure sources for each well
- Filter though SBS filter plates
- Collects in SBS deep well plates

HAMILTON
MPE2

Workcell Integrated Plate Reader

FLUOSTAR

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 355 nm, 410 nm, 485 nm, 544 nm, 584 nm, 650 nm, or 700 nm fixed wavelength excitation filters (5 nm bandpass)

Emission

- High voltage PMT detector
- 420 nm, 460 nm, 520 nm, 590 nm, 620 nm, or 750 nm fixed wavelength emission filters (5 nm bandpass)
- Top or bottom of plate read mode

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 96 well) per batch

Sample Injection

- 2x 500 µL injection syringes per batch
- 50 µL dead volumes, 0.5 µL precision
- 25 mL/min maximum injection speed
- 2 mL microcentrifuge tubes, 15 mL conical tubes, or 50 mL conical tube sources

ExperimentAcousticLiquidHandling[]

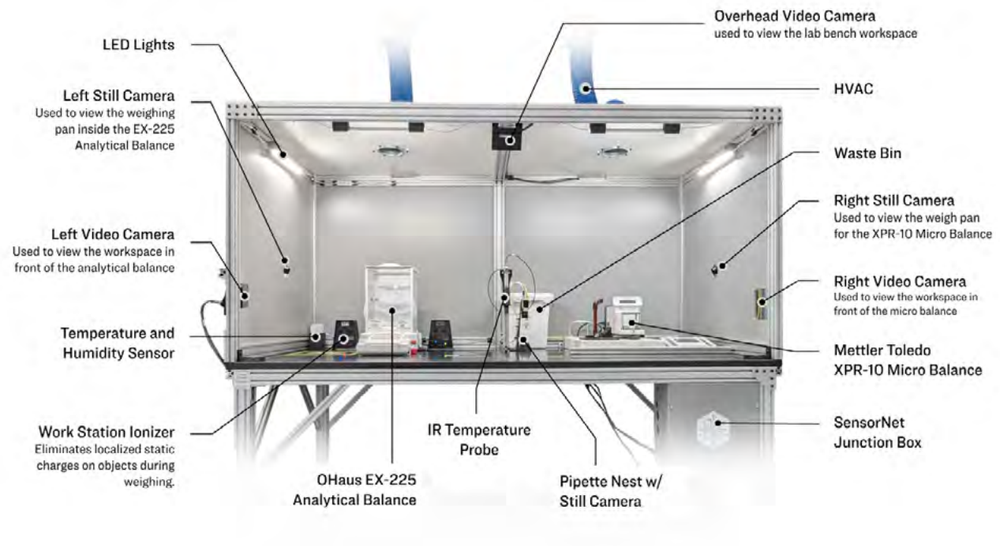
Acoustic Liquid Handler

- Contact-free tipless liquid transfer
- 2.5 nL to 5 µL volume (± 10%)
- Dispense from 384-well Echo Qualified plates into any 96- or 384- shallow well SBS-format plates
- Fine-grained dispense position control allowing multiple distinct droplets per well
- Dispenses up to 200 droplets (500 nL) per second
- Rapid high-precision dispensing of small volumes of liquids
- Capable of handling high-viscosity aqueous solutions

LABCYTE ECHO 650

ExperimentManualSamplePreparation[]

Manual Sample Preparation Workcell



UNIT OPERATIONS

Sample Preparation

Label Sample
Label Container
Wait
Transfer
Incubate
Mix
Centrifuge
Aliquot
Absorbance Spectroscopy
Absorbance Intensity
Absorbance Kinetics
Luminescence Spectroscopy
Luminescence Intensity
Luminescence Kinetics
Fluorescence Spectroscopy
Fluorescence Intensity
Fluorescence Kinetics
Fluorescence Polarization
Fluorescence Polarization Kinetics
AlphaScreen
Nephelometry
Nephelometry Kinetics
Filter
SPE
Pellet
Fill To Volume
AdjustpH
Cover
Uncover
Serial Dilute
Measure Refractive Index
Resuspend
Dilute
Degas
Magnetic Bead Separation
Flash Chromatography
Coulter Count
Count Liquid Particles
Cross Flow Filtration
Desiccate
Grind
Measure Melting Point
Visual Inspection
Grow Crystal
Microwave Digestion
Measure Contact Angle
Dynamic Light Scattering

Synthesis

PCR

Post Processing

Image Sample
Measure Weight
Measure Volume

Large Volumetric Transfers

Graduated Cylinders

- Transfers of liquids and slurries
- Optional overhead mixing/heating during addition
- Glass cylinders: 10 mL, 25 mL, 50 mL, 100 mL, 250 mL, 500 mL, 1 L, 2 L, 4 L

Volumetric Flasks

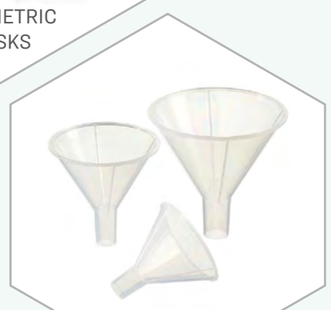
- Provides accurate volume measurements during liquid/slurry transfers
- Composed of borosilicate 3.3 expansion glass
- Glass flasks: 25 mL, 100 mL, 250 mL, 500 mL, 1 L, 2 L

Funnels

- Glass funnels: 25 mm, 45 mm, 60 mm, 65 mm, 75 mm, 80 mm, 100 mm, 150 mm
- Compatible with
  - 38-430 (4 L amber glass bottle)
  - GL-45 (100 mL, 250 mL, 500 mL, 1,000 mL, 2,000 mL, and 5,000 mL glass bottle)
  - 83B cap carboys (10 L and 20 L carboys)
  - Various sized graduated cylinders
  - Polypropylene

GRADUATED CYLINDERS

VOLUMETRIC FLASKS



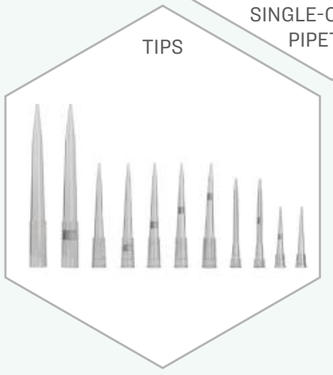
FUNNELS

Small Volumetric Transfers

Air Displacement Pipettes

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
  - Liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers
  - Temperature-sensitive source/destination samples can be marked to be chilled (-86 to 10°C) or heated (30 to 105°C) during transport (for more information, see Sample Transport section)
- Single-channel pipettes
  - 0.1 to 2.5 µL
  - 2 to 20 µL
  - 20 to 200 µL
  - 100 to 1,000 µL
  - 0.5 to 5 mL
- Compatible tip types
  - 10 µL reach tips, sterile
  - 20 µL barrier tips, sterile
  - 200 µL gel loading tips
  - 200 µL tips, non-sterile
  - 200 µL tips, sterile
  - 200 µL wide-bore tips, non-sterile
  - 1,000 µL wide-bore tips, non-sterile
  - 1,000 µL reach tips, sterile
  - 1,000 µL tips, non-sterile
  - 5,000 µL tips, non-sterile

SINGLE-CHANNEL PIPETTES



TIPS

Serological Pipettes

- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
  - Liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers
  - Temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Variable dispense/aspirate speed (8 settings)
- 15 hours of continuous operation before recharging
- Compatible plastic serological pipette tips
  - 2 mL plastic barrier serological pipettes, sterile
  - 5 mL plastic barrier serological pipettes, sterile
  - 10 mL plastic barrier serological pipettes, sterile
  - 25 mL plastic barrier serological pipettes, sterile
  - 50 mL plastic barrier serological pipettes, sterile
- Compatible glass serological pipette tips
  - 1 mL glass barrier serological pipettes, sterile
  - 2 mL glass barrier serological pipettes, sterile
  - 5 mL glass barrier serological pipettes, sterile
  - 10 mL glass barrier serological pipettes, sterile
  - 25 mL glass barrier serological pipettes, sterile
  - 50 mL glass barrier serological pipettes, sterile

Volumetric Pipettes

- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
  - Liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers
  - Temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Variable dispense/aspirate speed (8 settings)
- 15 hours of continuous operation before recharging
- Compatible glass volumetric pipette tips
  - 0.5 mL glass volumetric pipets, sterile, Class A
  - 1 mL glass volumetric pipets, sterile, Class A
  - 2 mL glass volumetric pipets, sterile, Class A
  - 3 mL glass volumetric pipets, sterile, Class A
  - 4 mL glass volumetric pipets, sterile, Class A
  - 5 mL glass volumetric pipets, sterile, Class A
  - 6 mL glass volumetric pipets, sterile, Class A
  - 7 mL glass volumetric pipets, sterile, Class A
  - 8 mL glass volumetric pipets, sterile, Class A
  - 9 mL glass volumetric pipets, sterile, Class A
  - 10 mL glass volumetric pipets, sterile, Class A
  - 13 mL glass volumetric pipets, sterile, Class A
  - 15 mL glass volumetric pipets, sterile, Class A

Positive Displacement Pipettes

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
- Temperature controlled transfers
- Temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Positive-Displacement Pipette MR-100
  - Min volume: 10 µL
  - Max volume: 100 µL
- Positive-Displacement Pipette MR-1000
  - Min volume: 100 µL
  - Max volume: 1 mL
- Compatible and supported tips
  - 100 µL positive displacement tips, sterile
  - 1,000 µL positive displacement tips, sterile

RAININ POS-D
MR-100, MR-1000

ZERO DEAD
VOLUME TIPS

Syringes

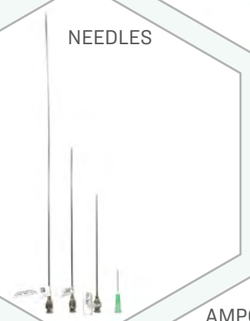
- 1 to 60 mL max volume
- 2 different connection types: Luer-Lok and Luer-Slip
- Polyethylene barrel and polypropylene plunger syringes
- Luer-Slip
  - 1 mL disposable syringe
  - 50 mL disposable Luer-Slip syringe
- Luer-Lok
  - 3 mL sterile disposable syringe
  - 5 mL sterile disposable syringe
  - 10 mL Luer-Lok syringe
  - 20 mL disposable Luer-Lok syringe
  - 60 mL sterile disposable syringe
- Needles
  - 21 G x 1 in stainless steel single-use needle
  - 18 G x 4 in reusable stainless steel non-coring needle
  - 18 G x 6 in reusable stainless steel non-coring needle
  - 18 G x 12 in reusable stainless steel non-coring needle

Ampoule Handling

- 1 to 2 mL
- 5 to 15 mL
- 20 to 30 mL

SYRINGES

NEEDLES



AMPOULE
BREAKER

Solid Handling

Scoops & Spatulas

- Solid and powder transfer on mg/g/kg scale
- Spatulas
  - Micro spatulas with color-coded handles
    - Blade widths: 0.1, 0.3, 0.5, and 1.0 mm
    - Used for handling solids on the milligram scale
  - Disposable polypropylene, single-use
    - 14 cm, 21 cm, and 31 cm
  - Flat-round stainless steel
  - Flat-spoon stainless steel

Tweezers

- Original wafer tweezers
- Stainless steel and anti-magnetic
- Straight broad flat tips

Pill Crushers

- In-house tablet parameterization including determining samples
  - Tablet count
  - Tablet weight
- Compatible with a variety of tablet sizes and weights

Chipping Hammers

- Used to break resins/solids into smaller pieces for precise transfers by weight

Scissors

- Used for cutting and transferring fabrics by weight

SCOOPS/
SPATULAS

ONE STAR
STRAIGHT FLAT
TIP TWEEZER

SILENT KNIGHT
PILL CRUSHER

CHIPPING
HAMMER

SCISSORS

Balances

Microbalances

- 1 µg to 6 g (± 1 µg)

Analytical Balances

- 100 µg to 220 g (± 100 µg)

Macro Balances

- 120 g to 6.2 kg (± 10 mg)

Bulk Balances

- 5 to 50 kg (± 10 g)

METTLER
TOLEDO XP6

OHAUS PIONEER
PA224 & PA124

OHAUS
EX6202

OHAUS DEFENDER
D31P60BL

Paste Handling

Transfer Tubes

- Used for gravimetric paste transfers in conjunction with an appropriate sized balance
- Polypropylene material
- Capacity per aspiration 4 mL
- 20 mm outer diameter,
  153 mm length x 6 mm inner diameter

Squeezable Containers

- Used for gravimentric paste transfers in conjunction with an appropriate sized balance

SPECTRUM™
TRANSFERTUBE™
TUBE

SQUEEZABLE
CONTAINERS

ORGANIC SYNTHESIS

ExperimentPeptideSynthesis[]
ExperimentPNASynthesis[]

Robotic Peptide Synthesizer

- Compatible with Fmoc coupling strategies
- Customizable coupling times, reagent amounts, and cycles
- Customizable cleavage conditions
- Customizable reagents and monomers
- Customizable resuspension conditions
- Double coupling after n-monomers available
- Pre-activation available
- 5 to 100 µmol scale

Reaction Vessels

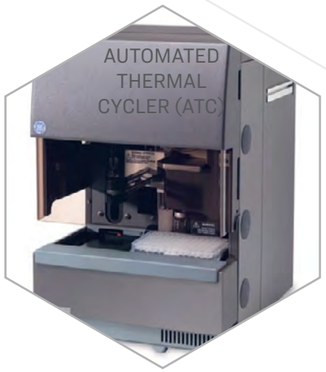
- Pressure push (nitrogen at 5 PSI) for flushing vessels
- 24x reaction vessels (12x with optional pre-activation)
- 10 mL vessels (~50 to 250 mg of resin) or 45 mL vessels (~50 mg to 1.125 g of resin)

Reagent Positions

- Driven by nitrogen pressurization of source bottles
- 28x 400 mL monomer positions
- 8x reagent bottle positions (1 L or 4 L bottles)
- 20 L of dimethylformamide (DMF) or other solvent containers

SYMPHONY X

AUTOMATED THERMAL CYCLER (ATC)



ExperimentPCR[]

Automated Thermocycler

- Temperature accuracy: ± 0.25°C (between 35.0 and 99.9°C)
- Max block ramp rate: 3.5°C/sec
- Max sample ramp rate: 1.8°C/sec
- Temperature range: 4 to 105°C
- Temperature uniformity: ± 0.50°C (20 sec after reaching 95°C)

Sample Constraints

- Plate format: 96-well PCR plate
- Sample volume: 10 to 100 µL

ExperimentDNASynthesis[]
ExperimentRNASynthesis[]

Robotic DNA Synthesizer

Synthesis Columns

- 40 nmol, 200 nmol, or 1 µmol scale ABI columns
- Standard or custom columns available
- 48x columns per batch

Reagents

- 8x standard phosphoramidate positions (standard or UltraMILD bases)
- 6x custom modification positions (any custom solution can be loaded)
- Positive pressure based delivery and draining (argon)

Synthesis Cycle

- Custom coupling times for each phosphoramidate and modification
- Double coupling after a programmable number of cycles
- Custom volumes and incubation durations available for each step in the cycle

Cleavage

- Heated or room temperature incubation with any custom cleavage cocktail for any programmable duration
- Purification by filter and washing (with programmable amounts of solvent)
- Optional neutralization and/or speedvacing or lyophilization of product
- Can leave strands uncleaved on support for further solid phase synthesis

ABI 3900

ExperimentBioconjugation[]

Bioconjugation

- Low-volume chemical linking of biomolecules including microbeads, oligomers, proteins, and antibodies
- Utilizes all available solid transfer, liquid transfer, and mixing instrumentation
- Biomolecule activation can be specified prior to conjugation
- Reaction quenching can be specified after conjugation
- Product workup including pelleting and filtering can be specified after conjugation

HAMILTON STAR

ExperimentSolidPhaseExtraction[]

Small Robotic Liquid Handler

- 20 PSI pressure push (independent for each vessel)
- 0.1 to 100 mL/min flow rates for solvent pushes
- Up to 20 L of wash solvent per batch
- Up to 700 mL of equilibration buffer and elution buffer per batch
- Filter through 3 cc or 6 cc SPE cartridges
- Collects in SBS deep well plates

ExperimentHPLC[]

Analytical HPLC with Photo Diode Array Detector

Quaternary Pump

- 0.1 to 2.2 mL/min flow rate
- 7,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Dynamic mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 5 L buffer source bottles/carboys

Detectors

- Absorbance diode array (PDA)
  - Deuterium lamp
  - 190 to 500 nm absorbance detection (1.2 nm resolution)
  - Quartz flow cell
    - 10 mm pathlength
    - 0.5 µL volume
    - 1,000 PSI maximum pressure

Column Oven

- 20 to 90°C (± 0.1°C) incubation
- Up to 2 columns connected in series per run
- 300 mm maximum column length
- 15 mm maximum column outer diameter

Sample Constraints

- 75 µL sample loop
- 250 µL autosampler syringe
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

Analytical HPLC with Fluorescence Detector

Quaternary Pump

- 0.1 to 2.2 mL/min flow rate
- 7,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Dynamic mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 5 L buffer source bottles/carboys

Detectors

- Ultraviolet absorbance
  - Deuterium lamp
  - 190 to 700 nm wavelength range
    - Fused silica flow cell with 10 mm pathlength
    - 0.5 µL volume
    - 1,000 PSI maximum pressure
  - Up to 80 points/second sampling rate
- Fluorescence (FLR)
  - 13 µL flow cell volume
  - Up to 80 points/second sampling rate
  - 1,000 PSI maximum pressure
  - 200 to 890 nm for excitation light (xenon arc lamp source)
  - 210 to 900 nm for emission light

Column Oven

- 20 to 90°C (± 0.1°C) incubation
- Up to 2 columns connected in series per run
- 300 mm maximum column length
- 15 mm maximum column outer diameter

Sample Constraints

- 75 µL sample loop
- 250 µL autosampler syringe
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

Analytical HPLC with Evaporative Light Scattering Detector

Quaternary Pump

- 0.1 to 2.2 mL/min flow rate
- 7,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Dynamic mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 5 L buffer source bottles/carboys

Detectors

- Ultraviolet absorbance
  - Deuterium lamp
  - 190 to 700 nm wavelength range
    - Fused silica flow cell with 10 mm pathlength
    - 0.5 µL volume
    - 1,000 PSI maximum pressure
  - Up to 80 points/second sampling rate
- Evaporative Light Scattering (ELS)
  - Nitrogen sheath gas
    - Flow rate between 20 and 60 PSI
    - Heatable to varying magnitude
  - 2 mL/min maximum flow rate
  - Up to 80 points/second sampling rate
  - Drift tube up to 100°C
  - Tungsten halogen light source

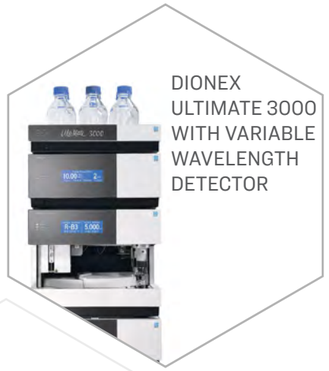
Column Oven

- 20 to 90°C (± 0.1°C) incubation
- Up to 2 columns connected in series per run
- 300 mm maximum column length
- 15 mm maximum column outer diameter

Sample Constraints

- 75 µL sample loop
- 250 µL autosampler syringe
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

Semi-Preparative HPLC with UV/Vis Detector



Quaternary Pump

- 0.2 to 8 mL/min flow rate
- 300 PSI minimum pressure
- 4,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Static mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 20 L buffer source bottles/carboys

Column Oven

- 5 to 80°C (± 0.1°C) incubation
- 300 mm maximum column length
- 25 mm maximum column outer diameter

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode
  - Tungsten deuterium lamp
  - 190 to 900 nm monochromator
  - 6 nm bandpass
  - Quartz flow cell
    - 10 mm pathlength
    - 11 µL volume
    - 725 PSI maximum pressure

Fraction Collection

- Absorbance-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 8x 96-well deep well plate fraction containers per batch

Sample Constraints

- 500 µL sample loop
- 500 µL autosampler syringe
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch

Semi-Preparative HPLC with Fluorescence Detector

Quaternary Pump

- 0.2 to 8 mL/min flow rate
- 300 PSI minimum pressure
- 4,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Static mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 20 L buffer source bottles/carboys

Column Oven

- 5 to 80°C (± 0.1°C) incubation
- 300 mm maximum column length
- 25 mm maximum column outer diameter

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode
  - Tungsten deuterium lamp
  - 190 to 900 nm monochromator
  - 6 nm bandpass
  - Quartz flow cell
    - 10 mm pathlength
    - 11 µL volume
    - 725 PSI maximum pressure
- Fluorescence
  - 8 µL flow cell volume
  - 290 PSI maximum pressure
  - 200 to 880 nm for excitation light (xenon flash lamp source)
  - 220 to 900 nm for emission light

Fraction Collection

- Absorbance-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 8x 96-well deep well plate fraction containers per batch

Sample Constraints

- 500 µL sample loop
- 500 µL autosampler syringe
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch

Semi-Preparative HPLC with pH/Conductivity Detector

Quaternary Pump

- 0.2 to 8 mL/min flow rate
- 300 PSI minimum pressure
- 4,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Static mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 20 L buffer source bottles/carboys

Column Oven

- 5 to 80°C (± 0.1°C) incubation
- 300 mm maximum column length
- 25 mm maximum column outer diameter

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode
  - Tungsten deuterium lamp
  - 190 to 900 nm monochromator
  - 6 nm bandpass
  - Quartz flow cell
    - 10 mm pathlength
    - 11 µL volume
    - 725 PSI maximum pressure
- pH
  - 28 µL flow cell volume
  - 100 PSI maximum pressure
  - 2 to 12 pH measurement range
  - Operating temperature between 4 and 50°C
- Conductivity
  - 21 µL flow cell volume
  - 725 PSI maximum pressure
  - 1 µS/cm to 1 S/cm conductivity measurement range
  - Operating temperature between 4 and 50°C

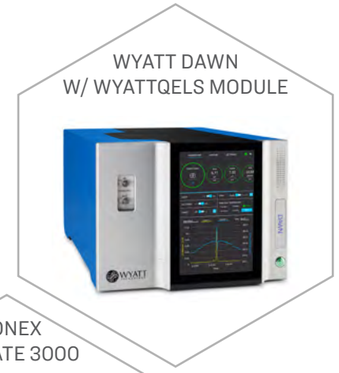
Fraction Collection

- Absorbance-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 8x 96-well deep well plate fraction containers per batch

Sample Constraints

- 500 µL sample loop
- 500 µL autosampler syringe
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch

Semi-Preparative HPLC with MALS/DLS Detectors



Quaternary Pump

- 0.2 to 8 mL/min flow rate
- 300 PSI minimum pressure
- 4,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Static mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 20 L buffer source bottles/carboys

Column Oven

- 5 to 80°C (± 0.1°C) incubation
- 300 mm maximum column length
- 25 mm maximum column outer diameter

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode
  - Tungsten deuterium lamp
  - 190 to 900 nm monochromator
  - 6 nm bandpass
  - Quartz flow cell
    - 10 mm pathlength
    - 11 µL volume
    - 725 PSI maximum pressure
- Multi-angle light scattering
  - Up to 36.6 points/sec sampling rate
  - 200 Da to 1,000 MDa molar mass range
  - 0.5 to 500 nm radius of gyration measurement range
  - Light scattering detectors at 18 angles
  - 658 nm laser wavelength
  - Operating temperature between -15 and 150°C
- Dynamic light scattering
  - Up to 36.6 points/sec sampling rate
  - 0.5 to 30 nm hydrodynamic radius measurement range

Fraction Collection

- Absorbance-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 8x 96-well deep well plate fraction containers per batch

Sample Constraints

- 500 µL sample loop
- 500 µL autosampler syringe
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch

Semi-Preparative HPLC with Refractive Index Detectors

WYATT OPTILAB

DIONEX ULTIMATE 3000

Quaternary Pump

- 0.2 to 8 mL/min flow rate
- 300 PSI minimum pressure
- 4,000 PSI maximum pressure
- 0.01 inch inner diameter PEEK system tubing
- Static mixer
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 20 L buffer source bottles/carboys

Column Oven

- 5 to 80°C (± 0.1°C) incubation
- 300 mm maximum column length
- 25 mm maximum column outer diameter

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode
  - Tungsten deuterium lamp
  - 190 to 900 nm monochromator
  - 6 nm bandpass
  - Quartz flow cell
    - 10 mm pathlength
    - 11 µL volume
    - 725 PSI maximum pressure
- Refractive Index detector
  - 7.4 µL flow cell volume
  - Absolute Refractive Index (RI) measurement mode and Differential Refractive Index (DRI) measurement mode available
  - 1.2 to 1.8 RIU Absolute Refractive Index range
  - 0.002 RIU Absolute Refractive Index sensitivity
  - -0.0047 to +0.0047 RIU Differential Refractive Index range
  - ± 7.5 x 10e-10 RIU Differential Refractive Index sensitivity
  - Temperature range 4 and 65°C
  - 660 nm light source
  - Dynamic Range > 16,000,000

Fraction Collection

- Absorbance-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 8x 96-well deep well plate fraction containers per batch

Sample Constraints

- 500 µL sample loop
- 500 µL autosampler syringe
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch

Large Scale Preparative HPLC with UV/Vis Detector

1290 INFINITY II AUTOSCALE PREPARATIVE LC SYSTEM

Binary Pump

- Up to 200 mL/min flow rate
- 6,000 PSI maximum pressure
- In-line degasser
- 2 to 20 L buffer source bottles/carboys

Column Selector

- Ambient temperature
- Switchable for up to 6 columns

Detectors

- Pump pressure sensor
- Ultraviolet-Visible absorbance detector
  - Deuterium lamp
  - 190 to 950 nm wavelength range
  - 1 nm wavelength bandpass
  - Up to 120 samples/second measurement (25 samples/second for dual channel)
    - Quartz flow cell 10 mm pathlength
    - 13 µL volume
    - 1,740 PSI maximum pressure

Fraction Collection

- Valve-based fraction collector
- Triggered collection
  - Peak threshold
  - Time based
- Tube container collection
  - Ranging from 2 to 45 mL capacity

Sample Constraints

- 20 mL sample loop
- Up to 16 mL injection volume
- Up to 60x 50 mL conical tubes or 216x 15 mL conical tubes

ExperimentGasChromatography[]

Gas Chromatography System

Flow System

- He carrier gas available
- Inlets available:
  - Split/Splitless capillary column inlet
  - Multimode temperature-programmable capillary column inlet
- Column head pressure up to 100 PSIG

Column Oven

- Temperature range: 30 to 450ºC
- Up to 120ºC/min temperature ramp
- Up to 2 capillary columns
- 0.53 mm maximum column inner diameter

Split/Splitless Capillary Inlet

- Suitable for capillary columns up to 0.53 mm inner diameter
- Split ratio up to 7,500:1 to prevent column overload
- Up to 1,250 mL/min total flow of He
- Inlet temperature 30 to 400ºC

Multimode Capillary Inlet

- Suitable for capillary columns up to 0.53 mm inner diameter
- Split ratio up to 7,500:1 to prevent column overload
- Up to 1,250 mL/min total flow of He
- Inlet temperature 30 to 400ºC
- Temperature programmable with ramp rates up to 900ºC/min

Mass Spectrometry

- Single quadrupole mass spectrometer
- 1.6 to 1,050 m/z mass range
- 100 to 200ºC quadrupole temperature
- 100 to 300ºC ion source temperature
- 100 to 350ºC transfer line temperature
- Scan speeds up to 12,500 m/z per second
- Electron ionization:
  - Dual filaments
- Chemical ionization:
  - Single filament
  - Methane reagent gas
  - Positive and negative mode

Flame Ionization Detector

- Responds to most organic compounds
- Minimum detectable level (for tridecane): < 1.2 pgC/s
- Linear dynamic range: > 10^7 (± 10%)
- Up to 1,000 points/second data measurement

Autosampler Rail System

- Vortex mixing up to 2,000 RPM
- Sample incubation 30 to 200ºC
- Liquid, headspace, and solid-phase microextraction sample preparation available
- 0.01 to 100 µL injection volumes for liquid injection
- 25 to 2,500 µL injection volumes for headspace injection
- Headspace syringe heating 40 to 150ºC

ExperimentSupercriticalFluidChromatography[]

Supercritical Fluid Chromatography Instrument with Quadrupole Mass Spec

Quaternary Pump

- Up to 4 cosolvent solutions
- 0.1 to 3.3 mL/min flow rate
- 10,000 PSI maximum pressure
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 1 L cosolvent source bottles

Convergence Manager

- 2,000 to 6,000 PSI range for adjustable back pressure

Makeup Solvent Manager

- Up to 1 mL/min flow rate for makeup solvent

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode array detector
  - Deuterium lamp
  - Up to 80 points/second sampling rate
  - 190 to 800 nm absorbance detection (1.2 nm resolution)
  - Quartz flow cell
    - 10 mm pathlength
    - 1 µL volume
    - 1,000 PSI maximum pressure
- Mass spectrometer detector
  - Single quadrupole
  - Electrospray ionization (both positive and negative)
  - 50 to 1,200 m/z quadrupole mass range
  - 50 ms scan time per spectra
  - 25 to 150°C probe temperature range
  - 120°C source temperature
  - 0.3 to 1.5 kV capillary voltage
  - 0.1 to 100 V sampling cone voltage

Column Selector

- 20 to 90°C (± 0.1°C) incubation
- Up to 8 columns, switchable using valves
- 300 mm maximum column length
- 15 mm maximum column outer diameter

Sample Constraints

- 50 µL sample loop
- 250 µL autosampler syringe
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

ExperimentIonChromatography[]

Ion Chromatography System

Pumps

- Dual channel system
  - Anion Channel: Isocratic pump with pure water being primary solvent
  - Cation Channel: Quaternary pump
- 0.1 to 10 mL/min flow rate
- 5,000 PSI maximum pressure
- Static mixer
- In-line degasser

Eluent Generator

- Electrolytic eluent generation for anionic applications
- 0.1 to 100 mM concentration

Dynamically Regenerated Suppressors

- Constant voltage and constant current mode
- Maximum suppressor capabilities:
  - Anion channel: 50 µeq/min
  - Cation channel: 35 µeq/min
- 0.25 to 0.75 mL/min flow rate

Conductance Detectors

- Passivated 316 stainless steel electrode
- Maximum range up to 15,000 µS conductance measurement
- 0.7 µL flow cell volume
- One detector for each channel
- Shared detection oven with 15 to 60ºC (± 0.5ºC) incubation

Column Oven

- 10 to 70°C (± 0.1°C) incubation
- One analytical column for each channel

Sample Constraints

- 10 µL sample loops
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch
- Sample chamber temperature controlled from 4 to 60°C

Ion Chromatography System with Electrochemical Detector

Quaternary Pump

- Single channel system
- 0.1 to 10 mL/min flow rate
- 5,000 PSI maximum pressure
- Static mixer
- In-line degasser

Ultraviolet absorbance detector

- Tungsten and Deuterium lamp
- 190 to 900 nm wavelength range (up to four channels)
- 6 nm wavelength bandpass
- Up to 100 samples/second measurement
- PEEK flow cell
  - 10 mm path length
  - 11 µL flow cell volume

Electrochemical detector

- < 0.2 µL internal volume
- 100 PSI maximum pressure
- Gold, platinum, carbon and silver working electrodes
- pH-Ag/AgCl reference electrode

Column Oven

- 10 to 70°C (± 0.1°C) incubation

Sample Constraints

- 25 µL sample loop
- Up to 40x HPLC/CE vials or 2x SBS style deep well plates per batch
- Sample chamber temperature controlled from 4 to 60°C

ExperimentFPLC[]

Fast Protein Liquid Chromatography System Medium and High Flow

System Pump & Mixer

- 0.001 to 25 mL/min flow rate (50 mL/min for column packing) for Avant 25
- 0.001 to 150 mL/min flow rate (300 mL/min for column packing) for Avant 150
- 20 MPa maximum pressure for Avant 25
- 5 MPa maximum pressure for Avant 150
- 1.4 L mixer volume
- ± 0.6% gradient composition accuracy for Avant 25
- ± 0.8% gradient composition accuracy for Avant 150

Detectors

- Pump pressure sensor
  - 0 to 20 MPa range
  - ± 0.02 MPa accuracy
- Temperature monitor
  - ± 1.5°C temperature accuracy
- Conductance sensor
  - 0.01 mS/cm to 1 S/cm conductance range
  - 22 µL flow cell volume
- Absorbance monitor
  - 190 to 700 nm wavelength range in increments of 1 nm wavelength
  - Up to 3 simultaneous wavelengths
  - UV flow cell
    - 0.5 mm, 2 mm, or 10 mm pathlengths
    - 1 µL, 2 µL, or 8 µL volumes
    - Noise < 0.08 mAU
- pH monitor
  - 0 to 14 range
  - ± 0.1 pH unit (within pH 2 to 12)

Fraction Collection

- Absorbance-based or conductivity-based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
  - Start collection with sample application or within the gradient
- 50 mL container, 15 mL container, or 96-well deep well plate fraction collection

Sample Constraints

- Autosampler mode
  - 50 to 10,000 µL sample loop volume
  - 1,000 to 10,000 µL µL autosampler syringe
  - Up to 168x HPLC/CE vials or 2x SBS style deep well plate per batch
  - Up to 12 large sample vials (10 mL) for preparative system
- Flow injection mode
  - Up to 50 mL to 4 L sample container volumes
  - Up to 5 containers
  - Controllable sample introduction rate (up to 150 mL/min)
- Superloop mode
  - 10 mL loop volume
  - Up to 50 mL to 4 L sample container volumes
  - Up to 5 containers

Fast Protein Liquid Chromatography System Low Flow

System Pump & Mixer

- 0.1 to 10 mL/min flow rate
- 3,500 PSI maximum pressure
- Static mixer
- Titanium pump casing
- 250 mL to 5 L buffer source bottles

Detectors

- Pump pressure sensor
  - 0 to 20 MPa range
  - ± 0.02 MPa accuracy
- Conductance sensor
  - 0.01 mS/cm to 1 S/cm conductance range
  - 22 µL flow cell volume
- Absorbance Diode
  - Mercury lamp
  - 254 or 280 nm wavelength
  - 4 nm bandpass
  - Quartz flow cell
    - 2 mm pathlength
    - 2 µL volume
    - 580 PSI maximum pressure

Fraction Collection

- Absorbance based fraction collection methods
  - Absolute threshold
  - Derivative detection
  - Time based
- Up to 4x 96-well deep well plate fraction containers per batch

Sample Constraints

- 1,000 µL sample loop
- 1,000 µL autosampler syringe
- Up to 24x HPLC/CE vials or 1x SBS style deep well plate per batch

ExperimentCapillaryGelElectrophoresisSDS[]

Protein Capillary Electrophoresis System

- 10 to 270 KDa molecular weight range
- Programmable sample electrokinetic injection and separation
  - Up to 20 steps
  - 0 to 6,500 V
- Sequential analysis on a single capillary
- Samples can be held at 4ºC, 10ºC, 15ºC, or ambient temperature while enqueued for injection

Detection

- UV absorbance: 220 nm
- Sensitivity: 0.3 µg/mL

Sample Constraints

- Minimum sample volume: 50 µL
- Up to 48 injections per batch
- Up to 12 injections per sample
- Up to 100 samples per cartridge
- Protein concentration: 0.2 to 2 mg/mL
- Salt concentration: up to 50 mM

PROTEINSIMPLE
MAURICE

ExperimentCapillaryIsoelectricFocusing[]

Protein Capillary Electrophoresis System

- 2.85 to 10.45 isoelectric point range
- Programmable focusing
  - Up to 20 steps
  - 0 to 5,000 V
- Modular ampholyte and internal standard composition
- Optional onboard mixing for sensitive samples
- Sequential analysis on a single capillary
- Samples can be held at 4ºC, 10ºC, 15ºC, or ambient temperature while enqueued for injection

Detection

- Whole capillary imaging using a CCD
- Sensitivity
  - UV absorbance: 3 µg/mL
  - Native fluorescence: 0.7 µg/mL
- Detectors
  - UV absorbance: 280 nm
  - Native fluorescence:
    - Excitation: 280 nm
    - Emission: 320 to 405 nm bandpass

Sample Constraints

- Minimum sample volume: 50 µL
- Up to 100 injections per batch
- Up to 12 injections per sample
- Up to 100 samples per cartridge
- Protein concentration: ~0.2 mg/mL
- Salt concentrations: up to 15 mM

PROTEINSIMPLE
MAURICE

ExperimentCrossFlowFiltration[]

Tangential Flow Filtration System

- Volume range of 10 mL to 2 L
- Filtration area of 13 to 3,700 cm^2
- Digitally controlled peristaltic pump
- Digital pressure monitor
- Automatic backpressure valve
- Digital conductivity monitors

Miniaturized Tangential Flow Filtration System

- Volume range of 3 to 50 mL
- Filtration area of 11 cm^2
- Disposable microfluidic chips
  - 5, 10, 30, 50, 100, and 300 kDa MWCO modified Polyethersulfone membranes
  - Diaphragm pump to move liquid across the membrane
- Digital pressure monitor
- Automatic volume tracking

REPLIGEN KROSFLO KR2I TFF SYSTEM

FORMULATRIX UPULSE - TFF

ExperimentFlashChromatography[]

Flash Chromatography System

Pumps

- 5 to 200 mL/min flow rate
- 200 MPa maximum pressure
- 2 buffers
  - 4 L maximum buffer volume each
- ±1% gradient composition accuracy

Detector

- Absorbance of UV
- 200 to 360 nm
- Up to three simultaneous measurements
  - Primary wavelength ±5 nm
  - Secondary wavelength ±5 nm
  - Average of a wide range of UV wavelengths
- Flow cell
- 0.1 mm path length
- 0.1 mL total flow cell volume
- 31 µL volume across detection path

Fraction Collection

- All fractions or just absorbance peaks
- Absorbance peak detection
  - Absolute threshold
  - Slope-based
- Collect only within specified time window
- 15 mL fraction collection tubes

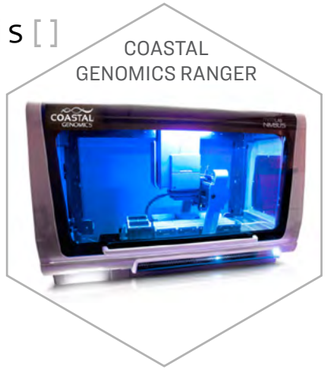
Sample Constraints

- 0.1 to 25 mL

TELEDYNE COMBIFLASH RF 200

ExperimentPAGE[]
ExperimentAgaroseGelElectrophoresis[]

Robotic Gel Electrophoresis System



Polyacrylamide Gel Electrophoresis

- Slab Gels
  - 4.5% and 10% TBE-Urea gels
  - 10% TBE gels
  - 7% and 12% Tris-Glycine gels
  - 5 mm width lanes
  - 3 mm depth gels
- Electrophoresis
  - 0 to 125 V
  - 1 to 100% duty cycle options
- Fluorescence Imaging
  - Post stained gels (stained with any custom solution)
  - Excitation filters
    - 470 nm (70 nm bandpass)
    - 625 nm (70 nm bandpass)
  - Emission filters
    - 540 nm (40 nm bandpass)
    - 678 nm (44 nm bandpass)
- Sample Constraints
  - Up to 20 µL of sample and loading buffer per lane
  - Up to 10 lanes per gel
  - Up to 4 gels per batch

Agarose Gel Electrophoresis

- Gels
  - Analytics (no sample recovery) or size selection (targeted recovery of analytes of particular sizes)
  - 0.5, 1.0, 1.5, 2.0, and 3.0% agarose
  - Independent lanes
- Electrophoresis
  - 100 V
  - 1 to 100% duty cycle options
- Fluorescence Imaging
  - Pre-stained markers ranging from 25 to 20,000 base pairs
  - Multiple in-run images
  - Excitation filters
    - 470 nm (70 nm bandpass)
    - 625 nm (70 nm bandpass)
  - Emission filters
    - 540 nm (40 nm bandpass)
    - 678 nm (44 nm bandpass)
- Sample Constraints (Size Selection)
  - Up to 50 µL of sample and loading buffer per lane
  - Up to 12 lanes per gel
  - Up to 4 gels per batch
- Sample Constraints (Analytical)
  - Up to 8 µL of sample and loading buffer per lane
  - Up to 23 lanes per gel
  - Up to 4 gels per batch

ExperimentWestern[]
ExperimentTotalProteinDetection[]

Capillary Western Blot System

Capillary Gel Electrophoresis

- 2 to 440 kDa molecular weight range
- 0 to 500 V separation voltage
- UV capillary crosslinking for protein immobilization

Secondary Antibodies Available

- Secondary Antibodies Available
  - Goat Anti-Rabbit HRP
  - Goat Anti-Mouse HRP
  - Goat Anti-Human IgG HRP
  - Donkey Anti-Goat HRP

CCD Camera-Based Capillary Imaging

- 100 ms to 512 sec exposure times
- Up to picogram sensitivity (depending on the primary antibody sensitivity)

Capacity

- 13 or 25 capillaries per batch
- 5 to 8 µL of sample required per capillary

ExperimentDialysis[]

Static Dialysis

Beakers Available

- 250 mL, 600 mL, 1 L, and 2 L
- Incubation range 5 to 45°C (below ambient temperatures available for 250 mL beakers only)
- Buffer mixing available

Tube-Based Dialysis Kits

- 3.5k, 6 to 8k and 12 to 14k molecular weight cutoffs (MWCOs) available
- 10 µL to 20 mL sample volume range
- 4 to 60°C incubation range
- Up to 9 samples per batch

Dialysis Tubing

- 3.5k, 6 to 8k, and 12 to 14k MWCOs available
- 30 to 130 mL sample volume range
- Continuous buffer flow to increase separation efficiency
- 1 sample per batch

Equilibrium Dialysis

- 8 MWCO available
- 50 to 500 µL sample volume range
- 4 to 60°C incubation range
- Up to 48 samples per batch

TUBE BASED DIALYSIS KITS

DIALYSIS TUBING

EQUILIBRIUM DIALYSIS

Dynamic Dialysis

- 3.5k, 6k, and 12k MWCOs available
- 30 to 130 mL sample volume range
- Continuous buffer flow to increase separation efficiency
- > 90% protein recovery after dialysis
- 1 sample per batch

SPECTRAFLO LAB SYSTEM

ExperimentLiquidLiquidExtraction[]

Robotic Phase Separator Plate

- Separates aqueous and organic phases via hydrophobic frit (allows organic phase to drain into collection plate)
- Requires denser organic phase compared to the aqueous phase
- Up to 2 mL sample volume per well

ISOLUTE 96 WELL PHASE SEPARATOR PLATE

Robotic Pipette Extraction

- Removal of aqueous or organic phase via robotic pipettor
- Aqueous / Organic boundary layer approximated via solvent volumes added
- Up to 200 mL sample volume

HAMILTON STAR

ExperimentMagneticBeadSeparation[]

Magnetic Racks

Robotic Separation

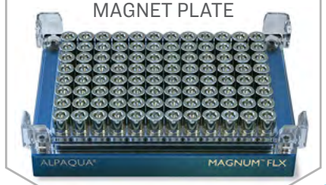
- Performed by a Hamilton liquid handler with the Alpaqua Magnum FLX magnet
- Sample volume constraints
  - 96-well plate magnet: up to 2 mL

Manual Separation

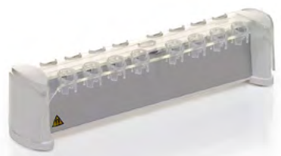
- Performed by an operator with the DynaMag magnets
- Sample volume constraints
  - 96-well plate magnet: up to 0.2 mL
  - 2 mL tube magnet: up to 2 mL
  - 15 mL tube magnet: up to 15 mL
  - 50 mL tube magnet: up to 50 mL

HAMILTON STAR

ALPAQUA MAGNUM FLX ENHANCED UNIVERSAL MAGNET PLATE



DYNAMAG-2 MAGNET

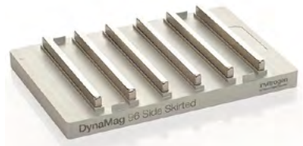


DYNAMAG-15 MAGNET

DYNAMAG-50 MAGNET

DYNAMAG-96 SIDE MAGNET

DYNAMAG-96 SIDE SKIRTED MAGNET



SPECTROSCOPY

ExperimentNMR[]
ExperimentNMR2D[]

500 MHz NMR

11.74 T Magnet

- 500 MHz for ^{1}H
- 126 MHz for ^{13}C
- 202 MHz for ^{31}P
- 470 MHz for ^{19}F

Probe

- SmartProbe $^{1}H/^{19}F/^{13}C/^{31}P$ 5 mm probe (-150°C to 150°C)
- Inverse Triple Resonance (TXI) $^{1}H/^{13}C/^{19}N$ 5 mm probe (-150°C to 150°C)

Autosampler

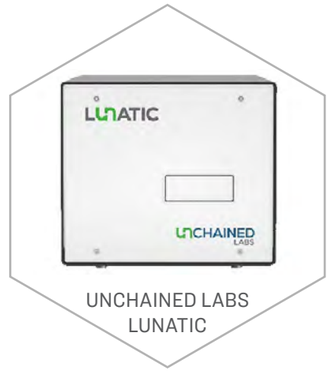
- 6 to 51°C incubation temperature
- 480 NMR tubes per batch
- Standard NMR tubes hold 600 µL to 1.5 mL
- Micro NMR tubes hold 40 µL

2D Experiment Types

- Correlation spectroscopy (COSY)
- Double-quantum filtered COSY
- COSY featuring a 45 degree pulse
- Total correlation spectroscopy (TOCSY)
- Heteronuclear single quantum correlation spectroscopy (HSQC, 1H-13C or 1H-15N)
- Heteronuclear multiple quantum correlation spectroscopy (HMQC)
- Heteronuclear multiple-bond correlation spectroscopy (HMBC, 1H-13C or 1H-15N)
- HSQC-TOCSY (1H-13C)
- HMQC-TOCSY (1H-13C)
- Nuclear Overhauser effect spectroscopy (NOESY)
- Rotating-frame Overhauser effect spectroscopy (ROESY)

ExperimentAbsorbanceSpectroscopy[]

Microfluidic Spectrometer



UNCHAINED LABS
LUNATIC

Light Source

- Xenon flash lamp

Absorbance Detection

- 250 to 750 nm wavelength selection

Microfluidics

- Fixed path length (0.1 or 0.7 mm) allows for quantification
- Extremely low volumes required (2 µL)
- 96 samples per batch

ExperimentFluorescenceSpectroscopy[]
ExperimentLuminescenceSpectroscopy[]

Multimode Plate Reader w/ Monochromators


CLARIOstar

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 340 to 740 nm excitation monochromator

Emission

- High voltage PMT detector
- 340 to 740 nm emission monochromator
- Top or bottom of plate read mode

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 1,536 well) per batch

ExperimentFluorescencePolarization[]

Fluorescence Polarization Plate Reader


PHERAstar

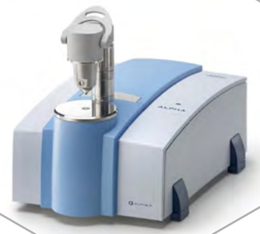
- Xenon flash lamp
- 1 to 100 flashes per well
- Dual high voltage PMT detectors
- 96-well and 384-well plate compatible
- Excitation Emission Filter Pairs
  - 485 nm, 520 nm
  - 540 nm, 590 nm
  - 625 nm, 675 nm
- Polarized Dual Simultaneous Emission Filters

ExperimentIRSpectroscopy[]

FTIR Spectrometer

- Deuterated TriGlycine Sulphate (DTGS) Detector
- 375 cm^{-1} to 7,500 cm^{-1} spectral range
- > 1,000:1 signal-to-noise ratio
- > 4 cm^{-1} spectral resolution
- Sample amounts from 20 to 70 µL or 20 to 70 mg required

BRUKER ALPHA



ExperimentRamanSpectroscopy[]

Terahertz Raman Spectrometer

- -10 to -800 cm^{-1} anti-Stokes spectral range
- 10 to 2,800 cm^{-1} Stokes spectral range
- > 4 cm^{-1} spectral resolution
- Solids, liquids, and tablets analyzed

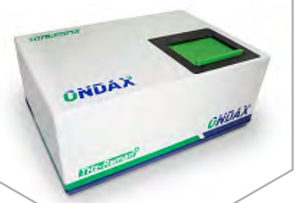
Optics

- 2, 4, 10, and 20x objective magnification or FloodLight for broad spot size
- Auto or manual focusing
- 785 nm laser wavelength
- 400 mW maximum laser power at sample

Sampling Patterns

- User definable sampling routines for intra-well measurements
  - Spiral
  - Filled spiral
  - Filled square
  - Grid
  - Rings
  - Coordinates
  - Single point

ONDAX TR-WPS-785



ExperimentDynamicLightScattering[]

Multimode Spectrophotometer

Multimode Spectrophotometer

- Measurement in sealed quartz capillaries requires only 9 µL of sample
- Measure up to 48 samples in one experiment
- Measurable parameters include: Z-average diameter, polydispersity, isothermal stability (including B22, kD, and G22)

Dynamic Light Scattering

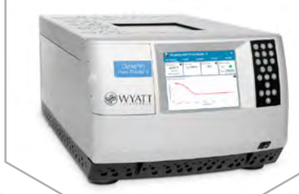
- 660 nm laser
- Avalanche photodiode module scattered light detector
- 0.3 to 1000 nm hydrodynamic radius range
- < 0.1 polydispersity
- 0.05 mg/mL minimum sample concentration
- 192 Da to 25 MDa molecular weight range

Thermodynamics

- Self-contained water-free temperature control system from 15 to 95ºC
- TEC heating/cooling plate temperature control accuracy 1ºC (at < 70ºC) and 1.5ºC (at > 70ºC)

UNCHAINED LABS UNCLE

WYATT DYNAPRO PLATE READER III



DLS Plate Reader

DLS Plate Reader

- Measurement in standard well plates, requires min. 25 µL of sample
- Measure up to 96 or 384 samples in one experiment
- Acquire images of samples in well plates
- Measurable parameters include: Z-average diameter, polydispersity, isothermal stability (including B22, kD, G22), molecular weight, aggregation temperature, melting temperature

Dynamic Light Scattering/Static Light Scattering

- 830 nm laser
- Linearized avalanche photodiode module scattered light detector, enables both dynamic and static light scattering
- 0.5 to 1000 nm hydrodynamic radius range
- 0.125 mg/mL minimum sample concentration for dynamic light scattering
- 1000 Da to 1 MDa molecular weight range for static light scattering

Thermodynamics

- Self-contained water-free temperature control system from 4 to 85ºC
- TEC heating/cooling plate temperature control accuracy 0.5ºC (at < 50ºC) and 1.0ºC (at > 50ºC)

```
ExperimentAbsorbanceKinetics[]
ExperimentFluorescenceKinetics[]
ExperimentLuminesceneKinetics[]
ExperimentFluorescencePolarizationKinetics[]
```

All Readers

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 1,536 well) per batch

Sample Injection

- 2x 500 µL injection syringes per batch
- 50 µL dead volumes, 0.5 µL precision
- 25 mL/min maximum injection speed
- 2 mL microcentrifuge tubes, 15 mL conical tubes, or 50 mL conical tube sources

Multimode Plate Reader w/ Monochromators

- 96-well plate compatible

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 340 to 740 nm excitation monochromator
- 680 nm laser (AlphaScreen)

Emission

- High voltage PMT detector
- 340 to 740 nm emission monochromator
- Top or bottom of plate read mode

CLARIOSTAR

PHERASTAR

FLUOSTAR OMEGA

Multimode Plate Reader w/ Filters

- 96-well plate compatible

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 355 nm, 410 nm, 485 nm, 544 nm, 584 nm, 650 nm, or 700 nm fixed wavelength excitation filters (5 nm bandpass)

Emission

- High voltage PMT detector
- 420 nm, 460 nm, 520 nm, 590 nm, 620 nm, or 750 nm fixed wavelength emission filters (5 nm bandpass)
- Top or bottom of plate read mode

Fluorescence Polarization Plate Reader

Sample Injection

- 2x 500 µL injection syringes per batch
- 50 µL dead volumes, 0.5 µL precision
- 25 mL/min maximum injection speed
- 2 mL microcentrifuge tubes, 15 mL conical tubes, or 50 mL conical tube sources

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 1,536-well) per batch

Optics

- Xenon flash lamp
- 1 to 100 flashes per well
- High voltage PMT detector
- Top or bottom read mode

Polarization Filters

- Excitation (vertical), Emission (vertical), Emission (horizontal)
  - 485 nm, 520 nm, 520 nm
  - 540 nm, 590 nm, 590 nm
  - 625 nm, 675 nm, 675 nm

ExperimentNephelometry[]
ExperimentNephelometryKinetics[]

Nephelometer

Sample Injection

- 2x 500 µL injection syringes
- 440 µL/s maximum injection speed

Sample Chamber

- Room temperature to 65°C incubation
- Actively regulates O2 and CO2 to 0.1-20%
- Mix by shaking before read options

Optics

- 635 ± 10nm 1mW self-monitoring laser diode
- 1.5 to 3.5 mm selectable beam width
- Side window photodiode detector
- Detects up to 80° full cone angle

NEPHELOSTAR PLUS

ExperimentCircularDichroism[]

Circular Dichroism Plate Reader

- Dual gratings monochromator
- 185 to 880 nm wavelength range (2 nm resolution)
- 96 well plate format
- 2 minute read time for plate (single wavelength)
- 1 hour read time for plate (full spectrum)
- 0.5 L nitrogen gas/min purge
- 45 µL sample volume

EKKO CD MICROPLATE READER

MASS SPECTROMETRY

ExperimentMassSpectrometry[]

ESI-QToF Mass Spectrometer

- High resolution, high mass accuracy mass spectrometer
- Conventional full-scan MS and MS/MS methods, data-dependent acquisition (DDA), as well as MS(E)

Electrospray Ionization (ESI) Ion Source

- 50 to 4,000 V ESI capillary voltage
- 1 to 200 V sampling cone voltage
- 60 to 18,000 L/hr cone gas flow rate
- 60 to 72,000 L/hr desolvation gas flow rate

Quadrupole, Time of Flight (QToF) Mass Analyzer

- 20 to 100,000 m/z ToF mass range
- 20 to 16,000 m/z quadrupole mass range
- 1 ppm RMS accuracy
- 22,500 FWHM mass resolution
- 2.46 kV (-1.8 kV grid) dual stage reflectron
- 25.2 µPa high vacuum pressure ToF Tube
- 350 V ion guide electrostatic lens
- Up to 30 spectra per second

Collision Cell

- 0 to 255 V collision cell voltage
- Argon collision cell gas
- 42.6 mPa high vacuum pressure collision cell

Sample Constraints

- Direct injection
  - Sample volume range: 0.5 to 30 mL
  - 2 mL HPLC vials or 30 mL reservoir bottles
  - Maximum of 20 samples per batch
- Autosampler-aided direct infusion
  - 75 µL sample loop for analytical flow, 10 µL for micro/nano flow
  - Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

WATERS
XEVO G2-XS
QTOF

ESI-QQQ Mass Spectrometer

- Standard triple quadrupole functions like MRM, precursor, neutral loss, and product ion scan
- QTRAP functionality allows for MS3 (MS/MS/MS)
- Enhanced scanning modes possible such as enhanced mass scans (EMS), enhanced resolution scans (ER), and enhanced product ion scans (EPI)
- 6 orders of magnitude dynamic range

Electrospray Ionization (ESI) Ion Source

- IonDrive Turbo V Ionization Source (NanoSource optional)
- 5 msec polarity switching in MRM and scheduled MRM modes
- Up to 4,500 V ion spray voltage
- Up to 750°C ion source temperature

Coupled LC system

- Waters Acquity UPLC I-Class System

Triple Quadrupole Mass Analyzer

- 20,000 Da/s scan speed and full scan linear ion trap sensitivity
- 5 to 2,000 m/z triple quadrupole mass range
- 50 to 2,000 m/z linear ion trap mass range
- Dual stage IonDrive QJet ion guide (non-funnel)
- Nitrogen collision cell for fragmentation
- Low, unit, and high resolution for Q1 and Q3

AB SCIEX
QTRAP 6500+

MALDI-ToF Mass Spectrometer

- Mass resolution up to 2,000 (at m/z of 1,500)
- Sensitivity down to 500 fmol BSA (66 kDa) with < 50 S/N
- Mass accuracy of < 30 ppm (internal calibration)
- Negative or positive ion modes
- Up to 500 kDa mass range

Laser Ionization Source

- 337 nm wavelength
- 60 Hz laser frequency
- 3 ns pulse width
- 9 mW power
- 1 to 1,000 shots per well

Time of Flight (ToF) Mass Analyzer

- 75 cm length ToF tube
- 2 µBar high vacuum
- Up to 20 kV accelerating voltage
- Up to 20 kV grid voltage
- 0.05 to 10 kV electrostatic lens voltage
- Up to 5,000 ns delay time

Sample Constraints

- Up to 2 µL of sample per well
- Up to 2 µL of calibrant per well
- 96 wells per experiment

`ExperimentICPMS[]`

ICP Mass Spectrometer

Sample Introduction

- Makeup solvent available
- Microwave digestion available
- Nebulizer spray chamber

Mass Analyzer

- 4.6 to 245 m/z Quadrupole mass range
- 0.3 to 1 m/z mass resolution
- Up to 10,000 scans per second

Sample Constraints

- Up to 15 mL injection volume
- Accommodates two types of sample vials
  - 15 mL vials: up to 60
  - 50 mL vials: up to 8

ExperimentLCMS[]

Liquid Chromatography Mass Spectrometer

Liquid Chromatography

- Analytical HPLC
  - 0.1 to 2.2 mL/min flow rate
  - 0.01 inch inner diameter PEEK system tubing
  - Up to 7,000 PSI operating pressure
  - In-line degasser
  - Photo diode array detector
    - 190 to 500 nm absorbance
    - 0.5 µL volume
  - 5 to 90°C (± 0.1°C) column compartment temperature range
  - Up to two columns connected in series up to 300 mm maximum in length (15 mm maximum outer diameter)**Mass Spectrometry**
- Analytical QToF
  - High resolution, high mass accuracy mass spectrometer
  - Conventional full-scan MS and MS/MS methods, data-dependent acquisition (DDA), as well as MS(E) acquisition modes
  - 20 to 100,000 m/z ToF mass range
  - 20 to 16,000 m/z quadrupole mass range
  - 22,500 FWHM mass resolution
  - 1 ppm RMS accuracy
  - Up to 30 spectra per second

- Analytical QQQ
  - Performs standard triple quadrupole functions like MRM, precursor, neutral loss, and product ion scan
  - Enhanced scanning modes possible such as MS3, enhanced mass scans (EMS), enhanced resolution scans (ER), and enhanced product ion scans (EPI)
  - 5 to 2,000 m/z triple quadrupole mass range
  - 50 to 2,000 m/z linear ion trap mass range
  - 6 orders of magnitude dynamic range
  - 5 msec polarity switching in MRM and scheduled MRM modes
  - 20,000 Da/s scan speed
  - Full scan linear ion trap sensitivity

Sample Constraints

- 75 µL sample loop for analytical LC, 10 µL sample loop for micro/nano LC
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

ExperimentGCMS[]

Gas Chromatography Mass Spectrometer

AGILENT 8890
GC SYSTEM WITH
5977B MSD

Flow System

- He carrier gas available
- Inlets available:
  - Split/Splitless capillary column inlet
  - Multimode temperature-programmable capillary column inlet
- Column head pressure up to 100 PSIG

Column Oven

- Temperature range: 30 to 450ºC
- Up to 120ºC/min temperature ramp
- Up to 2 capillary columns
- 0.53 mm maximum column inner diameter

Split/Splitless Capillary Inlet

- Suitable for capillary columns up to 0.53 mm inner diameter
- Split ratio up to 7,500:1 to prevent column overload
- Up to 1,250 mL/min total flow of He
- Inlet temperature 30 to 400ºC

Multimode Capillary Inlet

- Suitable for capillary columns up to 0.53 mm inner diameter
- Split ratio up to 7,500:1 to prevent column overload
- Up to 1,250 mL/min total flow of He
- Inlet temperature 30 to 400ºC
- Temperature programmable with ramp rates up to 900ºC/min

Mass Spectrometry

- Single quadrupole mass spectrometer
- 1.6 to 1,050 m/z mass range
- 100 to 200ºC quadrupole temperature
- 100 to 300ºC ion source temperature
- 100 to 350ºC transfer line temperature
- Scan speeds up to 12,500 m/z per second
- Electron ionization:
  - Dual filaments
- Chemical ionization:
  - Single filament
  - Methane reagent gas
  - Positive and negative mode

Autosampler Rail System

- Vortex mixing up to 2,000 RPM
- Sample incubation 30 to 200ºC
- Liquid, headspace, and solid-phase microextraction sample preparation available
- 0.01 to 100 µL injection volumes for liquid injection
- 25 to 2,500 µL injection volumes for headspace injection
- Headspace syringe heating 40 to 150ºC

ExperimentSupercriticalFluidChromatography[]

Supercritical Fluid Chromatography Instrument with Quadrupole Mass Spec

WATERS
UPC2
SYSTEM

Quaternary Pump

- Up to 4 cosolvent solutions
- 0.1 to 3.3 mL/min flow rate
- 10,000 PSI maximum pressure
- In-line degasser
- Titanium pump casing with sapphire pump heads
- 250 mL to 1 L cosolvent source bottles

Convergence Manager

- 2,000 to 6,000 PSI range for adjustable back pressure

Makeup Solvent Manager

- Up to 1 mL/min flow rate for makeup solvent

Detectors

- Pump pressure sensor
- Column temperature sensor
- Absorbance diode array detector
  - Deuterium lamp
  - Up to 80 points/second sampling rate
  - 190 to 800 nm absorbance detection (1.2 nm resolution)
  - Quartz flow cell
    - 10 mm pathlength
    - 1 µL volume
    - 1,000 PSI maximum pressure
- Mass spectrometer detector
  - Single quadrupole
  - Electrospray ionization (both positive and negative)
  - 50 to 1,200 m/z quadrupole mass range
  - 50 ms scan time per spectra
  - 25 to 150°C probe temperature range
  - 120°C source temperature
  - 0.3 to 1.5 kV capillary voltage
  - 0.1 to 100 V sampling cone voltage

Column Selector

- 20 to 90°C (± 0.1°C) incubation
- Up to 8 columns, switchable using valves
- 300 mm maximum column length
- 15 mm maximum column outer diameter

Sample Constraints

- 50 µL sample loop
- 250 µL autosampler syringe
- Sample chamber temperature controlled from 5 to 40°C (± 3°C)
- Up to 48x HPLC/CE vials or 2x SBS style deep well plates per batch

BIOASSAYS

ExperimentELISA[]

Robotic ELISA Device

Detection

- Absorbance
  - CCD detector
  - 220 to 1,000 nm wavelength selection
- Excitation
  - Xenon flash lamp
  - 1 to 100 flashes per well
  - 320 to 740 nm excitation monochromator
- Emission
  - High voltage PMT detector
  - 320 to 850 nm emission monochromator

Incubation

- 4 to 50ºC temperature control
- Shaking 0 to 2,500 RPM

Washing

- 8-channel or 96-channel washer
- Up to 4 buffers switching

NIMBUS ELISA SYSTEM

HAMILTON STAR W/PLATEWASHER

ExperimentCapillaryELISA[]

Capillary ELISA Device

- All incubation, washing, and detection steps are automated
- 72 samples with 1 analytes, or 32 samples with up to 8 analytes
- Built-in duplicate or triplicate measurement per sample
- 25 µL volume required per sample
- 4 to 5 logs of dynamic range
- 75 minute run time

PROTEIN SIMPLE ELLA

ExperimentqPCR[]

qPCR Thermocycler

Excitation Filters

- 470 nm (15 nm bandwidth)
- 520 nm (10 nm bandwidth)
- 550 nm (10 nm bandwidth)
- 580 nm (10 nm bandwidth)
- 640 nm (10 nm bandwidth)
- 662 nm (10 nm bandwidth)

Emission Filters

- 520 nm (15 nm bandwidth)
- 558 nm (12 nm bandwidth)
- 587 nm (10 nm bandwidth)
- 623 nm (14 nm bandwidth)
- 682 nm (14 nm bandwidth)
- 711 nm (12 nm bandwidth)

Halogen Lamp Reaction Conditions

- 4 to 100°C temperature range
- 204°C/min maximum temperature ramp rate
- Programmable thermal cycle program (up to 100 cycles)
- Reactions in 384-well plates or array cards

THERMO FISHER
VIIA 7

ExperimentBioLayerInterferometry[]

Bio-Layer Interferometer (BLI)

Instrument Details

- 8 parallel channels per read
- Sample temperature range: 15 to 40°C
- Orbital flow capacity: Static or 100 to 1,500 RPM
- Uses commercially available bio-probes
- Baseline noise: < 3 pm

Experiment Types

- Kinetics
  - Measure association and dissociation rates
  - Up to 12 samples per plate
- Quantitation
  - Measure analyte concentration
  - Up to 96 samples per plate
- Epitope binning/cross-blocking
  - Determine modes of interaction through analyte competition
  - Up to 8 samples per plate

Detection Range

- Analyte molecular weight: > 150 Da
- Affinity range: 1 mM to 10 pM
- Association rate range: 10^{1} to 10^{7} M^{-1} s^{-1}
- Dissociation rate range: 10^{-6} to 10^{-1} s^{-1}

Sample Constraints

- Sample input format: 96-well
- Minimum sample volume: 180 µL
- Recoverable samples/non-destructive analysis
- Sample types:
  - Proteins/Peptides
  - Small molecules/Fragments
  - Oligonucleotides/DNA/RNA
  - Virus-like particles
  - Antibodies
  - Serum containing media
  - DMSO containing buffers
  - Crude cell lysates

OCTET
RED96E

ExperimentDigitalPCR[]

Digital PCR System

- Up to 480 samples per run
- Absolute quantification of DNA/RNA targets
- Dynamic range: 0.25 to 5,000 targets per µL sample
- Multiplexing with 4 detection channels per sample
- Multiplex up to 8 targets per sample with amplitude multiplexing

Sample Constraints

- 20 µL sample volume
- 96-well plate format
- Fluorescent probe-based detection

Droplet Generation

- In-plate microfluidics for droplet formation
- Up to 20,000 nanoliter-sized droplets per sample
- Droplet generation for 16 wells in parallel

Thermocycling

- 100°C maximum temperature
- 150°C/min maximum temperature ramp rate
- Programmable temperature gradient over columns
- Programmable thermal cycling (Up to 99 cycles)

Droplet Reading

- Sample illumination: LED
  - 505 nm (30 nm bandwidth)
  - 622 nm (15 nm bandwidth)
- Detector: Multi-pixel Photon Counter
- Emission filters
  - 538 nm (25 nm bandwidth)
  - 572 nm (40 nm bandwidth)
  - 662 nm (40 nm bandwidth)
  - 720 nm (60 nm bandwidth)

QX ONE
DROPLET DIGITAL
PCR SYSTEM

ExperimentWestern[]
ExperimentTotalProteinDetection[]

Capillary Western Blot System

Capillary Gel Electrophoresis

- 2 to 440 kDa molecular weight range
- 0 to 500 V separation voltage
- UV capillary crosslinking for protein immobilization

Secondary Antibodies Available

- Secondary Antibodies Available
  - Goat Anti-Rabbit HRP
  - Goat Anti-Mouse HRP
  - Goat Anti-Human IgG HRP
  - Donkey Anti-Goat HRP

CCD Camera-Based Capillary Imaging

- 100 ms to 512 sec exposure times
- Up to picogram sensitivity (depending on the primary antibody sensitivity)

Capacity

- 13 or 25 capillaries per batch
- 5 to 8 µL of sample required per capillary

PROTEINSIMPLE
WES

ExperimentDNASequencing[]

Genetic Analyzer

- Accurate reads of DNA templates up to 900 base pairs by Sanger sequencing
- 10 to 100 µL volume
- 96-well plate format
- All-in-one capillary cartridge containing universal polymer, anode buffer, and capillaries for easy experimental set-up
- Run times returning high quality reads in as little as 30 minutes

SEQSTUDIO

ExperimentFragmentAnalysis[]

Multiplexed Capillary Electrophoresis System

- Automated parallel capillary electrophoresis for high throughput and reliable quality control of nucleic acid samples
- Qualitative and quantitative analysis, including DQN and RQN analysis
- Wide size range
  - 1 to 20,000 bp range for DNA samples
  - 15 to 6,000 nt range for RNA samples
- Customizable template Analysis Methods optimized based on sample properties

Capillary Array

- 96-capillary array bundle
- Versatile short capillary array (33 cm)

Sample Constraints

- Up to 96 samples in a 96-well plate format
- 2 µL sample volume
- High sensitivity range
  - Standard (ng/µL)
  - High (pg/µL)

ExperimentDifferentialScanningCalorimetry[]

Differential Scanning Calorimeter

- Capillary based liquid sample cells
- 500 to 700 µL sample and reference cell volume
- 10°C per hour to 300°C per hour temperature scan rate
- 1°C minimum temperature to 140°C maximum temperature (± 0.1°C precision)
- 1.25 µCal/°C energy repeatability

Autosampler

- Sample incubation at 4 to 40°C
- 6x SBS plates per batch

ExperimentUVMelting[]

UV/Vis Spectrometer with Thermal Controller

- Simultaneously scan a full wavelength range, on 8 channels, in less than a second
- Each pair of cuvettes can be held at a different temperature: Perform 4 different temperature experiments at the same time
- Simultaneously measure standards, samples, and controls under exactly the same conditions
- Measurement modules do not contain any moving parts (permanent optical alignment)

Absorbance Detection

- Photometric system: Double beam with rear beam access
- Long-life xenon flashlamp source
- 250 points per second data collection rate
- 190 to 1,100 nm wavelength range (limiting resolution 0.1 nm, wavelength accuracy ± 0.2 nm)
- 150,000 nm/min maximum scan rate
- Tightly-controlled beam geometry (< 1.5 mm at sample interface)
- Silicon photodiode detectors for simultaneous measurement of all channels
- 8 cuvette positions can be measured simultaneously

Thermodynamics

- Temperature control system is self-contained, integrated, and air-cooled
- Water-free temperature cycling from 0 to 110°C
- Peltier block probe ± 0.5°C temperature accuracy
- Sample probe ± 0.25ºC temperature accuracy
- < ± 0.15°C cell to cell variation
- Maximum ramp rate 40°C/min
- Minimum ramp rate 0.1°C/min
- 1, 2, or 4 independently controlled temperature zones

ExperimentThermalShift[]

qPCR Thermocycler

THERMO FISHER
VIIA 7

Excitation Filters

- 470 nm (15 nm bandwidth)
- 520 nm (10 nm bandwidth)
- 550 nm (10 nm bandwidth)
- 580 nm (10 nm bandwidth)
- 640 nm (10 nm bandwidth)
- 662 nm (10 nm bandwidth)

Emission Filters

- 520 nm (15 nm bandwidth)
- 558 nm (12 nm bandwidth)
- 587 nm (10 nm bandwidth)
- 623 nm (14 nm bandwidth)
- 682 nm (14 nm bandwidth)
- 711 nm (12 nm bandwidth)

Halogen Lamp Reaction Conditions

- 4 to 100°C temperature range
- 204°C/min maximum temperature ramp rate
- Programmable thermal cycle program (up to 100 cycles)
- Reactions in 384-well plates

Multimode Spectrophotometer

- Simultaneously measure fluorescence spectra and static light scattering of samples enabling assessment of melting point and aggregation point
- Measurement in sealed quartz capillaries requires only 9 µL of sample
- Measure up to 48 samples in one experiment including standards, samples, and controls

Fluorescence and Static Light Scattering Detection

- 266 nm and 473 nm laser light sources with neutral density filtering available
- CCD spectrometer at full 250 to 750 nm spectral range simultaneously detects fluorescence emission spectra and static light scattering intensity at 266 nm and 473 nm
- Melting point precision < 2% CV
- Static light scattering resolution can detect ~15 kDa change in mean molecular mass

Thermodynamics

- Temperature control system is self-contained
- Water-free temperature cycling from 15 to 95ºC
- TEC heating/cooling plate temperature control accuracy 1ºC (at < 70ºC) and 1.5ºC (at > 70ºC)
- Maximum ramp rate 10ºC/min
- Minimum ramp rate 0.1ºC/min

ExperimentTotalProteinQuantification[]

Total Protein Quantification

- Absorbance- and fluorescence-based assays
- Customizable excitation and quantification wavelengths
- Protein quantification between 0.025 and 2 mg/mL
- Between 5 and 25 µL of sample required
- Bovine serum albumin or bovine gamma globulin standards

Instrumentation

- Reagent preparation, plate loading, and mixing performed on Hamilton liquid handler
- Absorbance measured on FLUOstar Omega plate reader
- Fluorescence measured on CLARIOstar plate reader

HAMILTON STAR

CLARIOSTAR

FLUOSTAR OMEGA

ExperimentAlphaScreen[]

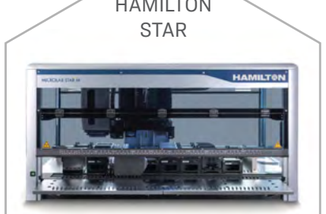
Amplified Luminescent Proximity Homogenous Assay Screen (AlphaScreen)

- Bead-based assay
- AlphaScreen laser and filter sets
- Selection of beads with a variety of affinity tags
- Support 96- or 384-well plate format
- 10 to 160 µL assay volume

Assays Available

- Screen Optimization
- Interaction Characterization
- Interaction Inhibitor Screen
- Interaction Inhibitor Dose Response
- Enzyme Activity Characterization
- Enzyme Inhibitor Screen
- Enzyme Inhibitor Dose Response
- Linker Screen
- Sample Quantification

HAMILTON STAR



CLARIOSTAR

ExperimentBioconjugation[]

Bioconjugation

- Low-volume chemical linking of biomolecules including microbeads, oligomers, proteins, and antibodies
- Utilizes all available solid transfer, liquid transfer, and mixing instrumentation
- Biomolecule activation can be specified prior to conjugation
- Reaction quenching can be specified after conjugation
- Product workup including pelleting and filtering can be specified after conjugation

CRYSTALLOGRAPHY

ExperimentPowderXRD[]
ExperimentSingleCrystalXRD[]

Cryo X-Ray Diffractometer

X-Ray Generation

- Copper rotating anode source
- 1,200 W X-ray beam (1.5406 Å wavelength)

Detection

- Hybrid Photon Counting detector
- Detector distance from X-ray source controllable from 30 to 180 mm
- Detector rotation relative to X-ray source controllable from -50 to +81 degrees

Sampling

- Powder sampling in X-ray transparent plate
  - Up to 96 samples per batch
  - Sample rotation relative to X-ray source controllable from -17 to +17 degrees
  - Rotation of sample and detector during data collection
- Powder and single-crystal sampling on loop
  - Temperature range from -190 to 126ºC
  - Rotation of detector and sample along multiple axes during data collection

ExperimentGrowCrystal[]

Liquid Handler

- Proficient in automated setup of precise nanoliter-scale and microliter-scale crystallization conditions
- Compatible with a wide variety of SBS format crystallization plates, up to 576 unique crystallization conditions per plate
- Compatible with Vapor Diffusion and Microbatch techniques

Crystal Incubator with built-in Imager

- Capable of storing and monitoring 190 SBS format plates
- Precise temperature control
- Capable of multiple Imaging Modes: Visible Light Imaging, Cross Polarized Imaging, UV imaging
- Capable of auto focusing and focus stacking

SAMPLE PREPARATION

```
ExperimentMix[]
ExperimentIncubate[]
```

Overhead Mixer

- Stainless IKA steel stirrers
- 50 to 1,000 RPM stir rate
- Available for 100 mL glass bottles to 20 L carboys volume ranges
- Room temperature (22°C ± 0.45°C (1 sigma)) to 500ºC temperature control
- -10ºC to room temperature control

Vortex

Tube

- 600 to 3,200 RPM
- Available for 1 to 50 mL volume ranges
- Holds 6x 50 mL tube, 12x microcentrifuge tube, 6x 15 mL tube
- Holds 4x 50 mL tubes, 4x 15 mL tubes
- Holds 4x 100 mL glass bottles

Microplate

- 100 to 3,200 RPM
- Holds 4x microplates
- Room temperature (22ºC) to 70ºC in 0.1ºC increments
- Heated lid to prevent condensation

Tube & Microplate

- -20 to 100ºC in 1ºC increments
- 200 to 1000 RPM in 100 RPM increments
- Holds 1x microplate
- Holds 24x 2 mL tubes
- Holds 6x 50 mL tubes

MINISTAR 40

IKA C-MAG HS 10

AHP-1200CPV

BENCHMARK INCU-MIXER MP

VORTEX GENIUE 2

MULTI-MICROPLATE GENIE

TORREY PINES ECHOTHERM ORBITAL MIXING CHILLING/ HEATING DRY BATH SC20XT

Rollers

Tube Roller

- 1 to 80 RPM roller rate
- 22ºC (room temperature) to 75ºC
- Available for
  - 2 mL, 15 mL, and 50 mL tubes
  - 10 L and 20 L carboys
  - 1 L, 2 L, and 5 L bottles

Drum Roller

- 40 RPM stir rate
- Available for 5 to 10 L carboys

Medium Bottle Roller

- 5 to 80 RPM stir rate
- Available for 100 mL to 2 L bottles

Acoustic Mixer

- Mixing and processing any combination of
  - Solutions with difficult solubility
  - Viscous solutions
  - Slurry materials
  - Solids/powder mixing
- Height-adjustable holder accepts many vessel types
  - Available for 2 mL tubes to 250 mL bottles
- Up to 1,000 gram maximum loading (including vessel)
- Mixing force from 0 to 100 Gs

ENVIRO GENIE

ROLLER 6 DIGITAL

MORSE DRUM ROLLER

LABRAM II

Hot Plate

- 22ºC (room temperature) to 500ºC
- Available for 100 mL glass bottle to 20 L carboy volume ranges

C-MAG HS 7 HOT PLATE

Heat Bath

Heating

- 22ºC (room temperature) to 150°C
- Container capacity per batch
  - 150x microcentrifuge tubes
  - 2x SBS plates
  - 12x 15 mL tubes
  - 5x 50 mL tubes
  - 2x 250 mL bottles
  - 2x 500 mL bottles

Cooling

- 22ºC (room temperature) to -20°C
- Container capacity per batch
  - 340x microcentrifuge tubes
  - 2x SBS plates
  - 30x 15 mL tubes
  - 16x 50 mL tubes
  - 4x 250 mL bottles
  - 2x 500 mL bottles

THERMAL-LOK 2510-1104

AHP-1200CPV

Heater Shaker

- 35 to 1,000 RPM shake rate
- Available for 1 mL to 1 L volume ranges
- 22ºC (room temperature ± 0.45°C (1 sigma)) to 75ºC temperature control

GENIE TEMP-SHAKER 300

Water Bath

- Room temperature to 100ºC in 0.1ºC increments
- Temperature accuracy of 0.24ºC
- Available for 2 mL tubes to 250 mL glass bottles

COLE-PARMER STABLETEMP DIGITAL UTILITY WATER BATHS

Bath Sonicator

- 40 kHz frequency
- 0 to 65ºC water bath
- Delivers unwavering cavitation
- Available for 2 mL to 5 L volume ranges
- High-temp safety alarm indicator
- High/low power control for normal to delicate applications
- Tabletop cleaner

BRANSON 1510

BRANSON 3800

Homogenizer

- 550 W at 20 kHz
- 22ºC (room temperature) to 100ºC temperature control
- 2 to 100ºC temperature control
- Available for 0.2 to 1,000 mL volume ranges
- Specialized accessories/tools to meet application requirements: 3 different horn/tip types allow us to process samples from 0.2 to 1,000 mL

BRANSON SFX550

Plate Sonicator

- Up to 700 watts power
- Can mix and perform cell lysis
- Holds 1x microplate
- Temperature range 5 to 45°C with recirculating chiller
- Pulse widths adjustable from 1 second to 24 hours

QSONICA 700

Cell Disruptor

- Available for 1.5 mL and 2 mL tubes
- 1,000 to 3,000 RPM
- 0.1 mm or 0.5 mm disruptor beads
- 1 to 75ºC

SCIENTIFIC INDUSTRIES DISRUPTOR GENIE

Automated Thermal Cycler

- Temperature accuracy: ± 0.25°C (between 35.0 and 99.9°C)
- Max block ramp rate: 3.5°C/sec
- Max sample ramp rate: 1.8°C/sec
- Temperature range: 4 to 105°C
- Temperature uniformity: ± 0.50°C (20 sec after reaching 95°C)

Sample Constraints

- Plate format: 96-well PCR plate
- Sample volume: 10 to 100 µL

AUTOMATED THERMAL CYCLER

Wrist Action Shaker

- 10 lb max load
- 385 oscillations per minute
- Up to 8x 250 mL flasks or smaller vessels

BURRELL SCIENTIFIC WRIST ACTION SHAKER

Nutator

- 2 to 60 RPM
- Available for 2 mL, 15 mL, 50 mL tubes, microplates, culture flasks, and dishes
- 5 to 40ºC

FISHERBRAND™ NUTATING MIXERS

PRECISION™ LOW TEMP BOD REFRIGERATED INCUBATOR

ExperimentCentrifuge[]

Microcentrifuge

- 10 to 14,800 RPM (16,166 g at Rmax)
- 36x tubes per batch
- Temperature range: -10 to 40ºC

Centrifuge

- 15 mL conical tubes
  - Up to 4,811 x g
  - Up to 56 tubes per batch
- 50 mL conical tubes
  - Up to 4,811 x g
  - Up to 16 tubes per batch
- SBS format plates
  - Up to 3,877 x g
  - Up to 24 regular plates per batch
  - Up to 8 deep well plates per batch
  - Up to 116 mm plate loading height
  - Temperature range: -10 to 40ºC
- Array cards
  - Up to 193 x g
  - Up to 12 array cards per batch
  - Temperature range: -10 to 40°C

BECKMAN COULTER MICROFUGE 16

BECKMAN COULTER MICROFUGE 20R

AVANTI J-15

EPPENDORF 5920R

SORVALL X4R PRO-MD

Ultracentrifuge

- Max rotation rate: 80,000 RPM
- Max force: 802,000 x g
- Speed control: ± 2 RPM of set speed (above 1,000 RPM)
- Max time: 999 hr 59 min
- Temperature control
  - Solid state refrigeration
  - Temperature range: 0 to 40°C in 1°C increment
- Rotors
  - Fixed-Angle Rotors
    - Type 45 Ti Titanium Rotor
      - 94 mL UltraClear tubes
      - Up to 45,000RPM
      - Up to 6 tubes per batch
    - Type 70 Ti Titanium Rotor
      - 32.4 mL OptiSeal tubes
      - Up to 70,000RPM
      - Up to 8 tubes per batch
    - Type 70.1 Ti Titanium Rotor
      - 8.9 mL OptiSeal tubes
      - Up to 70,000RPM
      - Up to 12 tubes per batch
  - Swing-Bucket Rotor
    - SW 32 Ti Rotor
    - 32.4 mL OptiSeal tubes
    - Up to 32,000RPM
    - Up to 6 tubes per batch

BECKMAN COULTER OPTIMA XPN 100K

`ExperimentPellet[]`

Microcentrifuge

- 10 to 14,800 RPM (16,166 g at Rmax)
- 36x tubes per batch
- Temperature range: -10 to 40ºC

Centrifuge

- 15 mL conical tubes
  - Up to 4,811 x g
  - Up to 56 tubes per batch
- 50 mL conical tubes
  - Up to 4,811 x g
  - Up to 16 tubes per batch
- SBS format plates
  - Up to 3,877 x g
  - Up to 24 regular plates per batch
  - Up to 8 deep well plates per batch
  - Up to 116 mm plate loading height
  - Temperature range: -10 to 40ºC

BECKMAN COULTER MICROFUGE 16

BECKMAN COULTER MICROFUGE 20R

AVANTI J-15

EPPENDORF 5920R

SAMPLE PREPARATION

Ultracentrifuge

- Max rotation rate: 80,000 RPM
- Max force: 802,000 x g
- Speed control: ± 2 RPM of set speed (above 1,000 RPM)
- Max time: 999 hr 59 min
- Temperature control
  - Solid state refrigeration
  - Temperature range: 0 to 40°C in 1°C increment
- Rotors
  - Fixed-Angle Rotors
    - Type 45 Ti Titanium Rotor
      - 94 mL UltraClear tubes
      - Up to 45,000RPM
      - Up to 6 tubes per batch
    - Type 70 Ti Titanium Rotor
      - 32.4 mL OptiSeal tubes
      - Up to 70,000RPM
      - Up to 8 tubes per batch
    - Type 70.1 Ti Titanium Rotor
      - 8.9 mL OptiSeal tubes
      - Up to 70,000RPM
      - Up to 12 tubes per batch
  - Swing-Bucket Rotor
    - SW 32 Ti Rotor
    - 32.4 mL OptiSeal tubes
    - Up to 32,000RPM
    - Up to 6 tubes per batch

BECKMAN COULTER OPTIMA XPN 100K

ExperimentFilter[]

Filter Membrane Housing with Peristaltic Pump

- 100 mL/min to 2.5 L/min peristaltic pump
- 4 to 20 L sample volume required

MDI MEMBRANE TECHNOLOGIES 142MM FILTER MEMBRANE HOUSING

Positive Pressure Filter

- 0 to 40 PSI independent pressure sources for each well
- Filter though SBS filter plates
- Collects in SBS deep well plates

VWR PP 3400

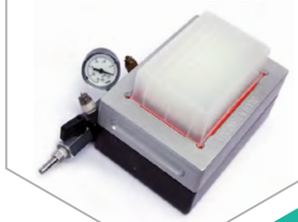
Filter Block with Vacuum Pump

- 26.4 inHg vacuum pressure
- 0.5 to 2 mL sample volume required

HAMILTON MPE2

WELCH 2030B-01

VACUUM MANIFOLD FOR 96 WELL PLATES



Filter Tops and Assemblies with Vacuum Pump

- 26.4 inHg vacuum pressure
- 50 mL to 1 L sample volume required

Centrifugal Filtration

- Concentrate proteins, DNA, or other macromolecules
- Molecular weight cut-off (MWCO): 3,000 to 100,000 Da
- 0.25 to 0.45 µm pore size
- 0.5 to 15 mL sample volume required

Syringe Filters

- 28 mL/min max flow rate
- 0.1 to 60 mL sample volume required

MILLIPORE SIGMA STERICUP AND STERITOP VACUUM FILTRATION

AMICON/ CENTRICON

SYRINGE FILTERS

NEW ERA PUMP SYSTEMS NE-1000 PROGRAMMABLE SYRINGE PUMP

ExperimentEvaporate[]

Rotovap

- ~1,000 mBar to ~10 mBar vacuum pressures
- 6.97 L water bath for 20 to 100°C incubation
- 300 RPM rotation
- 50 mL to 3 L round bottom flasks available for evaporation
- 2 L trap capacity
- -20°C recirculating condenser, with -105°C supplemental cold finger

Speedvac

Vacuum Centrifuge

- 5.1 Torr minimum pressure
- 5 available vacuum ramp rates between 5 Torr/min and 70 Torr/min
- Vacuum pump displacement of 36 L/min
- -50°C integrated cold trap
- Ambient or 35 to 80°C incubation in 5°C increments
- Sample constraints: 8x SBS style plates per batch

Genevac

- 375 mTorr minimum pressure
- -35°C integrated cold trap
- 2,150 RPM max rotation rate
- Ambient or 35 to 80°C incubation in 5°C increments
- Sample Constraints
  - 48x 2 mL microcentrifuge Tubes
  - 12x 15 mL conical Tubes
  - 12x 50 mL conical Tubes
  - 4x SBS style plates per batch

Needle Dryer

- 1x SBS style deep well plate per batch
- 96 stainless steel needles
- Adjustable needle height for precise gas flow delivery
- 25 to 100°C incubation range
- 25 L/min maximum nitrogen flow rate

IKA RV 10

THERMO FISHER SAVANT SPD2030

SP SCIENTIFIC EZ2-ELITE

VWR 099A EV9612S

Nitrogen Evaporator

- 48 nitrogen delivery nozzles
- 3.5 L/min maximum flow rate per nozzle
- 25 to 90°C bath temperature control range
- ± 2°C temperature accuracy
- Sample constraints:
  - 48x 2 mL tubes per batch
  - 48x 15 mL tubes or test tubes per batch
  - 24x 50 mL tubes per batch

BIOTAGE TURBOVAP LV

ExperimentLyophilize[]

Lyophilizer

- < 150 mTorr minimum pressure
- -55 to 60°C shelf temperature control range
- -85°C lowest condenser temperature
- Temperature uniformity of ± 1°C
- 4 L ice condensing capacity in 24 hours
- Sample constraints
  - 384x microcentrifuge tubes per batch
  - 8x SBS style plates per batch

SP SCIENTIFIC ADVANTAGE PRO EL

ExperimentAutoclave[]

Autoclave

- Chamber volume: 254 L
- Maximum temperature: 134°C
- Maximum pressure: 45 PSI
- Liquid and dry cycles available
- Programmable cycles (temperature, time)

BMT UNISTERI 559-1

ExperimentMicrowaveDigestion[]

Automated Microwave Digestion System

- Fully digest organic and inorganic samples for elemental analysis
- Up to 20 mL of prepared sample in digestion mixture in 80 mL reaction vessels
- Heat samples up to 300 Celsius and pressurize up to 500 PSI, with specified venting parameters
- Autosampler can load up to 24 samples in one run

CEM
DISCOVER SP-D 80

ExperimentFlashFreeze[]

Liquid Nitrogen Submersion

- Flash freezing samples in liquid nitrogen to -196ºC
- Available for up to 50 mL volumes
- Automated liquid nitrogen dispenser for easy dewar filling

WILMAD-LABGLASS
DEWAR FLASKS

ExperimentDesiccate[]

Desiccator

- Drying solid samples using a bell jar desiccator
- Solid or liquid desiccant
- Under vacuum or at atmospheric pressure

BEL-ART
SPACE SAVER
VACUUM DESICCATOR

ExperimentDegas[]

Freeze-Pump-Thaw Apparatus

- Flash freezing in liquid nitrogen
- Vacuum pump pressure: 1x10^{-4} Torr
- Water bath for thawing: 22ºC (room temperature) to 180ºC
- Headspace gas replacement using nitrogen, argon, or helium
- Available for up to 50 mL volume ranges

IKA HB DIGITAL WATER
BATH

WILMAD-LABGLASS
DEWAR FLASKS

SAVANT VP100
VACUUM PUMP

Sparging Apparatus

- Gas options
  - Nitrogen
  - Argon
  - Helium
- Glass gas dispersion tube
- Impeller stir bar
- Gas flow rate: between 20 to 100 mL/min
- Available for 50 mL to 4 L volume ranges

IKA VACSTAR
CONTROL

Vacuum Sonicate Apparatus

- Vacuum pump pressure: controllable between 1.5 to 770 Torr
- Sonicator: 40 KHz frequency, 2.5 gallon capacity
- Headspace gas replacement using nitrogen, argon, or helium
- Available for 10 mL to 3 L volume ranges

BRANSON
5800

ExperimentAdjustpH[]

Immersion pH Meters

- pH range 0 to 14 pH (± 0.02)
- 50 µL minimum sample size (consumes no volume)
- Measures and records pH over time
- Temperature correction

INLAB MICRO

INLAB REACH 225

METTLERTOLEDO SEVENEXCELLENCE

pH Titrators

- Minimum dispense volume 0.02 µL
- Base and acid solution can be added with remote control
- Allow pH measurements and overhead stirring performed at the same time

MICROLAB 600

ExperimentGrind[]

Ball Mill

- Mixer Mill MM400
  - Grinding rate of 180 to 1,800 RPM
  - 0.2 to 50 mL conical tubes or steel jars
  - Maximum feed fineness of 8 mm
  - Final fineness of 5 µm
- BeadBug3
  - Grinding rate of 2,800 to 4,000 RPM
  - 2 mL microcentrifuges
  - Maximum feed fineness of 1 to 2 mm
- Bead Genie
  - Grinding rate of 250 to 2,400 RPM
  - 1.5 to 50 mL conical tubes
  - Maximum feed fineness of 1 to 2 mm

Mortar Grinder

- Automated Mortar Grinder
  - Grinding rate of 20 to 90 RPM
  - 5” agate mortar (150 mL)
  - Maximum feed fineness of 2 mm

Knife Mill

- Tube Mill Control
  - Grinding rate of 5,000 to 25,000 RPM
  - Disposable 40 mL chambers
  - Maximum feed fineness of 10 mm
  - Final fineness of 1 to 100 µm

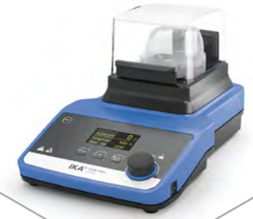
MIXER MILL MM400

BEADBUG3

BEAD GENIE

AUTOMATED MORTAR GRINDER

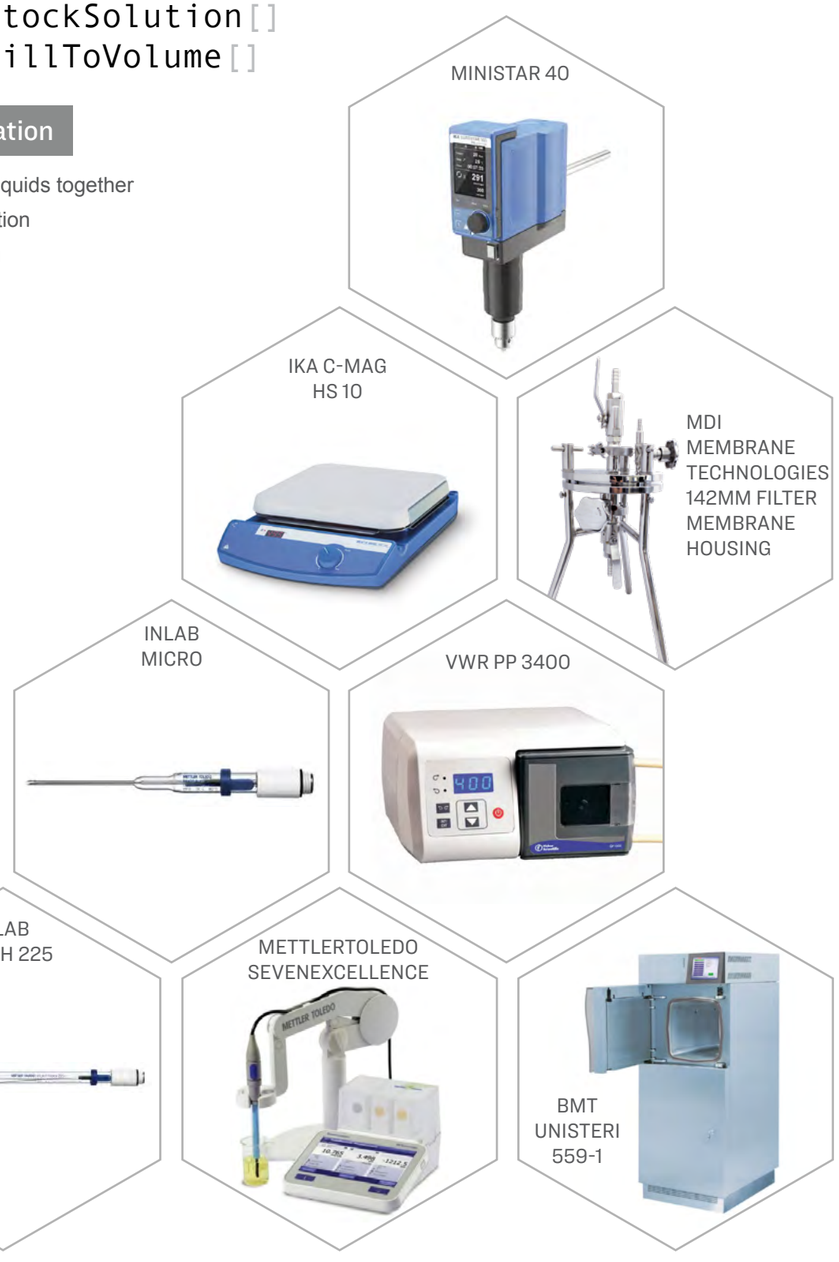
TUBE MILL CONTROL



ExperimentStockSolution[]
ExperimentFillToVolume[]

Solution Preparation

- Transfer solids and liquids together
- Mix and/or heat solution
- Adjust pH of solution
- Filter solution
- Autoclave solution



Volumetric Flasks

- Provides accurate volume measurements during liquid/slurry transfers
- Composed of borosilicate 3.3 expansion glass
- Volumetric Flasks
  - 25 mL
  - 100 mL
  - 250 mL
  - 500 mL
  - 1 L
  - 2 L glass

HANDLING ENVIRONMENT

Transfers procedures can be carried out in a variety of atmospheric environments.

`ExperimentTransfer[]`

Biosafety Cabinet

- Laminar flow rate of 105 ft/min
- Internal dimensions: 1.74 x 0.438 x 0.635 m
- Has 2 vacuum traps for general cell culture aspiration needs
- UV germicidal light for surface disinfection
- 30% HEPA filtered exhaust air and 70% recirculated HEPA filtered air
- Will have precision and analytical balances inside for gravimetric transfers

THERMO SCIENTIFIC 1300 SERIES CLASS II, TYPE A2

Fume Hood

- Airflow velocity readout that is tracked by ECL Constellation: 60 to 100 ft/min
- Internal dimensions:
  - 4’ floor mounted hood: 37 x 28 x 84.5 in
  - 5’ hood: 49 x 22.5 x 48 in
  - 6’ hood: 61.5 x 22.5 x 48 in
  - 8’ hood: 85.5 x 22.5 x 48 in
- Supplied with nitrogen via in-house plumbing
- Vacuum plumbing capabilities
- pH, temperature, relative humidity, pressure sensors installed (tracked by ECL Constellation)
- Equipped with analytical and precision balances for gravimetric transfers

LABCONCO PROTECTOR XL FLOOR-MOUNTED FUME HOOD

LABCONCO PROTECTOR PREMIER LABORATORY HOOD

Glove Box

- Constant H_2O, O_2, and pressure monitoring
- <1 ppm H_2O
- <1 ppm O_2
- Attached -35ºC freezer
- No-downtime cartridge-based purifiers
- Automatic antechamber cycle control

NEXTGEN

Hermetic Transfers

- Backfill of hermetic container with nitrogen or argon gas
- Compatible with a wide range of needles and syringes to support a wide variety of hermetic containers
- Hermetic transfers only happen in the fume hoods
- Capable of anhydrous transfers

RNase Free

- Optional RNase Away treatment for all materials and work surfaces

RNASE AWAY

Sterile Transfers

- Optional 70% Ethanol treatment of all materials and work surfaces

Hot/Cold Transfers

- Samples can be transferred in warmed (30 to 105°C) and chilled (10 to -86ºC) conditions
- Temperature immersion probe or IR probe for temperature verification during the transfer

BENCHMARK SCIENTIFIC MYBLOCK DRY BATH INCUBATOR BSH5002

ICECO GO12 & GO20

DISON BC-1500A

STIRLING ULTRACOLD

LAB REPCO PORTABLE FREEZER

SAMPLE TRANSPORT

Samples can be transported around the lab between their storage conditions and usage on instruments using a variety of temperature control systems.

Transport Warmed

- Temperature-sensitive samples can be marked for transportation in warmed (30 to 105°C) conditions when being moved around the lab during protocol execution
- Applies only to samples in transit
- Available dimensions up to 93.1 x 146.3 x 82.3 mm

Transport Chilled

- Temperature-sensitive samples can be marked for transportation in chilled (4°C) conditions when being moved around the lab during protocol execution
- Applies only to samples in transit
- Available capacity up to 25 L

BENCHMARK SCIENTIFIC MYBLOCK DRY BATH INCUBATOR BSH5002

ICECO GO12 & GO20

DISON BC-1500A

STIRLING ULTRACOLD

LAB REPCO PORTABLE FREEZER

STORAGE CONDITIONS

`StoreSamples[]`

Room Temperature Sample Storage

- 27 trays
- Max tray payload capacity: 551 lb/250 kg
- Tray dimensions: 98.42 x 33.74 in
- Throughput: up to 120 trays/hr

Conditions

- 25°C ± 0.45°C (1 sigma)

Sample Constraints

- Can store any size container from microcentrifuge tubes to 20 L carboys.
- Max height of stored materials: 27.36 in

5°C Sample Storage

- 25 trays
- Max tray payload capacity: 551 lb/250 kg
- Tray dimensions: 74.8 x 25.75 in
- Throughput: up to 120 trays/hr

Conditions

- 4°C storage (± 1°C)

Sample Constraints

- Can store any size container up to 5 L bottles
- Max height of stored materials: 27.36 in

FRIGIDAIRE
FFU21M7HW

-20°C Sample Storage

Conditions

- -22°C storage (± 2°C)

Sample Constraints

- Can store microcentrifuge tubes, SBS format plates, 15 mL conical tubes, 50 mL conical tubes, and reagent bottles up to 500 mL

STORAGE CONDITION

-80°C Sample Storage

Conditions

- -80°C storage (± 0.5°C)

Sample Constraints

- Can store microcentrifuge tubes, SBS plates, 15 mL conical tubes, and 50 mL conical tubes

STIRLING
ULTRACOLD
SU780UE

CUSTOM
BIOGENICS V-1500

Cryostorage

Conditions

- -165°C storage (± 1°C)

Sample Constraints

- Can store microcentrifuge tubes and cryotubes

Flammable Cabinet Sample Storage

Conditions

- 25°C ± 0.45°C (1 sigma)

Sample Constraints

- Capable of storing flammable reagents such as solvents
- Can store any size container from microcentrifuge tubes to 20 L drums

GLOBAL INDUSTRIAL
BM-120

Desiccated Sample Storage

- Room temperature (22°C ± 0.45°C (1 sigma)) and refrigerated (5°C) available
- Vacuum desiccation available (at room temperature) for ultra high sensitivity needs

BEL-ART 45L CABINET-STYLE VACUUM DESICCATOR

BEL-ART 102L GRANDE DESICCATOR CABINET

COLE PARMER 59L HORIZONTAL DRY-KEEPER DESICCATOR CABINET

Environmental Stability Chambers

- 5 to 70°C temperature range
- 0.1°C temperature control resolution
- Temperature uniformity of ± 0.3°C
- 20 to 95% relative humidity range
- 2% humidity control resolution

CARON 7000-10

Photostability Chamber

- Average UVA light intensity is 2 to 36 W/m^2
- Average VIS light intensity is 2 to 29 klux
- 10 to 35°C temperature range (lights on)
- 0.2°C temperature control resolution
- Temperature uniformity of ± 2.5°C (lights on)
- 40 to 70% relative humidity range
- 3% humidity control resolution

CARON PHOTOSTABILITY CHAMBER

Cytomat

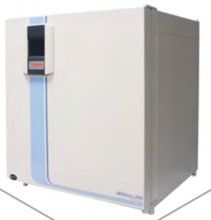
Conditions

- 37°C (± 0.5°C)
- 5% CO_2 (± 0.1%)
- 95% relative humidity (± 3%)

Capacity

- Houses SBS cell culture plates
  - 1-well
  - 6-well
  - 12-well
  - 24-well
  - 96-well

THERMO FISHER HERACELL 240I TT 10 SMD IR



Bacterial and Yeast Solid Media Incubators

Conditions

- 37°C (± 0.5ºC) for bacteria
- 30°C (± 0.5°C) for yeast

Capacity

- Houses SBS solid culture plates of the following formats:
  - 1-well
  - 4-well
  - 8-well

THERMO FISHER
HERAcell 240i TT 10

Liquid Culture Incubators

Yeast Incubation

- 30°C (± 0.5°C)
- SBS deep well culture plates, 125 mL, 250 mL, 500 mL, 750 mL, 1 L, and 2 L flasks available
- 200 RPM shaking rate (2.54 cm radius) for flasks; 400 RPM shaking rate (2.54 cm radius) for plates

Bacterial Incubation

- 37°C (± 0.5°C)
- SBS deep well culture plates, 125 mL, 250 mL, 500 mL, 750 mL, 1 L, and 2 L flasks available
- 250 RPM shaking rate (2.54 cm radius) for flasks; 400 RPM shaking rate (2.54 cm radius) for plates

Custom Incubation

- Ambient to 40°C (± 0.5°C)
- Ambient to 95% relative humidity (± 3%)
- Ambient to 5% CO_2 (± 0.1%)
- SBS deep well culture plates, 125 mL, 250 mL, 500 mL, 750 mL, 1 L, and 2 L flasks available
- 0 to 400 RPM shaking rate (2.54 cm radius) for flasks; 0 to 1,000 RPM shaking rate (3 mm radius) for plates

EPPENDORF
INNOVA 44

INFORS HT
MULTITRON PRO

PROPERTY MEASUREMENT

ExperimentImageSample[]

Plate Imager Robotics

Overhead Imaging (Multiwell Plates)

- 5 megapixel close-up images on a per-well basis
- Fields of view: 22 mm and 35 mm
- Lighting: Top or bottom LED illumination, or ambient
- Imaging interval: 9 sec
- Camera travel speed: Up to 5 m/min

Large Sample Camera

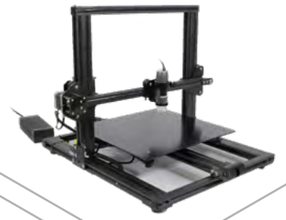
Side-on Imaging (Bottles and Other Vessels)

- Canon Rebel Ti EOS 750D
- 24.2 megapixel images
- 18, 24, and 55 mm focal lengths to accommodate containers ranging from 8 mm glass vials up to 20 L carboys
- Lighting: Top, bottom, or side (trans-) LED illumination, or ambient

Top Imaging (Bottles and Other Vessels)

- 14 megapixel images
- 12 mm fixed focal length lens
- Lighting: Top, bottom (trans-), or side LED illumination, or ambient

VISION M4
PLATE IMAGER



EDGE AM751MTZL

CANON REBEL TI
EOS 750D

ExperimentVisualInspection[]

Sample Inspector

- Visual detection of insoluble particulates in solution samples
- Color videos of samples containing a color calibration chart
- Sample compatibility: liquid samples in 2 or 50 mL transparent glass vials
- Lighting: Top, front, back
- Temperature: Chilled (~4°C) or ambient
- Sample Mixing Rate: Up to 6,000 RPM

COOLED VISUAL
INSPECTOR WITH
ORBITAL SHAKER

ExperimentMeasureVolume[]

Ultrasonic Detectors

Ultrasonic Sensor Methods Available

- Compatible with any parameterized container
  - Microcentrifuge tubes or SBS style plate wells (including 24-, 48-, 96-, and 384-well plates; ± 125 µL)
  - 15 mL conical tubes (± 55 µL)
  - 50 mL conical tubes (± 230 µL)
  - 250 mL bottles (± 5 mL)
  - 500 mL bottles (± 5 mL)
  - 1 L bottles (± 10 mL)
  - 2 L bottles (± 10 mL)
  - 4 L jugs (± 20 mL)
  - 5 L bottles (± 20 mL)
  - 10 L carboys (± 100 mL)
  - 20 L carboys (± 100 mL)

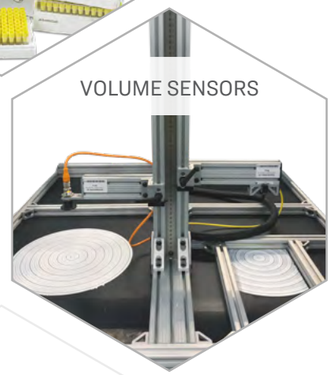
Balances

Gravimetric Volume Measurement Available

- Requires samples with known densities in single sample containers
- 1 µg to 60 kg measurement range to determine volume

VOLUMECHECK
50, 100, 384

VOLUME SENSORS



ExperimentMeasureCount[]

Balances

- 100 µg to 220 g (± 100 µg)

OHAUS PIONEER
PA224 & PA124

ExperimentMeasureWeight[]

Microbalance

- 1 µg to 6 g (± 1 µg)

Analytical Balance

- 100 µg to 220 g (± 100 µg)

Macrobalance

- 120 g to 6.2 kg (± 10 mg)
- 30 cm x 40 cm measurement platform

Bulk Balance

- 5 to 50 kg (± 10 g)
- 75 kg max mass tolerance
- 42 cm x 55 cm measurement platform

METTLER TOLEDO XP6

OHAUS PIONEER PA224 & PA124

OHAUS EX6202

OHAUS DEFENDER D31P60BL

ExperimentMeasurepH[]

Immersion pH Meters

- pH range 0 to 14 pH (± 0.02)
- 50 µL minimum sample size (consumes no volume)
- Measures and records pH over time
- Temperature correction

INLAB MICRO & REACH 225

METTLERTOLEDO SEVENEXCELLENCE

ExperimentMeasureConductivity[]

Conductivity Meter

- 0.001 µS/cm to 2,000 mS/cm conductivity measuring range
- 0.001 µS conductivity resolution
- ± 0.5% conductivity accuracy
- Built-in temperature sensor for temperature correction
- Linear, non-linear and pure water temperature compensation algorithms
- 150 µL minimum sample volume

METTLER TOLEDO SEVENEXCELLENCE

ExperimentMeasureDensity[]

Density Meter

U-tube Oscillation Measurement Method

- 0 to 3 g/cm^3 density measurement range
- 7x10^{-6} g/cm^3 density measurement accuracy
- Reproducibility of 5x10^{-7} g/cm^3
- 5 to 100°C temperature control range
- 0.01°C temperature accuracy
- Automatic viscosity and temperature correction
- 1.5 mL minimum sampling volume
- No restrictions on containers

Fixed Volume Weight Measurement Method

- 50 µL to 1.5 mL sampling volume per measurement
- 1 µg to 5 g (± 0.8 µg) weight range
- No restrictions on sample volume or containers

ANTON PAAR DM5000

ExperimentMeasureRefractiveIndex[]

Refractometer

- 1.26 to 1.72 Refractive Index (RI) scale measurement range
- 1x10^{-6} RI measurement resolution
- ± 2x10^{-5} RI measurement accuracy
- 4 to 125°C temperature measurement range
- 0.01°C temperature resolution
- ± 0.03°C temperature measurement accuracy
- ± 0.002°C temperature stability
- Sapphire optical measurement plate

Sample Compatibility

- All sample containers compatible
- ~120 µL sample measurement volume

ABBEMAT 650

ExperimentMeasureMeltingTemperature[]

Melting Point Apparatus

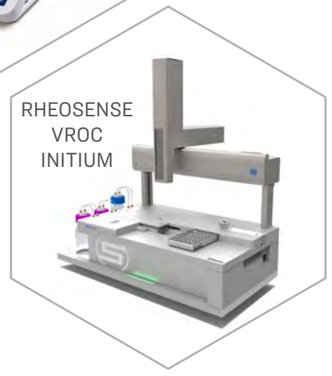
- 25°C (room temperature) to 400°C
- Heating rate from 0.1 to 20°C/minute
- Color video of samples throughout heating cycle (up to 300 minutes)
- Up to 6 capillary samples per heating cycle

*MP90 MELTING POINT SYSTEM

ExperimentMeasureViscosity[]

Robotic Viscometer

- Viscosity measurable from 0.3 to 1,000 mPaS (± 2% accuracy)
- Shear rate range 40 to 125,000 1/s
- 4 to 70ºC measurement temperature range
- Minimum 26 µL sample volume
- Sample constraints:
  - Up to 40 HPLC/CE vials
  - 1x 96-well PCR plate



RHEOSENSE VROC INITIUM

ExperimentMeasureSurfaceTension[]

Tensiometer

- 8 DyneProbes simultaneously measure in 96-well plate
  - Self-cleaned in electrical furnace
  - Customizable cleaning solution
  - Amendable to robotic handling
- Minimum 50 µL sample volume
- Surface tension measurable from 10 to 100 mN/m (0.2 mN/m resolution)
- Balance resolution at 0.050 µg
- Plate measured every 3 minutes

DELTA-8

ExperimentDynamicFoamAnalysis[]

Dynamic Foam Analyzer

- 0.2 to 1 L/min sparging flow rate of air or nitrogen
- Up to 8,000 RPM stir rate
- Double-jacketed columns for temperature control: 4 to 70ºC
- Visible (460 nm) and infrared (850 nm) wavelengths
- Electrodes with 10 Ω to 2 MΩ detection range
- Camera with 2 fps at 1280 x 1024 pixels

DYNAMIC FOAM ANALYZER

ExperimentCoulterCount[]

Coulter Counter

- Aperture tubes available with nominal diameters from 10 µm to 2000 µm
- Particle size ranges from 0.2 µm to 1600 µm
- Particle size and count precision accurate up to 0.5%
- Particles are generally mixed and suspended with conductive electrolyte solutions non-intrusive
- Supports both aqueous and non-aqueous solutions
- 25 mL, 100 mL, 200 mL, and 400 mL vessel sizes
- Can stir the measurement vessels from 1 to 60 RPM

BECKMAN COULTER MULTISIZER 4E

ExperimentCountLiquidParticles[]

Liquid Particle Counter

- HRLD series light obscuration liquid particle counting sensors
- Particle size ranges from 1 to 100 µm
- Particle size precision is 0.1 µm
- Temperature range from 0 to 80 ºC
- Mixing by a magnetic stir bar during data collection
  - 50 to 350 RPM
- Sample amounts are varied with experiment setup, generally requires at least ~0.5 mL

ExperimentCyclicVoltammery[]

Electrochemical Reactor

- Cyclic voltammetry electrodes
  - Glassy carbon 3 mm disc
  - Platinum plated
  - Ag, Ag/AgCl, Ag/Ag⁺ reference electrode options
- Pro-Seal vial caps available for reactions requiring controlled atmosphere
- Supports both aqueous and non-aqueous solutions
- 5 mL, 10 mL, and 20 mL vial sizes
- Large potential window: ± 2.5 V
- CV voltage reading accurate to ± 1 mV
- CV current reading accurate to ± 1 µA
- Can stir reaction vessels from 50 to 1,500 RPM

ExperimentMeasureDissolvedOxygen[]

Dissolved Oxygen Meter

- 0 to 50.00 mg/L dissolved oxygen measuring range
- 0.01 mg/L dissolved oxygen resolution
- Built-in temperature and barometric pressure sensor for correction
- 25 mL minimum sample volume

ExperimentMeasureOsmolality[]

Osmometer

Vapor Pressure Osmometry Method

- 20 to 3,200 mmol/kg osmolality measurement range
- 1 mmol/kg osmolality resolution
- ± 1% accuracy within 100 to 1,000 mmol/kg calibrated range
- ± 5% accuracy outside of calibrated range
- Reproducibility of 2 mmol/kg standard deviation
- 10 µL sample volume
- Aqueous samples

ExperimentMeasureContactAngle[]

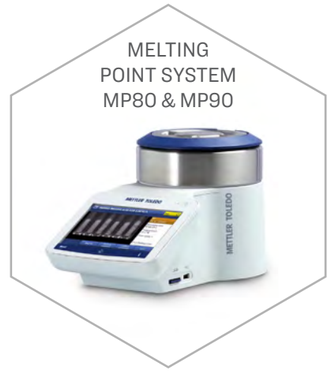
Tensiometer

- Requires single fiber samples with > 5 µm in diameter
- 0 to 6 g force sensor weight range
- 0.1 µg force sensor weight resolution
- 0 to 110 mm sample stage position range
- 0.1 µm sample stage position resolution

ExperimentMeasureMeltingPoint[]

Melting Point Apparatus

- Measures the melting point of solid substances by capillary method
- Needs a small amount of sample
- Capable of measuring melting points from ambient temperature up to 400 °C
- Automatically determines the melting temperature
- provides video footage of the entire melting process
- Capable of measuring Pharmacopeia and Thermodynamic temperatures
- Simultaneous analysis of up to 6 capillaries



ExperimentDissolution[]

Dissolution Apparatus

- USP Apparatus 1 and 2 supported
- Automatic dosage delivery system
- Automatic sampling with filtration on cannula tip, in-line or using disk filters
- Automatic evaluation of the mechanical issues with sampling
- Image and video of the dissolution process acquisition

DISTEK
2500 BATHLESS
WITH ECLIPSE 5300
AUTOSAMPLER AND FILTER
CHANGER

ExperimentKarlFischerTitration[]

Karl Fischer Titrator

Coulometric

- Automatic Headspace Sampling with Autosampler
- 50 to 250ºC oven Temperature
- Up to 35 samples per batch
- 10 to 150 mL/minute headspace gas flow rate

Volumetric

- Direct addition of liquid or solid samples to reaction vessel
- Doses up to 10 mL of Karl Fischer reagent per titrated sample
- Up to 20 samples per batch, performed in sequence

METROHM 901
TITRANDO

METROHM
851 TITRANDO W/OUT
DIAPHRAGM WITH 874 AUTO
SAMPLE PROCESSOR

WATER SOURCES

Water Purifier

Elix

- Distribution flow rate: up to 2 L/min from POD
- Flow rate: 15 L/hour
- Product water resistivity at 25 °C: > 5 MΩ·cm (Typically 10 to 15 MΩ·cm)
- Product water TOC: < 30 ppb
- Voltage: 100 to 230 V/50 to 60 Hz

MilliQ

- Feed water nature: potable tap water
- Flow rate: 3 L/hour
- Product water volume: 60L/day
- Product water conductivity: 0.056 uS/cm
- Product water resistivity:
  - Ultrapure water: 18.2 MΩ·cm
  - Pure water: > 5 MΩ·cm
- Product water TOC: < 5 ppb
- Voltage: 100 to 240 V/50 to 60 Hz

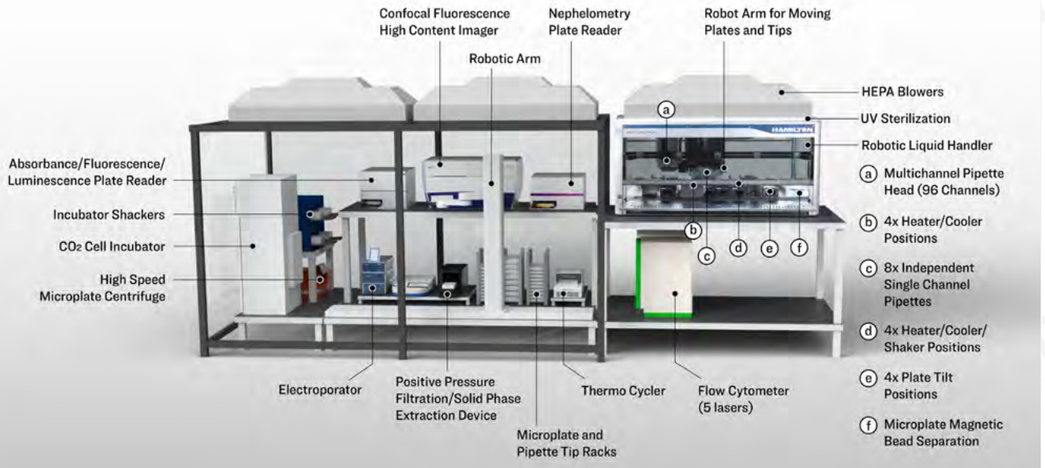
ELIX
ADVANTAGE 15

MILLIQ
INTEGRAL 3

CELL CULTURE

`ExperimentRoboticCellPreparation[]`

Liquid Media Cell Preparation Workcell



UNIT OPERATIONS

Sample Preparation

`Transfer[]`
`Dilute[]`
`SerialDilution[]`
`Aliquot[]`
`Consolidate[]`
`Resuspend[]`
`Incubate[]`
`Mix[]`
`Centrifuge[]`
`Filter[]`
`MagneticBeadExtraction[]`
`SolidPhaseExtraction[]`
`Pellet[]`
`LiquidLiquidExtraction[]`
`Cover[]`
`Uncover[]`

Spectroscopy

`AbsorbanceSpectroscopy[]`
`AbsorbanceKinetics[]`
`FluorescenceSpectroscopy[]`
`FluorescenceKinetics[]`
`LuminescenceSpectroscopy[]`
`LuminescenceKinetics[]`
`Nepholometry[]`
`NepholometryKinetics[]`

Cell Maintenance

`WashCells[]`
`SplitCells[]`
`ChangeMedia[]`
`QuantifyCells[]`
`TreatCells[]`
`AliquotCells[]`
`IncubateCells[]`
`SynchronizeCells[]`
`CocultureCells[]`
`Inoculate[]`

Cell Preparation

`LyseCells[]`
`ExtractCystolicProtein[]`
`ExtractPlasmaMembraneProtein[]`
`ExtractNuclearProtein[]`
`ExtractRNA[]`
`ExtractGenomicDNA[]`
`ExtractPlasmidDNA[]`
`ExtractOrganella[]`
`HarvestMedia[]`
`HarvestProtein[]`
`HarvestVirus[]`
`HarvestCells[]`
`HarvestExosome[]`

Cell Analysis

`FixCells[]`
`StainCells[]`
`ImageCells[]`
`FlowCytometry[]`

Transform Cells

`ElectroporateCells[]`
`PermeabilizeCells[]`
`TransformCells[]`
`TransfectCells[]`
`TransduceCells[]`
`MakeCompetent[]`

Workcell Integrated Micro Liquid Handler

HAMILTON STAR

8x Independent Single Channel Pipettes

- 1 µL to 1 mL volume (± 1%)
- 1 to 500 µL/sec aspirate and dispense rate
- Disposable polypropylene filter tips

1x Multichannel Pipette (96 Channels)

- Capable of any simultaneous rectangular pipetting up to dimensions 8x12
- 1 µL to 1 mL volume (± 2%)
- 1 to 500 µL/sec aspirate/dispense rate
- Disposable polypropylene filter tips

Large Capacity Deck

- 4x SBS tilt-plate positions (for media aspiration)
- 1x Heating/Cooling/Shaking SBS plate position
  - 100 to 2,000 RPM shaking rate
  - Orbital or linear shaking patterns available
  - 4 to 70°C temperature incubation
- 5x incubated plate positions (-15 to 95°C)
- 7x SBS plate positions
- 4x 200 mL reagent trough positions
- 12x 50 mL tube positions
- 64x microcentrifuge tube positions
- Robotic arm for movement of plates, lids, and racks around the deck and to/from integrations
- Vacuum block for filtering
  - SBS microtiter filter plate source
  - SBS collection plate (deep well)
  - Source and destination plate movable

Workcell Integrated Incubator

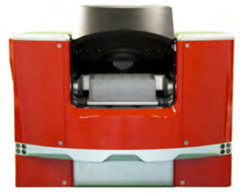
- Temperature range: 33 to 50°C
- Ambient to 95% relative humidity
- 0.04 to 20% CO_2

LICONIC
STX44-ICBT

Workcell Integrated High Speed Centrifuge

- 5,700 RPM maximum speed (4,000 x g at Rmax)
- 350 g maximum weight (per position)
- 50 g maximum imbalance
- 2x SBS plate footprint positions

BIONEX HIG4



Workcell Integrated Positive Pressure Filter

- 0 to 40 PSI independent pressure sources for each well
- Filter though SBS filter plates
- Collects in SBS deep well plates

HAMILTON
MPE2

Workcell Integrated Confocal High Content Imager

- Camera: > 4.7 Megapixel CMOS
- Field of view (10x magnification): 1.96 mm^2
- Speed: Up to 200,000 wells/day
- Objectives: 1x to 100x air and oil
- Filter changer: 5 position filter cube changer
- Autofocus: Laser and image autofocus
- Fully automated X-Y and Z stages with resolution better than 100 nm
- Environmental control

Imaging Modes

- Digital phase contrast
- Transmitted light
- Brightfield
- Fluorescence

Sample Constraints

- Up to 1,536-well plates

IMAGEXPRESS
MICRO CONFOCAL

Workcell Integrated Plate Reader

- Supports absorbance, fluorescence and luminescence reads

Absorbance

- CCD detector
- 220 to 1,000 nm wavelength selection

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 320 to 740 nm excitation monochromator (8 nm bandpass)
- 680 nm laser (AlphaScreen)

Emission

- High voltage PMT detector
- 320 to 850 nm emission monochromator (8 nm bandpass)

CLARIOSTAR

Sample Injection

- 2x 500 µL injection syringes per batch
- 50 µL dead volumes, 0.5 µL precision
- 25 mL/min maximum injection speed
- 2 mL microcentrifuge tubes, 15 mL conical tubes, or 50 mL conical tube sources

Sample Chamber

- Room temperature (25°C ± 0.45°C (1 sigma)) to 45°C incubation
- Mix by shaking before read options
- 1x microtiter plate (6 to 1,536 well) per batch

Nephelometer

Sample Injection

- 2x 500 µL injection syringes
- 440 µL/s maximum injection speed

Sample Chamber

- Room temperature to 60°C incubation
- Actively regulates O2 and CO2 to 0.1-20%
- Mix by shaking before read options
- 1x microtiter plate (up to 384-well) per batch

Optics

- 635 ± 10nm 1mW self-monitoring laser diode
- 1.5 to 3.5 mm selectable beam width
- Side window photodiode detector
- Detects up to 80° full cone angle

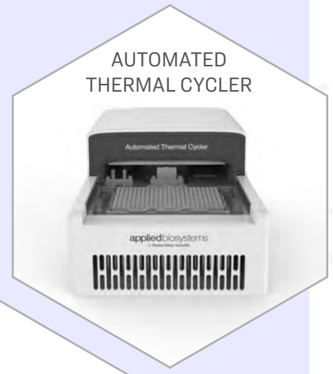
NEPHELOSTAR PLUS

Automated Thermal Cycler

- Temperature accuracy: ± 0.25°C (between 35.0 and 99.9°C)
- Max block ramp rate: 3.5°C/sec
- Max sample ramp rate: 1.8°C/sec
- Temperature range: 4 to 105°C
- Temperature uniformity: ± 0.50°C (20 sec after reaching 95°C)

Sample Constraints

- Plate format: 96-well PCR plate
- Sample volume: 10 to 100 µL



AUTOMATED THERMAL CYCLER

Incubator Shakers

- 400 to 1800 RPM
- Programmable shaking pattern
- 1x deep well or 1x microtiter plate or 24x 2ml tubes
- Incubation at temperatures between ambient and 80ºC

INHECO INCUBATOR SHAKER DWP

Flow Cytometer

Fluidics

- 0.025 to 3.5 uL/sec sample flow rate

Optics

- 5- spatially separated lasers
- 355 nm, 50 mW
- 405 nm, 100 mW
- 488 nm, 100 mW
- 561 nm, 50 mW
- 640 nm, 100 mW

Detectors

- 30 PMT detectors including 2 FSC and 1 SSC
- 100,000 eps maximal acquisition rate with all parameters engaged

FSC Particle Size Resolution

- 0.2 um

Fluorescence Sensitivity

- FITC: 70 MESF, PE: 50 MESF, APC: 40 MESF

Sample Formats

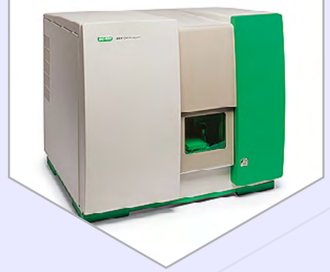
- 5mL tube, microcentrifuge tube, 96-well standard/ deep well plates, 384-well standard/deep well plates.

Sample Environmental Control

- Sample agitation and temperature control between 18 to 28ºC

High-throughput Sampling Speed

- 15 minutes for 96-well plate
- 60 minutes for 384-well plate



BIO-RAD ZE5 CELL ANALYZER

Plate Based Electroporator

Instrument subject to change

- 5 to 300 V range
- 5% voltage delivery accuracy
- Square wave and exponential decay pulse mode options
- Pulse delivery
  - 10 µs to 999 ms pulse length range
  - 1 to 99 pulses per sample
  - 0.1 to 10 sec pulse intervals
  - 10 to 3,775 µF capacitance, dependent on pulse mode and voltage
- 50 to 1,000 Ω in 50 Ω steps
- 96-well plate with either 100 µL or 200 µL well options

`ExperimentManualCellPreparation[]`

Manual Cell Preparation Station

Biosafety Cabinet

- Laminar flow rate of 105 ft/min
- Internal dimensions: 1.74 m x 0.438 m x 0.635 m
- 2 vacuum traps for general cell culture aspiration needs
- UV germicidal light for surface disinfection
- 30% HEPA filtered exhaust air and 70% recirculated HEPA filtered air
- Equipped with balances for aseptic gravimetric transfers and camera for streaming
- Temperature and relative humidity sensors installed (tracked by ECL Constellation)

Micropipettes

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers: liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers: temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Optional rinsing of tips with specified wash solution prior to use in transfers
- Optional Aspiration/Dispense mixing via pipetting mixing and swirling
- Single-channel pipettes
  - 0.1 to 2.5 µL
  - 2 to 20 µL
  - 20 to 200 µL
  - 100 to 1,000 µL
  - 0.5 to 5 mL
- Multi-channel pipettes: 8-channel and 12-channel
  - 0.5 to 1.0 µL
  - 1 to 10 µL
  - 30 to 300 µL
  - 120 to 1,200 µL
- Compatible tip types
  - 10 µL reach tips, sterile
  - 20 µL barrier tips, sterile
  - 200 µL gel loading tips
  - 200 µL tips, non-sterile
  - 200 µL tips, sterile
  - 200 µL wide-bore tips, non-sterile
  - 1,000 µL wide-bore tips, non-sterile
  - 1,000 µL reach tips, sterile
  - 1,000 µL tips, non-sterile
  - 5,000 µL tips, non-sterile

SINGLE-CHANNEL PIPETTES

MULTI-CHANNEL PIPETTES

TIPS

Positive Displacement Pipettes

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
- Temperature controlled transfers: temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Positive-Displacement Pipette MR-100
  - Min volume: 10 µL
  - Max volume: 100 µL
- Positive-Displacement Pipette MR-1000
  - Min volume: 100 µL
  - Max volume: 1 mL
- Compatible and supported tips
  - 100 µL positive displacement tips, sterile
  - 1,000 µL positive displacement tips, sterile

RAININ POS-D MR-100, MR-1000

ZERO DEAD VOLUME TIPS

Serological Pipette

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers: liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers: temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Variable dispense/aspirate speed (8 settings)
- 15 hours of continuous operation before recharging
- Optional rinsing of tips with specified wash solution prior to use in transfers
- Compatible plastic serological pipette tips
  - 2 mL plastic barrier serological pipettes, sterile
  - 5 mL plastic barrier serological pipettes, sterile
  - 10 mL plastic barrier serological pipettes, sterile
  - 25 mL plastic barrier serological pipettes, sterile
  - 50 mL plastic barrier serological pipettes, sterile
- Compatible glass serological pipette tips
  - 1 mL glass barrier serological pipettes, sterile
  - 2 mL glass barrier serological pipettes, sterile
  - 5 mL glass barrier serological pipettes, sterile
  - 10 mL glass barrier serological pipettes, sterile
  - 25 mL glass barrier serological pipettes, sterile
  - 50 mL glass barrier serological pipettes, sterile

HIRSCHMANN PIPETUS

PLASTIC TIPS

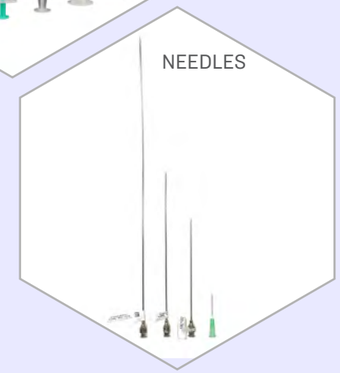
GLASS TIPS

Syringes

- 10µL to 60mL max volume
- 2 different connection types: Luer-Lok and Luer-Slip
- Polyethylene barrel and polypropylene plunger syringes
- Luer-Slip
  - 1 mL disposable syringe
  - 50 mL disposable Luer-Slip syringe
- Luer-Lok
  - 3 mL sterile disposable syringe
  - 5 mL sterile disposable syringe
  - 10 mL Luer-Lok syringe
  - 20 mL disposable Luer-Lok syringe
  - 60 mL sterile disposable syringe
- Needles
  - 21 G x 1 in stainless steel single-use needle
  - 18 G x 4 in reusable stainless steel non-coring needle
  - 18 G x 6 in reusable stainless steel non-coring needle
  - 18 G x 12 in reusable stainless steel non-coring needle

SYRINGES

NEEDLES



Cell Aspirators

Handheld vacuum-aspirator with interchangeable adapter heads

- Pressure-sensitive button controls amount of vacuum applied to aspirate sample
- Adapter heads accept single-use, disposable tips and contain ejectors to exchange tips
- All parts may be autoclaved

Available adapter heads

- 8-channel head compatible with 200 µL pipette tips
- Single channel head compatible with disposable 2 mL aspirating pipettes

ARGOS TECHNOLOGIES HANDE-VAC HANDHELD WASTE DISPOSAL SYSTEM

ExperimentSpreadCells[]
ExperimentStreakCells[]
ExperimentPickColonies[]
ExperimentImageColonies[]
ExperimentQuantifyColonies[]

Solid Media Cell Preparation Workcell

Colony Picker

- 3,000 colonies picked per hour (brightfield) and 2,000 per hour (fluorescence)
- Capable of acquiring bright field (trans-illuminated)
  or fluorescent images to identify colony positions

Fluorescent Filtering Options

- 377 nm excitation filtering with 447 nm emission filtering (good for DAPI/Hoechst)
- 457 nm excitation filtering with 536 nm emission filtering (good for FITC/GFP)
- 531 nm excitation filtering with 593 nm emission filtering (good for Cy3/DS Red)
- 531 nm excitation filtering with 624 nm emission filtering (good for Rhodamine/Texas Red)
- 628 nm excitation filtering with 692 nm emission filtering (good for Cy5)

QPIX 420 HT

Imaging

- Colony image and fluorescence intensity data available for each colony picked (5.3 megapixel images)

Sample Constraints

- 2x source solid media plates per batch
- 16x SBS deep well plate destination positions for liquid media

ExperimentMedia[]
ExperimentPlateMedia[]

Biosafety Cabinet

- Laminar flow rate of 105 ft/min
- Internal dimensions: 1.74 m x 0.438 m x 0.635 m
- 2 vacuum traps for general cell culture aspiration needs
- UV germicidal light for surface disinfection
- 30% HEPA filtered exhaust air and 70% recirculated HEPA filtered air
- Equipped with balances for aseptic gravimetric transfers and camera for streaming
- Temperature and relative humidity sensors installed (tracked by ECL Constellation)

THERMO SCIENTIFIC 1300 SERIES CLASS II, TYPE A2

Autoclave

- Chamber volume: 254 L
- Maximum temperature: 134°C
- Maximum pressure: 45 PSI
- Liquid and dry cycles available
- Programmable cycles (temperature, time)

BMT UNISTERI 559-1

Water Bath

- Room temperature to 100ºC in 0.1ºC increments
- Temperature accuracy of 0.24ºC
- Available for 2 mL tubes to 250 mL glass bottles

COLE-PALMER STABLETEMP DIGITAL UTILITY WATER BATHS

ExperimentInoculateLiquidMedia[]

Solid Media Cell Preparation Workcell

Large Capacity Deck

- 8x/12x multi-well plate positions for SBS deep well or microtiter plates
- 2x imaging plate positions for agar omnitrays
- 3x wash bath positions
- Sterilization by interior UV light and halogen drying of pins

Integrated Imager

- Capable of acquiring Bright-field (trans-illuminated) or fluorescent images to identify colony positions
- 377 nm excitation filtering with 447 nm emission filtering (good for DAPI/Hoechst)
- 457 nm excitation filtering with 536 nm emission filtering (good for FITC/GFP)
- 531 nm excitation filtering with 593 nm emission filtering (good for Cy3/DS Red)
- 531 nm excitation filtering with 624 nm emission filtering (good for Rhodamine/Texas Red)
- 628 nm excitation filtering with 692 nm emission filtering (good for Cy5)
- Optional blue-white screen filter
- High resolution imaging (5.3 megapixel) with auto-focus and auto-exposure

Robotic Gantry

- Optimized for multiple taskings including imaging solid media plates, picking colonies from solid media, and plating suspended colonies onto solid media
- 10 to 130 microliter pipette transfer with pre-aspiration mixing
- Compatible with various head cassettes for spreading, streaking, and picking
- Agar height sensor for maximum picking efficiency with variable pour volumes
- Organism-specific picking pins

QPIX 420 HT

Liquid Media Cell Preparation Workcell

- Robotic inoculation for liquid media inoculation sources

HAMILTON STAR

Biosafety Cabinet

- Laminar flow rate of 105 ft/min
- Internal dimensions: 1.74 m x 0.438 m x 0.635 m
- 2 vacuum traps for general cell culture aspiration needs
- UV germicidal light for surface disinfection
- 30% HEPA filtered exhaust air and 70% recirculated HEPA filtered air
- Equipped with balances for aseptic gravimetric transfers and camera for streaming
- Temperature and relative humidity sensors installed (tracked by ECL Constellation)

THERMO SCIENTIFIC 1300 SERIES CLASS II, TYPE A2

Serological Pipette

- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
  - Liquids can be transferred by weight (gravimetrically), from µg to kg, in both sterile and non-sterile environments
- Temperature controlled transfers
  - Temperature-sensitive source/destination samples can be marked to be chilled (4ºC) or heated (30 to 105ºC) during transfers (for more information, see Sample Transport section)
- Variable dispense/aspirate speed (8 settings)
- 15 hours of continuous operation before recharging
- Compatible plastic serological pipette tips
  - 2 mL plastic barrier serological pipettes, sterile
  - 5 mL plastic barrier serological pipettes, sterile
  - 10 mL plastic barrier serological pipettes, sterile
  - 25 mL plastic barrier serological pipettes, sterile
  - 50 mL plastic barrier serological pipettes, sterile
- Compatible glass serological pipette tips
  - 1 mL glass barrier serological pipettes, sterile
  - 2 mL glass barrier serological pipettes, sterile
  - 5 mL glass barrier serological pipettes, sterile
  - 10 mL glass barrier serological pipettes, sterile
  - 25 mL glass barrier serological pipettes, sterile
  - 50 mL glass barrier serological pipettes, sterile

HIRSCHMANN PIPETUS

PLASTIC TIPS

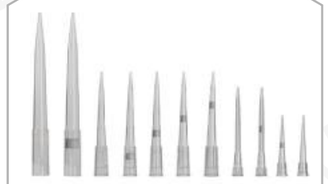
GLASS TIPS

Micropipettes

- Reverse pipetting available
- Aspiration dispense mixing (slurry transfers)
- Gravimetric transfers
  - Liquids can be transferred by weight (gravimetrically), from µg to kg, in a sterile environment
- Temperature controlled transfers
  - Temperature-sensitive source/destination samples can be marked to be chilled (-86 to 10°C) or heated (30 to 105°C) during transport (for more information, see Sample Transport section)
- Single-channel pipettes
  - 0.1 to 2.5 µL
  - 2 to 20 µL
  - 20 to 200 µL
  - 100 to 1,000 µL
  - 0.5 to 5 mL
- Compatible tip types
  - 10 µL reach tips, sterile
  - 20 µL barrier tips, sterile
  - 200 µL gel loading tips
  - 200 µL tips, sterile
  - 1,000 µL reach tips, sterile

SINGLE-CHANNEL PIPETTES

TIPS



ExperimentIncubateCells[]

Static Plate Incubator

- Dedicated instruments for mammalian, bacterial, and yeast sample incubation
- Simultaneous incubation of up to 210 shallow plates
- Default mammalian incubation condition: 37°C, 5% CO_2, 93% relative humidity
- Default bacterial incubation condition: 37°C
- Default yeast incubation condition: 30°C

Shaking Plate Incubator

- Dedicated instruments for bacterial and yeast sample incubation with shaking
- Simultaneous incubation of up to 48 shallow or deep well plates with shaking
- Default shaking rate: 200 RPM with 25.4 mm shaking radius
- Default bacterial incubation condition: 37°C
- Default yeast incubation condition: 30°C

Shaking Flask Incubator

- Dedicated instruments for bacterial and yeast sample incubation with shaking
- Simultaneous incubation of up to 6x 1000mL Erlenmeyer flasks, 8x 250mL Erlenmeyer flasks, and 11x 125mL Erlenmeyer flasks with shaking
- Default shaking rate: 200 RPM with 25.4 mm shaking radius
- Default bacterial incubation condition: 37°C
- Default yeast incubation condition: 30°C

Custom Shaking Plate Incubator

- Simultaneous incubation of up to 20 shallow or deep well plates with shaking
- 25 to 80°C cell incubation
- 0 to 20% carbon dioxide concentration
- 20 to 85% relative humidity
- 50 to 1000 RPM shaking rate with 3 mm shaking radius

Custom Shaking Flask Incubator

- Simultaneous incubation of up to 6x 1000mL Erlenmeyer flasks, 8x 500mL Erlenmeyer flasks, and 10x 250mL Erlenmeyer flasks with shaking
- 25 to 80°C cell incubation
- 0 to 20% carbon dioxide concentration
- 20 to 85% relative humidity
- 20 to 400 RPM shaking rate with 25 mm shaking radius

Robotic Incubator with Humidity Control

- Integrated with Hamilton bioSTAR robotic liquid handler for mammalian sample incubation
- Simultaneous incubation of up to 20 shallow or deep well plates
- 33 to 50°C cell incubation
- 0 to 10% carbon dioxide concentration
- 0 to 100% relative humidity

Robotic Shaking Incubator

- Integrated with Hamilton bioSTAR robotic liquid handler for bacterial and/or yeast sample incubation
- Simultaneous incubation of up to 16 shallow or deep well plates with shaking
- 33 to 50°C cell incubation
- 25 to 600 RPM shaking rate with 3 mm shaking radius

ExperimentImageCells[]

Confocal High Content Imager

- Camera: > 4.7 Megapixel CMOS
- Field of view (10x magnification): 1.96 mm^2
- Speed: up to 200,000 wells/day
- Objective magnifications: 4x and 10x (air), 20x, 40x and 60x (water immersion)
- Filter changer: 5 position filter cube changer
- Autofocus: laser and image autofocus
- Fully automated X-Y and Z stages with resolution better than 100nm
- 2048 x 2048 image resolution

Imaging Modes

- Confocal & widefield
  - Digital phase contrast
  - Bright-field
  - Fluorescence

Sample Constraints

- Up to 1,536-well plates

Inverted Epifluorescence Microscope

Possible Imaging Modalities

- Epifluorescence
- Bright-field
- Phase contrast (requires additional attachments)
- Differential Interference Contrast (requires additional attachments)
- Total Internal Reflection Fluorescence (requires additional attachments)

Specs

- Motorized control of stage
- Objectives on rotation turret
- Customizable objectives, based on Excitation wavelength and Emission wavelength: DAPI - Excitation 350 nm, Emission 460 nm; FITC - Excitation 470 nm, Emission 525 nm; TRITC - Excitation 545 nm, Emission 620 nm
- Stable time-lapse imaging with automatic focus correction system
- Compatible with plastic dishes and well plates
- Modular illumination system
- 1392 x 1040 image resolution
- Objective magnifications: 4x,10x, 20x, and 40x (air)

`ExperimentQuantifyCells[]`

UV/Vis Spectrometer with Thermal Controller

- Simultaneously scan a full wavelength range, on 8 channels, in less than a second
- Each pair of cuvettes can be held at a different temperature: Perform 4 different temperature experiments at the same time
- Simultaneously measure standards, samples, and controls under exactly the same conditions
- Measurement modules do not contain any moving parts (permanent optical alignment)
- Sample temperature range -5 to 110ºC

Absorbance Detection

- Photometric system: Double beam with rear beam access
- Long-life xenon flashlamp source
- 250 points per second data collection rate
- 190 to 1,100 nm wavelength range (limiting resolution 0.1 nm, wavelength accuracy ± 0.2 nm)
- 150,000 nm/min maximum scan rate
- Tightly-controlled beam geometry (< 1.5 mm at sample interface)
- Silicon photodiode detectors for simultaneous measurement of all channels
- 8 cuvette positions can be measured simultaneously

Multimode Plate Reader with ACU

- 96-well plate compatible
- -5 to 110 °C temperature control
- 0.1% to 20% range control of oxygen and carbon dioxide concentrations

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 340 to 740 nm excitation monochromator
- 680 nm laser (AlphaScreen)

Emission

- High voltage PMT detector
- 340 to 740 nm emission monochromator
- Top or bottom of plate read mode

Multimode Plate Reader w/ Filters

- 96-well plate compatible

Excitation

- Xenon flash lamp
- 1 to 100 flashes per well
- 355 nm, 410 nm, 485 nm, 544 nm, 584 nm, 650 nm, or 700 nm fixed wavelength excitation filters (5 nm bandpass)

Emission

- High voltage PMT detector
- 420 nm, 460 nm, 520 nm, 590 nm, 620 nm, or 750 nm fixed wavelength emission filters (5 nm bandpass)
- Top or bottom of plate read mode

Fluorescence Polarization Plate Reader

- Xenon flash lamp
- 1 to 100 flashes per well
- Dual high voltage PMT detectors
- 96-well and 384-well plate compatible
- Excitation emission filter pairs
  - 485 nm, 520 nm
  - 540 nm, 590 nm
  - 625 nm, 675 nm
- Polarized Dual Simultaneous Emission Filters

Nephelometer with ACU

Sample Injection

- 2x 500 µL injection syringes
- 440 µL/s maximum injection speed

Sample Chamber

- -5 to 110 °C temperature control
- 0.1% to 20% range control of oxygen and carbon dioxide concentrations
- Mix by shaking before read options

Optics

- 635 ± 10nm 1mW self-monitoring laser diode
- 1.5 to 3.5 mm selectable beam width
- Side window photodiode detector
- Detects up to 80° full cone angle

ExperimentCoulterCount[]

Coulter Counter

- Aperture tubes available with nominal diameters from 10 µm to 2000 µm
- Particle size ranges from 0.2 µm to 1600 µm
- Particle size and count precision accurate up to 0.5%
- Particles are generally mixed and suspended with conductive electrolyte solutions non-intrusive
- Supports both aqueous and non-aqueous solutions
- 25 mL, 100 mL, 200 mL, and 400 mL vessel sizes
- Can stir the measurement vessels from 1 to 60 RPM

BECKMAN COULTER MULTISIZER 4E

ExperimentWashCells[]
ExperimentLyseCells[]

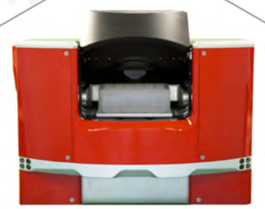
Liquid Media Cell Preparation Workcell

- Robotic inoculation for liquid media inoculation sources

HAMILTON STAR

High Speed Centrifuge

- Up to 4000 x g rotational forces
- Up to 350 grams per bucket for dual position rotor
- Up to 61 mm plate height
- Compatible with ANSI/SBS plates, PCR plates
- Integrated with Hamilton bioSTAR robotic liquid handler



BIONEX HIG4

Incubator Shaker

- 25 to 80°C incubation
- 400 to 1800 RPM shaking rate

INHECO INCUBATOR SHAKER DWP

Heater Shaker

- 4 to 70°C cooling or incubation
- 100 to 3000 RPM shaking rate

INHECO THERMOSHAKE AC

Heater Cooler

- 4x heater/cooler plate positions
  - heating up to 110°C
  - cooling down to 0°C

HAMILTON HEATER COOLER

ExperimentFreezeCells[]

Controlled Rate Cell Freezing Apparatus

- Maximum cooling rate 1°C per minute
- Minimum temperature -100°C
- Programmable temperature profile
- Temperature monitoring data recorded during the run

Sample Constraints

- 48x cryotubes (2 mL) maximum per batch

ASYMPTOTE VIA FREEZE

ExperimentThawCells[]

Controlled Rate Cell Thawing Apparatus

- 37°C heating element
- ~3 min thawing times
- 1x cryovial (2 mL) maximum per batch

THAWSTAR

Water Bath

- Room temperature to 100ºC in 0.1ºC increments
- Temperature accuracy of 0.24ºC
- Available for 2 mL tubes to 250 mL glass bottles

COLE-PARMER STABLETEMP DIGITAL UTILITY WATER BATHS

ExperimentElectroporation[]

Plate Based Electroporator

**Instrument subject to change*

- 5 to 300 V range
- 5% voltage delivery accuracy
- Square wave and exponential decay pulse mode options
- Pulse delivery
  - 10 µs to 999 ms pulse length range
  - 1 to 99 pulses per sample
  - 0.1 to 10 sec pulse intervals
  - 10 to 3,775 µF capacitance, dependent on pulse mode and voltage
- 50 to 1,000 Ω in 50 Ω steps
- 96-well plate with either 100 µL or 200 µL well options

*LONZA 4D NUCLEOFECTOR WITH 96-WELL SHUTTLE

ExperimentBioreactor[]

Robotic Multi-Parallel Bioreactors

**Instrument subject to change*

- Integrated, automated liquid handling for all liquid samples and additions
- Up to 12 bioreactor stations
- Three gases per bioreactor (O_2, CO_2, N_2, Air)
- Four positive displacement liquid pumps per bioreactor
- Individual bioreactor temperature control with heating or cooling
- Individual bioreactor impeller speed control

Vessels

- 100 to 250 mL working volume with baffles
- Dual 20 mm pitched-blade or Rushton impeller
- Spot-based DO sensor
- Disposable pH electrode
- Integrated gas and liquid inlet filters
- Robotic compatible cap for sampling

Large Lab Bioreactor

**Instrument subject to change*

- Temperature range: 0 to 40°C
- Maximum relative humidity: 80% (up to 31°C), decreasing to 50% (40°C)
- Motor speed ranges:
  - 1 L glass: 30 to 1,400 RPM
  - 2 L glass: 30 to 1,100 RPM
  - 5 L glass: 30 to 800 RPM
  - 2 L single-use: 30 to 400 RPM

Liquid Handling

- 3 pumps
- Fixed speed: 43 RPM
- Flow rate: 0.8 mL/min (ID 0.5 mm) up to 20.2 mL/min (ID 3.2 mm)

Probes and Controllers

- Glass vessels
  - Temperature sensor (pH probe integrated)
    - Control range: 0 to 60°C
    - Display resolution: 0.1°C
  - DO probe (reusable)
    - Polarographic probe
    - Digital communication with Control Tower
    - Range: 0 to 100%
    - Display resolution: 0.1%
  - pH probe (reusable)
    - Combination electrode
    - Range: 2 to 12 pH
    - Display resolution: 0.01 pH
  - Foam, alternative level
    - Electrical conductivity sensor

- Single-use vessels
  - Temperature sensor (standalone)
    - Control range: 0 to 40°C
    - Display resolution: 0.1°C
  - DO sensor (single-use)
    - Sensor patch
    - Range: 0 to 100% air saturation
    - Display resolution: 0.1% air saturation
  - pH sensor (single-use)
    - Sensor patch
    - Range: 6 to 8 pH
    - Display resolution: 0.1 pH

Aeration

- Two-gas (microbial)
  - Continuous automatic aeration control for air and O_2
  - Flow rates: 100 to 7,500 ccm
  - Flow accuracy: ± 5% full scale
- Four-gas (cell culture)
  - Continuous automatic aeration control for air, O_2, N_2, CO_2
  - Flow rates: 10 to 550 ccm (air and N_2); 5 to 250 ccm (O_2 and CO_2)
  - Flow accuracy: ± 5% full scale

Cooling (Microbial)

- Supply temperature: 8°C ± 2°C at ambient temperature

ExperimentFlowCytometry[]

Flow Cytometer

Fluidics

- 0.025 to 3.5 uL/sec sample flow rate

Optics

- 5- spatially separated lasers
- 355 nm, 50 mW
- 405 nm, 100 mW
- 488 nm, 100 mW
- 561 nm, 50 mW
- 640 nm, 100 mW

Detectors

- 30 PMT detectors including 2 FSC and 1 SSC
- 100,000 eps maximal acquisition rate with all parameters engaged

FSC Particle Size Resolution

- 0.2 um

Fluorescence Sensitivity

- FITC: 70 MESF, PE: 50 MESF, APC: 40 MESF

Sample Formats

- 5mL tube, microcentrifuge tube, 96-well standard/deep well plates, 384-well standard/deep well plates.

Sample Environmental Control

- Sample agitation and temperature control between 18 to 28ºC

High-throughput Sampling Speed

- 15 minutes for 96-well plate
- 60 minutes for 384-well plate

BIO-RAD ZE5
CELL ANALYZER

ExperimentFACS[]

Fluorescence Activated Cell Sorter

Sorting Technology

- Instrument supports conventional flow cytometry based sorting with compensation controls or spectral flow cytometry based sorting

Sensitivity

- < 100 MESF for FITC, PE, APC
- < 0.2 µm FSC resolution with small particle detection module

Sample Input

- 6 tube input positions for 1.5mL, 5mL, or 15mL tubes
- Temperature control (4 to 37°C) and agitation for all positions

Sort Output

- Up to 6-way sorting into tubes
- Configurable tube holders include 1.5, 5, 15, and 50mL adapters
- Multi-way micro-well plate sorting up to 1,536 wells

Temperature control

- 4 to 37°C for all media types.

Nozzle

- 50, 70, 100, 120, and 150µm ceramic nozzle tips with adjustable pressure settings

Biocontainment

- Integrated Class II biocontainment cabinet for protection of sample and user
- Separate AES for sort chamber evacuation

Optics

- Excitation: seven lasers (all 100mW)
  - 349, 405, 445, 488, 561, 640, and 785nm
- Detection: Up to 60 parameters including FSC and SSC

PROPEL LABS
BIGFOOT

Electronics

- Speed: > 100,000 eps acquisition and > 70,000 eps sorting with all 60 parameters
- Data processing:
  - Simultaneous measured peak, area, and width for every channel
  - 24 Bit data for peak and area to maximize dynamic range
  - True measured width at half-height
  - Low noise converters and proprietary digital processing reduce channel noise

ORGANIC SYNTHESIS

ExperimentSynthesis[]

Robotic Milligram Scale Parallel Reactors

- Reaction vessels with operation volumes from 0.5 to 125 mL
- Automated liquid dispensing from 10 µL to 10 mL
- Positive displacement pipettes for viscous liquids
- Automated solid dispensing from 2 to 150 mg
- Overhead stirring up to 750 RPM
- In situ pH sensors
- On-deck viscosity measurement
- Operational temperature range from -55 to 180°C
- Low oxygen and low moisture levels via nitrogen purge box

UNCHAINED LABS JUNIOR

Gram Scale Jacketed Reactor

- Reaction vessels with operation volumes from 50 mL to 5 L
- Operational temperature range from -40 to 180°C
- Temperature control achieved through jacket of heating/cooling fluid around reaction vessel
- In situ temperature, pH, conductivity, Raman, and/or IR sensors
- Automated dosing via syringe pump (30 µL/min to 200 mL/min)
- Overhead stirring up to 1,000 RPM

OPTIMAX

EASYMAX 402

Cryo Reactor

- Operational temperature as low as -65ºC without use of any circulating cooling fluid, dry ice, or liquid nitrogen
- Reaction vessels with operation volumes from 1 to 100 mL
- In situ temperature, pH, conductivity, IR, and/or Raman sensors
- Automated dosing via syringe pump (30 µL/min to 200 mL/min)
- Overhead stirring up to 1,000 RPM

EASYMAX 102 LT

High Pressure Reactor

- Stainless steel reaction vessels with operation volumes up to 100 mL
- Operational temperature range from -20 to 200°C
- Operational pressure up to 60 bar
- In situ temperature and pressure sensors
- Overhead stirring

EM60-100-HC PRESSURE REACTOR SET

ExperimentFlowSynthesis[]

Flow Reactor

- -70 to 250°C temperature range
- 20 µL/min to 10 mL/min flow rate range
- 42 bar maximum reaction pressure
- Tube and column reactors
- In situ UV/Vis and IR measurement
- Automated reagent loading and product collection
- Photoreactors available in 220 to 600 nm wavelength range

VAPOURTEC RS-400

ExperimentMicrowaveSynthesis[]

Microwave Reactor

- 900 W magnetron
- Reaction durations up to 100 h
- Up to 100 mL per reaction vial (10, 35, & 100 mL vessels)
- 21 Bar maximum operation pressure
- 300ºC maximum operation temperature
- In situ temperature measurement with IR sensors
- Autosampler with up to 48 (10 mL) or 24 (35 mL) vials


CEM
DISCOVER 2.0

ExperimentElectrochemicalSynthesis[]

Electrochemical Reactor

- Capable of running cyclic voltammetry, constant current, and constant potential experiments
- Divided and undivided sample chambers available
- Minimum voltage step of 10 mV
- Voltage reading accurate to ± 16 mV
- Current reading accurate to ± 6.2 µA
- Various available electrodes (including glassy carbon, platinum, graphite, gold, and many others)
- 1 mL, 2 mL, 5 mL, 10 mL, and 20 mL reaction vessel sizes
- Able to run up to 6 reaction vessels at once
- Can stir reaction vessels from 50 to 1,500 RPM


ELECTRASYN
2.0

ExperimentSolidPhaseSynthesis[]

Small Robotic Liquid Handler

Synthesis Columns

- Up to 6x 3 cc or 6 cc columns per batch (loaded with any resin)

Synthesis Cycle

- Custom coupling times for addition
- Custom volumes and incubation durations available for each step in the cycle

Reagents

- 6x 500 mL reagent bottles (any custom solution can be loaded)
- 20x 12 mL reagent vials (any custom solution can be loaded)
- 1x system wash solvent (up to 20 L carboys)
- Positive pressure based delivery and draining (argon)


GILSON
GX-271

ExperimentReactionCalorimetry[]

Reaction Calorimeter

- 10 to 1,000 mL usable reactor volume
- Capable of measuring power as low as ± 0.1 W
- Operational at isothermal, isoperibolic, constant or ramp heat flow, and temperature scanning modes
- Stirring from 30 to 1,200 RPM
- Capable of operating under difficult conditions such as reflux or at phase changes


OPTIMAX
HFCAL

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Contact us to inquire about additional instrumentation

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