

Making ideas work for a better world

GENOTYPE TO PHENOTYPE



THE UNIVERSITY
of EDINBURGH



EDINBURGH
INNOVATIONS



THE UNIVERSITY of EDINBURGH
School of Biological Sciences

Discover

the University of Edinburgh's world class facilities that can support your projects from genotype to phenotype.

Access cutting edge facilities and technologies to make new discoveries and translational developments across all organisms, from people to plants.



Healthcare and
Disease



Pharmaceuticals and
Medical Biotechnology



Life Sciences and
Industrial Biotechnology



Food and
Drink



Agri-Tech, Agri-food
and Plant Biology

Genotype to phenotype can be a complex journey but we're here to help guide you,

**every step
of the way.**



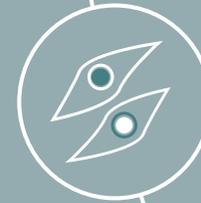
DNA Assembly, Sequencing and Bioinformatics



Protein Production



Cell Free Testing



Cell Based Testing



Organism Phenotype



DNA Assembly, Sequencing and Bioinformatics

Our facilities build genetic constructs for academic and industrial customers to equip cells or whole organisms with new or improved functions. We work on projects as diverse as programming stem cells for use in personalised medicine, vaccine development, gene therapy and living biosensors for basic biological research. Our facilities have supported a diverse range of academic and commercial projects.



Edinburgh Genome Foundry

TECHNOLOGIES AVAILABLE

The Edinburgh Genome Foundry (the Foundry), based at the University of Edinburgh, is a research facility specialising in the high-throughput modular assembly of DNA constructs using a highly automated, species agnostic, robotic platform. We build genetic constructs for academic and industrial customers to equip cells or whole organisms with new or improved functions. We work on projects as diverse as programming stem cells for use in personalised medicine, vaccine development, gene therapy and living biosensors for basic biological research.

With its unique expertise and technology platforms, the Foundry can help you accelerate your research today. Our facility has supported a diverse range of academic and commercial projects. Contact us to talk through your ideas.

SERVICES AVAILABLE

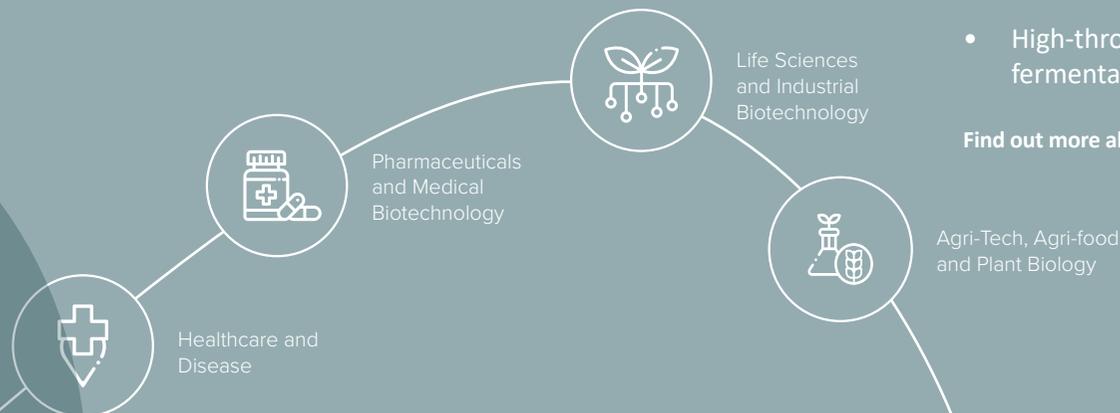
DNA Assembly

- Support with design of optimal DNA constructs using our open access industry grade bespoke software.
- Access to multiple, established assembly methodologies.
- Assembly of DNA constructs for engineering a wide range of cell types including mammalian, plant, yeast, bacteria and algae.
- Viral vector assembly for multiple applications including gene therapy.

Automated Molecular Biology Protocols

- Miniaturisation of molecular protocols using acoustic dispenser with optimisation for automation.
- Automated PCR and qPCR.
- Automated transformation (bacteria, yeast, algae) plating and colony picking.
- High-throughput mini bioreactor fermentation.

Find out more about the [Edinburgh Genome Foundry](#).





||| CYTOMAT |||

||| CYTOMAT |||

Thermo
SCIENTIFIC

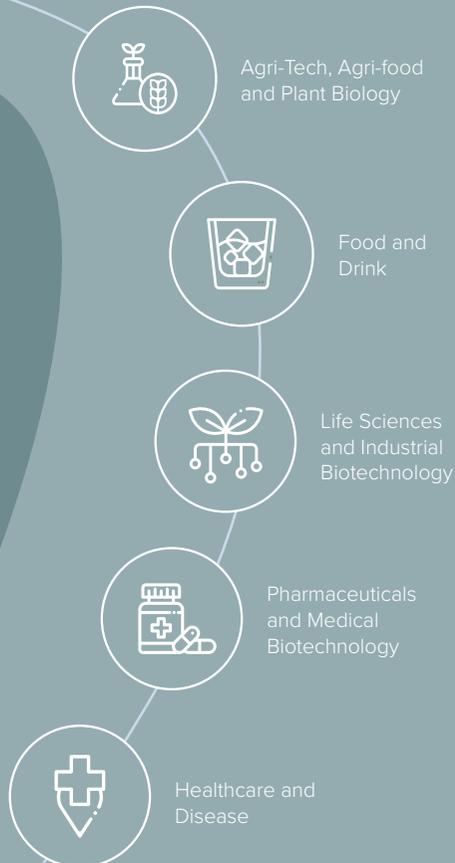
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Edinburgh Genomics



TECHNOLOGIES AVAILABLE

Sequencing

Advanced genomics services: high-throughput next generation sequencing (NGS) data using Illumina platforms, and long-read single molecule sequencing data using Oxford Nanopore and PacBio sequencers. Modular and flexible access to the latest genomics technologies as services or collaborations.

End-to-end support on projects from extracted nucleic acids to data analysis for the sequencing and analysis of genomes, transcriptomes, epigenomes, metagenomes and single cells.

Bioinformatics

Bioinformatics services ensure high-quality sequencing data generation. Bespoke bioinformatics analysis using tailored tools and automatic workflows, which will distil the many millions of data points into biologically interpretable information. Our Bioinformatics team has considerable expertise analysing data across many applications including de novo genome assembly and annotation, variant interpretation, transcriptome profiling and annotation, epigenetics, metagenomics and metabarcoding.

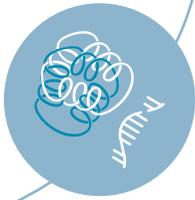
EQUIPMENT AVAILABLE

Wide range of sequencing platforms: Illumina's MiSeq and NovaSeq 6000 instruments, Pacific Biosciences Sequel IIe platform, MinION and PromethION sequencers from Oxford Nanopore Technologies. Bioinformatics operations are supported by a dedicated high-performance compute cluster infrastructure, 3,000 compute cores, 7PB of storage and several dedicated servers.

The combination of sequencing and computing infrastructure with the team's expert knowledge across a broad range of applications, enables us to support a diverse portfolio of sequencing projects. Bespoke bioinformatics analysis and training also available.

Find out more about [Edinburgh Genomics](#).





Protein Production

We offer a wide range of equipment and resources for the production, purification and characterisation of proteins, protein complexes and their ligands.



Edinburgh Protein Production Facility (EPPF)

TECHNOLOGIES AVAILABLE

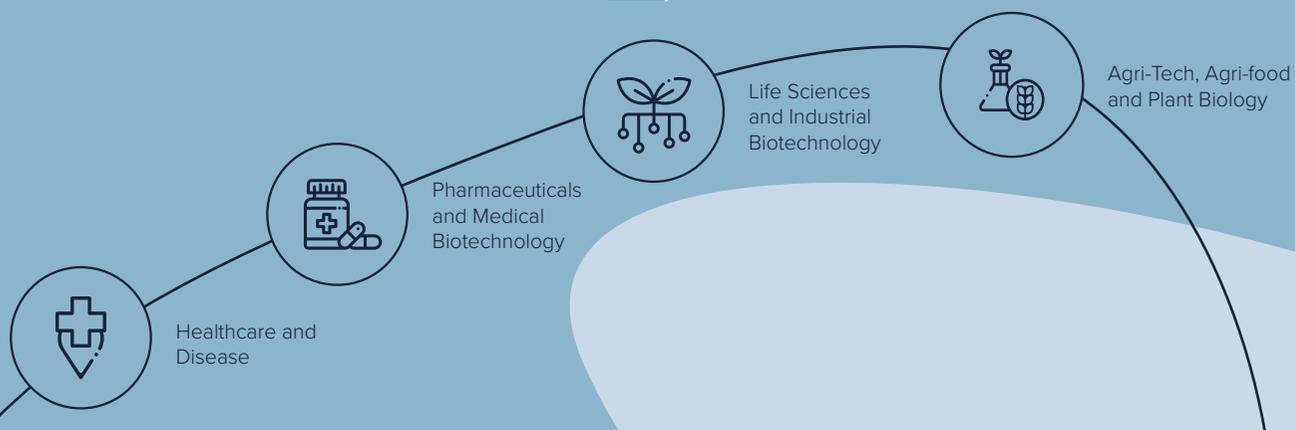
A centre of excellence for protein-related life science projects, the EPPF can provide a full service for both internal and external users and is frequently used by biopharma for such work. The highly trained facility staff have more than 80 years combined expertise in molecular biology, protein expression and purification and biophysical analysis of proteins and their ligands. They have been involved in driving large, complex biophysical themes within multi-disciplinary projects. Staff have knowledge of the capabilities and limitations of the equipment and user experiments, as well as a high-level understanding of the theory and wider biological context. This ensures more effective and efficient research results. Practical training (basic and advanced) for users, ranging from individually tailored one-on-one instruction to frequent centralized training courses are offered.

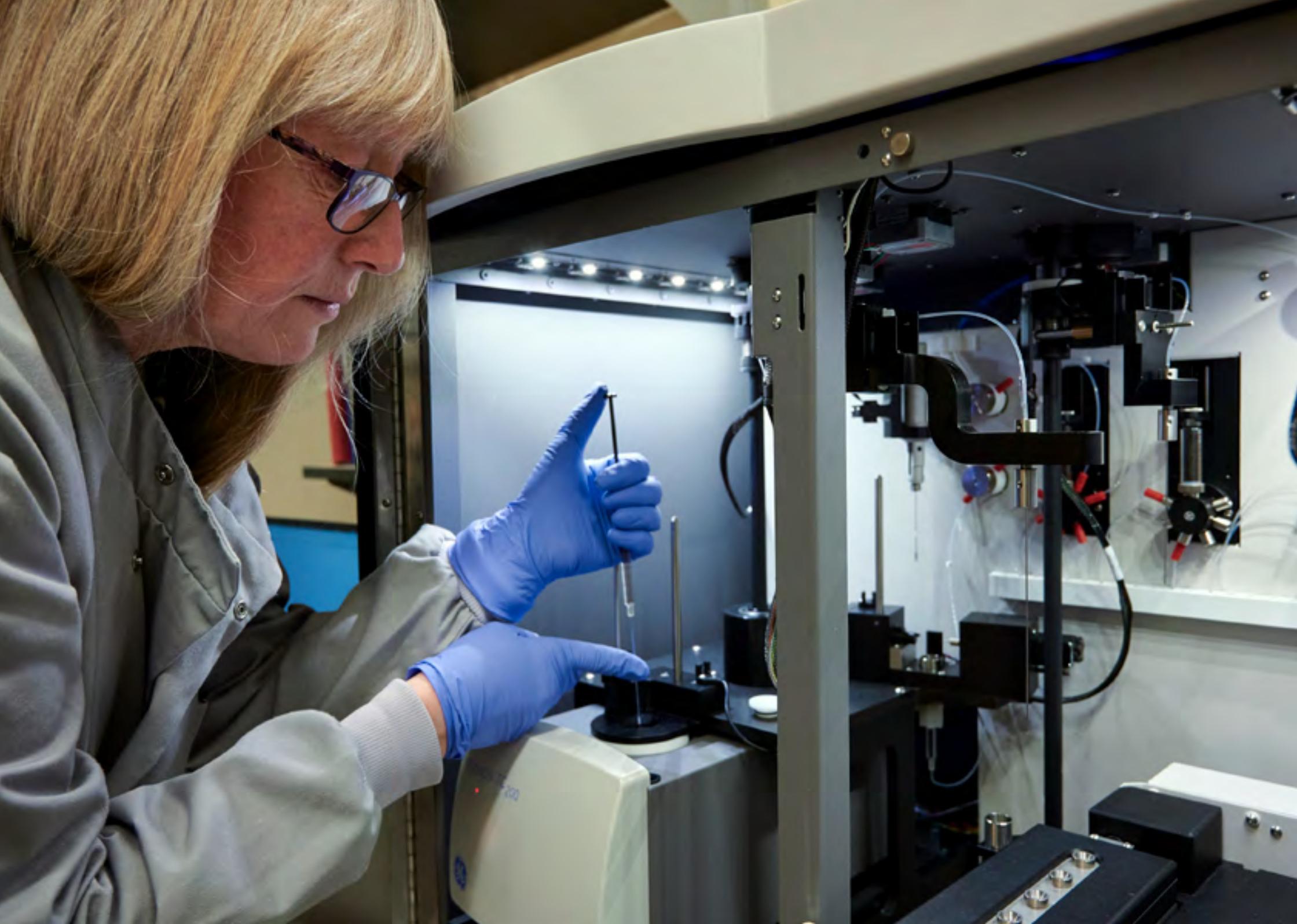
EQUIPMENT AVAILABLE

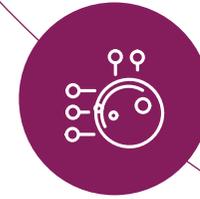
The EPPF has the following equipment in one place to allow for the whole research pipeline:

- 7 modern liquid chromatography systems
- a large resin/column library, configured to give flexibility for production and purification
- capacity for the culture of bacteria, yeast, and mammalian cells
- a comprehensive suite of analytical instruments for examining the biophysical state of proteins and protein complexes
- surface plasmon resonance (SPR) instruments for studying kinetics
- calorimetry (ITC) instruments for studying thermodynamics
- a series of spectroscopy and light scattering technologies (DLS and MALS), to define the size, shape and activity of proteins or protein reagents, in their native solution states

Find out more about the [Edinburgh Protein Production Facility](#).







Cell Free Testing

The High-Throughput Microarray facility houses cutting-edge protein, antibody and transcriptome microarray facilities for the analysis of complex signalling pathways and secreted factors across pre-clinical and clinical samples.



EdinOmics

SERVICES AND EXPERTISE

The EdinOmics core facility provides global metabolome and proteome analyses. We apply analytical mass spectrometry-based workflows on biological samples to probe cellular components (proteins or metabolites) to help researchers better understand the underlying mechanisms that lead to biologically observed phenotypes.

We offer unique end-to-end expertise to help you design the right experiment with sample processing, complementary preliminary tests and data analysis to obtain optimal output. We also offer a rapid metabolomics method that reduces analytical time and cost per sample.

EQUIPMENT AVAILABLE

EdinOmics is home to the only ion mobility mass spectrometer in Scotland, which provides unique capabilities for separating small molecules and proteins based on their size and shape. The facility's gas chromatography system is coupled to an automation platform for sample preparation and data acquisition, which assures greater consistency across the samples in a dataset.

We uniquely offer a simultaneous metabolite, protein, lipid extraction workflow to assess multiple molecular classes from one sample with equal efficiency and reproducibility, allowing for deeper insights into molecular mechanisms being investigated.

Find out more about [EdinOmics](#).



Food and
Drink



Life Sciences
and Industrial
Biotechnology



Pharmaceuticals
and Medical
Biotechnology



Agri-Tech, Agri-food
and Plant Biology

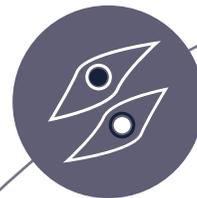
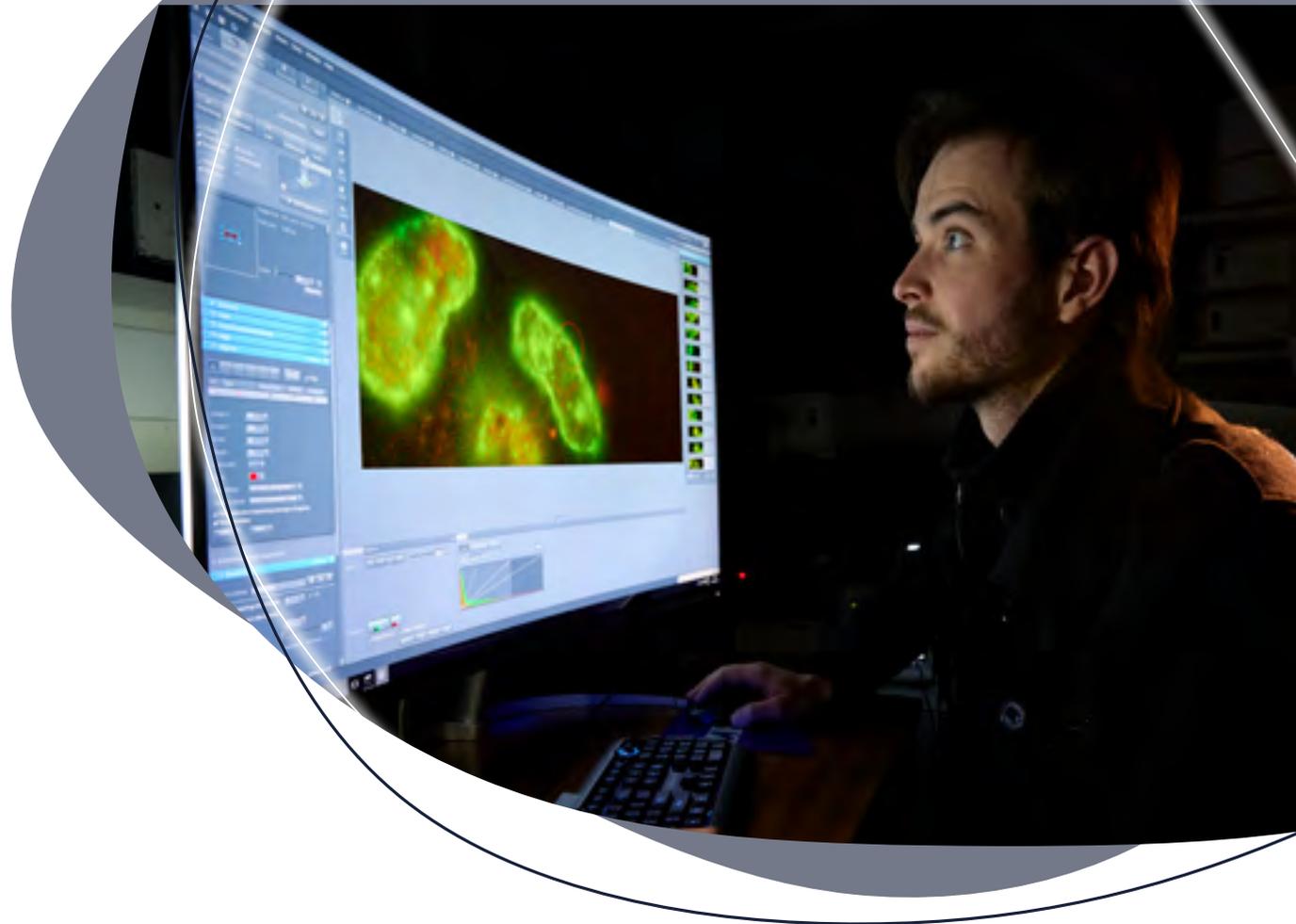


Healthcare and
Disease



Cell Based Testing

Our facilities address testing at the cell and tissue level as well as offering advanced microscopy and imaging capabilities such as electron and cryo-electron microscopy. We support projects across a wide range of prokaryotic and eukaryotic organisms.



Centre Optical Instrumentation Laboratory (COIL)



Food and Drink



Agri-Tech, Agri-food and Plant Biology



Life Sciences and Industrial Biotechnology



Pharmaceuticals and Medical Biotechnology



Healthcare and Disease

TECHNOLOGIES AVAILABLE

The COIL facility houses a range of microscopes capable of performing timelapse imaging at high temporal and spatial resolutions whilst maintaining focus. These can examine specimens from yeast and fungus through to embryos and polymer lattices. The facility staff offer their expertise and guidance to ensure researchers use the correct setup to achieve their desired outcome and are adept at writing bespoke ImageJ plugins to create analysis pipelines. These can assist by speeding up the analysis process or adding functionality to the existing software.

EQUIPMENT AVAILABLE

Microscopes capable of performing timelapse imaging at high temporal and spatial resolutions whilst maintaining focus.

- Zeiss LSM 980 Airyscan Confocal
- Zeiss LSM 880 Airyscan confocal
- Leica SP5 laser scanning confocal microscope
- Zeiss TIRF III
- Nikon Ti2 CSU-W1 Spinning Disk Confocal
- Nikon Ti2 widefield microscope
- Zeiss Axio Observer widefield microscope
- Deltavision Elite widefield microscope
- Thermo Fisher Attune NxT Flow Cytometer

SOFTWARE AVAILABLE

Image Analysis/Processing

- Imaris
- ImageJ/Fiji
- Metamorph
- Zeiss Zen 3.0

Find out more about the [Centre Optical Instrumentation Laboratory](#).



Beacon[®] – Edinburgh Genome Foundry



Food and
Drink



Agri-Tech, Agri-food
and Plant Biology



Life Sciences
and Industrial
Biotechnology



Pharmaceuticals
and Medical
Biotechnology



Healthcare and
Disease

TECHNOLOGIES AVAILABLE

The integration of the Beacon[®] system (currently the only instrument of its kind in a European academic establishment) builds on and expands Edinburgh Genome Foundry's sophisticated automated platform. The system is a game-changing platform that uses light to move individual cells around and trap them in isolated chambers (nanopens). Cells are maintained in a precisely controlled environment and a large number of assays can be performed repeatedly on thousands of single cells while high resolution images (5-colour fluorescence & brightfield) of single cells are captured over time.

Identifying cells with useful medical or research properties involves the analysis of thousands of cells to isolate those with the optimal properties, prior to cell line selection and scaling up of their production. The Beacon[®] provides researchers with a high-throughput one-stop shop that automates and simplifies this process - improving accuracy, reducing costs and shortening timescales from months to days. Use of EGF's Beacon[®] enables our academic and industrial customers to make important discoveries at an unprecedented speed and scale providing us with the ability to identify the "needle in a haystack" cell.

EGF provides open access to the system (fee for service), making it available to new and existing customers in academia and industry across the world.

AVAILABLE HIGH-THROUGHPUT WORKFLOWS:

- Cell Line Development (CLD; suspension and adherent cells)
- Antibody Discovery (AbD)
- Single cell transcriptome (OptoSeq Single cell 3' mRNA)

To follow:

- Cell Therapy Development

Contact us to explore how the EGF team and Beacon[®] can help accelerate your research and development needs today.

Find out more about our [Beacon[®] system](#).



Cryo Electron Microscope Facility

TECHNOLOGIES AVAILABLE

The Cryo-EM facility offers high-resolution imaging of biological samples under cryogenic conditions as well as electron crystallography capability.

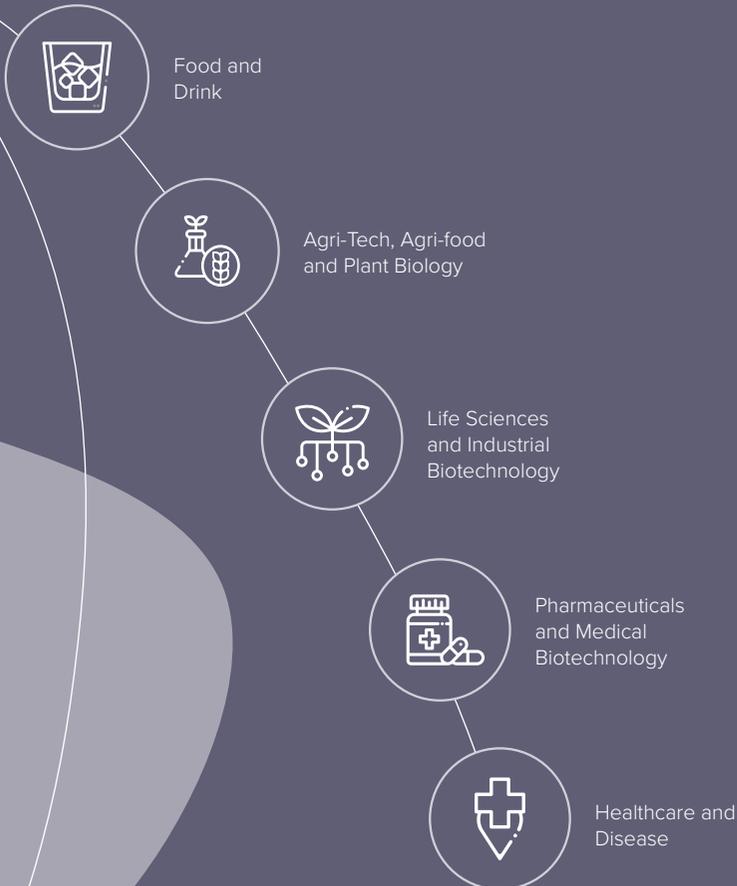
Techniques:

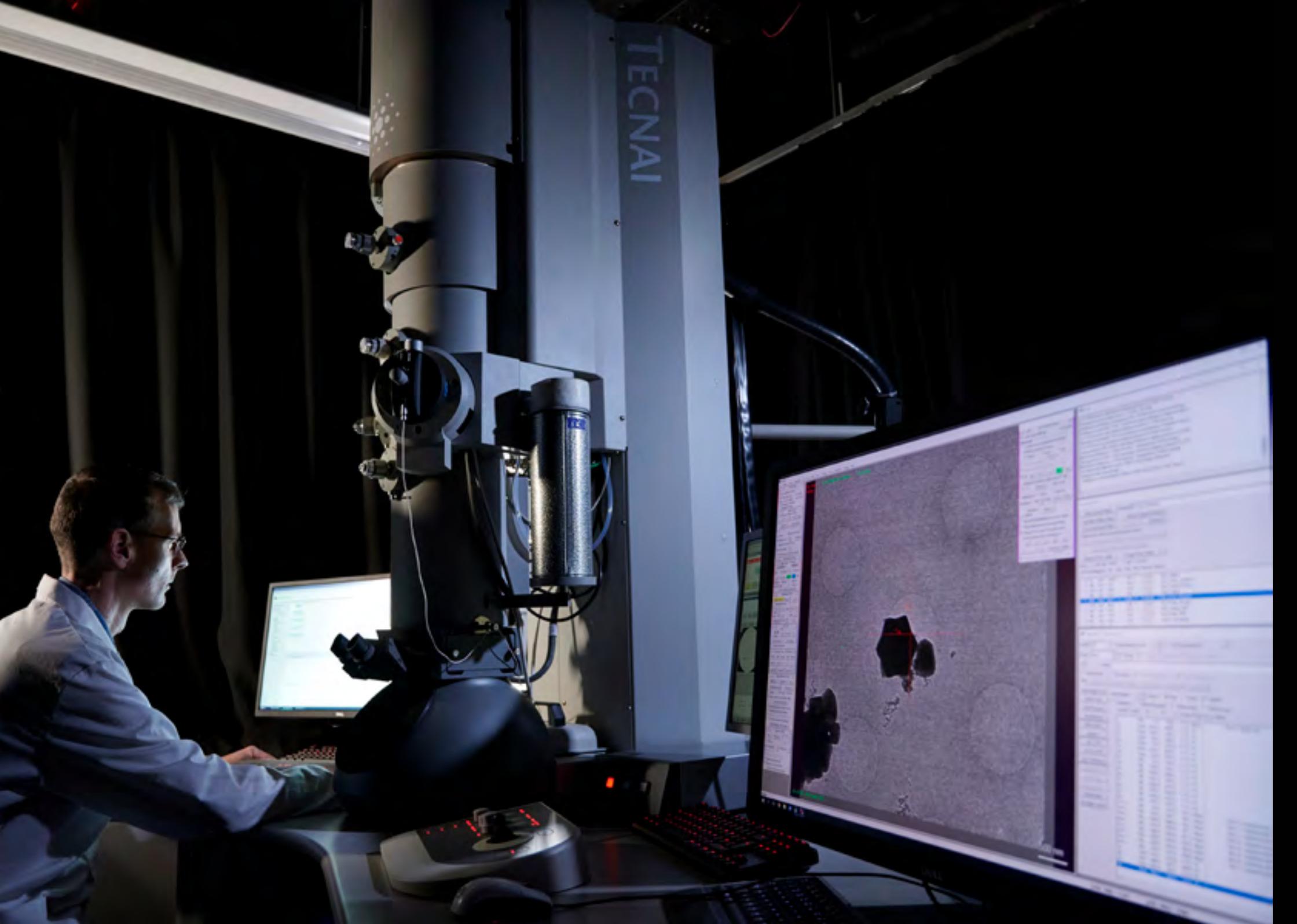
- Standard 2D projection imaging of thin samples.
- Single-particle analysis of proteins is the core strength of the facility.
- (Cryo-) electron tomography provides 3D information of a single specimen by physically tilting the specimen inside the microscope.
- Electron diffraction provides structural information on crystalline material.
- Extensive training (or service) for users, ranging from negative stain sample preparation, conventional room-temperature TEM, to plunge-freezing, cryo-TEM and processing of single-particle data.

EQUIPMENT AVAILABLE

- Thermo Fisher Scientific Tecnai F20 electron microscope (200 kV, field emission gun) equipped with an 3k x 3k CMOS camera (Gatan Rio) and Gatan K2 direct electron detector.
- Gatan single tilt liquid nitrogen cryo-transfer holders (Gatan 626 and 698), with transfer-stations, pumping station and temperature control units.
- Thermo Fisher Scientific Vitrobot automated vitrification unit (Vitrobot mark IV).
- Various supporting equipment, such as a glow-discharge unit, negative stain facilities and a room-temperature holder.
- Extensive computer resources for data processing.

Find out more about the [Cryo Electron Microscope Facility](#).





Transmission Electron Microscope Facility

TECHNOLOGIES AVAILABLE

The TEM facility offers a variety of preparation and imaging services for room-temperature samples, including plastic sections, negative-stain and shadowed materials. Training can be provided.

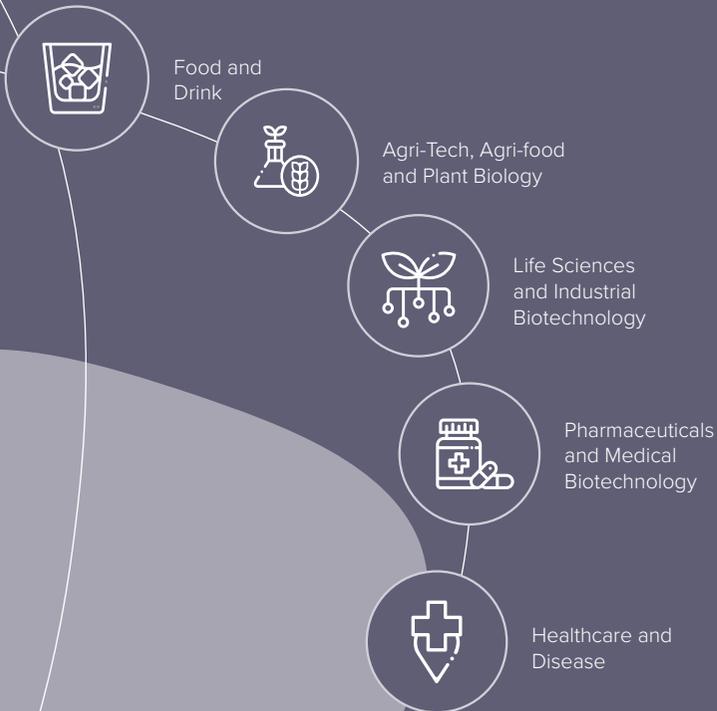
- TEM processing to block
- SEM processing to stub
- Critical Point Drying
- Semi-thin sectioning
- Ultra-thin sectioning
- Sputter coating
- Negative staining
- Carbon coating
- Provision of grids

EQUIPMENT AVAILABLE

Our wide range of equipment includes:

- Jeol JEM1400 Plus Transmission Electron Microscope with OneView Camera
- Gold Palladium Sputter Coater
- Quorum Glow Discharger
- Leica ACE-600 Rotary Shadower
- Leica Ultracut UCT Ultramicrotome
- Edwards Vacuum Coater

Find out more about the [Transmission Electron Microscope Facility](#).







Organism Phenotype

We address organism phenotype through cell sorting using flow cytometry, and plant phenotypes via our plant growth facility. These have supported a diverse range of academic and commercial projects.



Flow Cytometry Core Facility

TECHNOLOGIES AVAILABLE

Flow cytometry is a laser-based technology that allows the multi-parameter measurement of characteristics of biological particles in a single cell suspension as they flow in a liquid medium past an excitation light source. This can be applied to whole cells as well as prepared cellular components such as nuclei or organelles. The underlying principle is that light is scattered, and fluorescence emitted, as light from the excitation source strikes individual moving particles. Flow cytometry is particularly important for biological research because it allows qualitative and quantitative examination of whole cells and cellular constituents that have been labelled with a wide range of commercially available reagents, such as dyes, reporter proteins and monoclonal antibodies.

We have 20 parameter multiplexing capability with aseptic cell sorting technologies, including 4-way simultaneously sorting and single cell cloning. The facility also offers HTS plate acquisition with support for experimental design and analysis.

EQUIPMENT AVAILABLE

Bench top analysers available for multiparameter analysis:

- FACSCalibur (BD) - dual laser - 488/633nm - 6 parameter
- FACSCanto II (BD) - 407/488/633nm - 2/4/2 colour
- LSR II (BD) - 355/407/488/633nm - 2/6/6/3 colour
- LSRFortessa (SORP-BD)- 407/488/561/633nm - 6/2/5/3 colour

Also available is a state-of-the-art high speed cell sorter:

- FACSAria IIu Cell Sorter - 407/488/561/633nm - 6/2/5/3 colour

The FACSAria cell sorter provides a method for dissecting a heterogenous mixture of biological cells into discreet sub-populations, one cell at a time, based upon the specific light scattering and fluorescent characteristics of each cell. It is a useful scientific instrument which provides fast, objective and quantitative recordings of fluorescent signals from individual cells as well as physical separation of cells of particular interest.

Find out more about the [Flow Cytometry Core Facility](#).



Agri-Tech, Agri-food
and Plant Biology



Life Sciences
and Industrial
Biotechnology



Pharmaceuticals
and Medical
Biotechnology

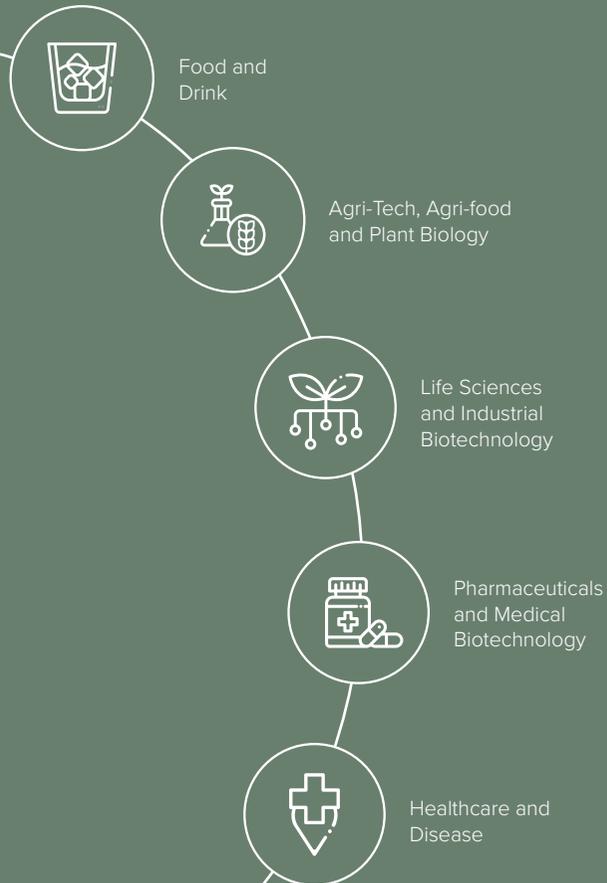


Healthcare and
Disease

Research Product



Edinburgh Plant Growth Facility



FACILITIES AVAILABLE

Current facilities for plant growth include standard glasshouse, controlled environment rooms, Grodome, growth cabinets and tissue culture rooms. We have standardized our light sources to LED daylight spectrums throughout the facility.

Tissue Culture Facility

Facilities for the maintenance and propagation of plant tissue culture:

- 3 temperature controlled rooms (21m² shelf space, lab with laminar flow hoods).

Controlled Environment rooms and cabinets

- 7 walk-in growth rooms (240m² of shelving.)
- 6 rooms run 16 hours light, 1 room runs 9 hours light.
- Five Snijders Economic Deluxe and two Snijders Microclima growth cabinets.
- Standard environmental conditions are 15°C - 40°C temperature range with up to 250µmol/m²/s of light intensity.

The Grodome

The Grodome is a containment glasshouse with a small header room attached. There are five chambers, one which is primarily used for growing transgenic plants and for research into plant pathogens.

Glasshouse

One heated glasshouse with a total bench surface of 134m² including 3m² of an automated misting unit. Temperature and day length are regulated through a BMS control system. Light levels in the heated glasshouse are ~150µmol/m²/s at bench height.

The plant growth facility can provide the following services:

- Plant maintenance
- Pest control
- Soil / media mixing and trials
- Plant propagation from seed/cuttings to harvest
- Regeneration of plants from cuttings
- Tissue culture
- Crossing
- Grafting
- Seed stock generation

Contact us for further details of our plant growth facilities and protocols.

Find out more about the [Edinburgh Plant Growth Facility](#).



FACILITY

SERVICES



Healthcare
and
Disease



Pharmaceuticals
and Medical
Biotechnology



Life Sciences
and Industrial
Biotechnology



Food
and
Drink



Agri-Tech,
Agri-food and
Plant Biology

DNA ASSEMBLY/SEQUENCING AND BIOINFORMATICS

Facility	Services	Healthcare and Disease	Pharmaceuticals and Medical Biotechnology	Life Sciences and Industrial Biotechnology	Food and Drink	Agri-Tech, Agri-food and Plant Biology
<u>EDINBURGH GENOME FOUNDRY</u>	<ul style="list-style-type: none"> High-throughput design and assembly of DNA constructs Access to multiple, established DNA assembly methodologies Miniaturisation of molecular protocols Automated PCR and qPCR Automated transformation, plating and colony picking Mini bioreactor 	✓	✓	✓	—	✓
<u>EDINBURGH GENOMICS</u>	<ul style="list-style-type: none"> Short read Sequencing: Illumina MiSeq and NovaSeq 6000 Long Read Sequencing: PacBio Sequel IIe, Oxford Nanopore PromethION Bioinformatics: software development, data analysis, large-scale genomics data Sequencing and bioinformatics projects design End-to-end genomics project support Bespoke bioinformatics analysis Development and delivery of tailored bioinformatics training 	✓	✓	✓	✓	✓

PROTEIN PRODUCTION

Facility	Services	Healthcare and Disease	Pharmaceuticals and Medical Biotechnology	Life Sciences and Industrial Biotechnology	Food and Drink	Agri-Tech, Agri-food and Plant Biology
<u>EDINBURGH PROTEIN PRODUCTION FACILITY</u>	<ul style="list-style-type: none"> Protein production and purification Bacterial, yeast and Baculovirus expression platforms Small-scale mammalian expression Centralised biophysical analysis platforms Low volume MicroCal AutoITC200 Viscotek SEC-MALS 20, BIAcore-T200 SPR Multimode plate reader, Thermal Shift Assay, DLS 	✓	✓	✓	✓	✓

CELL FREE TESTING

Facility	Services	Healthcare and Disease	Pharmaceuticals and Medical Biotechnology	Life Sciences and Industrial Biotechnology	Food and Drink	Agri-Tech, Agri-food and Plant Biology
<u>EDINOMICS</u>	<ul style="list-style-type: none"> Global metabolome and proteome workflows Sample processing and complementary preliminary tests Rapid metabolomics method for data analysis Target-specific quantitative methods for customer needs Simultaneous metabolite, protein, lipid extraction protocol 	✓	✓	✓	✓	✓

FACILITY

SERVICES



Healthcare
and
Disease



Pharmaceuticals
and Medical
Biotechnology



Life Sciences
and Industrial
Biotechnology



Food
and
Drink



Agri-Tech,
Agri-food and
Plant Biology

CELL BASED TESTING

<p><u>CENTRE OPTICAL INSTRUMENTATION LABORATORY (COIL)</u></p>	<ul style="list-style-type: none"> • Reverse Phase Protein Arrays • Forward Phase Antibody Microarrays • NanoString • Quantification of biomarkers: transcriptomic / post-translational levels • Microscopes capable of performing timelapse imaging • Microscopes maintain focus at high temporal / spatial resolutions 	✓	✓	✓	✓	✓
<p><u>BEACON® EDINBURGH GENOME FOUNDRY</u></p>	<p>High-throughput capabilities (mammalian cells)</p> <ul style="list-style-type: none"> • Cell Line Development (CLD; suspension and adherent cells) • Antibody Discovery (AbD) • Single cell transcriptome (OptoSeq Single cell 3' mRNA) <p>• BioLector Pro mini bioreator with microfluidics capability (bacteria and yeast)</p>	✓	✓	✓	✓	✓
<p><u>CRYO ELECTRON MICROSCOPE FACILITY</u></p>	<ul style="list-style-type: none"> • High-resolution imaging under cryogenic conditions • Standard 2D projection imaging of cryo-samples • Single-particle analysis: single protein, protein complex • 3D information of a single specimen • Electron crystallography 	✓	✓	✓	✓	✓
<p><u>TRANSMISSION ELECTRON MICROSCOPE FACILITY</u></p>	<ul style="list-style-type: none"> • Preparation and imaging for room-temperature samples • TEM processing to block • SEM processing to stub • Critical Point Drying • Semi and Ultra-thin sectioning • Sputter coating, negative Staining • Carbon coating, provision of grids 	✓	✓	✓	✓	✓

ORGANISM PHENOTYPE

<p><u>FLOW CYTOMETRY CORE FACILITY</u></p>	<ul style="list-style-type: none"> • Multi-parameter characteristics in single cell suspension • Qual- and quant cell examination: whole / constituents • 20 parameter multiplexing capability • Aseptic single cell cloning • 4-way simultaneous cell sorting • HTS plate acquisition • Support for experiment design and analysis 	✓	✓	✓	—	✓
<p><u>EDINBURGH PLANT GROWTH FACILITY</u></p>	<ul style="list-style-type: none"> • 134m2 of benched glasshouse space • 7 controlled environment rooms (240m2 of shelving) • Grodome (containment glasshouse) • Maintenance / propagation of plant tissue culture materials • Growth / care of non-transgenic plants, natural conditions 	✓	✓	✓	✓	✓



Get in touch

This brochure lists some of the University of Edinburgh's cutting-edge facilities that are available to enable and accelerate innovation.

Edinburgh Innovations can help facilitate the best solution to your research demands whether it be a routine or bespoke service.

If you have any enquires related to access and use of facilities please contact:

Cameron Chalmers

Consultancy Associate
School of Biological Sciences
Edinburgh Innovations

SBS-Facilities@ei.ed.ac.uk



Healthcare and
Disease



Pharmaceuticals and
Medical Biotechnology



Life Sciences
and Industrial
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Food and
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and Plant Biology



THE UNIVERSITY
of EDINBURGH



EDINBURGH
INNOVATIONS

**Edinburgh Innovations is the University of
Edinburgh's commercialisation service.**

We benefit society and the economy by helping researchers, students and industry drive innovation. We seek opportunities, we build partnerships for mutual benefit, we make the journey easy, and we add value at every stage.

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