

Facilities and Technologists

SULSA's infrastructure investments fall into six broad areas:

- » Next Generation DNA Sequencing
- » Proteomics and Metabolomics
- » Biological and Biomedical imaging
- » Drug discovery
- » Micro and Nano Fabrication
- » Mouse Transgenics

Next Generation DNA Sequencing

sulsa.ac.uk/dnasequencing

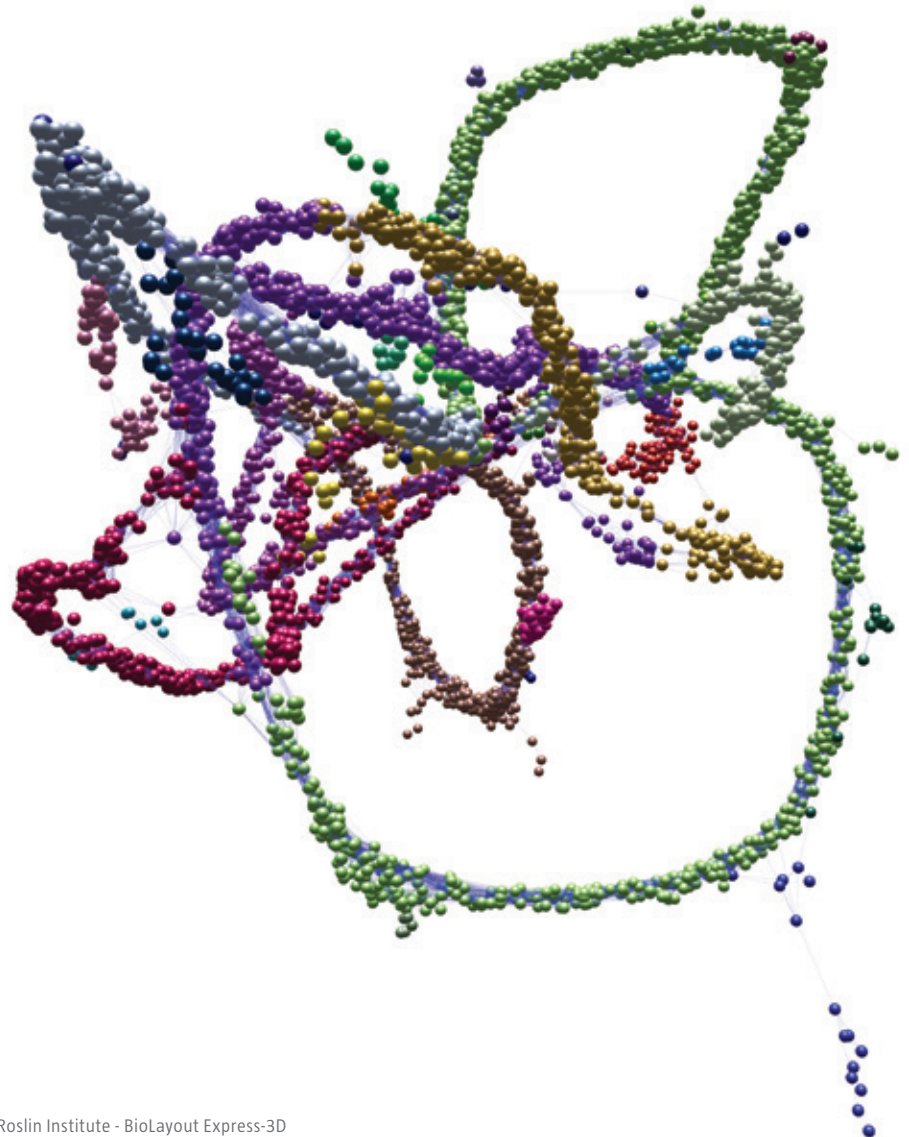
» SULSA researchers benefit from a fast, low-cost next generation DNA sequencing and analysis service provided by the Gene Pool at the University of Edinburgh, the Sir Henry Wellcome Functional Genomics Facility at the University of Glasgow, and ARK-Genomics at the Roslin Institute.

The Gene Pool offers gigabase-scale DNA sequencing using Illumina Solexa and Roche 454 platforms, with a range of data-analysis services provided by a dedicated SULSA bioinformatician. The Gene Pool also offers a low-cost Illumina digital transcriptomics (Illumina-DT) service that is supported by a SULSA technologist. A SULSA bioinformatics specialist based at the Sir Henry Wellcome Functional Genomics Facility is available to assist SULSA users with their Illumina-DT data analysis.

The ARK-Genomics centre for comparative and functional genomics has the latest Illumina HiSeq 2000 sequencer, and can offer sequencing of genomic DNA, transcriptome profiling by RNA-Seq, analysis of transcription factors using ChIP-Seq, microRNA sequencing, epigenetic sequencing (Bisulfite or Methylated DNA capture) and sequencing of targeted regions including exome sequencing. The ARK-Genomics team of bioinformaticians are available to assist with data analysis and visualisation.

SULSA is ensuring that life scientists in Scotland have access to the state-of-the-art facilities and cutting-edge technology platforms they need to stay at the forefront of their fields. Facilities across Scotland are supported by SULSA and all can be accessed by researchers based at any Scottish University at local-user rates.

SULSA has also created 25 SULSA technologist positions across Scotland. By providing technical support and training, and by developing new tools and methodologies, these technologists are expanding research capabilities at Scottish Universities



The Roslin Institute - BioLayout Express-3D

Proteomics and Metabolomics [sulsa.ac.uk/ proteomicsmetabolomics](http://sulsa.ac.uk/proteomicsmetabolomics)

Scottish Structural Proteomics Facility

» The Scottish Structural Proteomics Facility (SSPF) is a collaborative high throughput structural genomics project involving the Universities of St. Andrews, Dundee, Glasgow and Warwick.

The facility, which is run on a collaborative basis, has an excellent track record of converting gene sequences into structural data, and has experience with both membrane and soluble proteins. SPPF staff have expertise in cloning, expression, purification and crystallisation, and new subjects for analysis can enter the pipeline with anything from a gene through to pure protein or even a crystal.

SULSA has supported the development of the SSPF by contributing to the enhancement of equipment and by providing funding for four SULSA technologists within the facility.

Edinburgh Protein Production Facility

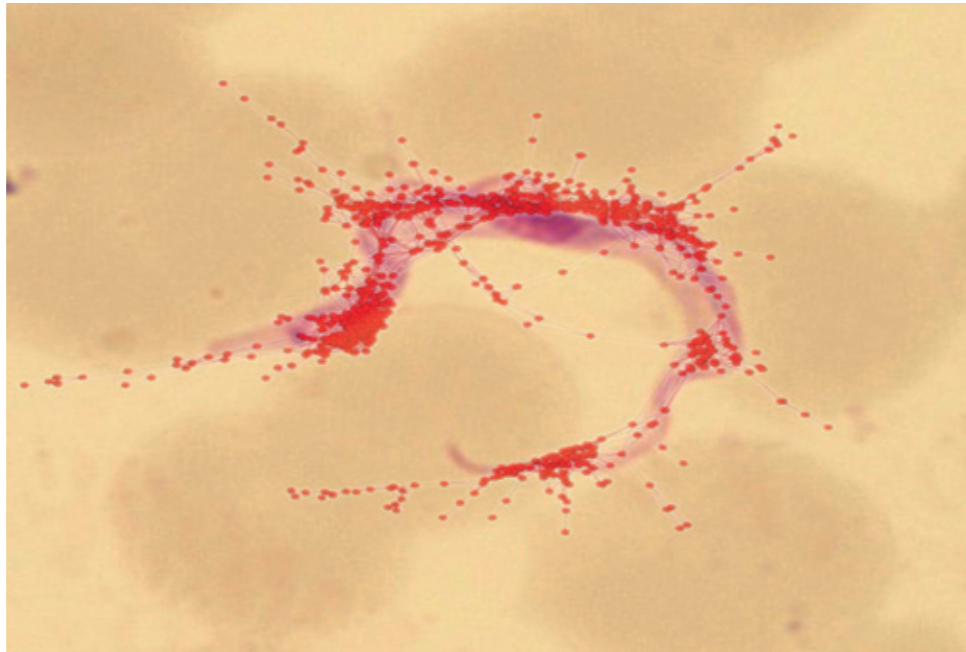
» The Edinburgh Protein Production Facility (EPPF) provides researchers with access to state-of-the-art equipment and expertise for rapid protein production. The SULSA-supported EPPF labs, located at the University of Edinburgh, include a purification suite, an extensive core column and chromatography resin library, high throughput robotic cloning and screening facilities, incubation areas, a tissue culture suite, and a set of core wet labs with access to automated cell lysis, centrifugation, and analysis instrumentation. Users of the EPPF benefit from the expertise of facility staff, including a SULSA technologist, who is highly trained in protein expression and purification.

Biophysical Characterisation Facility

» The SULSA-supported Biophysical Characterisation Facility (BCF) at the University of Edinburgh offers state-of-the-art equipment for crystallisation robotics, ITC, surface plasmon resonance, NMR, light scattering and fluorescent spectroscopy. Technical support is provided by expert BCF facility staff, including two SULSA technologists.

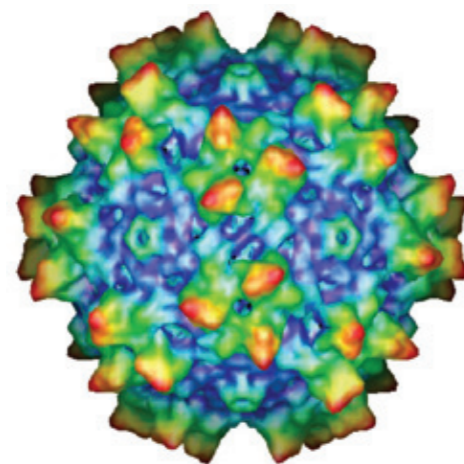
Scottish Metabolomics Facility

» Metabolomics is a relatively new approach in biological and biomedical research, in which thousands of metabolites that represent the dynamic status of a living



Scottish Metabolomics

system are measured simultaneously. Environmental perturbations or genetic changes are reflected in changes in metabolite levels. Metabolomics is, therefore, a key tool in systems biology and systems medicine. The SULSA-funded Scottish Metabolomics Facility (ScotMet), is a state-of-the-art facility combining mass spectrometry, separations technology and bioinformatics. It is a collaboration between the Universities of Glasgow and Strathclyde that builds on relevant, long-standing expertise at these centres. ScotMet aims to provide a world-class facility staffed by experts in metabolomics, working closely with leaders in the fields of genomics, proteomics and bioinformatics, who can provide training, sample analysis and collaboration on experimental design and data handling.



Electron Cryomicroscopy

Biological and Biomedical imaging sulsa.ac.uk/imaging

SULSA OMX microscope

» The SULSA OMX microscope at the University of Dundee is one of only seven OMX structured-illumination microscopes in the world. The technology used by OMX can generate images with a resolution approximately twice that which is normally possible - to 100nm in xy and 200nm in z. In real terms, this means that biological structures that were once indistinguishable from one another can now be identified as separate entities.

Two main imaging protocols are available: fast live 3D imaging and 3D structured illumination microscopy. These functions allow users to explore the spatial and temporal elements of biological processes with greater resolution than ever before. The SULSA OMX is open to users at any Scottish University and is supported by a dedicated SULSA technologist.

Electron Cryomicroscopy Facility

» Essential cell functions depend on the interplay of specific proteins, RNA and DNA in large complexes at defined locations within the cell. By their nature, many of these complexes are scarce, flexible, or of variable composition, which renders them difficult targets for structural studies by X-ray crystallography. Electron cryomicroscopy is a high resolution, single molecule approach to determine the structure of macromolecular complexes. Specimens are imaged at

cryogenic temperatures without fixing or staining, thus capturing macromolecular assemblies in their native state. The method can be used to study temporal changes in the structure and composition of complexes, and generates near-atomic resolution models to inform subsequent studies of molecular function.

The SULSA-supported Electron Cryomicroscopy Facility at the University of Edinburgh will provide access to, and training and technical support for: sample preparation, electron microscopy and cryomicroscopy on a field emission gun electron microscope equipped with a state-of-the-art detector, basic techniques in single particle image reconstruction

Centre for Live Cell Imaging and Molecular Physiology

» SULSA is supporting the establishment of a multidisciplinary live-cell imaging and molecular physiology facility based at the University of Aberdeen. From 2010 the facility will provide Scottish researchers with the tools to study molecular dynamics, intermolecular interactions, and intracellular signalling mechanisms in live organisms. The facility will be supported by a dedicated SULSA technologist and will offer the following capabilities: electrophysiology recordings on a multi-cell, patch-clamp platform, single channel recordings, on-site cell culture capability and live-cell imaging using 2-photon microscopy, histochemical facility, expertise in correlated imaging and electrophysiology experiments, guidance and training in the above technologies, specialized technical support for *in vivo* imaging.

SULSA Imaging Technologist

» The SULSA Imaging Technologist at the University of Glasgow will support the biological imaging community

within Scotland by: providing technical advice and support on a range of imaging systems including two-photon confocal microscopy, whole organ/body fluorescence/luminescence imaging and structured light applications, writing customised open source software for image analysis for university laboratories across Scotland, coordinating and the teaching courses on computational techniques associated with imaging.

Bioworkstation

» The Bioworkstation at the University of St Andrews is an interdisciplinary collaboration between physicists and biologists that has led to the development of novel cellular manipulation and imaging capabilities, including phototransfection of cells, optical sorting and tweezing of cells, and single molecule imaging techniques. The SULSA Biophysical Cell Technologist will contribute to the development of these cutting edge technologies and make them available to researchers at SULSA universities.

Preclinical PET Imaging Facility

» The SULSA-supported preclinical positron emission tomography (PET) facility at the University of Aberdeen offers tracing of pharmaceuticals in small animal models and can be accessed by researchers based at SULSA institutions.

IVIS Spectrum Imager

» A system for non-invasive imaging of bioluminescent and fluorescent reporters in living animals is available at the University of Glasgow. The IVIS Spectrum imager can be used for *in vivo* monitoring of disease, cell migration and gene expression. This SULSA-supported facility is supported by a dedicated SULSA technologist and is open to users across SULSA.

Drug discovery sulsa.ac.uk/drugdiscovery

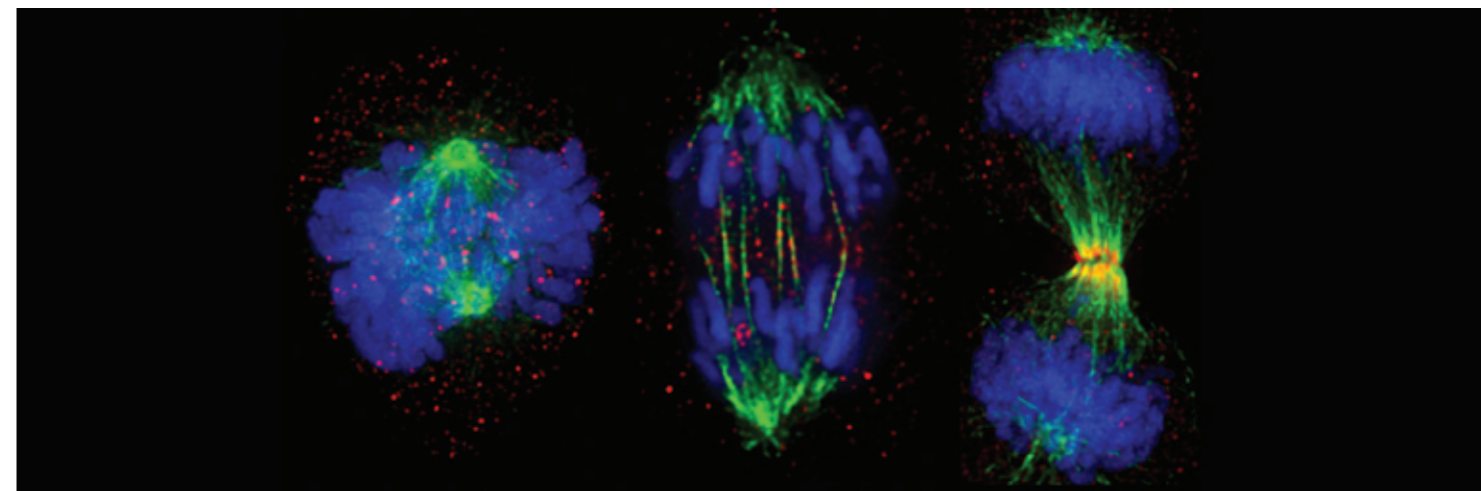
Scottish Hit Discovery Facility

» Researchers at SULSA universities can access industry-standard screening capabilities through collaboration with the SULSA-supported Scottish Hit Discovery Facility (SHDF) at the University of Dundee. The SHDF specialises in medium and high throughput screening of small molecule libraries against both molecular target and cell-based assays, and provides quality controlled starting points for medicinal chemistry programmes.

The purpose-designed laboratories boast industry-standard equipment and software, with all standard screening technology outputs for isolated target and cell-based screening represented. The current screening capabilities of the unit are based around a series of compound sets amounting to a total of >90,000 compounds. These include known bioactive sets, gene family or biology focused sets and diversity sets. The large volume of data generated is managed within a secure, queryable database using purpose designed tools that link biological data to compound structure.

Drug Discovery Portal

» The Drug Discovery Portal (DPP), based at the University of Strathclyde, is a centralised resource for both chemists and biologists to work in tandem to enhance their drug discovery efforts. The DPP matches structures provided by chemists to targets provided by biologists, and uses advanced *in silico* screening for hit identification. The DPP also offers database creation and secure storage of proprietary molecules, virtual screening, druggability filtering and molecular docking analysis. DPP users can also access a proprietary collection of



University of Dundee - SULSA OMX super-resolution microscope.



Drug Discovery Unit

compounds synthesised by chemists, an extensive natural products collection, and a commercial collection from commercial suppliers.

Scottish Bioscreening Facility

» The Scottish Bioscreening Facility originated as a joint SULSA and Wellcome Trust funded initiative to stimulate collaborations and enable large siRNA and compound library screens. The SBF is based around High Content Image Based Screening (HCS) with the GE IN Cell 2000©. This wide-field fluorescence microscopy platform is useful for high throughput image capture and analysis of numerous parameters in a biologically relevant context (e.g. whole cells). The system uses automated microscopy of samples in a variety of sample containers ranging from samples mounted on microscopy slides to uniwell, 96 well, 384 well and even 1536 well microplates, capturing multiple fields of view per well and computer-assisted image analysis gives you values for biological systems with a greater statistical significance.

Cell imaging-based high content analysis (HCA) and high content screening (HCS) are essential tools in many areas of life science research and drug discovery. High content analysis employs image based cellular assays in a high throughput imaging and analysis format. This allows researchers to increase the number of questions they can ask whilst simultaneously decreasing the time taken to achieve their results.

Compound libraries

» SULSA is supporting the development of unique compound libraries, which will be

accessible to SULSA researchers for screening assays. The Strathclyde Natural Products Library comprises 5120 extracts from around the world. With coverage of 90% of plant families, it is one of the most biodiverse (and hence chemically diverse) collections available for screening. The library can be accessed through collaboration with Strathclyde Innovations in Drug Research (University of Strathclyde), which offers facilities for high throughput screening, fractionation of hit extracts, isolation of active compounds, and determination of structures.

Scottish Biologics Facility

» Biologic ligands including classical monoclonal antibodies (and their fragments), peptides and alternative binding scaffolds are invaluable tools for biomarker validation, diagnostic assay development, *in vivo* imaging and drug discovery. Using phage display technology, large antibody or protein libraries can be selected and screened for target binding, by displaying binding sites on the surface of bacteriophage. The SULSA-supported Scottish Biologics Facility (SBF) at the University of Aberdeen will offer antibody-library screening services against a wide range of targets including proteins, peptides and haptens. In addition, SULSA-researchers will be able to gain training in phage display based selection, screening techniques, antibody reformatting etc. through the experienced technologist working within the facility. The facility has recently increased its staff and has moved to new facilities on the University of Aberdeen's Forseterhill site. Protocols are also available for antibody selection.

The Aberdeen Natural Products Library Facility

» The Aberdeen Natural Products Library Facility will make compound libraries available for screening; these will include a purified extract library and a pure compound library. The compounds will be produced by the established Marine Biodiscovery Centre in Aberdeen, which has considerable expertise in obtaining extracts and pure compounds from marine biota. The libraries will be available to researchers at SULSA institutions for testing of diverse biological targets using various high throughput screening platforms.

Marine Biodiscovery Centre Compound and Extract Libraries

» The centre brings together complementary expertise in biology, chemistry, compound isolation and characterisation. The centre has a library of extracts and pure compounds from marine organisms, because the marine environment provides a broad range of habitats and organisms that studies have indicated produce a diverse range of novel compounds and structures with potent biological activities.

Micro and Nano Fabrication sulsa.ac.uk/micronano

» The James Watt Nanofabrication Centre (JWNC) at the University of Glasgow offers microfabrication/nanofabrication capabilities to the interested researcher in the life science community in Scotland who wishes to apply miniaturisation techniques (lab-on-a-chip devices) to solve various technological problems including: cell sorting, microfluidic gradient formation, biosensor fabrication, and thin film electrodes.

Mouse Transgenics sulsa.ac.uk/mouse

» Human diseases can be associated with genetic alterations including gene deletions, point mutations, polymorphisms and gene duplications. The Aberdeen Transgenic Facility can assist SULSA researchers to model human genetic diseases via gene targeting or transgenic approaches. Transgenes can be plasmidbased constructs or artificial chromosomes. A dedicated SULSA technologist is available to provide assistance at various levels including bioinformatics, construct design, micromanipulations, and phenotypic analyses.