

STEM BIOLOGICAL INSIGHT

Cellular components

STEM researchers apply physical principles to answer fundamental biological questions. Highly specialised tools have been developed to model and visualise processes from the cellular scale down to the atomic level. Highlighted here are the scales across which this fundamental work is carried out, boosting understanding of cells, lipids and metabolites, proteins, genes and atoms.



CANCER RESEARCH UK

CAMBRIDGE CENTRE

CELLS

- In vitro modelling
- Microfluidics
- High resolution imaging

Clinical context

Imaging technologies enable 3D cell cultures and organoids to be mapped in multiple colours for high content phenotyping. Super-resolution approaches can visualise processes at nanometre resolution allowing for studies of mitosis, malignant transformation and metastasis.

LIPIDS & METABOLITES

- Metabolic modelling and sensitivity analysis
- Physical and analytical chemistry
- Big data and imaging

Clinical context

Modelling how cancer alters metabolism to synthesize more DNA and cell membranes provides novel targets for the treatment of cancer. Metabolic imaging of tumours allows us to understand how the tumour interacts with surrounding tissues.

PROTEINS

- Physical chemistry
- Nanotechnology
- Microfluidics
- Fluorescence
- Mass spectrometry
- Bioinformatics

Clinical context

Sensitive detection of protein assembly, aggregation and organisation allows for assessment of cell signalling and biomarker detection in bodily fluids. One current project is looking at p53 aggregates in biofluids using fluorescence to develop a method for early detection of cancer.

GENES

- Sequencing
- Computational biology
- Molecular mechanisms

Clinical context

Signatures of gene expression are frequently used to stratify patients into groups corresponding to different sub-types of cancer. One large still on-going project is the METABRIC consortium, which identified novel subtypes of breast cancer, thereby helping diagnosis and providing insight into appropriate treatment decisions.

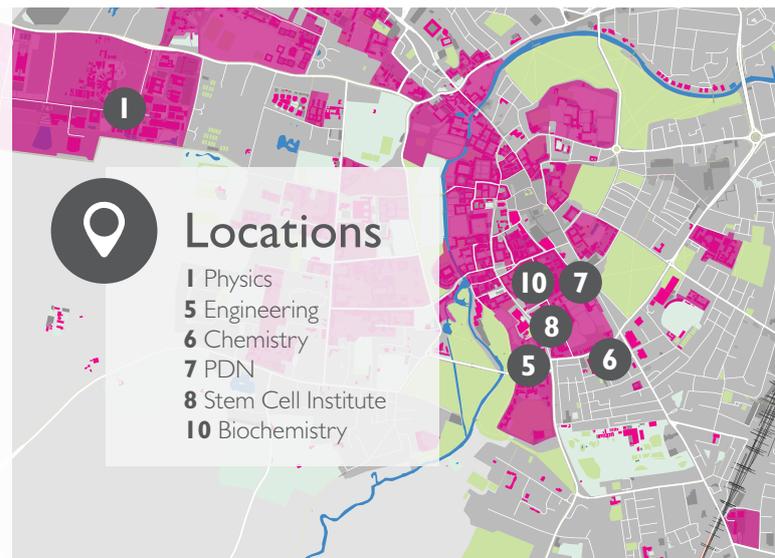
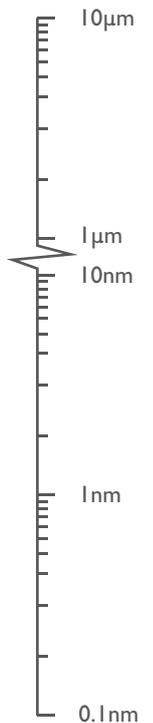
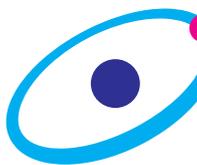
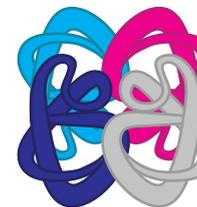
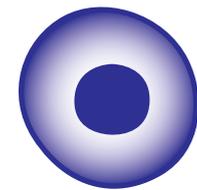
ATOMIC LEVEL

- Fundamental physics

Clinical context

Fundamental principles are applied to compute basic properties of molecules. Currently used to, for instance, accurately predict binding of oxygen and carbon monoxide to haemoglobin and understand binding of drugs.

Cellular components



Locations

- 1 Physics
- 5 Engineering
- 6 Chemistry
- 7 PDN
- 8 Stem Cell Institute
- 10 Biochemistry