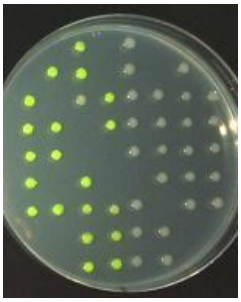
Bioprocessing (manufacture and purification)

Biomanufacture



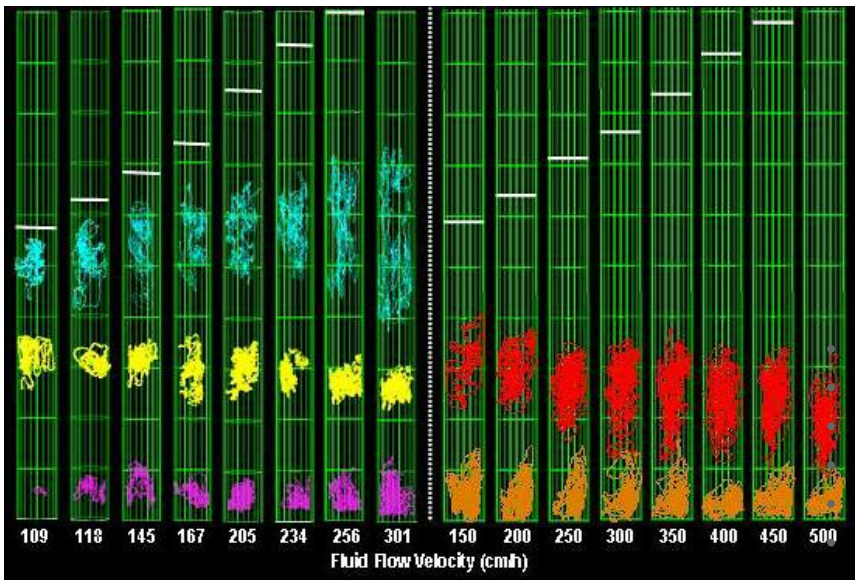
Cells can be used in the production of a range of chemicals and high-value biopharmaceuticals (e.g. recombinant proteins, antibodies, plasmid DNA, major histocompatibility complex class I (MHC-I) molecules, 'designer' carbohydrates and novel antibiotics). In Biochemical Engineering we aim to optimise production processes by using a combination of traditional reaction engineering and modern systems biological approaches to maximise product yield. In reaction engineering we are currently investigating:

- How micro- and macro- mixing effects influence production processes.
- How process conditions can affect the mechanical properties of single cells.

With the advent of genome sequencing and advances in high-throughput methodologies it has become possible to consider organisms as a whole rather than their individual components. This has opened up the possibility of targeting specific pathways to intensify the production of biopharmaceuticals while maintaining optimal cell yields. In Biochemical Engineering, we are actively investigating:

- The way cells sense and respond to bioprocess conditions and the impact that this has on growth and productivity.
- The way in which we can modify cell regulatory networks to optimise bioprocesses.
- Methods to produce correctly folded proteins in vivo, a critical factor affecting function e.g. vaccine candidates

Downstream processing



Direct visualisation of the motion of individual absorbent particles within expanded beds using Positron Emission Particle Tracking (PEPT)

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A current limiting factor in the commercial exploitation of many biopharmaceuticals is the economical isolation and purification of the product from the reaction medium. **Professor Owen Thomas (/staff/profiles/chemical-engineering/thomas-owen.aspx)** is currently pioneering novel methods that seek to achieve this by:

Intensifying downstream process sequences for biopharmaceuticals

Magnetic particle-based separations

Re-design and scale-up of expanded bed adsorption chromatography

Inclusion body processing and protein refolding

Crystallization of industrial enzymes

Synthesis of new support designs and nano-bio-structures and their application for separation, solid-phase analysis, synthesis and assembly of macromolecules

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