Bioprocessing in the New Digital Age

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Automobile Industry

Pharmaceutical Industry

Source: https://synthace.com/computeraided-biology-web
Introduction

• Industry 4.0 has the potential to revolutionise the life sciences sector within the next 5-10 years (automation & robotics, interconnected devices & interconnected people, data retrieval & analysis and AI).

• Digitalisation of data will significantly change the healthcare industry – from drug discovery, to manufacturing & supply and how patients receive treatments.

• Advanced automation will eliminate human intervention and wearable technology and biometrics will guide work and assure data integrity.

• Adoption of digital technologies will not be without its challenges and partnering with regulators will be essential.

• Enabling the UK to be a leader requires a digitally-skilled work force capable of supporting the future growth and competitiveness of the industry.
How we work today

How we will work in the future

‘Factory of the future’

Process digitisation & advanced automation

• ‘Lights out facilities’ through highly automated physical & virtual processes.
• 100% RFT.
• Interconnected devices and implementation of new process analytical technologies (PAT).

Digital workforce

• Employees empowered through data – driven analysis to improve decision making and performance.
• Agile workforce performing only value added activities.

Product & process robustness

• Quality parameters optimised, monitored and evaluated in/on line instead of QC labs.
• Real time release testing (RTRT).
• Adaptive control strategies & continuous manufacturing methods.
• Rapid tech transfer & process validation with modular capability of automation.

Sustainable manufacture, synchronised & optimised

• Live, integrated planning & scheduling enabling demand driven, JIT supply.
• No scrap & minimised yield loss.
• Consistent golden batches & 85% + OEE.
• Sustainability built into our processes - environment, society, economic.
• Fully integrated, synchronised & optimised supply chain.

Source: Adapted from Mire-Sluis, A. (2019) The Bioprocessing Summit, Boston, MA, USA
Case study

Automation & system integration

- Will drastically increase throughput of process development improving productivity and reducing time-to-clinic
- Automation of analytics will improve reproducibility and reliability of our processes, increasing product quality and reducing COGs

Digitalisation & machine learning

- OXB is working with Synthace using its Antha® software (for device interconnectivity) and the Station B team at Microsoft Research (for its cloud computing, machine and deep learning capabilities)
- Digitalisation of OXB’s process development and manufacturing datasets to develop in silico models and novel algorithms will improve process understanding and efficiency of its LentiVector® manufacturing platform

Virtual facility tours/training tools

- VR/AR environments are being used to simulate “real life”, every day manufacturing processes in an artificial, “safe” training environment.
- Interactive training tools are being used for SOPs, training assessments and step by step guides
- “Learn by doing” approaches enables operators to learn and to practice each process step in detail without any risk
Potential impact of VP scheme

• Graduates need to be ‘industry-ready’ and equipped to meet of the challenges ahead with Industry 4.0.

• Areas being considered include:
  
  – Establish a digital strategy framework in conjunction with the Aston Advanced Therapies Advisory Group (include STEM academics not just engineering and industrial SMEs).
  
  – Engage students at all levels within the Schools of Engineering & Applied Science and Life & Health Sciences to raise awareness of inter-disciplinary approaches to solving complex problems e.g. digital skills for careers that serve the needs of Industry 4.0, through lectures, external speakers and workshops.
  
  – Develop “industry – ready” graduates to solve complex problems (self-motivated, proactive, and action-oriented people, leadership skills, change management and “thinking outside the box”).
  
  – Consider providing additional Minor degree subjects ‘bridging the gap’ in knowledge and understanding i.e. in industrial digital technologies, industrial data management, physical digital integration, IoT and AI applications.
  
  – Develop a VR/AR-based environment to simulate real life, every day manufacturing processes to help students understand manufacturing – related issues.
  
  – Establish interdisciplinary research projects (PhD/EngD) with industry including Knowledge Transfer Projects (Innovate UK) to help develop innovative digital solutions.