

Making peptides: enabling a medical revolution

Max Besenhard, Benoît Chachuat, Amparo Galindo, Jerry Y. Y. Heng, George Jackson, Cleo Kontoravdi, Sergei Kucherenko, Ye Seol Lee, Andrew G. Livingston, Hamish Mitchell, Nilay Shah, Eva Sorensen, Vivek Verma, Daryl Williams, Elena Corujo-Simon, Claire S. Adjiman

Headlines

Opportunities

- Peptide-based drugs have seen rapid uptake, becoming top-selling global medicines.¹
- Peptide-based medicines offer advantages such as higher selectivity, improved efficacy, and reduced toxicity compared to small-molecule therapeutics.
- Manufacturing is an essential step in the journey from drug discovery to patient, but peptide manufacturing technologies remain challenging.
- With the right investment in advanced manufacturing research, data infrastructure, and regulatory alignment, the UK can become a global hub for the sustainable production of next-generation peptide and hybrid therapeutics, reaping economic and health benefits.

Issues

- Peptide drugs are difficult and costly to manufacture due to complex synthesis and purification processes that result in a high environmental footprint and low scalability.
- There is insufficient understanding of key peptide properties.
- SMEs and CDMOs play a critical role in bringing manufacturing innovations to commercial scale but face limited access to capital, infrastructure, and regulatory engagement.
- Divergent global regulatory requirements increase costs, delay market access, and hinder the adoption of advanced manufacturing technologies.

Solutions

- Establish a National Centre for Emerging Medicines Manufacturing (NCEMM) to integrate scientific discovery, engineering innovation, and scale-up.
- Stimulate research on platform technologies: understanding and prediction of peptides properties; innovation in synthesis and separation technologies and implementation of process systems engineering, digitalisation and AI approaches.
- Launch a Peptide Genome Initiative (PGI) to support a coordinated effort to generate and share large-scale peptide structure-property data.
- Support PharmaTech SMEs and Innovation Clusters by providing targeted funding, shared facilities, and regulatory engagement opportunities
- Pursue international regulatory harmonisation by working through MHRA and global bodies to align peptide classification and approval pathways.

Conclusions and policy recommendations

The UK government has stated its ambition to unlock the potential of the Life Sciences sector to drive economic growth and improve health.² The recently published Life Sciences Sector Plan outlines a series of measures aimed at stimulating the discovery of new medicines and encouraging investment in manufacturing facilities to enhance the speed and capacity for delivering clinical trials and bringing transformative medicines to patients.

This is especially critical for the manufacturing of emerging modalities, such as peptides, oligonucleotides, antibody-drug conjugates (ADCs) and peptide-drug conjugates (PDCs). These fast-growing modalities are transforming treatment for a range of diseases, including diabetes and cardiovascular disorders. However, their complex production requires targeted investment and coordination across sectors to accelerate clinical trials, enable at-scale production, and overcome sustainability challenges.

The Sargent Centre for Process Systems Engineering host experts in pharmaceutical manufacturing technologies, systems engineering, mathematical modelling and data science. Through collaborations such as PharmaSEL, an EPSRC-Eli Lilly and Company Prosperity Partnership, they advance the state-of-the-art in pharmaceutical manufacturing.³

To support peptide manufacturing, we recommend a focused research effort on understanding and predicting peptide properties, accompanied by a Peptide Genome Initiative, as well as the development of better synthesis and separation technologies. Extending investments in health data generation to manufacturing-relevant data would help to address the UK's commercialisation gap and support companies to scale up production domestically. To further enable scale-up and commercialisation, we also propose investing in process systems engineering, digitalisation and AI innovation.^{4,5}

The UK is well positioned to build on its world-class innovation and manufacturing capabilities to seize the opportunities offered by peptide medicines.^{6,7} This includes leveraging its advanced pharmaceutical manufacturing infrastructure and its strong academic research base in manufacturing. By aligning these assets with strategic investments, the UK can position itself as a key player in the global supply chain for peptide therapeutics while improving healthcare services and delivering benefits to patients.

In agreement with the Life Sector Plan's five interconnected action areas – access to finance, skills, manufacturing, net zero and high value partnerships – we propose the following interventions:

- higher investment to align basic manufacturing research and production at scale;
 - international cooperation to achieve regulatory alignment;
 - up-skilling through targeted training and education initiatives.
- Establishing a National Centre for Emerging Medicines Manufacturing (NCEMM) to integrate scientific discovery with engineering innovation and translation. The centre would support the full pipeline from basic research on platform technologies for manufacturing to commercial-scale production. Such a centre would help drive health innovation, ensuring safe, timely and cost-effective access to medicines and medical technologies for patients.
 - Partnering with industry to drive growth and innovation. Greater interaction between pharmaceutical companies, contract development and manufacturing organisations (CDMOs), manufacturing start-ups and SMEs, universities, regulators, and funders, including venture capitalists and UKRI, is essential. Facilitating these connections through innovation clusters, shared facilities, and public-private partnerships will foster a more agile and responsive ecosystem.²
 - Supporting NCEMM through coordinated R&D Investment. The NCEMM's activities should be supported by a range of related R&D investments by UKRI and other parties in order to:
 - i. obtain data on the behaviour of peptides and other emerging modalities – the Peptide Genome Initiative;
 - ii. increase our ability to exploit these data via AI and other digital modelling platforms;
 - iii. support the invention and adoption of new technologies through fundamental research and translational projects.

A supportive policy framework is also critical. In addition to the targeted incentives for investment in manufacturing capacity afforded by the UK's Life Sciences Innovative Manufacturing Fund (LSIMF), the UK could provide transformative support to its PharmaTech and Original Equipment Manufacturers (OEM) by embedding them in the NIHR Innovation Catalyst.

- Streamlining and aligning regulation. The UK, through the MHRA, could assume global leadership by seeking streamlined regulatory pathways for emerging modalities through better alignment of the designation of these medicines across the world, contributing significantly to cutting red tape.⁸ The overarching aim should remain to prioritise regulatory compliance for medicines while shortening timelines for the benefit of patients.

- Strengthening skills and workforce development. The UK must strengthen its research and skills base to deliver a qualified and interdisciplinary workforce.^{2,9} This includes expanding training programmes for highly skilled graduates, particularly in areas such as advanced manufacturing, systems engineering, and digitalisation & AI.
- Net zero and sustainability. Supporting innovative approaches to process development and sustainable process technologies is essential to ensure the alignment of the sector with the UK's net zero and sustainability goals.¹⁰

By taking these coordinated steps, the UK can not only meet domestic healthcare needs but also become a global hub for the production of next-generation medicines – delivering economic growth, high-value jobs, and improved patient outcomes.

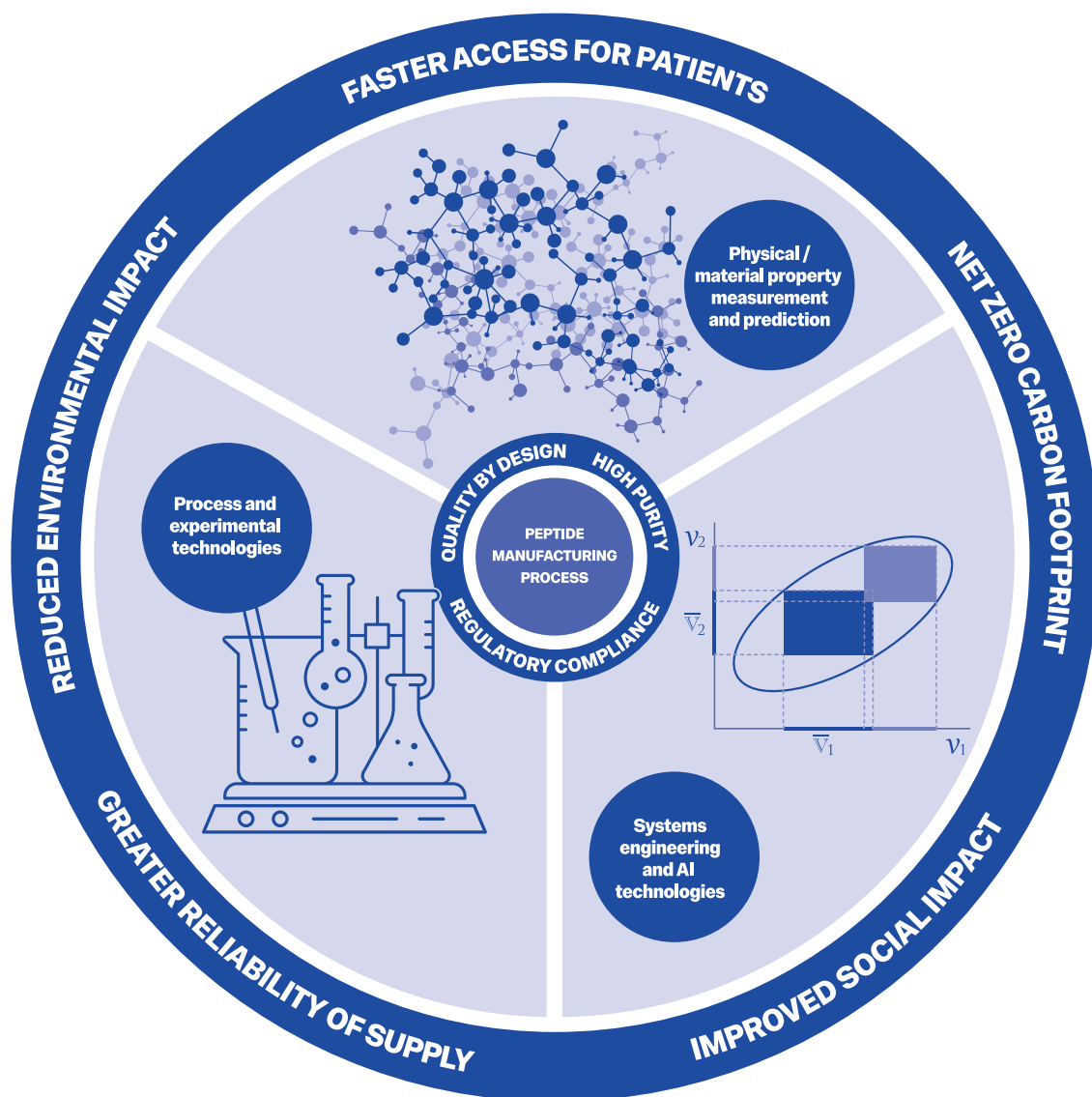


Figure: A holistic approach to manufacturing research and development. Key areas of manufacturing innovation that require a coordinated effort to support the UK Life Sciences sector in developing a world-leading peptide manufacturing capability, improving the health of the population and bringing economic benefits.

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