



Vaccines, biotherapeutics and...cellular meat?!

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From messenger RNA (mRNA) vaccines in response to the COVID-19 pandemic, or a revolutionary treatment to combat Crohn's disease to animal-based products created through cellular agriculture for human consumption, CPI does it all!

CPI are a company, located in the North-East of England and more recently, Scotland. We help a wide range of companies, as well as academic institutions, to develop and scale-up their processes. The products and processes are moved from the ideas and development stage to become a commercial process. Our vision is to create a healthier society, cleaner environment, and a vibrant UK economy by ensuring that every great invention gets the best opportunity to become a successfully marketed product. CPI are a key part of the High Value Manufacturing Catapult (HVMC), which is a group

of manufacturing research centres across the UK dedicated to helping UK universities progress their world-leading research towards commercial uses.

When someone asks me, "So, what kind of science do CPI do?" my go to response is usually "We work on lots of different projects with varying specialist areas, helping customers take their ideas to market". After this interaction, I am more often than not faced with someone that has a puzzled expression on their face. It is sometimes difficult to explain what you do, especially when each day is different from the last and there is not a specific product that you work with on a daily basis.

Over the last couple of years, CPI have been involved in a heap of cutting-edge research and helped bring bright ideas to life! Here are some of my personal favourites that I would love to share with you.

Oral Monoclonal Antibody Treatment for Crohn's Disease

Crohn's disease is a type of inflammatory bowel disease (IBD) in which the immune system attacks the body, resulting in the long-term impairment of the digestive system through chronic inflammation. There are currently no known cures for inflammatory bowel disease, including Crohn's, however the chronic condition can be managed using therapies involving monoclonal antibodies which work by keeping the immune system under control.

Infliximab is a successfully marketed mAb used to relieve the symptoms of Crohn's. Due to monoclonal antibodies being unstable in the digestive system, inflammatory bowel disease therapies are administered in hospitals via intravenous (IV) infusion or injections. Although this method of delivery is effective, it is also time-consuming, invasive, and often inconvenient for the patient. Oral monoclonal antibodies have the potential to be life-changing by enabling a less invasive and painless therapy for individuals suffering with an inflammatory bowel disease.

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In a project led by Intract Pharma, CPI collaborated with SGS Quay Pharma and Pharmidex to develop the first ever oral formulation of infliximab. CPI played an important part in determining process parameters for the large-scale manufacture of an oral infliximab capsule product, characterising the infliximab in the final drug product, assessing the stability of the drug product under varying conditions, and provided Intract Pharma with a successful process to take the oral infliximab to clinical trials.

In summary, CPI helped to accelerate this novel treatment to clinical trials, making Intract Pharma's dream of their oral infliximab being used to help people living with an IBD one step closer to coming true.

Growth Media for Cultured Meat Production

Farming animals for food products is the cause of 51% of all greenhouse gases. By creating animal-based products from cell culture as an alternative, it will help to meet the consumer demand for meat alternatives that is quickly growing. On top of this, cellular agriculture is considered by many to be both more ethical and more sustainable than traditional meat production.



To address this issue, CPI worked with 3D Bio-Tissues to develop a cost-effective and ethical growth medium for cultured meat production.

In order to successfully produce cultured meat in the lab, several essential nutrients are required to support the growth of the cells. Traditional growth media that is often used is Fetal Bovine Serum which is produced from the blood taken from foetuses of pregnant cows when they are slaughtered. Using this component in cellular agriculture prevents the product from being truly animal free and therefore creates an ethical barrier.

To address this issue, CPI worked with 3D Bio-Tissues to develop a cost-effective and ethical growth medium for cultured meat production.

We helped 3D Bio-Tissues with their cellular meat production by developing a high-throughput screening platform using our robotic liquid handling system to test the impact of different macromolecules in order to see how they effected the growth of animal cells and tissues. We then identified the best macromolecules that encouraged the cells to grow the most and helped to reduce the time it took to create a growth media product that is ready for the commercial market.

As a result of CPI's help, 3D Bio-Tissues has been able to create an eco-friendly, animal-free and cost effective growth media product for the cellular agriculture of animal-based products, known commercially as City-Mix Supplements. To date, there are five different types of this product that are available which support various cell types and applications.

RNA Vaccine in Response to the COVID-19 Pandemic

COVID-19 affected all of our lives in some way or another. The whole world came to a halt, teaching moved online and there was a national shortage of toilet paper! The world was required to respond rapidly to the coronavirus outbreak and CPI played a helping hand in that by aiding Imperial College London in their development of an RNA vaccine.

Vaccines prepare your immune system to recognise and respond to invading pathogens, including viruses. Traditional vaccines use very small or inactivated doses of disease-causing pathogens, so that when you are infected by the real thing, your immune system can quickly recognise and destroy them before disease is caused or lessen the severity of disease symptoms. The world of vaccines does not stop with the traditional ones though; over the last decade, the interest in DNA/RNA based vaccines has increased and more recently, have started to take this space by storm.

What is an RNA vaccine? To put it simply, an RNA vaccine contains the genetic material that instructs the human body to make a molecule from the disease causing pathogen (usually a protein) which then enables the immune system to recognise the invading pathogen's protein as foreign and produce a response against it.

CPI Biologics worked alongside Imperial College London to help them develop their messenger RNA (mRNA) vaccine using self-amplifying RNA (saRNA).

We developed a process that successfully made 4 litres of saRNA (the largest scale saRNA vaccine manufacture in the UK!!) and worked with one of our other business units (CPI Formulation) to package the saRNA into lipid nanoparticles (LNPs) to enable the pre-clinical studies. We are also still supporting the UK Government in developing an RNA manufacturing capability in the UK, equipping the UK to respond rapidly to a pandemic.

The case studies discussed in this article are just the tip of CPI's iceberg. There is an entire assortment of research and amazing products that will improve the lives on many, still in the process of being uncovered!

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Glossary

CPI – Centre for Process Innovation, a company that brings together academia, businesses, government, and investors to translate bright ideas and research into a successfully marketed product.

HVMC - High Value Manufacturing Catapult, a group of manufacturing research centres in the UK that form part of the Catapult centres initiative.

Inflammatory Bowel Disease (IBD) – A term used to describe long-term conditions that cause inflammation of the gut.

Gastrointestinal (GI) Tract – The passageway of the digestive system.

Chronic Condition – A disease that is long-lasting in its effects.

Monoclonal Antibodies (mAbs) – A type of protein that is made in a lab that can bind to specific targets in the body.

Intravenous (IV) Infusion – A medical technique where fluids are delivered directly into the patient's vein.

Cellular Agriculture – Production of animal-based products via cell culture methods instead of animal farming.

Macromolecules – A very large molecule that is essential to bioprocess.

Pathogens – Any organism or agent that can cause disease.

DNA – Deoxyribonucleic acid, the hereditary material containing the instructions needed for an organism to be able to grow, develop, survive, and reproduce that is present in almost all organisms.

RNA – Ribonucleic acid, a nucleic acid that is present in all living cells which is involved in coding, decoding, regulation, and gene expression.

Messenger RNA (mRNA) – A single-stranded RNA molecule that corresponds to the genetic sequence of a gene and acts as an intermediate instruction from DNA to the synthesised protein in protein expression within a cell.

Self-Amplifying RNA (saRNA) - An RNA molecule that can produce more copies of itself within a living cell.

Lipid nanoparticles (LNPs) – A nanoparticle composed of lipids that is used as a pharmaceutical drug delivery system.

Find out more

All information used to write this article can be found on CPI's website as follows:

www.uk-cpi.com

www.uk-cpi.com/news/cpi-joins-national-taskforce-to-develop-covid-19-vaccine

www.uk-cpi.com/innovation-in-rna-therapeutics

www.uk-cpi.com/case-studies/revolutionising-ibd-treatment

www.uk-cpi.com/case-studies/3d-bio-tissues

www.cowspiracy.com/facts#:~:text=Livestock%20and%20their%20byproducts%20account,all%20worldwide%20greenhouse%20gas%20emissions.

About the author

My name is Emma, and I am a degree level apprentice at CPI. Sounds fancy, doesn't it? Essentially, I work for CPI whilst they pay for my university studies. I always wanted a job that would help make a difference to the world. I studied my A Levels and did intend to go to university full-time, however I realised that doing so wasn't for me. Instead, I got a job in a little shop until this position came along! I am now about to go into the fifth and final year of my apprenticeship!

Key skills: Creativity, digital skills, teamwork and problem solving.

