Melbourne Biomedical Precinct.

Research Platform 04

Drug discovery

Defining drug discovery

Most pharmaceutical medicines are small molecule drugs, such as acetylsalicylic acid, which is the active ingredient in aspirin. These are chemically manufactured molecules that are easily ingestible and are absorbed into the bloodstream. Most regulate a biological process by binding to a 'target' molecule in the body, such as on the surface of a cell. The drug then modifies the activity of that target or cell, such as by preventing the production of other chemicals that cause pain and inflammation, as in the case of acetylsalicylic acid.

The Melbourne Biomedical Precinct is building on its existing strengths across the breadth of the research and commercialisation pipeline to become one of the world's top drug discovery centres.

A typical drug takes over a decade and approximately $2 billion to move from the laboratory to the market where it can ultimately improve patients' lives. This multi-step process begins in the laboratory with basic research in biology, where therapeutic targets in human diseases are identified and characterised. The next step involves a transition from biology to medicinal chemistry, where promising potential drugs go through high-throughput screening to determine their effects. This process aims to identify, design and develop small molecules that can be progressed to be used in clinical trials to determine their safety and efficacy.

The complexity and expense of drug discovery means that no single organisation, other than major multinational pharmaceutical companies, can take a drug from the laboratory all the way to commercialisation. Rather than being a solo event, drug development is a baton relay, where the potential medicine is passed from researcher to researcher as it is progressively improved and tested before it enters clinical trials. These new medicines then need to clear multiple clinical trials and pass the rigorous demands of regulatory bodies like the Australian Therapeutic Goods Administration or the US Food and Drug Administration before they can be used to treat patients.

In spite of the cost and complexity, the Melbourne Biomedical Precinct has had a number of examples of translating fundamental science into drugs such as anti-flu drug Relenza (Zanamivir), Axiron (transdermal testosterone) and Fibrotech's clinical candidate for fibrosis-related disease. Notably, Venetoclax, which is the product of a highly successful partnership between the Walter and Eliza Hall Institute and pharmaceutical companies AbbVie and Genentech, was recently approved for sale in Australia, Europe and the United States, and is already saving thousands of lives.

The path to developing these new medicines is challenging, however the Melbourne Biomedical Precinct has a solid pipeline of drug discovery projects, any one of which could become the next billion-dollar life-saving drug.

Current strengths and opportunities

Capability across the pipeline

The Melbourne Biomedical Precinct has strength across all areas of the drug development pipeline, spanning basic science, clinical trials and commercialisation. As demonstrated by the success of Venetoclax, WEHI has expertise in high-throughput screening, medicinal chemistry and strong links with the international biopharmaceutical sector. Monash University is currently ranked second in the world for pharmacy and pharmacology and is a world leader in the complex medicinal chemistry and biopharmaceutical testing necessary to optimise drugs. Cancer Therapeutics CRC (CTx) has expertise in drug development and commercialisation, including a licensing deal with MSD to develop a promising new group of drugs in both cancer and non-cancer blood disorders. The Melbourne Biomedical Precinct is home to some of the best hospitals and clinical trial sites in Australia. Melbourne is also home to the Australian Synchrotron at the Clayton Innovation Cluster, the most powerful device of its kind in the southern hemisphere, which is used to identify new drug targets and to refine drugs in development.

Growing expertise

The Melbourne Biomedical Precinct will need to leverage experience from within and outside its boundaries in the process of commercialisation. The Monash Medicines Innovation Centre (MMIC) and BioCurate, a joint venture of Monash University and University of Melbourne with support from the Victorian Government, bring commercial expertise to help develop attractive investable ideas out of new discovery.

Strengthening collaboration

Melbourne Biomedical Precinct leaders have identified the need for greater collaboration within the Melbourne Biomedical Precinct among key opinion leaders (KOLs) across different research institutions with different facilities and expertise. The recent formation of a drug discovery sub-group will help to develop stronger alliances and leverage the collective strength of the Melbourne Biomedical Precinct's Drug Discovery capability.

Future opportunities

Academic drug discovery through to market

Demand for small molecule drugs is high. The pharmaceutical industry is growing rapidly and is expected to be worth US$1.4 trillion in 2022. Pharmaceutical companies are increasingly looking to partner with academic institutes and researchers to develop the next generation of drugs, offering increased opportunity for the Melbourne Biomedical Precinct's drug discovery community.

Industry growth

High-quality basic research is crucial for attracting pharmaceutical partners, requiring improved data transparency and the adoption of standardised protocols and data formats.