Molecular biology investigates the intricate mechanisms of life science at the molecular level. It involves the study of vital biological molecules like DNA, RNA and proteins, as well as various smaller compounds and analysing their functions and interactions within organisms. Researchers in this field investigate the complex pathways and processes that cells utilise to carry out fundamental tasks such as DNA replication, gene expression, and cellular communication. By investigating these processes at a molecular level, scientists gain a range of insights into the underlying causes of diseases and potential therapeutic interventions.

Molecular biology research involves a range of different focuses including molecular biology, genetics, biochemistry, structural biology, cell biology and microbiology. This involves the processes of DNA replication, gene expression, and cell signalling. Oncologists focus on molecular aspects of cancer, while developmental biologists examine genetic cues in embryonic growth. Immunologists investigate immune system specific molecules and proteins. These researchers collaborate to unravel the molecular mechanisms underlying biological processes, shaping fields like genetics, cell biology, and precision medicine.

Molecular biology is an incredibly broad and complex topic that spans over a very wide range of applications and techniques, below is a list of the most frequently used tools and reagents.

More recent advancements in molecular biology have resulted in remarkable advancements that have revolutionised our understanding of life's intricacies. These breakthroughs have far-reaching implications, spanning from medical breakthroughs to ecological insights. A spear heading example of this is precision medicine and its advances in molecular biology enable personalised medical treatments based on a patient's genetic makeup. This includes tailoring drug regimens, predicting disease susceptibility, and identifying optimal therapies paving the way for further novel applications such as the CRISPR/Cas9 gene editing system which has revolutionised the ability to precisely modify genomes. Such technology has applications in research, but also holds potential for treating genetic disorders and developing personalised medicine.