



## Molecular Oncology Services Section Home

### History

The history of molecular oncology is intertwined with the broader history of cancer research. Throughout the ages, cancer has been a formidable foe, and its mysteries have captivated scientists for centuries. However, it wasn't until the mid-20th century that the molecular aspects of cancer began to be unveiled. Breakthroughs in understanding the genetic basis of cancer included the identification of oncogenes—genes with the potential to drive cancerous transformation—and tumor suppressor genes—genes that normally keep cell growth in check. The discovery of the Ras oncogene in the 1980s marked a pivotal moment in understanding the genetic basis of cancer, highlighting the importance of molecular alterations in cancer development.

### Harold Varmus

His work on the oncogene v-src and his co-discovery of retroviral oncogenes earned him a Nobel Prize, underscoring the role of oncogenes in cancer.

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### Mary-Claire King

She is renowned for discovering the BRCA1 gene, a key player in hereditary breast and ovarian cancers, illustrating the power of genetics in cancer research.

### Genetic Approaches

The earliest steps involved identifying specific genes involved in cancer using genetic mapping and linkage analysis.

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### DNA Sequencing

The advent of DNA sequencing technologies enabled the characterization of entire cancer genomes, revealing a landscape of mutations and alterations.

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### Next-Generation Sequencing

This transformative technology revolutionized cancer genomics by enabling large-scale

sequencing and analysis of tumor genomes.

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## **Single-Cell Analysis**

The ability to analyze individual cancer cells has exposed the heterogeneity within tumors, shedding light on therapy resistance and disease progression.

## **Precision Medicine**

Molecular oncology forms the foundation of precision medicine, tailoring treatments based on a patient's unique molecular profile.

2.

## **Targeted Therapies**

Molecular oncology informs the development of targeted therapies that specifically inhibit cancer-associated molecular pathways.

4.

## **Genetic Counseling**

Molecular oncology provides the tools for genetic counseling to assess an individual's risk of hereditary cancers.

6.

## **Tumor Profiling**

Comprehensive molecular profiling of tumors reveals genetic alterations that can be exploited for targeted treatment.

8.

## **Cancer Immunotherapy**

Molecular insights drive the development of immunotherapies that harness the immune system to target cancer cells.

10.

## **Circulating Tumor Cells**

Molecular analysis of circulating tumor cells provides insights into metastasis and treatment response.

12.

## **Functional Genomics**

Molecular techniques are used to uncover the functional roles of genes and their effects on cancer

progression.

14.

## **Oncogenic Signaling**

The aberrant signaling pathways that drive cancer are investigated, leading to therapeutic targets.

16.

## **Angiogenesis Inhibition**

Molecular techniques uncover the molecular regulators of angiogenesis, aiding in anti-angiogenic therapies.

18.

## **Liquid Biopsy**

Molecular analysis of bodily fluids detects minimal residual disease and tracks treatment responses.

20.

## **Future Prospects**

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## **Liquid Biopsies for Early Detection**

Molecular techniques will enhance the sensitivity of liquid biopsies for detecting cancer at early stages.

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## **Non-Coding RNAs**

Molecular oncology will uncover the roles of non-coding RNAs in cancer initiation, progression, and treatment response.

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## **Synthetic Biology**

Molecular oncology will contribute to the design of synthetic biological approaches for cancer therapy.

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