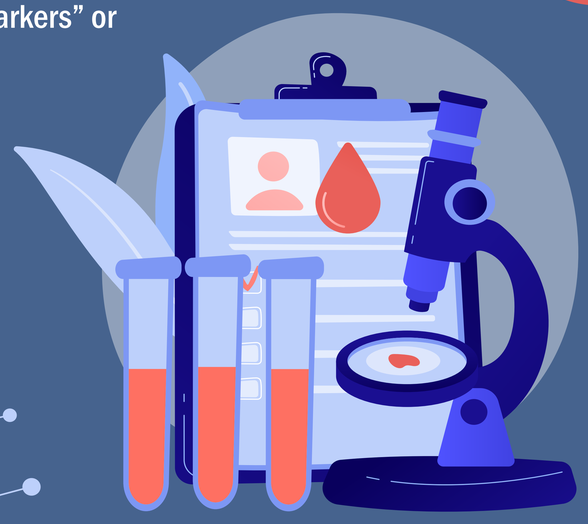
Understanding Biomarkers

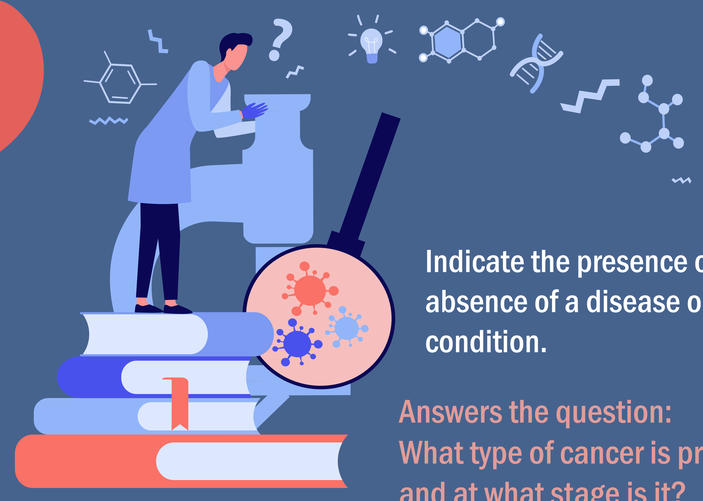
A biomarker is a substance in the body that can indicate if something is normal or abnormal. Doctors use biomarkers to find out if a person has a disease or condition. They also help doctors see how well a treatment is working. Biomarkers can also be called “molecular markers” or “signature molecules.”

Biomarkers can be grouped based on their function, application, or other factors. This series of graphics describes each biomarker, how they may be used and provides an example.

OMPRN
Ontario Molecular Pathology Research Network



Diagnostic Biomarkers



Indicate the presence or absence of a disease or condition.

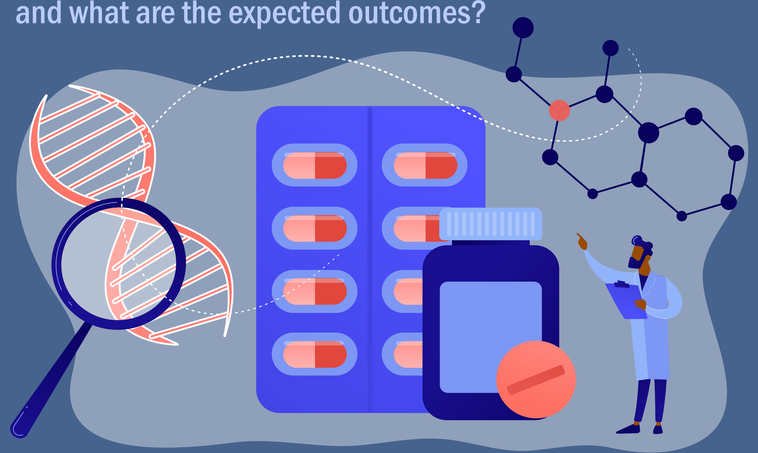
Answers the question:
What type of cancer is present, and at what stage is it?

Example:
Increased levels of Carbohydrate Antigen (CA 19-9) are diagnostic biomarkers used in pancreatic cancer detection and monitoring.

Prognostic Biomarkers

Provide information about disease progression and outcome.

Answers the question: What is the likely course of the disease and what are the expected outcomes?



Example:
Elevated levels of circulating tumor cells (CTCs) are prognostic biomarkers associated with poor survival outcomes in various cancers.

Predictive Biomarkers

Predict response to treatment or therapy.

Answers the question: How likely is it that a specific treatment or therapy will be effective?

Example:
Epidermal Growth Factor Receptor (EGFR) mutation status in non-small cell lung cancer predicts response to targeted therapies against EGFR.

Therapeutic Biomarkers

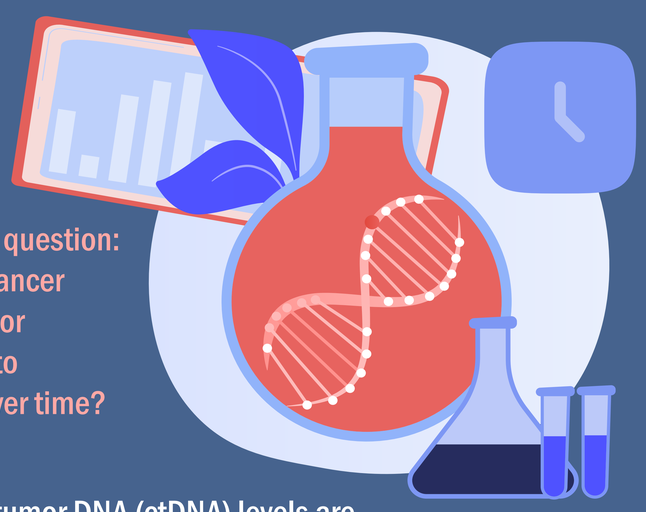
Monitors and predicts the effect of treatment.

Answers the question: How is the current treatment working for the patient?

Example:
Carcinoembryonic Antigen (CEA) is used to monitor treatment response in colorectal cancer. Decreasing CEA levels means that the cancer is responding to therapy.

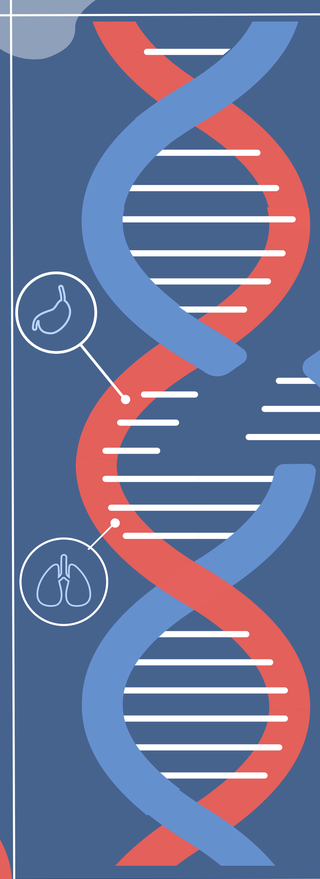
Monitoring Biomarkers

Track disease progression or treatment response over time.



Answers the question: How is the cancer progressing or responding to treatment over time?

Example:
Circulating tumor DNA (ctDNA) levels are monitoring biomarkers used to track disease progression and treatment response in advanced cancers.



Risk Biomarkers

Predict the chances of developing a disease in the future.

Answers the question: Is there a genetic predisposition to cancer, and if so, which specific variants are present?

Example:
Variants in the BRCA1 and BRCA2 genes are genetic biomarkers associated with increased risk of hereditary breast and ovarian cancer.

Protein Biomarkers

Proteins detected in biological samples like blood, urine or tissues.

Answers the question: Are there any abnormal levels of specific proteins associated with cancer present in the body?

Examples:
Prostate-specific antigen (PSA) is a protein biomarker used for screening and monitoring prostate cancer.
CA-125 is a protein biomarker used for monitoring ovarian cancer progression and response to treatment.

Metabolic Biomarkers

Reflect changes in chemical pathways in the body.

Answers the question: Are there any chemical abnormalities that would indicate the presence or aggressiveness of cancer?

Example:
Increased levels of lactate in tumor tissues serve as metabolic biomarkers indicating tumor aggressiveness and poor prognosis in various cancers.

Cellular Biomarkers

Indicators related to cell structure, function or activity.

Answers the question: Are there any abnormal cellular activities or structures indicative of cancer?

Example:
Antigen Kiel (Ki-67) protein expression is a cellular biomarker associated with active cell division and used for predicting tumor aggressiveness in various cancers.

Imaging Biomarkers

Observable through imaging techniques like magnetic resonance imaging (MRI), computed tomography (CT) scans, or positron emission tomography (PET) scans.

Answers the question: What is the location, size, and extent of the cancerous growth within the body?

Example:
Prostate-specific membrane antigen (PSMA) PET scans use radioactive chemicals to detect PSMA on prostate cancer cells. PSMA PET is an imaging biomarker that can be used to look for prostate cancer metastasis.