



# Role of Metabolism in Cancer

An Introduction to the Basics

## Outline

1. What is Cancer?
2. Normal Cell Metabolism
3. Why Cancer Alters Metabolism
4. Importance in Medicine

# What is Cancer?

---

A disease of uncontrolled growth and division of abnormal cells, caused by genetic mutations in **oncogenes** & **tumor suppressor genes**.

## Hallmarks of Cancer (Hanahan & Weinberg):

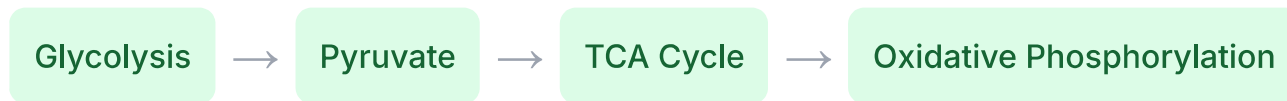
- Sustained proliferation
- Evasion of apoptosis (programmed cell death)
- Induction of angiogenesis (new blood vessels)
- Invasion & metastasis
- **Altered metabolism**

Cancer cells need a **continuous supply of energy** and building blocks for growth.

# Normal Cell Metabolism

---

## Glucose Metabolism Pathway:



Produces **~36 ATP** per glucose (efficient but oxygen-dependent).

### Mitochondria

The powerhouse of the cell, where the TCA cycle and oxidative phosphorylation occur.

### Metabolism Balances:

- ATP production (energy)
- Biomolecule synthesis (building blocks)

Normal cells adjust metabolism based on **energy needs & oxygen availability**.

# Why Cancer Alters Metabolism

---

Rapid proliferation creates a higher demand for nutrients and energy.

The tumor microenvironment is often **hypoxic** (low oxygen).

## The Warburg Effect

Cancer cells shift to **aerobic glycolysis**. Though less efficient for ATP, this process is much faster.

## Glycolysis Provides Intermediates for:

- **Nucleotide synthesis** (for DNA/RNA)
- **Amino acid synthesis** (for proteins)
- **Lipid synthesis** (for cell membranes)

**Altered metabolism supports cancer growth, survival, and invasion.**

# Importance in Medicine

---

## Diagnostic Applications

**PET imaging** detects increased glucose uptake in tumors, helping to locate and stage cancer.

## Therapeutic Applications

Developing drugs that target key metabolic pathways like **glycolysis** or **glutamine metabolism**.

## Research Applications

Helps us understand tumor biology and links biochemistry to clinical oncology.

**Key Point: Altered metabolism is both a hallmark and a therapeutic target in cancer.**

