

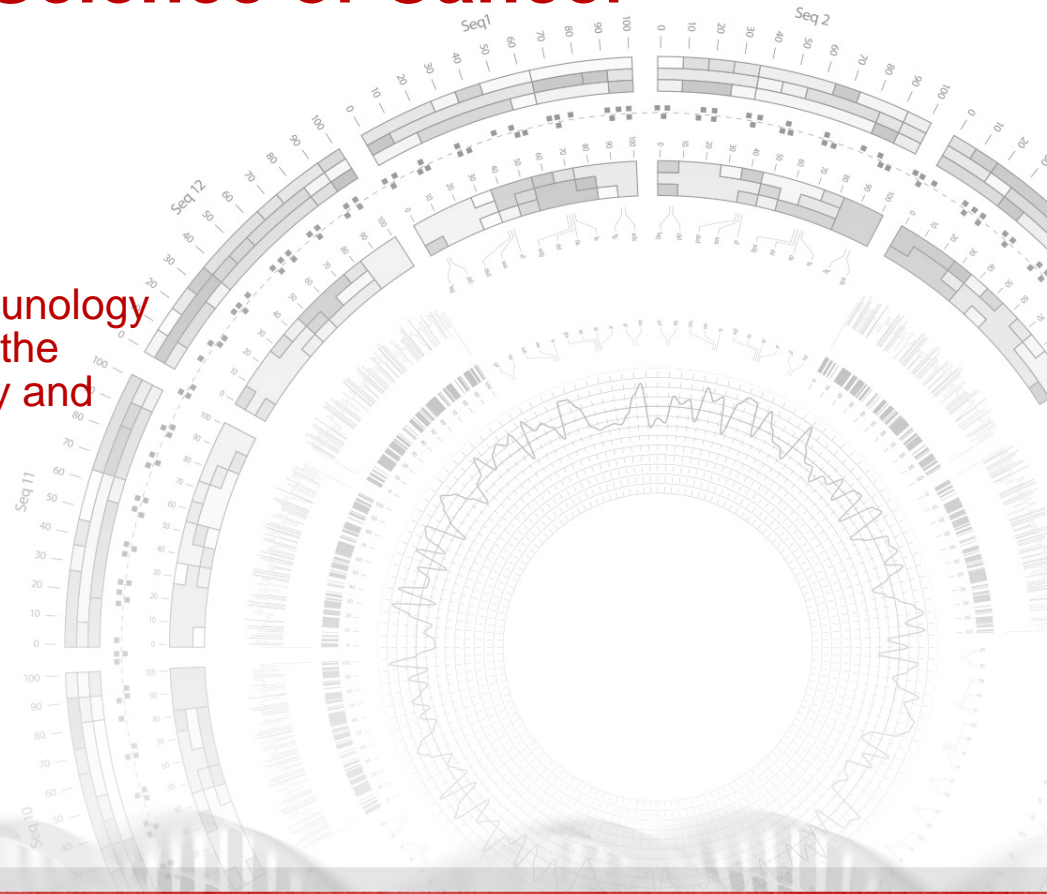
# Introduction to the Science of Cancer

## Module 1 – What is Cancer?

### Anatomy of a Cell

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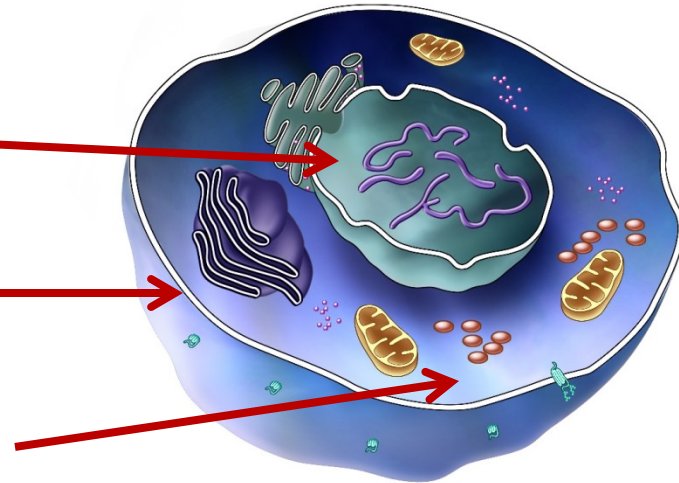
# All cancers begin in a cell

- Cells are the basic building blocks of the human body
- Human beings begin life as a single cell – a fertilized egg – that contains all the genetic information needed to make a human being
- The fertilized egg divides to produce two daughter cells, each with the same set of genetic information
- Cell division continues in a very controlled way until a human being is formed
- Along the way, cells differentiate to form the roughly 200 different types of cells that make up the tissues found in the human body

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# Cells typically have three main areas

- A nucleus that contains the cell's chromosomes (23 pairs in humans)
- A delicate membrane that surrounds it
- The cell cytoplasm, the area between the nucleus and the cell membrane
  - It contains structures called organelles that maintain the life and health of the cell
  - Events such as the making of proteins also take place there

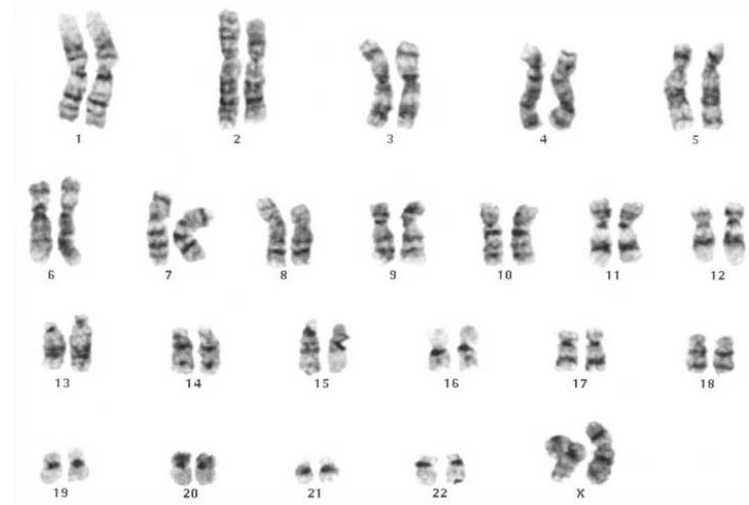


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# Cell nucleus

It is a sphere within the cell that contains the cell's two sets of chromosomes (23 pairs) →

- One set of chromosomes comes from the mother and one from the father
- The nucleus is also bounded by a membrane
- Pores in the membrane allow molecules to move from nucleus to cytoplasm and from cytoplasm to nucleus

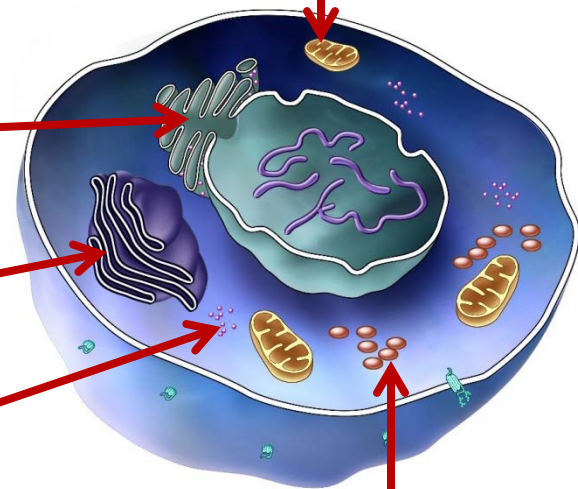


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# Cell cytoplasm

Contains the nucleus and other organelles necessary for the life and function of the cell

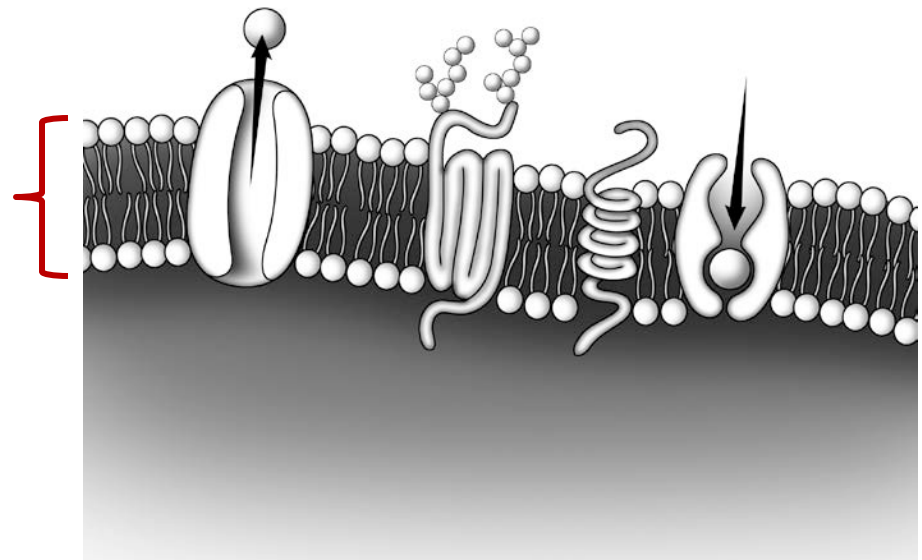
- Mitochondria – produce energy needed by the cell and the body for life
- Endoplasmic reticulum – channels involved in making proteins and lipids;
- Golgi complex – layers of saclike spaces that package proteins for release or secretion by the cell
- Ribosomes – tiny organelles involved in synthesizing proteins
- Lysosomes – packages of enzymes



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# Cell membrane

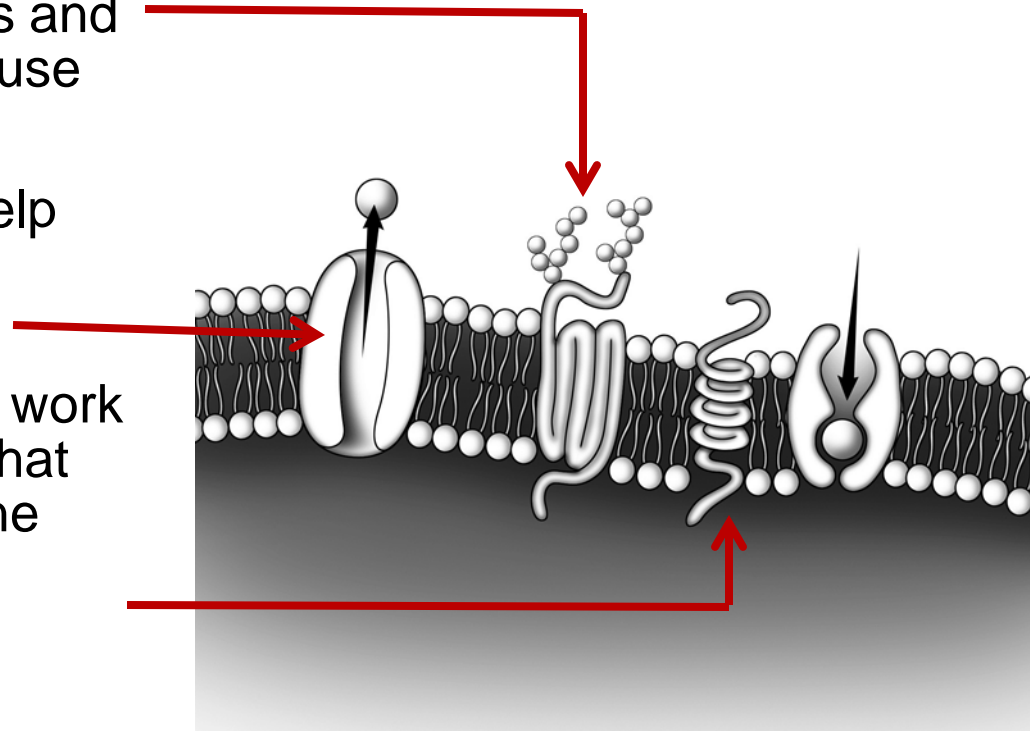
- Made of fat-like lipid molecules
- The molecules have a “head” that is water-loving, or hydrophilic, and two tails that are water-hating, or hydrophobic
- The molecules lie side by side — heads out, tails in — to form a double layer called a lipid bilayer
- Penetrating the membrane are protein molecules that carry out the activities of the membrane. Membrane molecules play important roles in cancer



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# Membrane protein molecules

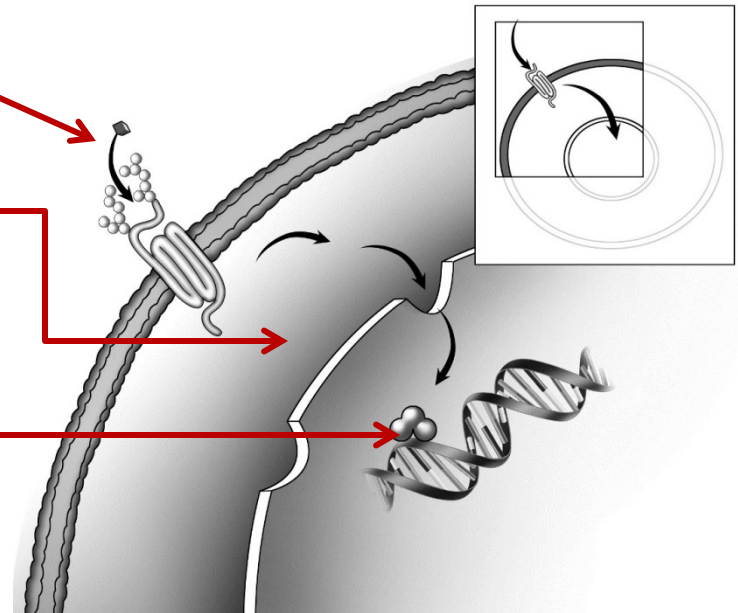
- Cell-surface receptor molecules – are activated by hormones, growth factors and other substances and cause some change in cells
- Transport molecules – help control what enters and leaves cells
- Recognition molecules – work like flags and signposts that help cells interact with one another



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# How cell-surface receptors cause changes in genes in the nucleus

- Substances such as growth factors bind with receptors on cells
- This triggers a chemical signal that travels through the cytoplasm to the nucleus
- The signal causes special proteins to bind with DNA and activate genes that cause the cancer cells to grow and divide, causing tumor growth
- Anticancer drugs are being developed that interfere with various receptors on the cell or that block molecules that are part of the signaling pathway inside the cell. These are called targeted therapy



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## The Ohio State University Comprehensive Cancer Center – Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC – James)

The OSUCCC – James strives to create a cancer-free world by integrating scientific research with excellence in education and patient-centered care, a strategy that leads to better methods of prevention, detection and treatment. Ohio State is a [National Cancer Institute](#)-designated Comprehensive Cancer Center. The James is one of the top cancer hospitals in the nation as ranked by *U.S. News & World Report*. To learn more about Ohio State's cancer program, please visit [cancer.osu.edu](http://cancer.osu.edu).

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