

Cellular Reproduction

What is cellular growth?

→ The result of a cell's ability to repair and reproduce itself.

Why do our cells grow and divide?

To form more cells – but WHY do we need more cells????

- To maintain a workable ratio of volume to surface area
- To replace worn out or damaged cells
- To heal cuts, repair broken bones, and replace cells that have a short life span
- To form new organisms

Living organisms are ALWAYS making cells. A healthy human adult produces 25 MILLION new cells EVERY SECOND....that's BILLIONS of cells every hour, and about 2 TRILLION additional cells a day!!

So why can't organisms be just ONE GIANT CELL??

Reason #1:

Diffusion!!! (yes, DIFFUSION)

- ⊛ Cells require a constant supply of nutrients to enter so it can carry out cellular respiration and produce ATP
- ⊛ Cells must also move waste products out quickly
- ⊛ Much of this occurs through diffusion – diffusion is pretty fast over SMALL distances
- ⊛ So...cells can only metabolize as fast as they can receive nutrients by diffusion
- ⊛ If the cell got bigger and bigger, diffusion would be too slow to get the stuff in and out in time
- ⊛ The result - - Cell would die waiting for what it needed

Reason #2:

A cell only has so much DNA (i.e. just one nucleus!)

- ✪ DNA makes RNA—RNA makes proteins
- ✪ If a cell doesn't have enough DNA to program its metabolism, it cannot live.

Reason #3:

Surface-area-to-volume ratio

- ✪ As a cell's size increases, its volume increases MUCH FASTER than its surface area

If a cell size was doubled, it would need EIGHT TIMES more nutrients (and have 8 times more waste). The surface area, however, would increase by a factor of only FOUR.

- ✪ Plasma membrane would not have enough surface area to diffuse molecules in and out in a timely manner
- ✪ Cell would either starve or be poisoned by the build up of waste products

So Growth and Repair of Cells Requires CELL DIVISION

- ☺ Necessary for reproduction of a single cell
- ☺ Necessary for reproduction of an entire multicellular organism

TWO TYPES OF REPRODUCTION

Asexual reproduction – production of offspring from one parent

- Simplest form is binary fission (cell splits into two)
 - Primary means of reproduction in prokaryotes
- Another method is through asexual reproductive cells called spores
 - Primary means of reproduction in molds and fungi

BOTH OF THESE METHODS BEGIN WITH THE REPLICATION OF THE CHROMOSOMES.

Sexual reproduction – results from the joining of two specialized sex cells called **GAMETES**

- ☐ The male gamete is called a sperm cell
- ☐ The female gamete is called an ovum, or egg cell
- ☐ In the process of fertilization, a sperm and an ovum combine to form a cell called a zygote

Cell Reproduction – The Role of CHROMOSOMES

So what exactly are chromosomes?

- ☺ A chromosome is a library of genetic information
- ☺ During most of a cell's life, chromosomes exist as chromatin, strands of DNA wrapped around protein molecules (looks like a plate of tangled-up spaghetti)
- ☺ Before a cell begins to divide, the threads of chromatin begin to coil
- ☺ The coils shorten and thicken, forming distinct chromosomes that are tightly packed with chromatin