14.18 ADVANCED

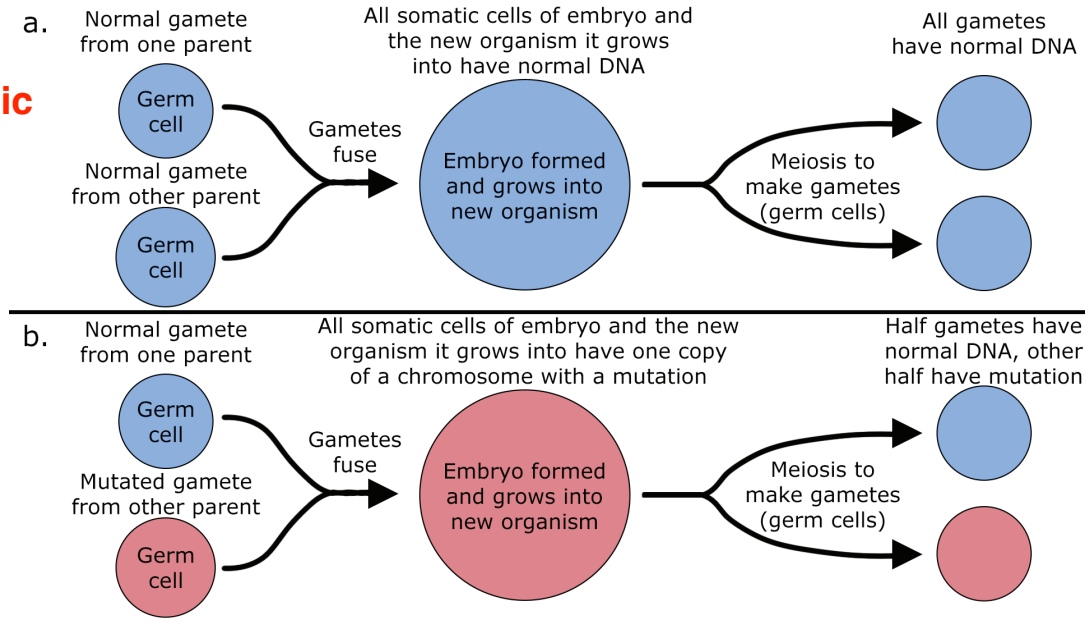
Let's go back to the germ cell versus somatic tumor concept. Recall that all organisms start out as one single cell. In sexually reproducing organisms, that single cell is formed when the male gamete fuses with the female gamete. When that occurs, the chromosomes combine. Then, through millions to trillions of mitotic events, the organism grows from a single cell into a multicellular life form. All cells of an individual grow from the single cell formed when a male gamete fuses with a female gamete. If one of those gametes has a mutation, then the cell formed when that gamete fuses with another gamete will have the mutation. As the single cell undergoes millions to trillions of mitotic events to grow in size from a single cell to a multicellular organism, that mutation is passed to all of the cells every time a cell divides. Then, assuming the organism lives to adulthood, half the gametes the organism produces will also have the mutation; the mutation could be passed on indefinitely.

Figure 14.18.1

Mutation in Somatic vs. Germ Cells

There are two types of cells in all sexually reproducing organisms: **germ cells** and **somatic cells**. Germ cells are the cells we have been calling gametes (sperm or eggs). Germ cells are formed during meiosis and are the cells that fuse with another gamete from an organism of the opposite sex to make a new organism. Somatic cells are all the other cells in the body or organism. Muscle cells, bone cells, skin cells, brain cells—you get the idea—are somatic cells. Figure (a) represents the usual condition in which the somatic cells and the germ cells are normal; that is, they have no mutations present in them. As the organism grows, all of the organism's growing and reproducing cells replicate normal DNA and pass normal genes on to offspring cells. When the organism makes new gametes, they are all normal. Figure (b) represents how a germ cell mutation may affect the offspring of an organism that itself inherited a germ cell mutation. The organism gets one set of normal chromosomes from one parent but one of the chromosomes from the gamete of the other parent has a mutation. Since the new organism is formed from the combination of genetic material of the two gametes, every time the new cell divides (by mitosis) to form more cells, every somatic cell of the new organism receives one copy of the chromosome with the original germ cell mutation. Then, when this new organism makes gametes, half of the gametes can be expected to also contain DNA with the mutation.

New Graphic



As you can imagine, a mutation which is passed from parents to offspring in this fashion almost always results in an organism which cannot survive. If the organism survives, then that mutation is passed to its offspring. It is important to remember that if a mutation occurs in the gametes, then the offspring resulting from those gametes will be born, hatched, or grown with that mutation. That is, it will be born, hatched, or grown if the mutation does not result in its death. If the organism with a mutation does live and can reproduce, the mutation is then passed down from generation to generation. All of the types of mutations we have just discussed are involved in creating various human genetic disorders, which we will discuss in the next chapter.