

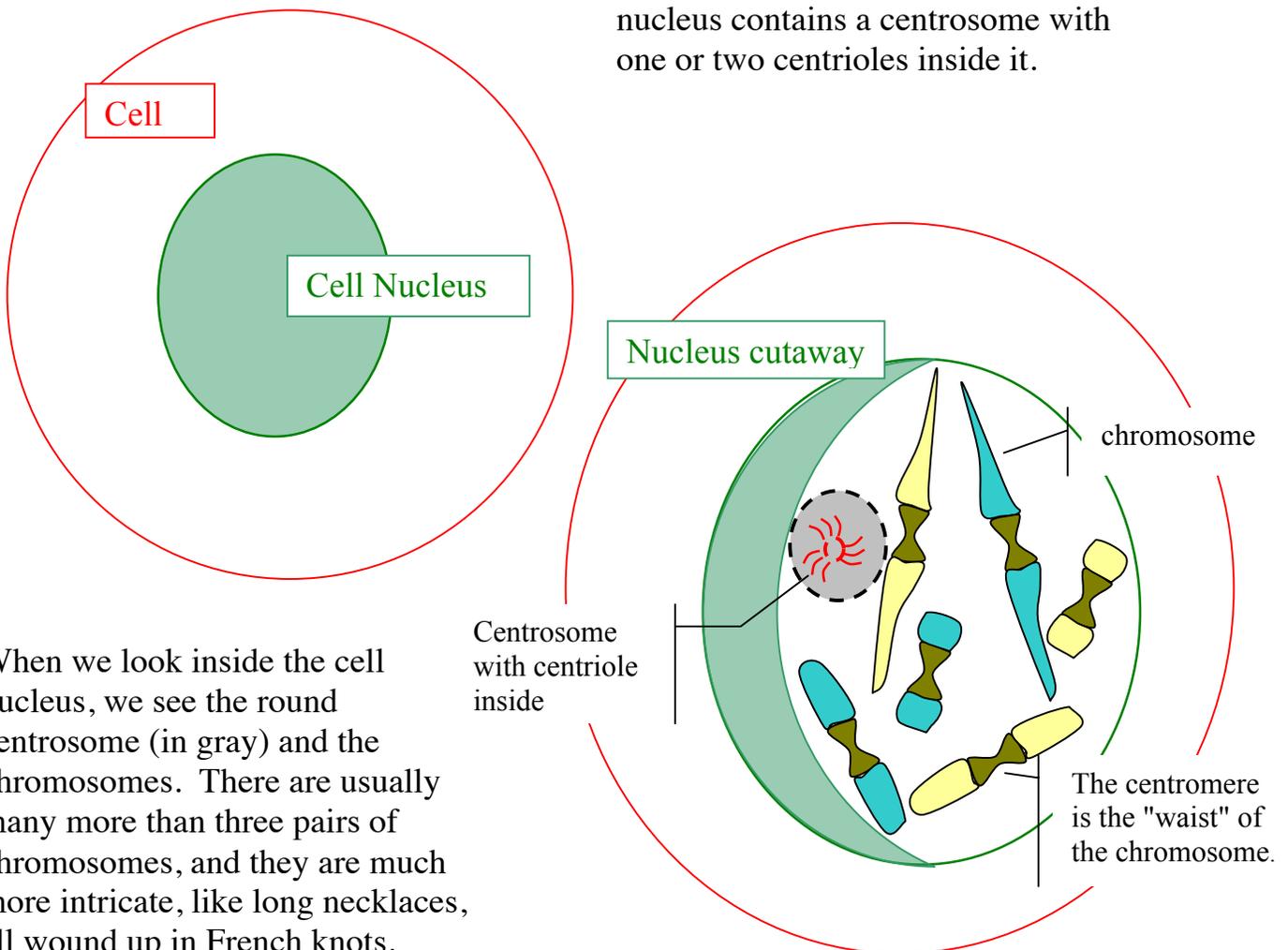
Meiosis / Gametogenesis

The production of cells with half-sets of chromosomes

The ordinary eukaryotic cell has a nucleus containing several pairs of chromosomes. Each chromosome determines specific characteristics of the individual, such as eye-color, overall size, or schedule of growth. The chromosomes come in pairs because the individual cell has one of each type from the father and one from the mother. When cells replicate (copy themselves) by mitosis, the new cells, called daughter cells, are, ordinarily, exactly the same as the original cell. You will notice that each chromosome has a central portion (called a centromere) which is drawn like an hourglass.

Usually, when we draw a cell, we just draw the nucleus as a single entity; there are lots of things going on in the cell, and lots of little organelles to make them happen. But to talk about meiosis, we are going to ignore everything else in the cell. The nucleus and the things in the nucleus that work for reproduction are all that matters.

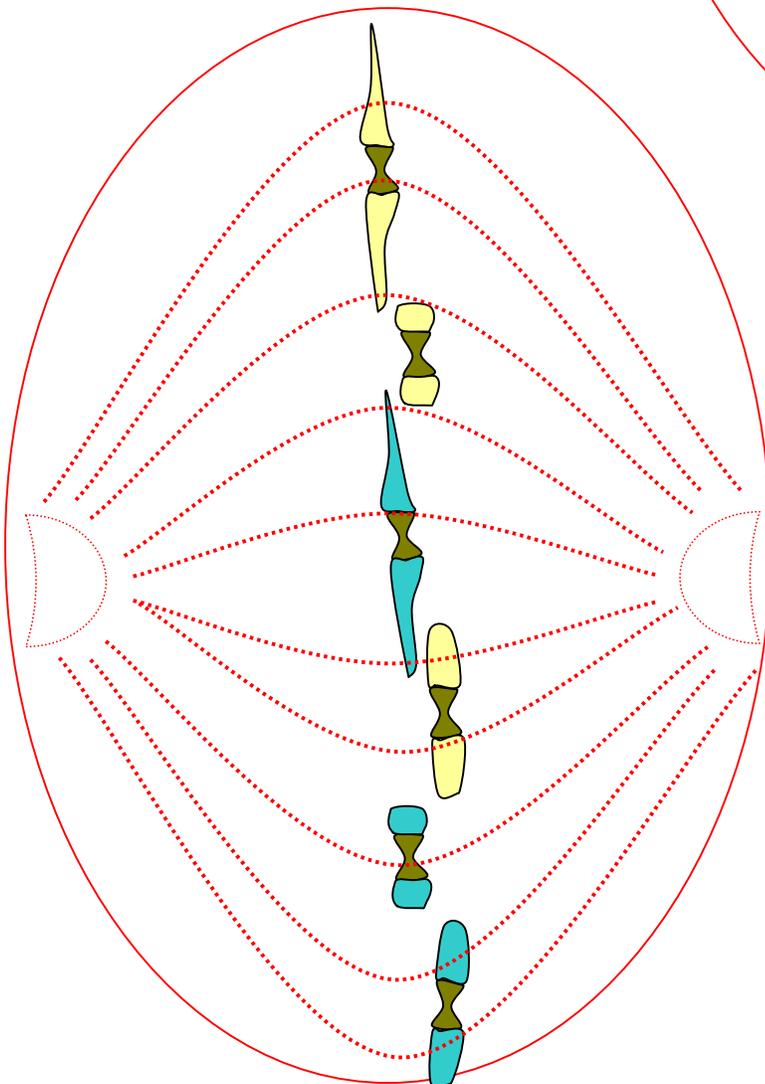
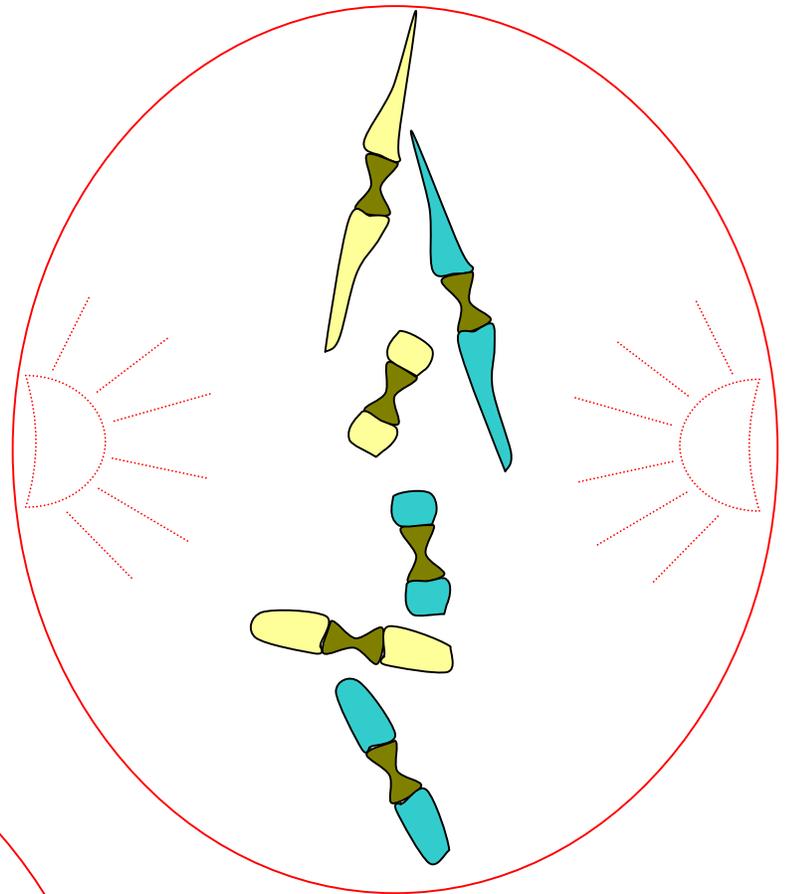
Besides the chromosomes, the nucleus contains a centrosome with one or two centrioles inside it.



When we look inside the cell nucleus, we see the round centrosome (in gray) and the chromosomes. There are usually many more than three pairs of chromosomes, and they are much more intricate, like long necklaces, all wound up in French knots.

At the start of meiosis, the wall of the nucleus dissolves and the chromosomes move towards the equatorial plane of the cell. Meantime, the wall of the centrosome dissolves and the centriole duplicates if there is only one.

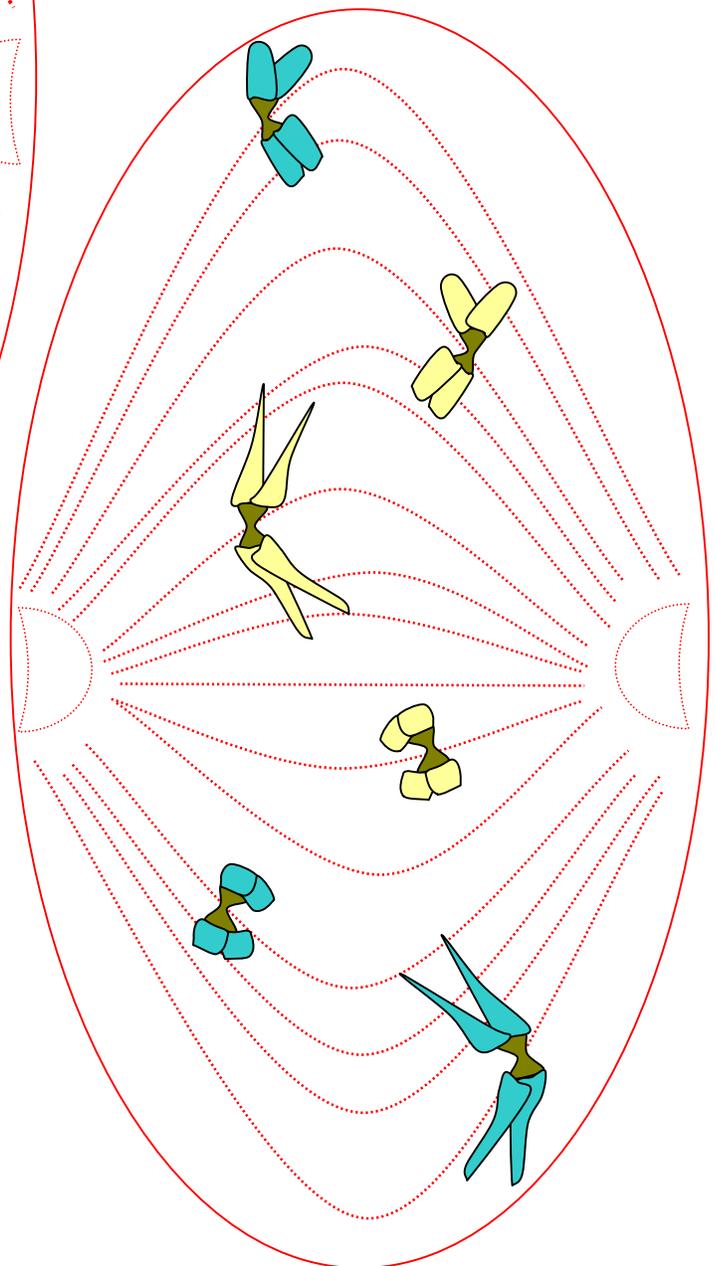
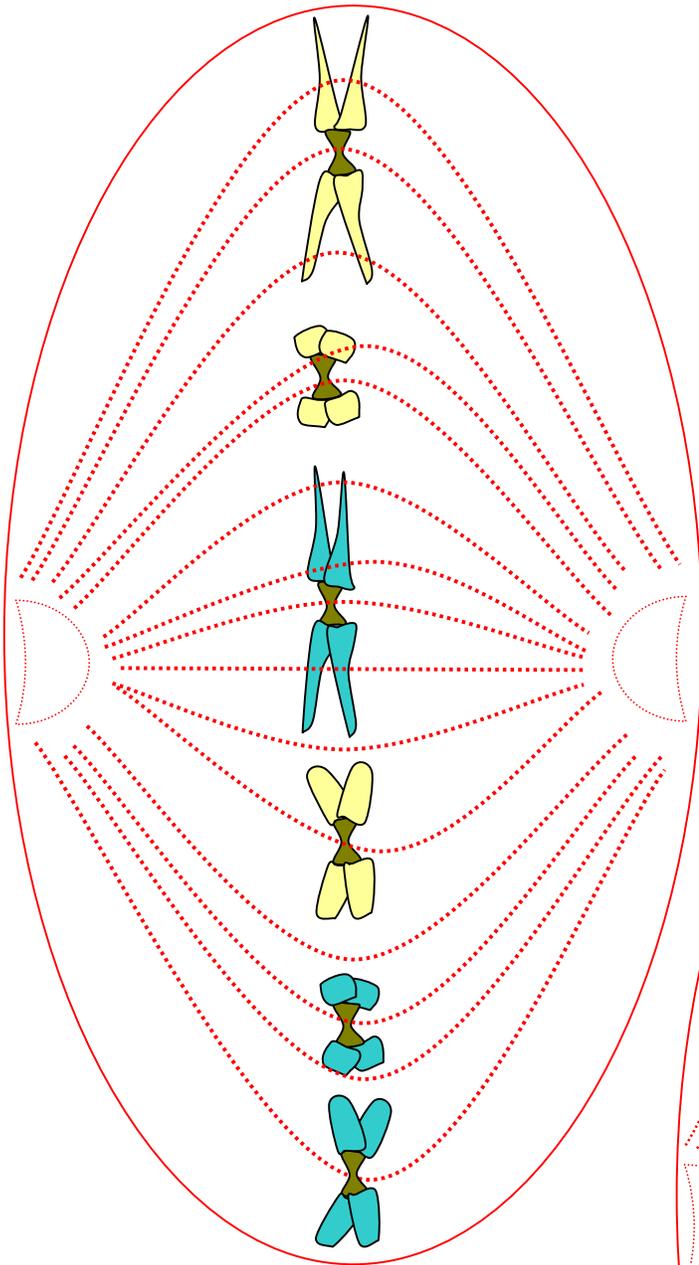
Then the centrioles move to opposite poles of the cell. ("centrioles move to poles") Long threads of cytoplasm called spindle fibers begin to radiate from the two centrioles. This is called the formation of asters, because it is like the flower called an aster.



In time the fibers reach entirely from one centriole to the other and the whole arrangement has the appearance of a spindle. The fibers are called spindle fibers.

[Note: the cell does not actually elongate; it remains round. I have drawn it this way so you can still count all the chromosomes.]

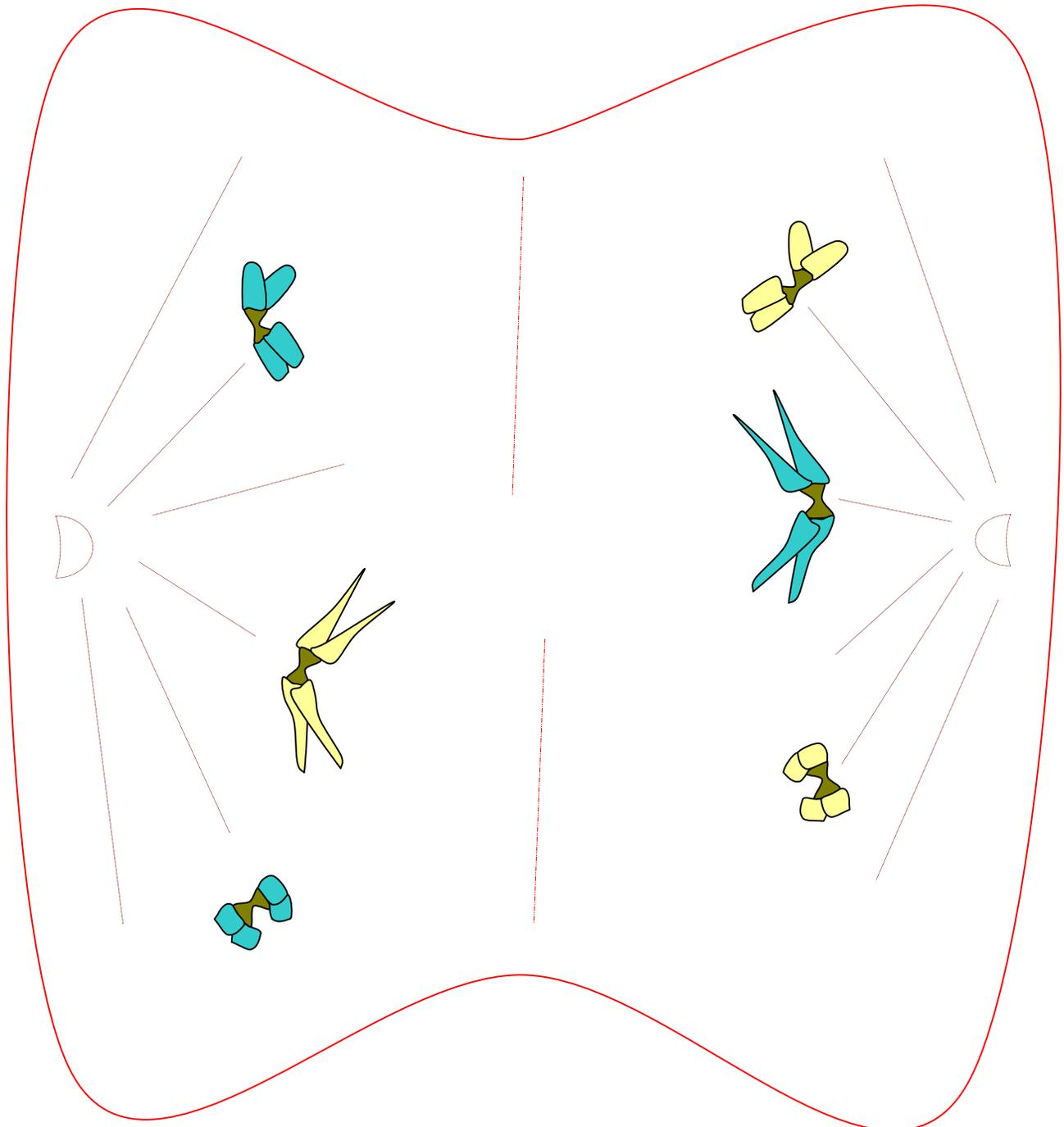
When the chromosome are all lined up in the equatorial plane of the cell, (that is, not just around the "equator" as I have drawn, but all across the cell in one flat disc), each takes its place on a spindle fiber and is exactly duplicated except for the centromeres which now hold four tails each, instead of two. They still hold on to the spindle fibers on which they will slide up towards the centrioles.



However, when they pull away to their opposite centrioles, each centriole pulls over a single, paired chromosome of each kind, instead of two slightly differing chromosomes of each kind.

When chromosomes are pulled over, each side has the correct number of chromosomes for its species, and a cell wall does form, but these daughter cells will not be like the mother cell.

How will they differ? Each daughter cell now has two identical chromosomes of each kind, either two from the father or two from the mother. The centromeres now replicate in preparation for the next change.

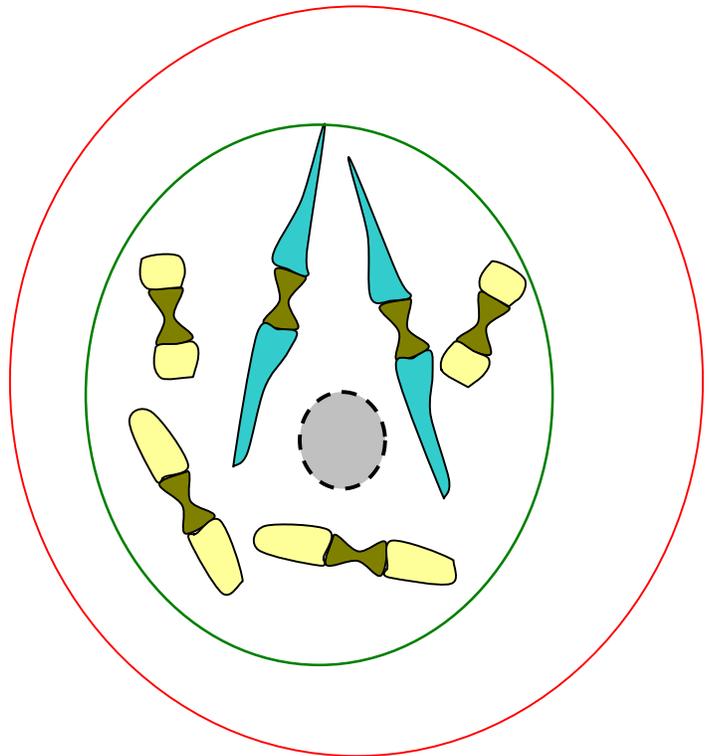
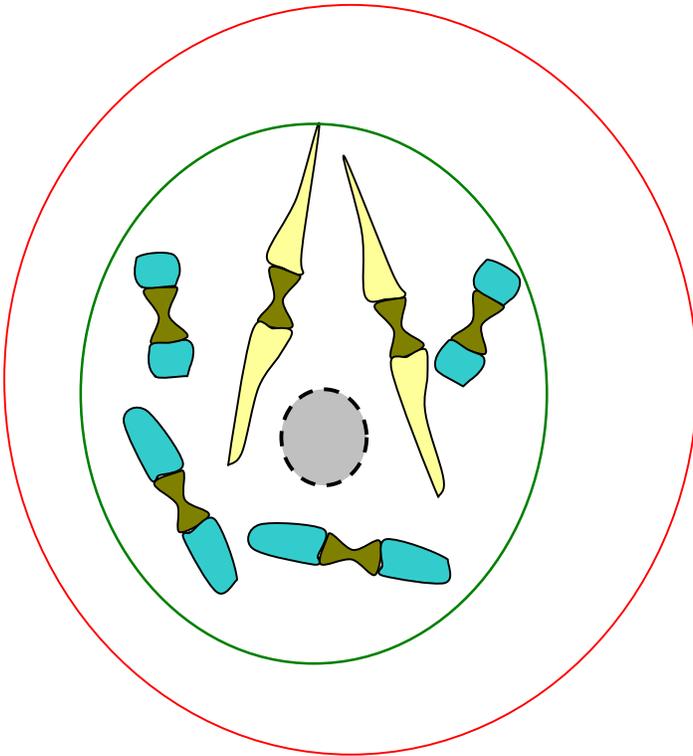


Meiosis is halfway-completed:

Here are two daughter cells, neither one identical with the original ("mother") cell. Each one has the correct number of chromosomes for its species type.

The nuclear walls have formed again, and the centrioles are once more hidden in centrosomes.

Although they have the correct number of chromosomes for the species, these cells almost never develop into individuals of the species. Instead, they undergo a further division.



Centr... what?

The centrioles make the poles.



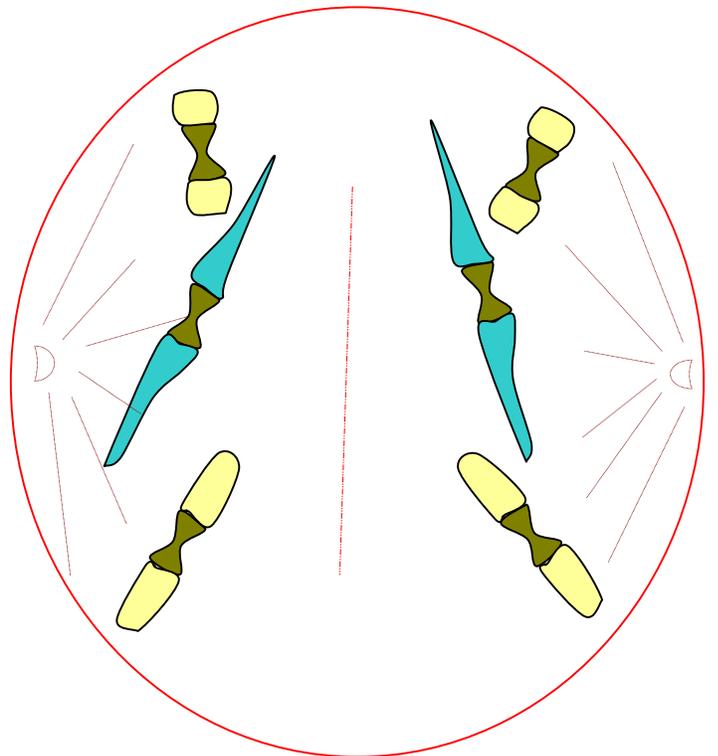
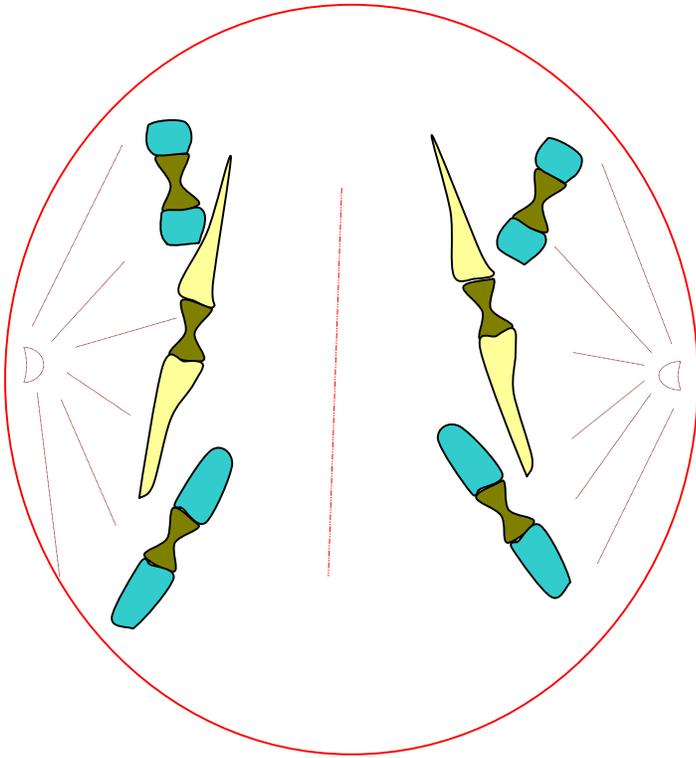
The centromere says, "Grab me here."



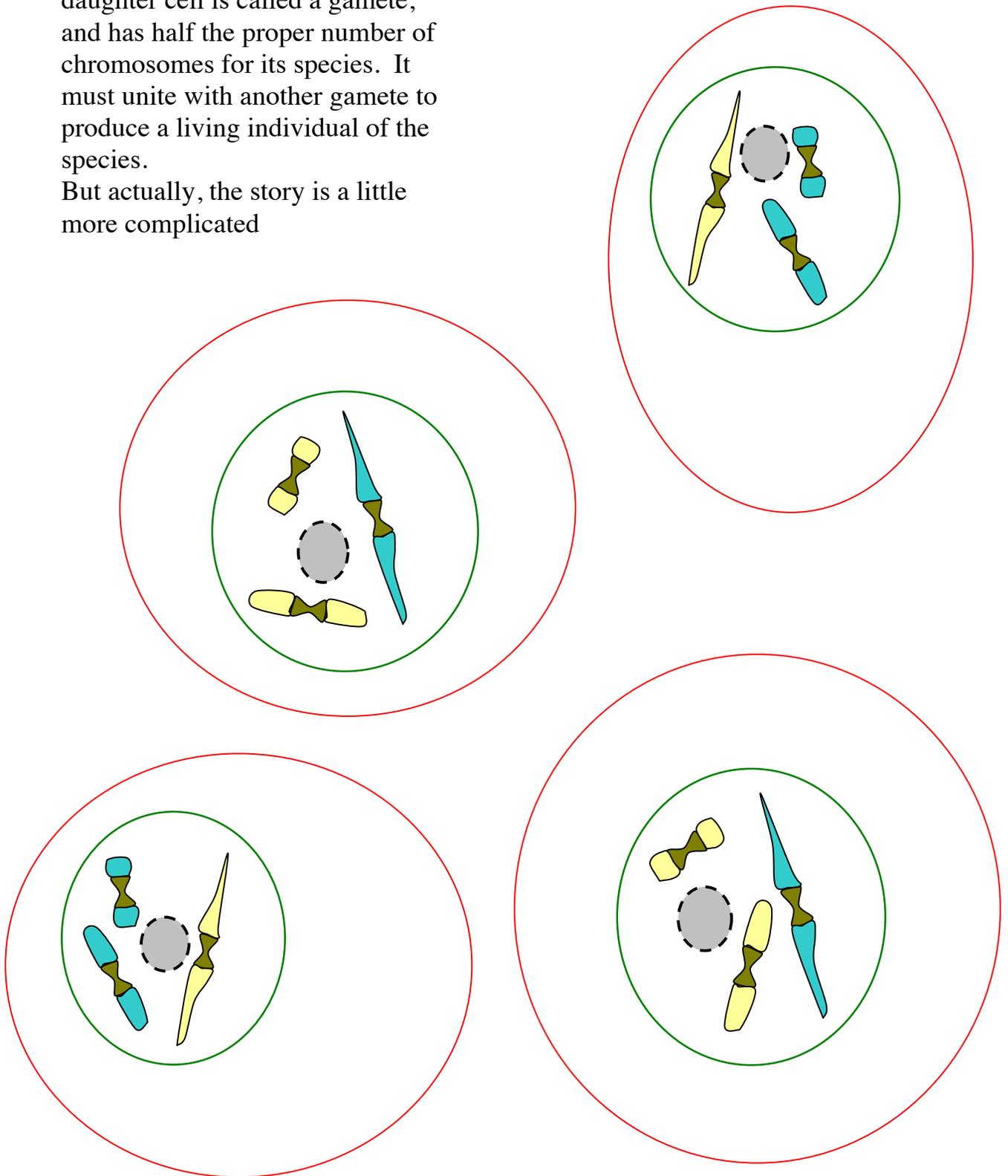
The centrosome is the centriole home.



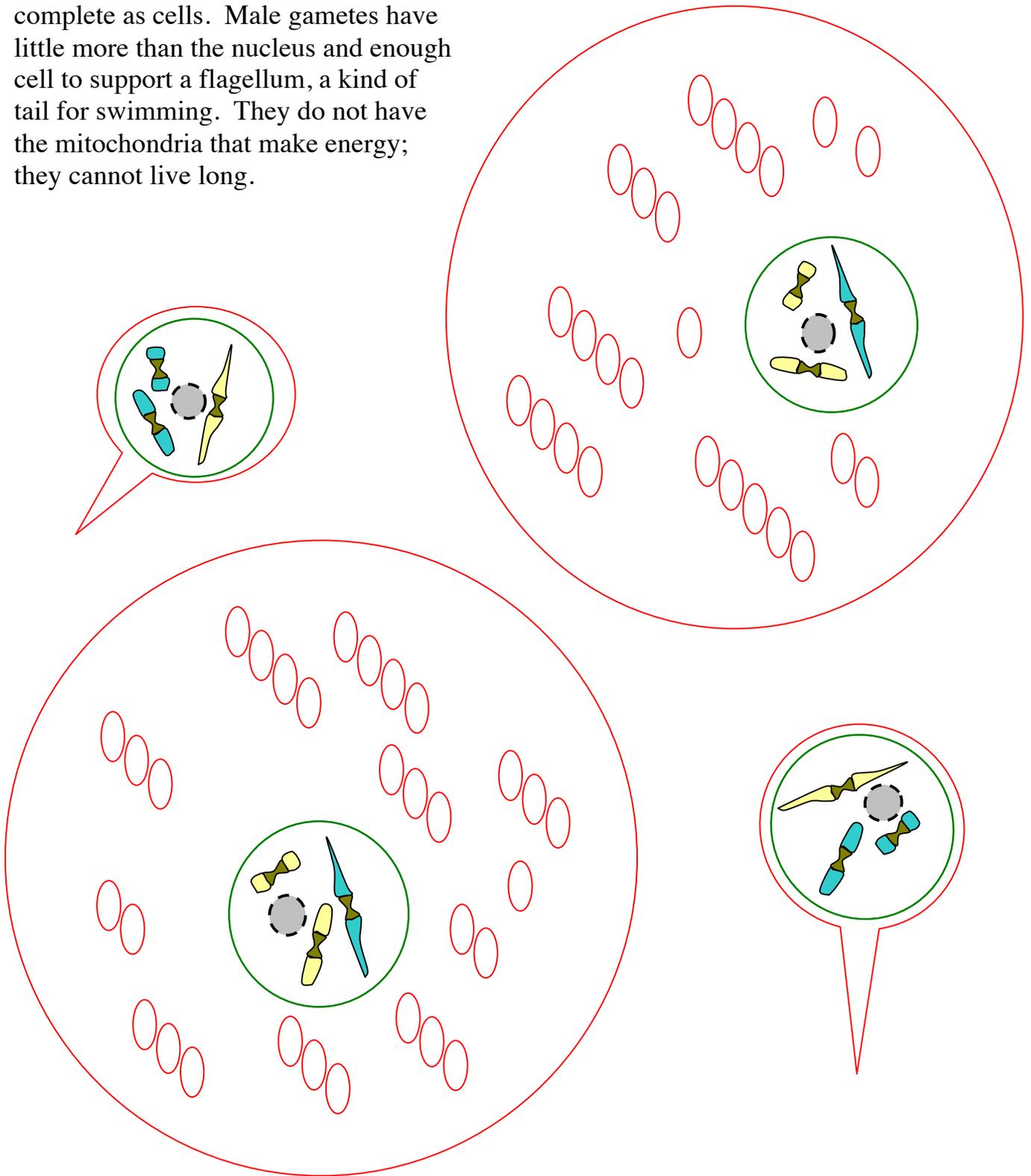
A further division makes two gametes, each with half the species number of chromosomes. When two gametes are joined, one being an egg cell from the mother and one a sperm cell from the father, there will be a complete set of chromosomes, one of each kind from each parent.



Meiosis is now complete. Each daughter cell is called a gamete, and has half the proper number of chromosomes for its species. It must unite with another gamete to produce a living individual of the species. But actually, the story is a little more complicated



Male and female gametes are different. Female gametes are very large and complete as cells. Male gametes have little more than the nucleus and enough cell to support a flagellum, a kind of tail for swimming. They do not have the mitochondria that make energy; they cannot live long.



Well... and there is another difference. The cells in the female line remain diploid partway down the fallopian tube, and only cut to the haploid number at some point during that trip. They do this by sending out the extra haploid chromosomes as a polar body. At the end of the trip, they hope to meet a sperm cell.

