Mitotic spindle forms

Chapter 16, pages 669-678. Up to now, we have discussed the stage of the cell cycle and the control that regulates the passage of cells from one stage to the other. When the cell successfully completes the S phase, the chromosomes are replicated, and once they pass through G2, they are ready to enter the M phase when a thread splitting occurs. During the yarn division, chromosomes are condensed, the nuclear envelope decomposes, and a threadable spindle is formed. Chromosomes adhere to spindle fibers, and sister chromatides move to the opposite end of the cell. Finally, cells are two-parted by a process called cytocanesis. In this class period, we will look at the stages of yarn division and how they are brought about as a result of the action of MPF (remember that MPF is a signal that sends non-fission cells to yarn division). What are the four main stages of yarn division? A filamentous spindle begins to form, and the nuclear envelope decomposes. Metaphase: chromosomes align themselves along the center of the threaded spindle anaphase: sister chromosomes separate and move to the opposite end of the spindle. Terror phase: Chromosomes are disized and nuclear envelopes are reconfigured. See how these changes are being made by a single agent named Figure 16.22 MPF. MPF, as you remember, is a protein kinase. It is effective by phosphoryting other proteins. Consider below how phosphorylation of the main component causes each of the major events of yarn splitting: Figure 16.25 Is mpf's role chromosomal condensation? This condensation process is carried out with the help of a protein complex called condensing. Condensin is inactive until phosphoryxid by MPF. Once they are phosphoryid, they begin the process of condensation. Figure 16.26 How is the decomposition of the nuclear envelope related to MPF activity? MPF phosphorytes lamine, the protein that constitutes the nuclear layer layer. Phosphorylation of lamine leads to the decomposition of the nuclear layer, which leads to the decomposition of the nuclear envelope. Figure 16.27 What happens to organelles like Golgi and ER? The MPF has been shown to be involved in this process as well, aling the details of its actions are not entirely clear. At least one Golgi protein, GM130, is known to phosphoryte by MPF. Does MPF affect spindle assemblies? As you know, the spindleThe dynamic behavior is changed by the MPF. MPF causes phosphorylation of microtubule-related proteins directly or by activating another protein kinase. This leads to changes in the microtubules resulting in the formation of a threadable spindle. What happens when the spindle is formed? Is the MPF also involved in the rest of the thread splitting? Cell metastasis depends on the degradation of certain important regulatory proteins. These proteins are tagged for destruction by adding ubiquitin to them by an enzyme called E3 ubiquitin rigase. Anaphas phase promotion complex or APC. This anaphas phase promotion complex is activated by MPF. Once activated, the anaphasic promoting complex decomposes certain proteins, and their loss set cells on the path to anaphas phase. What proteins are broken down by anaphas phase-promoting complexes? Scc 1 is part of a complex of proteins called agglomerations that hold sister chromats together (see Figure 16.26). When Scc 1 deteriorates, the connection between the sisters chromatide is disconnected, allowing it to be separated and moved to the opposite pole of the spindle. What is the effect of decomposing cyclin B? As mentioned earlier, MPF consists of Cdk1 and Cyclin B, both of which must be associated for MPF to be active. If Cyclin B is destroyed, the level of active MPF decreases. As the MPF level drops, the cells begin to return to a phase-to-phase state. Inactivation of MPF also causes the next stage of cell division, i.e. cytocanesis. What happens with cytocanesis? During cytocanesis in animal cells, the contraction ring of actin and myosin II filaments is formed under the plasma membrane. This ring acts by sandwiching cells between two cells by the contracting action of actin myosin filaments. Figure 16.32 Is cell splitting always before cell partitioning? Obviously, in the early stages of embryonic development, fertilized eggs must divide to produce more cells before those cells are assigned a specific function. However, it has already been separated in adults, and cells in the tissues that have become separated may need to divide to replace dead or injured cells. As already explained, the divided cells of some organs, such as the liver, divide as needed, and cells in other parts of the body, such as the heart muscles, lose this ability. In other cases, such as blood cells, they need to be continuously replenished, and the new cells do not result from cell division of fully separated cells, but lessCells called stem cells. How does this process work? These stem cells are called pluripotent, meaning they can be partified into different types of cells. When stem cells divide, new cells may divide into one of the blood cell types or remain as stem cell stock (see Figure 17.16). Cell division no longer occurs when cells completely divide to form certain types of blood cells. This means that the only way to get new blood cells is from stem cell division. Figure 17.17 See why stem cells are interesting. In contrast to fully-sized cells, stem cells can turn into many different types of cells, depending on the signals they receive. As mentioned earlier, bone marrow stem cells can create all the different types of blood cells we need. Stem cells (ES cells) in the early stages of embryonic development have the greatest potential in this regard. In the process of development, this ability is gradually lost, completely, for example, in the case of hepatocytes. Bone marrow stem cells retain a small part of this potential in the sense that they can make several different types of blood cells, but they no longer have the potential to create nerve cells. Recent research suggests that it may be possible to re-program more-parted cells to make them behave like embryonic stem cells, but science is still in a very preliminary stage. Scientists are interested in understanding the biology of stem cells because they have great potential to treat diseases and save lives. Stem cells can also help answer basic questions, such as how cells are specialized to perform certain functions. So far, we have been studying ways to control and adjust various cellular processes in multicellular organisms. For the normal growth, development and functioning of organisms, this precise control and orchestration of various cellular events is necessary. One of the important mechanisms in the maintenance and embryonic development of adult tissue is programmed cell death or apoptosis. Let's take a quick look at this fascinating phenomenon and its role in the normal life of multicellular organisms. Programmed cell death What is programmed cell death? Programmed cell death is sometimes called apoptosis (pronounced Apo-TOE-sis, and apoptosis does not have a pop sound. Why is there?There are many good reasons to have a regulated pathway for cells to die? Some of these are: 1. To give shape to the development of the embryo (literally, sculpting its shape so that the sculptor removes the pieces of stone to create the shape of the sculpture). 2. Maintain adult tissue with a balance between cell proliferation and cell death. 3. To eliminate cells that can be infected with the virus, the virus replicates and does not spread to other cells in the organism. 4. To get rid of many DNA-damaged cells, do not pass mutations or turn them into cancerous cells in the offspring. How is programmed cell death different from normal cell death due to injury, for example? Programmed cell death is a great, orderly way for cells to shrink, cytoskeletons to collapse, nuclear envelopes to break down, DNA fragments to be destroyed, cells to die. The cell surface of such cells also informs that the cell is receiving apoptosis, and the cell is immediately cytosis (involved) by adjacent, healthy cells. There, the components of dead cells are recycled. There is no messy breakdown of cells, which can spew cell contents throughout adjacent cells, causing inflammation seen in cell death caused by injury. How do cells suddenly begin to dismantle all components when they receive PCD? These enzymes are activated when cells receive a signal that directs suicide. What tells cells to receive PCD? The binding of death signals to death signal receptors begins the process of cell death programmed by activating the first of a series of caspase. How is caspase activated? The first caspase to be activated in this way can cut other inactive caspase and activate them. These can in turn still activate other caspases. Therefore, the event that activates the first caspase will lead to a series of events that result in the activation of many different caspase. This is called caspase cascade. Does it protect cells from any PCD? Many peptide growth factors, like NGF, are cell survival signals. During the development of the nervous system, neurons that get enough NGF survive, and the remaining neurons die. Back to Lecture Summary Page

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