Name: _____

Stem Cell Worksheet

Directions: *Below you will read descriptions of different examples of stem cells. Read through all the examples with the following tasks in mind:*

Task 1: What is a stem cell? Based on these examples form your own definition.

Task 2: What are some ways we could group or categorize the examples below? You will work with a partner to decide which examples "go together" and explain why you put those examples together. If possible, create a name for the grouping.

Bone marrow stem cells are rare, only 1 in 10,000 to 1 in 15,000 cells in your bone marrow are stem cells. These cells are special in that they have the ability to differentiate into many different types of blood cells, such as red blood cells, white blood cells, T cells, B cells, macrophages, etc. Each of these cells looks remarkably different and has a distinct role in the blood or immune system. Scientists have recently been able to manipulate these cells to create other non-blood related cells, such as liver cells, neurons, and muscle cells. Bone marrow stem cells are used to treat blood disorders and blood cancers such as leukemia. They are also being researched by scientists for other medical and scientific purposes do to their ability to turn into multiple different types of cells.	**Embryonic stem cells (ES)** are usually harvested from left-over blastocysts from the IVF industry. These cells are immortal and have an almost unlimited potential to develop into other types of cells depending on how they are manipulated by scientists. The proliferative and developmental potential of human ES cells promises an essentially unlimited supply of specific cell types for basic research and for transplantation therapies for diseases ranging from heart disease to Parkinson's disease to leukemia.
While most blood stem cells reside in the bone marrow, a small number are present in the bloodstream. These **peripheral blood stem cells (PBSCs)**, can be used just like bone marrow stem cells to treat leukemia, other cancers and various blood disorders. Since they can be obtained from drawn blood, PBSCs are easier to collect than bone marrow stem cells, which must be extracted from within bones. This makes PBSCs a less invasive treatment option than bone marrow stem cells. PBSCs are sparse in the bloodstream, however, so collecting enough to perform a transplant can pose a challenge.	**Intestinal stem cells** divide continuously throughout life to produce the cells lining the surface of the small and large intestines that constantly need to be renewed. These stem cells can give rise to limited number of different types of stem cells. For example, a an intestinal stem cell normally can differentiate into four different types of cells needed that line the intestine, but it will not give rise to blood cells, muscle, or other body cell types.

Umbilical cord blood stem cells are obtained from the umbilical cord that traditionally was discarded once it was cut from the infant. These stem cells have proven useful in treating the same types of health problems as those treated using bone marrow stem cells and PBSCs. Umbilical cord blood stem cell transplants are less prone to rejection than either bone marrow or peripheral blood stem cells. This is probably because the cells have not yet developed the features that can be recognized and attacked by the recipient's immune system. Also, because umbilical cord blood lacks well-developed immune cells, there is less chance that the transplanted cells will attack the recipient's body, a problem called graft versus host disease. Both the versatility and availability of umbilical cord blood stem cells makes them a potent resource for transplant therapies. Umbilical cord blood stem cells can differentiate into a limited range of different cell types.	**Neural stem cells** are found in the brain. For a long time scientists believed that the brain could not generate new cells. However in the 1990s stem cells in the brain were discovered that could give rise to three different types of cells found in the brain: astrocytes and oligodendrocytes, which are non-neuronal cells, and neurons, or nerve cells. These neural stem cells have therapeutic potential to treat brain injury patients and perhaps treat neurodegenerative disorders such as Parkinson's and Huntington's diseases.
Fetal stem cells are stem cells taken from the 8^{th} week of development. These cells show the same ability to differentiate into nearly all cell types that embryonic stem cells show. There is research into harvesting fetal stem cells without harming the fetus. Currently most fetal stem cells come from aborted fetuses. Fetal stem cells hold incredible potential to be used to treat all types of illnesses and are useful in research because scientists manipulate them to generate different cell and tissue types necessary for research.	

1. Based on the above examples, form a tentative definition of stem cells. Try to include two characteristics of stem cells in your definition:
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   _____
   _____

2. Based on the above examples, try to organize these 7 examples into at least 2 different groups. Explain your rational for creating the groups and why you put each stem cell example into that group (use separate paper if necessary.)
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