



# Stem Cells

## Teacher information

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### Summary:

Students read about adult and embryonic stem cells. They sequence pictures of the steps used to create an embryonic stem cell line. They use simulated stem cells and growth factors from differentiated cells that could be used to treat diseases.

### Core concepts:

- Stem cells are unspecialized cells that have the potential to form new stem cells or to differentiate into more specialized types of cells.
- Embryonic stem cell lines can be created from donated embryos.
- Growth factors can be used to make stem cells differentiate into specialized cell types.

### Class time required:

Two 40-minute class periods

### Additional Resources (optional):

Visit the Life Sciences Learning Center website to explore extension activities, videos, and slide shows that can be used to accompany this lab activity.

<http://lifesciences.envmed.rochester.edu/downloads.html>

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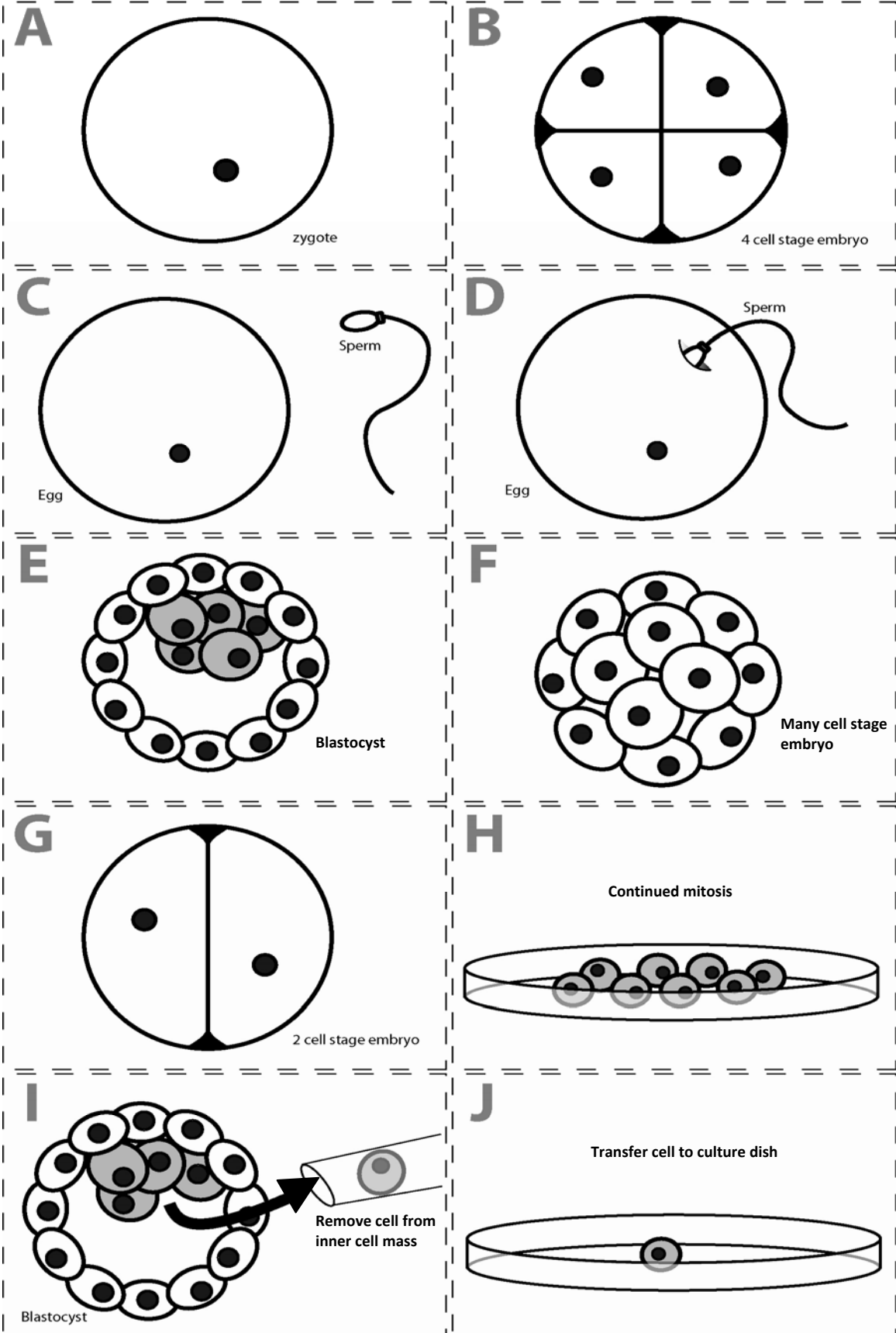
### Preparing lab materials:

1. For each student lab group, label 8 microtubes (or small test tubes) and 8 droppers with the following labels: *Adult Stem Cells - ASC*, *Embryonic Stem Cells - ESC*, *GFA*, *GFB*, *GFC*, *GF1*, *GF2*, and *GF3*.
2. Prepare the solutions indicated in the chart below and fill the labeled tubes.

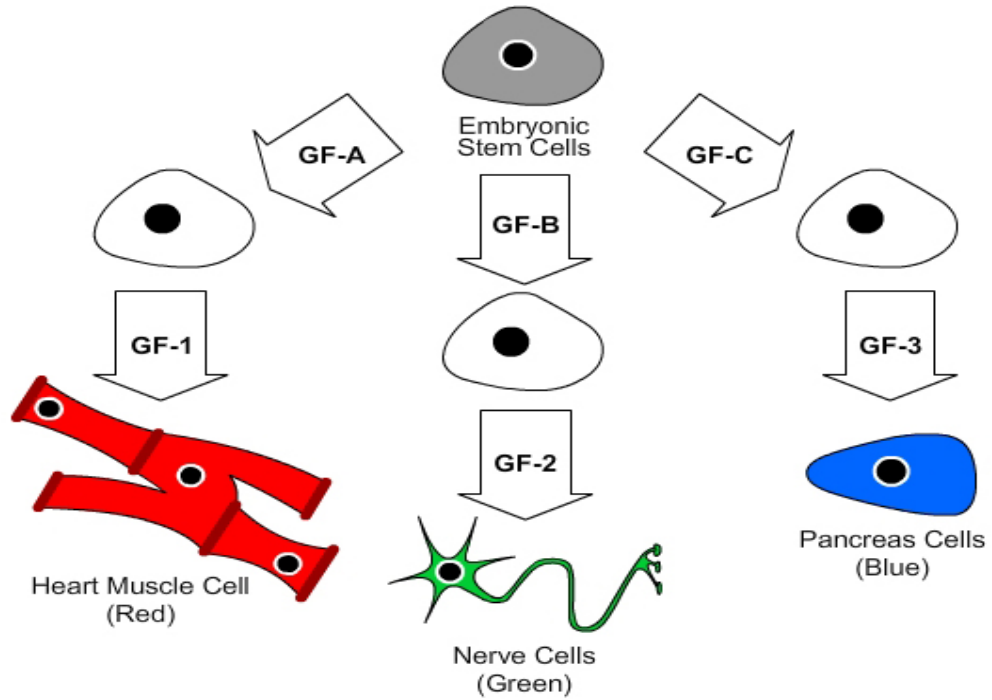
Label on tubes <u>and</u> droppers	Solution	Amount of solution needed per lab team
Embryonic Stem Cells - ESC	0.1% bromothymol blue	2 ml
Adult Stem Cells - ASC	100 ml water + 1 drop india ink + 1 drop yellow food color	2 ml
GF A	0.05% methyl red	0.5 ml
GF B	0.05% methyl red	0.5 ml
GF C	0.05% methyl red	0.5 ml
GF 1	100 ml pH 3 buffer + 2 drops yellow food color	0.5 ml
GF 2	100 ml pH 7 buffer + 2 drops yellow food color	0.5 ml
GF 3	100 ml pH 10 buffer + 2 drops yellow food color	0.5 ml

3. Each student lab group gets the following materials (see the Quick Guide graphic):
  - 8 labeled droppers: Adult Stem Cells - ASC, Embryonic Stem Cells - ESC, GFA, GFB, GFC, GF1, GF2, and GF3
  - 8 labeled, filled tubes: Adult Stem Cells - ASC, Embryonic Stem Cells - ESC, GFA, GFB, GFC, GF1, GF2, and GF3
  - 1 microtube rack (optional)
  - 6 "Culture Cups" – use small (1 oz.) condiment cups or a spot plate with at least 6 depressions
  - 1 *Growth Factors (GF) Involved in Stem Cell Differentiation* diagram
  - Scissors
4. Each student gets the following materials:
  - 1 copy of *Stem Cells* student instructions
  - 1 copy of *Development Diagram Sheet*
  - Goggles
  - Gloves (optional)

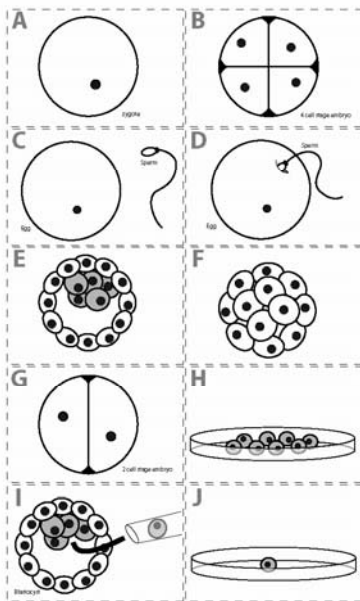
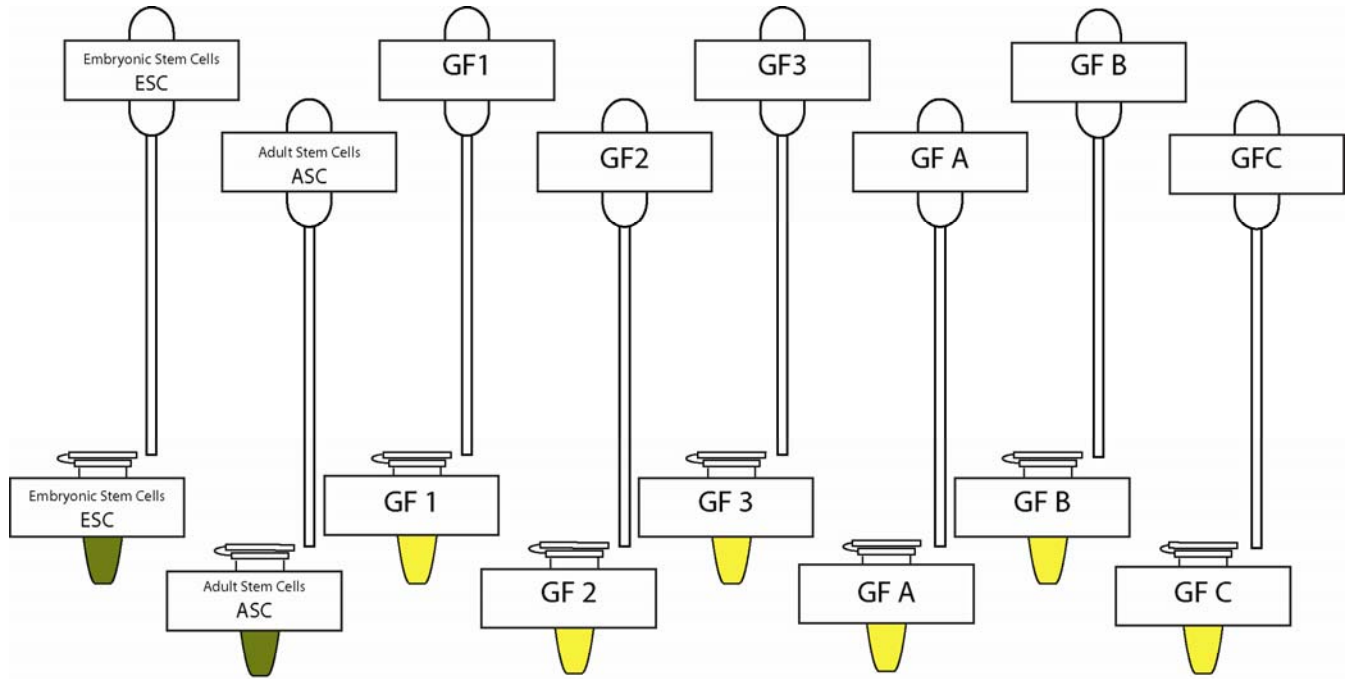
# Development Diagram Sheet



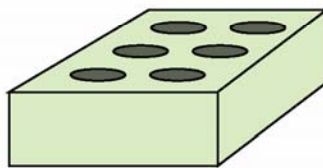
## Growth Factors (GF) and Stem Cell Differentiation Flow Chart



**Quick Guide:**



Culture Cups



Microtube Rack

