

# Start as a stem cell!

## Introduction

‘Start as a stem cell!’ was designed to introduce people to the idea that cells differentiate to produce mature cells, that differentiation pathways are controlled by signals within and outside the cell and that stem cells are at the start of these pathways. The blood system has been chosen as the model for this game, as out of all the systems in the human body this is the most well characterised. The game can be discussed and adapted to suit many different levels.

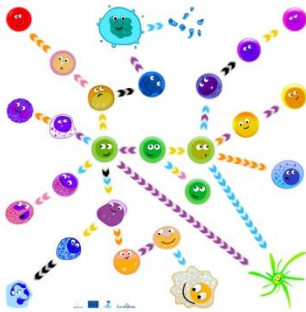
The central cell is the blood stem cell which is capable of dividing to produce copies of itself (self renew) or different cells. The first division of stem cells gives rise to progenitor cells which are shown in a different shade of green on the game board. The type of progenitor cell the stem cell gives rise to depends on the molecules present in its environment. Different molecules can control which part of a cell’s DNA is transcribed, altering the proteins produced and therefore the type of cell made.

These pathways are tightly controlled and enable the body to grow, maintain and repair itself. An active area of current research aims to understand what controls these pathways. This understanding allows scientists to manipulate cell environments so that they can initiate cells to differentiate in a direction they chose. An example of this is in the production of induced pluripotent stem cells (iPS cells) where scientists produce ‘embryonic like’ stem cells from mature cells.

### **Misconception be aware!**

One misconception that may arise if not discussed after playing the game is that one stem cell will produce one mature cell. As at each division two cells are born, it’s worth discussing how many actual cells would have been produced during the game (a bit of multiplication needed here).

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## Aim of the activity:

To create as many mature cells as you can in 5 minutes. The game can be played by between 1- 6 players in a team or as individuals.

1. One player places their counter on the central blood stem cell and the five minute countdown is started.
2. The player throws the three dice together to display a three colour combination. The player moves in the direction of the colours shown. If a direction shows a multi coloured arrow then all of those colours are needed to go in that direction.
3. Once the first player has moved, a second player (if there is more than one player) puts their counter on the central blood stem cell and throws the dice, moving in the direction the colour combination allows. Any player on the board can move when the dice is thrown whether or not they threw the dice.
4. When a player reaches a mature cell (they can't differentiate any further) they place a tick on the game results board next to the image of that mature cell and place their counter back on the central stem cell.
5. If a player 'self renews' by throwing a blue, pink and yellow when on the central stem cell, they can place two ticks on the game results board next to the mature cell they next become.
6. Once the five minutes are over count the number of mature cells produced. The winner is the one with the most mature cells. If playing as a team the result can be recorded to compare to the next teams result.

## You will need:

1. The game board. 2. The game results board. 3. Counters for each player.
4. The three coloured dice. 5. White board /OHP pen. 6. Timer.

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## Learning outcomes

1. Stem cells are able to produce copies of themselves (self renew) and give rise to different cells .
2. That different cells produced are increasingly more restricted in the types of cells they can give rise to.
3. At the end of the pathway a mature cell is formed that cannot divide to give rise to different cells.
4. The process of cells dividing to become ever more specialised is called differentiation.
5. That new cells are produced from cell division
6. The type of cell produced and when this happens depends on the signals that a cell receives from its environment (both internal and external).
7. The types of mature cells produced from blood stem cells.
8. Scientists are manipulating cell environments in the lab to go backwards along these signal pathways.

## Ideas for use in class:

1. The game could be used as a group activity to either introduce or consolidate stem cell concepts.
2. The game was developed originally as a floor game which works very well for a whole class introduction. To recreate this the board could be drawn out using chalk in the playground in a 3 x 3 m<sup>2</sup> square (see example to the right).



Instead of using counters, pupils move around the board. To replace the 'game results board' ping pong balls can be placed in plastic cups, each marked with a different cell type.

3. The game could be used as a starter activity before pupils research about how blood stem cells can be used for blood transfusion. A good starting point for information on the internet is: <http://www.stemcellsforblood.org>
4. After the game, discussion and or research could take place about when and why the body might produce more of a particular cell type. For example, when you cut yourself more red blood cells are produced to maintain the bodies blood volume.