

Stem Cell Differentiation Game

Goal of the Game

The goal of the game is to form a pancreatic beta cell. This is accomplished when one member of a two-player research team accumulates the appropriate number of points/cards.

The color of the cards and the point values represent the differentiation and specialization of cells in the development of the pancreas. Interactions between the cells of the endoderm and mesoderm are especially important.

In order to be successful, a researcher must be able to answer questions about his/her work. Therefore, there are times during the game when a player is called upon to correctly answer stem cell, development, and microarray related questions. After accumulating the correct number of points, the final step in the successful formation of a beta cell requires each member of a two person team to correctly answer an additional question.

Preparing the Deck

For each set of four players, prepare a basic UNO deck by removing all of the red and DRAW TWO cards. This should leave:

- 19 *Blue* number cards. These represent ectoderm cells and are worth face value.
- 19 *Green* number cards. These represent mesoderm cells and are worth face value.
- 19 *Yellow* number cards. These represent endoderm cells and are worth face value.
- 4 *Wild* cards. These represent pluripotent stem cells and are worth one point of any color.
- 4 *Wild Draw Four* cards. These represent a researcher trying to de-program a cell to make it an induced pluripotent stem cell.
- 6 *Reverse* cards. These represent a setback in the next player's research. When played, play goes in the opposite direction. For the reverse action to go into effect, the person playing the card must correctly answer the question on a card from the Question Card deck. Play left becomes play right and vice versa.
- 6 *Skip* cards. These represent a loss of funding. The next player is skipped over unless they are able to correctly answer the question on a Question Card drawn by the person playing the skip card.

Question Cards

Each card has one stem cell, development, or microarray-related question along with its answer. These cards will be used when a player must answer a question to avoid being skipped, to reverse the direction of play, during the Wild Draw Four Card series of four questions, and at the conclusion of the game.

Picking the Dealer

Every player draws a card. The player who draws the highest number deals. If you pick a *word* or *wild card*, that's too bad. They don't count. The player to the left of the dealer goes first.

Starting Play

Each player is dealt 6 cards with the remaining cards placed face down to form the draw pile. The top card of the draw pile is turned over and placed to the side of the draw pile to begin the discard pile.

The first player takes the top card from the draw pile. From the cards now in the first player's hand, one card is selected for discard and placed on the discard pile. Play then moves to the next person with each player drawing the top card from the Draw Pile and discarding one card. Cards are not taken from the discard pile. If cards in the draw pile run out, shuffle the discard pile and place it face down to become the new draw pile.

The Game

In order to form a complete organism, all three germ layers must be present. Researchers have learned that external growth factors from the blood supply (mesoderm) signal the differentiation of endoderm cells into pancreatic cells...specifically the endocrine cells of the islets of Langerhans. This process is represented by the point values and the color of the cards a winning player must have:

Ectoderm = 5 points (blue)

Mesoderm = 15 (green)

Endoderm = 15 (yellow)

Note: The point value on the face of each card is what is counted to reach the necessary total. A wild card counts as one point in any germ layer. Also, it is OK to have extra points. The above germ layer totals represent the minimum a winning player must hold.

Each player should be provided with a *Stem Cell Score Guide*. If a player is unfamiliar with which cards are which, they should also be provided with a *Stem Cell Card Decoder*.

When a Question is Required—Skip, Reverse, Wild Draw Four, and Peer Review

Skip Card: The person playing a Skip Card draws the top card from the Question Card pile and directs the question to the person who is potentially being skipped. If the response is correct, the person is not skipped and play continues. If the answer is incorrect, the person is skipped and the next player takes a card from the draw pile.

Reverse Card: When a reverse card is played, the person that would be next to draw a card from the draw pile instead draws a question card. The person playing the reverse card must answer the question correctly for the direction of play to be reversed. If the question is answered incorrectly, the direction of play continues, as it would have without the reversal.

Wild Draw Four: When it is the player's turn, a player holding a Wild Draw Four card may request to be asked four questions. The questions will be drawn, one card at a time, from the Question Card deck. If the player answers the first question correctly, they get to draw a card from the draw pile. They are then asked a second question. This would allow a successful player to add four cards to their hand and then discard the Wild Draw Four card. If a question is missed, the player just discards the Wild Draw Four card and play moves to the next person.

Peer Review Questions: When one member of a team has the points necessary to win, a player on the opposing team draws a card from the Question Card deck and reads it aloud. Either member of the potential winning team may elect to answer it.

Next, the person who did not answer the first question must answer the question on a second card drawn from the Question Card deck. Even if the first person answers his/her question incorrectly, the second member of the team must be asked a question.

If both members of the team answer their questions incorrectly, their lab is shut down and the opposing team wins.

If one of the questions is missed, the person providing the incorrect response must place all of their cards on the bottom of the Draw Pile and remove the top six cards to form a new hand. Play continues.

If both questions are answered correctly, the game is over and the team wins..

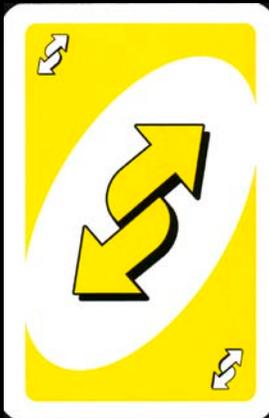
Helpful Hint

Players may want to lay down the cards that count toward successful stem cell differentiation face side up in front of them. This makes it easier for them to see exactly what is needed to win the game. These cards can be moved back into play if a player gets one that has a value that puts them closer to winning.

Stem Cell Card Decoder



Wild card: one point any germ layer Wild +4 card: ask four questions



Reverse direction of play card



Skip next player card



Germ layer - point card

Stem Cell Score Guide		
Germ Layer	Color	Points Needed
Ectoderm	Blue	5
Mesoderm	Green	15
Endoderm	Yellow	15
Wild Card	Any germ layer	1

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