

Learning Constellation on Membrane Flow (ER – Golgi – Exocytosis)

Goal of the simulation

Participants experience how proteins are produced in the endoplasmic reticulum, modified in the Golgi apparatus, and then exported out of the cell through exocytosis.

Preparation in the room

- 13 participants form the cell membrane (standing in a circle, holding hands)
- 5 participants represent the endoplasmic reticulum (ER)
- 5 participants represent the Golgi apparatus (dictyosome)
- One object represents a protein (e.g. enzyme X → symbolically a pen, scissors, etc.)

Process of the simulation

1. The protein (enzyme X) is produced in the ER.
2. In order to prevent it from drifting freely into the cytoplasm, a vesicle is formed (2 participants “pinch off” a membrane).
3. The vesicle moves to the Golgi and fuses there.
4. In the Golgi apparatus, the protein is modified (metaphor: open / turn / mark the object).
5. A new vesicle is formed which travels to the cell membrane.
6. **Exocytosis:** the vesicle fuses with the membrane and the protein is released.

Reflection

- What is the function of the Golgi apparatus for the cell?
 - Why are vesicles necessary?
 - What does this embodied representation show more clearly than a drawing?
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Learning Constellation on Endocytosis and Digestion

Goal of the simulation

Nutrient uptake, vesicle formation and digestion by enzymes become physically tangible.

Preparation in the room

- A bar of chocolate serves as food
- Cell membrane → circle of participants

- 3 participants as enzymes: “paper enzyme”, “foil cutter”, “chocolate cutter” (these originate from the Golgi apparatus)

Process of the simulation

1. The membrane invaginates and surrounds the chocolate → a vesicle is formed.
2. Enzyme vesicles fuse with the nutrient vesicle.
3. Enzymes “digest” the chocolate (broken / divided into smaller pieces).
4. At the end, all participants receive small pieces → symbolic distribution of breakdown products.

Reflection

- How does it feel to take in food and distribute it within the cell?
 - Why do enzymes work so specifically?
 - Where do we encounter endocytosis principles in everyday life?
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Source

The core ideas for these two learning constellations originate from Beat Schlüchter (Gymnasium Thun) and were further developed didactically by Sebastian Schmied.