

Game 1

Game Title: "Connect the Charge – Electromicrobiology Match Game"

Objective:

Students are presented with **images of key elements** from electromicrobiology. They must **drag and drop the correct label** onto each image.

Example Images and Labels

Image Description	Correct Label	Explanation
1. A rod-shaped bacterium like <i>Geobacter</i> or <i>Shewanella</i>	Electroactive Microbe	These microbes transfer electrons to/from minerals or electrodes.
2. A stylized electron (negative charge symbol)	Electron	The fundamental particle involved in electron transport.
3. A molecule losing electrons (with a minus symbol moving away)	Oxidation	Oxidation is the loss of electrons during a reaction.
4. A molecule gaining electrons (with a minus symbol approaching)	Reduction	Reduction is the gain of electrons during a reaction.
5. A microbe with hair-like projections conducting current	Microbial Nanowire	Conductive pili or extensions used by microbes to transfer electrons over distances.
6. An electrode in a bioelectrochemical system (e.g., an anode in a microbial fuel cell)	Electrode	Solid surface that accepts or donates electrons in these systems.
7. A biofilm covering an electrode surface	Biofilm	Dense microbial community that often facilitates electron transfer.
8. Arrows showing flow of electrons from microbe to electrode	Extracellular Electron Transfer (EET)	The process by which microbes move electrons to external acceptors.
9. A two-chambered microbial fuel cell with microbes and electrodes	Microbial Fuel Cell (MFC)	A device that uses microbes to generate

Image Description	Correct Label	Explanation
		electricity from organic matter.
10. A molecule like ferric iron (Fe^{3+}) turning into ferrous iron (Fe^{2+})	Electron Acceptor	Terminal molecule that receives electrons in microbial respiration.
11. A power symbol or electric current generated on a screen	Electricity Generation	Result of microbial metabolism in systems like MFCs.

Game Mechanics

- **Drag and Drop:** Students see a panel of **10–12 images** on one side and **labels** on the other.
- When the student **drags a label onto the correct image**, a sound/visual cue confirms the match.
- Incorrect matches can either **snap back** or give a hint like “Try again!” or “Think about electron flow!”
- This can also be made on paper and just printed.

Learning Outcomes

- Understand basic redox processes (oxidation and reduction).
 - Identify key elements in microbial electron transfer.
 - Visualize microbial nanowires and their function.
 - Recognize the structure and function of microbial fuel cells.
 - Learn terminology like EET, biofilm, and electron acceptors.
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Game 2

"Cable Connect – The Electron Relay Race"

Objective:

Students role-play **cable bacteria cells**. They must **form a cable** and **pass electrons (balls)** along the chain to reach the **electron acceptor (basket)** at the end. This demonstrates **long-distance electron transport** by cable bacteria in oxygen-limited environments.

Roles:

- **Students:** Each one is a "cable bacterium cell"
- **Ball:** Represents an electron

- **Basket:** Represents an **electron acceptor** (like oxygen)
 - **Ground/Environment Zones:**
 - **Anoxic Zone (No oxygen):** Where metabolism begins (electron donors are found, e.g., sulfides)
 - **Oxic Zone (Has oxygen):** Where the final electron acceptor is located
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Game Setup:

- Divide a space into two zones:
 - **Zone A (Back of room / floor):** *Anoxic zone* – Students start here with balls.
 - **Zone B (Front of room / stage):** *Oxic zone* – Place a basket or multiple baskets here.
 - All students start **separated**, each with:
 - A **ball (electron)**
 - A **basket** (pretend terminal acceptor)
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Phase 1: Free-Living Chaos

- Students roam freely (not connected).
- Each tries to move their electron (ball) to their own basket.
- But the rule is: they can't move **both ball and basket at once**, and **oxygen is scarce**—so they fail.
- After a few failed tries, the instructor says:

“The environment is changing! Oxygen is only found far away, and you must work together to survive!”

Phase 2: Cable Formation

- Students now **connect arm-in-arm or shoulder-to-shoulder**, forming a **human chain** from Zone A to Zone B.
 - Only the **first person** (at the anoxic zone) has a ball.
 - The goal is to **pass the ball (electron)** down the line, person-to-person, until it reaches the **last student**, who has the **basket (oxygen acceptor)**.
 - Each pass represents **intracellular electron conduction** via conductive filaments (like in real cable bacteria).
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Creative Elements to Enhance the Experience:

Energy Tokens:

- Every time a ball successfully reaches a basket, the group earns an "**Energy Token**"—symbolizing energy conservation during respiration.

Supercharged Cable Mode:

- Introduce a **time challenge**: how many electrons can they pass in 30 seconds?
- Encourage strategies like shorter chains (faster transfer) or better coordination.

Disruption Round:

- Simulate a **toxic environment** (e.g., no sulfides or blocked oxygen).
- Remove a middle person from the chain. The ball can no longer reach the end.
- Discuss how **environmental disruptions** affect cable bacteria function.

Learning Reflection:

- After the game, discuss:
 - Why couldn't individuals complete the task alone?
 - What does the human chain simulate?
 - How do real cable bacteria "live apart but breathe together"?