**Name:** **Date:** **Section:**

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# Membrane Explorer Activity: Cell Membrane Structure and Function

## Cell Membranes: Nature's Security Gates!

### Phase 1: ENGAGE (5 minutes)

- *Getting Started:**

Open peebedu.com and navigate to Membrane Permeability Explorer

You're looking at a cell's boundary - its security system!

- *First Look:**

1. What molecules are waiting to cross? _____
2. What color are different molecules? _____

- *Big Question:**

Why can't everything just enter a cell freely?

- *Think About It:** 🤔

Your house has walls and doors. How is a cell membrane similar?

## Phase 2: EXPLORE (18 minutes)

- *Mission 1: Size Security Check!* 🔪*

Test which molecules can sneak through based on size.

- *Size Test Results:**

| Molecule | Size | Time to Cross | Can it Pass? |
|---|---|---|---|
| Oxygen ($O_2$) | Tiny | | Yes/No/Slowly |
| Water | Small | | Yes/No/Slowly |
| Glucose (sugar) | Medium | | Yes/No/Slowly |
| Protein | Huge | | Yes/No/Slowly |

- *Pattern Found:** _____ molecules cross easier!

- *Mission 2: The Oil and Water Test!* 💧*

The membrane is oily inside. Test what likes oil!

- *Molecule Personality Check:**

| Molecule | Likes Oil? | Likes Water? | Crosses Easily? |
|---|---|---|---|
| $O_2$, $N_2$ | Yes | No | |
| Water | No | Yes | |
| Sugar | No | Yes | |
| Steroid | Yes | No | |
| Salt ($Na^+$) | No | Yes | |

- *Discovery:** Molecules that like _____ cross the oily membrane easily!

- *Mission 3: Special Doorways!* 🚪*

Turn on channels and see what happens.

- *Channel Magic:**

| Molecule | Without Door | With Special Door | WOW Factor! |
|---|---|---|---|
| Sugar | _____ s | _____ s | _____ × faster |
| Sodium | Won't cross | _____ s | Finally! |
| Water | _____ s | _____ s | _____ × faster |

- *Coolest Discovery:** _____
- *Mission 4: Temperature Test!* 🌡️*

Change the temperature and watch oxygen.

- *Hot vs Cold Results:**
- Room temp (25°C): Moves _____
- Hot (50°C): Moves _____
- *Like a Race:** Heat makes molecules run _____!
- *Pattern Hunt (find 3):** 🔍

1. _____

### Phase 3: EXPLAIN (12 minutes)

- *How Cell Security Works**

1. **The Membrane Structure:**

Draw the membrane like a sandwich:

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Outside: 🌊 Water

🔵 Heads (love water)

🟡 Tails (hate water, love oil)

🟡 Tails (hate water, love oil)

🔵 Heads (love water)

Inside: 🌊 Water

```

The oily middle blocks _____ molecules!

1. **Three Ways to Cross:**

- *Way 1: Sneak Through (Simple Diffusion)**
- Who: Small, oily molecules
- How: Slip between the molecules
- Examples: $O_2$, $CO_2$, steroids

- *Way 2: Use a Door (Facilitated Diffusion)**
- Who: Large or water-loving molecules
- How: Special protein channels
- Examples: Glucose, water, ions

- *Way 3: Energy Elevator (Active Transport)**
- Who: Molecules going against the flow
- How: Uses cell energy (ATP)
- Examples: Sodium pump

1. **Why Temperature Matters:**

Think of the membrane like butter:

- Cold = Stiff and hard
- Warm = Soft and flexible

Molecules move through soft butter _____!

1. **Channel Specificity = Special Keys:**

Each channel is like a special door:

- Glucose channel = Only fits glucose 🍭
- Sodium channel = Only fits $Na^+$ 🧪
- Water channel = Only fits $H_2O$ 💧

Why? Safety and control!

## Phase 4: ELABORATE (8 minutes)

- *Real-World Connections**

1. **Your Body's Membranes at Work:**

- *In Your Lungs:**
- $CO_2$ crosses _____ (easily/hardly)
- Why breathing works!

- *In Your Intestines:**

- Water uses _____ for speed

1. **When Membranes Go Wrong:**

- *Cystic Fibrosis:**
- Problem: Chloride channels don't work
- Result: Thick, sticky mucus

1. **Cool Comparisons:**

| Situation | What Happens | Why? |
|---|---|---|
| Fish in ocean | Lose water | |
| Fish in lake | Gain water | |
| Pickle in salt | Shrinks | |
| Raisin in water | Swells | |

- *Design Challenge: Medicine Delivery!* 💊*

Design a medicine that can enter cells:

- Size: _____ (small/large)
- Special feature: _____
- Drawing: [Your medicine molecule]

## Phase 5: EVALUATE (7 minutes)

- *Show What You Know!**

1. **Security Check Game:**

Circle what passes easily:

- Oxygen / Sugar / Protein
- Oil / Water / Salt
- $CO_2$ / Glucose / $Na^+$
- Steroid / Ion / Starch

1. **True or False** (circle):

- T / F: All molecules can cross membranes
- T / F: Channels help big molecules cross
- T / F: Hot temperatures slow diffusion
- T / F: Membranes keep cells safe

1. **Fill in the Blanks:**

1. **Problem Solving:**

A cell needs glucose but it's too big to cross alone.

Solution: _____

A cell has too much sodium inside.

Solution: _____

1. **Math Connection:**

If oxygen takes 2 seconds to cross at 37°C:

- At 0°C it might take: _____ seconds
- Pattern: _____
- *Big Picture Question:**

Why is selective permeability important for life?

- Keeps good things: _____
- Maintains balance: _____
- *Fun Challenge:**

If you were a molecule, which would you be and why?

- I'd be _____ because _____
- *Exit Ticket:** 🎟️

- One question I have: _____

- --

****Cool Membrane Facts:****

- Your body has 37 trillion cell membranes! 🤯
- Soap breaks membranes (that's how it kills germs!) 🧼
- Some snake venoms destroy membranes 🐍
- Membranes can repair small holes by themselves! 🩹
- Brain cells have super-selective membranes 🧠

**Key Vocabulary:**

See activity for vocabulary specific to this topic.