Soil-microbial Fuel Cells (MFC)

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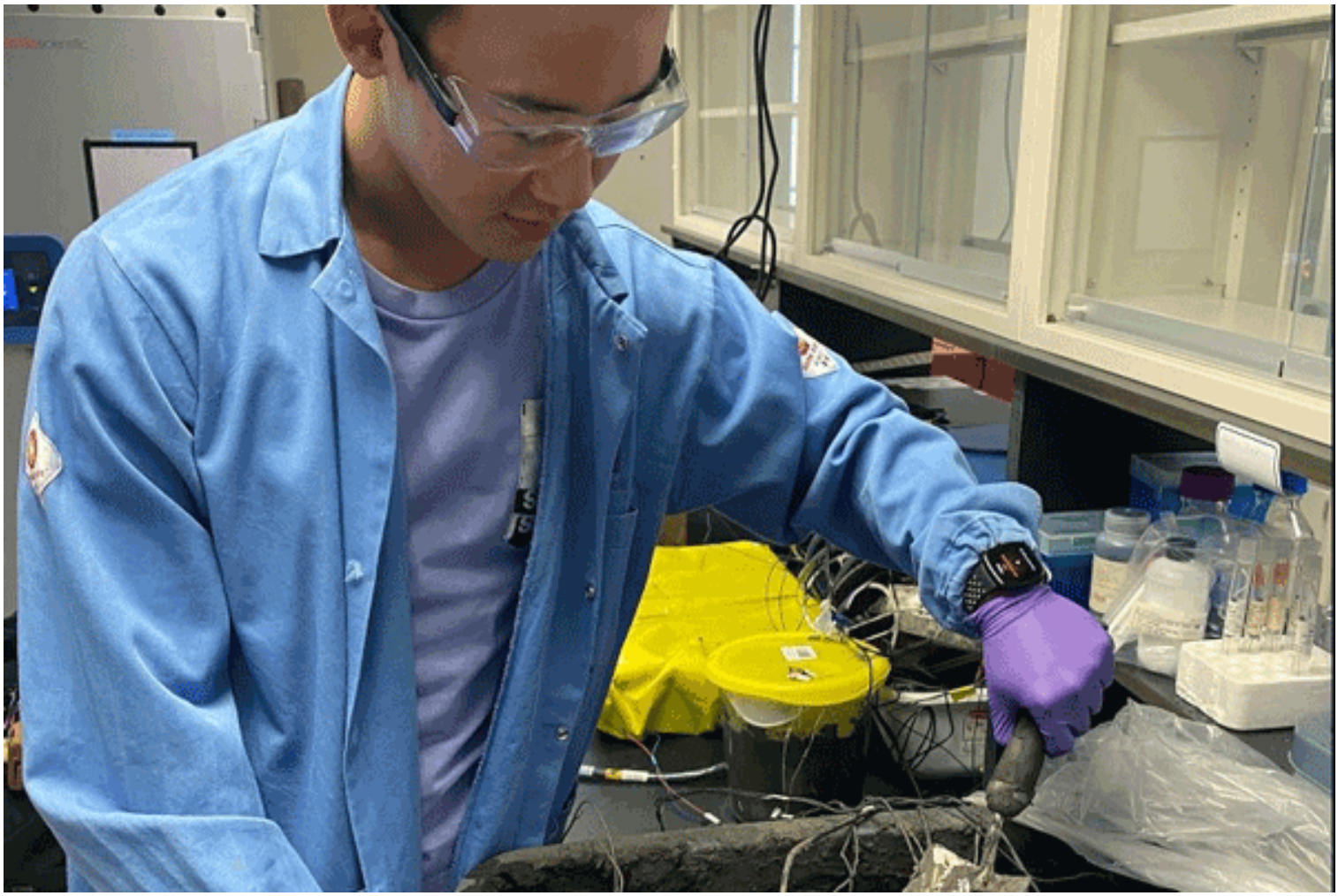

Soil-microbial Fuel Cells (MFC)

Researchers recently developed a **new soil-powered fuel cell** that can **harvest energy from microbes** living in the soil.

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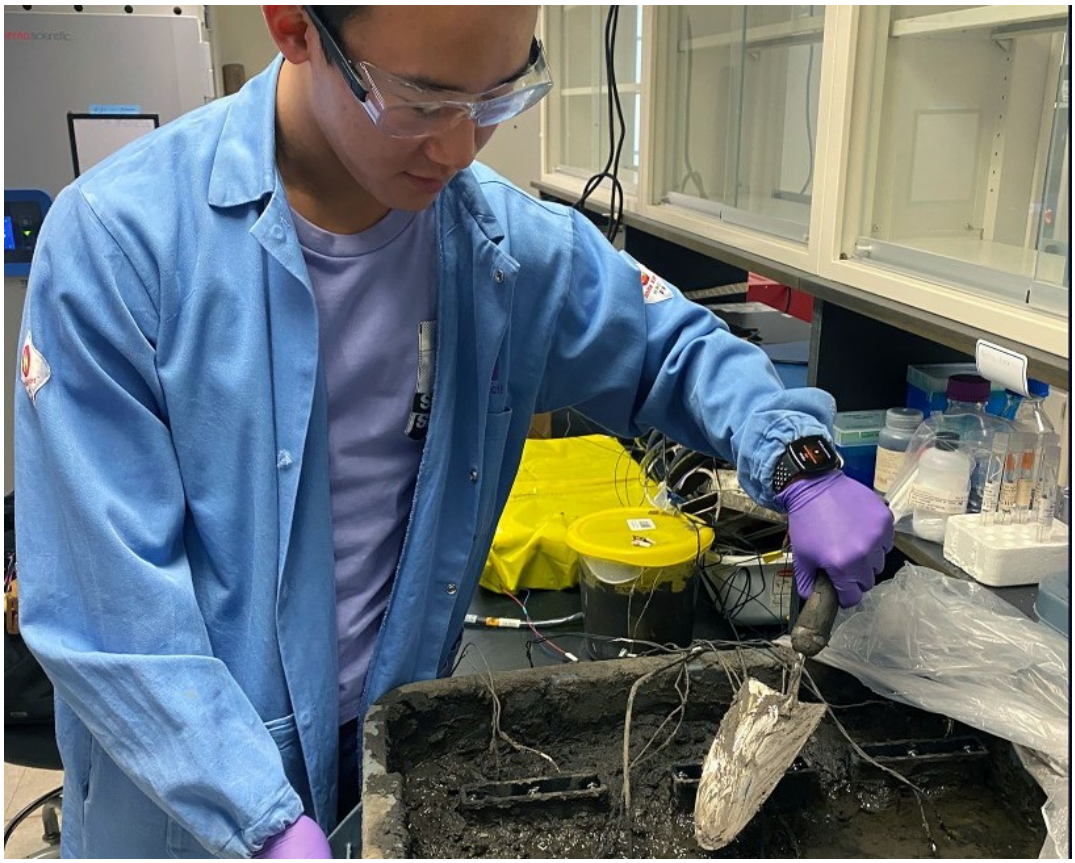

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About Soil-powered Fuel Cell:

- The researchers turned to **soil microbial fuel cells**, which **utilize microbes** to break down soil and convert the energy into power for sensors.
- **Power sensors** measured soil moisture and detected touch, making them useful for tracking passing animals.
- The microbes used in the fuel cells are **already present in soil**, and simple engineered systems can capture their electricity.
- The research **aims to address the environmental concerns** associated with traditional batteries, through a sustainable solution for powering **IoT (Internet of Things)** devices.

Innovation in Design:

- The new fuel cell was designed with a **perpendicular geometry**, departing from the traditional parallel design.
- A **vertical structure** ensures the top end remains flush with the ground surface even when buried, but stays hydrated even when exposed to sunlight.
- A **3D-printed cap prevents debris** from falling, and an air chamber facilitates consistent airflow.
- A **waterproof coating** on part of the cathode enables breathing during floods, addressing challenges posed by dry and wet conditions.
- The fuel cell was equipped with a **tiny antenna** for wireless communication, to transmit data to a neighboring base station by **reflecting existing radio frequency signals.**

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Significance of the technology:

- **History:** MFCs were first created in 1911, and operate similarly to batteries, featuring an **anode, cathode, and electrolyte.**
- They **harness electricity** from bacteria naturally emitting electrons to nearby conductors.
- As long as there is organic carbon in the soil for the microbes to break down, the fuel cell can **potentially last indefinitely.**
- It **may not power entire cities**, but it can capture small amounts of energy to fuel practical, **low-power applications**.
- It can perform well in **both wet and dry conditions**, and its power output exceeds that of similar technologies **by 120%.**
- It can potentially be used to fuel underground sensors used in **green infrastructure and precision agriculture.**
- This can be a **sustainable, renewable alternative to batteries** that use toxic and flammable chemicals that leak into the ground when used in the soil.
- This can **reduce supply chain disruptions** and electronic waste.

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