

What if fungal fuel cells powered medical devices in remote communities?

Power Fungi

03

UNCERTAINTIES

Nature, Technology

MEGATREND (Most significant)

Materials Revolution

TRENDS

Biomimetics
Communicable & Non-communicable
Diseases
Longevity & Vitality
Mobilising Innovation

TECHNOLOGIES

Fuel Cells HealthTech Sensor Technologies

SECTORS IMPACTED

Agriculture & Food Communication Technologies & Systems Government Services Health & Healthcare Materials & Biotechnology

KEYWORDS

Chronic Disease Management Fungal Fuel Cells Off-Grid Medical Technology Remote Diagnostics Rural Healthcare Within Reach

Transitional

√isionary

Bioelectricity generated by fungi powers small medical devices in remote areas, letting doctors check on patients even where there are limited sources of micropower, allowing advanced monitoring capabilities in previously unreachable areas.





While the global rural population today consists of 3.4 billion people, it is projected to decline to 3.1 billion by 2050, with China and India having the largest rural populations. ⁵¹⁰ In the Middle East and North Africa, following a period of steady migration, only 37% of the population lived in rural areas in 2023 compared with 66% in 1960. ⁵¹¹ Nevertheless, despite these reductions, the number of people living in rural areas in the future will still be significant.

Rural residents are affected by chronic disease more than people living in urban areas. In a study carried out in China in 2015, rural residents had a higher prevalence of chronic disease than urban residents, at nearly 83% and 80%, respectively. Similarly, in the United States, the 46 million Americans (13.8% of the population) living in rural areas face higher rates of premature death from heart disease, cancer, lung disease, and stroke.

Implementing behavioural interventions for chronic disease prevention in rural areas is often challenging. ⁵¹⁵ Due to technological and staffing barriers, rural areas face a shortage of healthcare specialists and primary care providers, and residents have limited access to the network connectivity that could help them seek healthcare remotely. ⁵¹⁶ Nearly 70% of people without internet access (2.6 billion globally) live in rural areas. ⁵¹⁷



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THE OPPORTUNITY



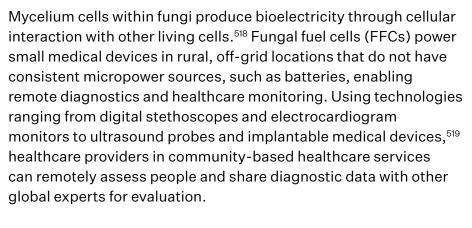
BENEFITS

Increased access to healthcare; sustainable, low-cost electricity generation from organic waste; support for disaster relief; reduced battery waste.



RISKS

Potential biosafety concerns with fungal species; reduced cell performance over time; potential toxicity and pathogenic infection.



FFCs generate electricity by breaking down biomass (i.e. organic materials such as wood, leather and paper)⁵²⁰ using an anode that contains fungi and a cathode that allows proton and oxygen exchange.⁵²¹ These cells can provide power as long as biomass or organic waste is available,⁵²² offering longer operational lifetimes than batteries and supporting the use of portable medical equipment in rural areas, field clinics, and disaster relief efforts.





Fungal fuel cells
power small medical
devices in rural,
off-grid locations that
do not have consistent
micropower sources

