Research Summary

Clinical Machine Learning for Early Triage

Purpose

I want clinicians to act sooner when primary amebic meningoencephalitis is possible. Delays cost lives. Early risk is hard to judge because symptoms overlap other conditions, and key tests are not always at hand.

What I have built so far

Amoebanator is a small web demo that estimates risk from information a clinician can collect in minutes: freshwater exposure, days since exposure, fever, headache, neck stiffness, CSF white cells, CSF protein, CSF glucose, and whether PCR or microscopy is available. The page returns a probability, a clear Low, Moderate, or High band, and a short note that shows which inputs moved the estimate. It runs in the browser, so no patient information leaves the computer. The current version uses a simple logistic model trained on a synthetic cohort and includes a calibration plot, a precision recall curve, and a decision curve. Each page ships with a model card, known limits, and an ethics note.

Montenegro's Medium is a lab method that raised Naegleria fowleri growth roughly three to five fold when compared with older recipes. It uses clean water, sterile technique, and ten percent FBS. I removed antibiotics to keep the method simple and more accessible.

Here's the tight, human summary you asked for:

We built an open, plate-based screen to stress Naegleria fowleri at three timepoints (24 h LDH, 48 h caspase-3, 72 h JC-1) in amoeba alone and in HeLa + amoeba co-culture. Across plates, the clearest, reproducible signal was that perturbing the endoplasmic reticulum/secretory axis,

specifically SERCA-dependent ER Ca²⁺ handling and COPII/ARF1 trafficking; most consistently blunted host injury and primed mitochondrial collapse. For future drug development, the ER–Golgi pathway (SERCA/COPII) is our top vulnerable organelle. A secondary, promising target is LeuRS-CP1 (translation quality control).

What I will do next

> • Run a small ED retrospective check (30–50 deidentified cases). Confirm which inputs are available at decision time, refresh calibration and net benefit, and share a one-page note, a model card, and a tiny demo.

> • Add uncertainty. Wrap the model with a simple conformal layer and include a short, plain error map a clinician can scan in two minutes.

> • Publish Montenegro's Medium as a clean methods note with a tidy dataset and open figures.

> • Grow Amoebanator into an edge friendly app (offline first, tablet ready, no PHI saved).

> • Expand to a simple meningitis differential: PAM, bacterial, and viral, using shared inputs.

> • Quietly automate routine triage steps behind safety gates, with easy human override.

Engineering notes

Next.js App Router, Tailwind, Recharts, and a small set of components. Tests with Vitest and Playwright.

Continuous integration on GitHub Actions. Keyboard navigation, skip link, contrast checks, and a light or dark theme. I track simple performance budgets and keep the initial payload small.

Service and values

I care about useful work and clear writing. I have more than six hundred fifty hours of verified service supporting campus food security, community projects, and student mentoring.

Links

Research

Playground

Collaborations

Publications

Contact