
Since the 1990s, there has been considerable interest in the use of cell-based biosensors for early detection of chemical and biological toxins. Cell-based biosensors use direct measurements of physiologic function (and changes induced by toxins), and therefore provide detection capability without requiring foreknowledge of the particular agent. One particular class of cell-based biosensors uses electrically active cells cultured onto microelectrode arrays to monitor cellular responses. While much work has been done on the development of cell-based biosensors in laboratory settings, this paper presents the first demonstration of a long-distance field trial where live cells were transported over several hours, rather than being carried a few feet from a commercial incubator to a bench.

This paper describes the design, implementation, and field-testing of the hardware and software platform required to transition cell-based biosensors from the laboratory to the field. The system consists of both cell-transport and data-acquisition instruments. The cell-transport module is a self-contained, battery-powered instrument that allows various types of cell-based modules to be maintained at a preset temperature and ambient CO$_2$ level while in transit or in the field. The second module is a data acquisition system that consists of the necessary electronics to amplify and filter the cellular electrical signals and to stream the resulting data to a computer for analysis. Both modules have sufficient internal power to permit realistic field-testing, such as the example presented in this paper.

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