

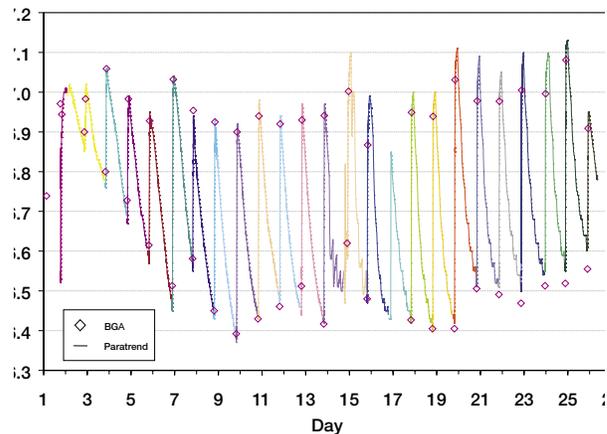
# Paratrend Sensor Evaluation

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Compact and automated sensors are necessary for assessing the health of cell cultures in biotechnology experiments. While several single-analyte sensors exist to measure culture health, a multi-analyte sensor would simplify the cell culture system. One such multi-analyte sensor, the Paratrend 7 manufactured by Diametrics Medical, consists of three optical fibers for measuring pH, dissolved carbon dioxide (pCO<sub>2</sub>), dissolved oxygen (pO<sub>2</sub>), and a thermocouple with which to measure temperature. The sensor bundle was designed for intra-vascular measurements in clinical settings and can be used in bioreactors operated both on the ground and in Space Shuttle and Space Station experiments.

We placed a Paratrend 7 sensor at the outlet of a bioreactor inoculated with BHK-21 [baby hamster kidney] cells. The pH, pCO<sub>2</sub>, pO<sub>2</sub>, and temperature data were transferred continuously to an external computer. Using a bench-top blood gas analyzer (BGA), we also assayed cell culture medium that was manually extracted from the bioreactor through a sampling port. We used two Paratrend 7 sensors over a single cell culture experiment lasting 64 days. When compared to the manually obtained BGA samples, the sensor had good agreement for pH, pCO<sub>2</sub>, and pO<sub>2</sub> with bias [and precision] 0.005 [0.024], 8.0 mmHg [4.4 mmHg], and 11.4 mmHg [17.7 mmHg], respectively, for the first two sensors. A third Paratrend sensor, which operated for 141 days, had similar agreement ( $0.02 \pm 0.15$  for pH,  $-4 \pm 8$  mm Hg for pCO<sub>2</sub>, and  $1 \pm 18$  mm Hg for pO<sub>2</sub>).

The resulting biases and precisions are comparable to Paratrend sensor clinical results. Although the pO<sub>2</sub> differences may be acceptable for clinically relevant measurement ranges, the oxygen sensor in this bundle may not be reliable enough for the ranges of pO<sub>2</sub> in these cell culture studies without periodic calibration. The pH results obtained from one of the cell runs are shown.



The pH results obtained from one cell run.

