Task ID: 425.012
Task Title: CMOS Biochip for Rapid Assessment of New Chemicals
Deliverable: Report on the data from the CMOS biosensor

Summary Abstract:

Initial work concentrated on calcium studies of cells with exposure to TCE. TCE was chosen because it is a known toxin and can be used to verify the sensor approach. Calcium was chosen since it is a common intracellular messenger used in cells. Initial results were successful in showing toxic response of heart cells. Future work will concentrate on new chemicals

Technical Results and Data:

While toxins may act via a variety of mechanisms, we have an interest in using assays that can be optimized for utilization in the CMOS biosensor. Calcium is a common intracellular messenger used in cells. Recent studies in the Runyan lab showed that the solvent, TCE, altered expression of several calcium channel genes in developing hearts. This lead to the prediction that calcium handling would be altered in cells exposed to low levels of TCE. While TCE is not a solvent of major concern for current manufacturing, it provides a useful toxin for laboratory studies as it is commonly found at Superfund cleanup sites, Figure 1 shows differences in calcium handling within TCE exposed cells using the fluorescent dye, Fura 2. P19 cells were exposed in culture to low levels of TCE for 24 hours and then treated with vassopression (VP) to produce an intracellular flux of calcium that could be measured by changes in fluorescence. The data show that intracellular calcium is delayed in both release and uptake from intracellular stores but that the total calcium flux is much greater in TCE treated cells. This may indicate the involvement of cell surface calcium channels as well. The images shown in this figure were produced with a conventional microscope and CCD camera, but we expect that the greater sensitivity of the CMOS chip will be able to provide efficient measurement of calcium changes and a more accurate measurement of calcium release from the intracellular store.

Figure 1. Panel of images captured at equivalent intervals after treatment with vasopressin to induce a calcium flux. Calcium intensity was measured by fluorescence and the scale was concerted to false color as indicated. The data show that calcium can be developed as a sensitive indicator of exposure.