Abstract: A sensitive biosensor (cytosensor) has been developed based on color changes in the toxin-sensitive colored living cells of fish. These chromatophores are highly sensitive to the presence of many known and unknown toxins produced by microbial pathogens and undergo visible color changes in a dose-dependent manner. The chromatophores are immobilized and maintained in a viable state while potential pathogens multiply and fish cell-microbe interactions are monitored. Low power LED lighting is used to illuminate the chromatophores which are magnified using standard optical lenses and imaged onto a CCD array. Reaction to toxins is detected by observing changes in the total area of color in the cells. These fish chromatophores are quite sensitive to cholera toxin, Staphylococcus alpha toxin, and Bordatella pertussis toxin. Numerous other toxic chemical and biological agents besides bacterial toxins also cause readily detectable color effects in the chromatophores. The ability of the chromatophore cell-based biosensor to distinguish between different bacterial pathogens was examined. Toxin producing strains of Salmonella enteritis, Vibrio parahaemolyticus, and Bacillus cereus induced movement of pigmented organelles in the chromatophore cells and this movement was measured by changes in the optical density over time. Each bacterial pathogen elicited this measurable response in a distinctive and signature fashion. These results suggest a chromatophore cell-based biosensor assay may be applicable for the detection and identification of virulence activities associated with certain air-, food-, and water-borne bacterial pathogens.