When studying gas channels in cells, surface and intracellular pH are determined in an oocyte using electrodes which measure the concentration of hydrogen ions (H⁺). It has been hypothesized that the presence of the electrode creates microenvironmental effects on pH measurements near the cell membrane. We develop a mathematical reaction-diffusion model of the electrode tip at the cell membrane which is restricted into a subdomain with artificial boundary conditions to keep the computational burden manageable. We consider an oocyte immersed in a liquid in which the pH is modulated by controlling the contents of carbon dioxide, CO₂, which reacts with water forming carbonic acid, H₂CO₃, which further dissociates to bicarbonate HCO₃⁻, thus releasing a proton H⁺. The local concentrations change due to diffusion, reaction, and gas transport through the cell membrane. To implement the solution numerically, we first discretize the solution in the spatial direction using a finite element scheme, reducing the problem into a system of ODEs. Through a series of numerical experiments, we show that the electrode does, in fact, create a microenvironment impacting the extracellular pH measurements. (Received September 26, 2017)