the pH in tissues is of diagnostic and therapeutic value. Imaging with small-molecule agents has been tested for measuring tumor pH. However, agents based on (1)H, (31)P, or (19)F MRS are limited by the inherent low sensitivity of spectroscopy and small pH-dependent chemical shift of these agents (18,19). The approach with gadolinium (Gd(3+)) chelate relaxation agents, which show a pH-dependent hydrogen exchange to the Gd(3+)-bound water, requires an accurate determination of the agent concentration, which in practice is difficult to achieve in vivo (20). Although positron emission tomography and optical imaging are sensitive, they appear have difficulty obtaining a pH map at high resolution (21–23). Furthermore, most of the published probes predominantly measure the pH within cells, which is more resistant to pH changes than the extracellular space. The data obtained by Gallagher et al. from hyperpolarized H(13)CO3(−) indicated that hyperpolarized H(13)CO3(−) provided a means to measure the pHe rather than the pHi (4). Given the range of pathological conditions in which the acid–base balance is altered, this technique may prove to be of diagnostic value not only in oncology but also in the imaging of ischemia and inflammation (4).

Shumyantseva, V. V. et al. (2015). "Electrochemical methods for biomedical investigations." *Biomed Khim* 61(2):188–202.

In the review, authors discussed recently published experimental data concerning highly sensitive electrochemical methods and technologies for biomedical investigations in the postgenomic era. Developments in electrochemical biosensors systems for the analysis of various bio objects are also considered: cytochrome P450s, cardiac markers, bacterial cells, the analysis of proteins based on electro oxidized amino acids as a tool for analysis of conformational events. The electroanalysis of catalytic activity of cytochromes P450 allowed developing system for screening of potential substrates, inhibitors or modulators of catalytic functions of this class of hemoproteins. The highly sensitive quartz crystal microbalance (QCM) immunosensor has been developed for analysis of bio affinity interactions of antibodies with troponin I in plasma. The QCM technique allowed real-time monitoring of the kinetic differences in specific interactions and nonspecific sorption, without multiple labeling procedures and separation steps. The affinity binding process was characterized by the association (ka) and the dissociation (kd) kinetic constants and the equilibrium association (K) constant, calculated using experimental data. Based on the electroactivity of bacterial cells, the electrochemical system for determination of sensitivity of the microbial cells to antibiotics cefepime, ampicillin, amikacin, and erythromycin was proposed. It was shown that the minimally detectable cell number corresponds to 106 CFU per electrode. The electrochemical method allows estimating the degree of *E. coli* JM109 cells resistance to antibiotics within 2–5°h. Electrosynthesis of polymeric analogs of antibodies for myoglobin (molecularly imprinted polymer, MIP) on the surface of graphite screen-printed electrodes as sensor elements with o-phenylenediamine as the functional monomer was developed. Molecularly imprinted polymers demonstrate selective complementary binding of a template protein molecule (myoglobin) by the "key-lock" principle.

Siligardi, G. et al. (2014). "Ligand- and drug-binding studies of membrane proteins revealed through circular dichroism spectroscopy." *Biochim Biophys Acta* 1838(1 Pt A):34–42.

A great number of membrane proteins have proven difficult to crystallize for use in X-ray crystallographic structural determination or too complex for NMR structural