

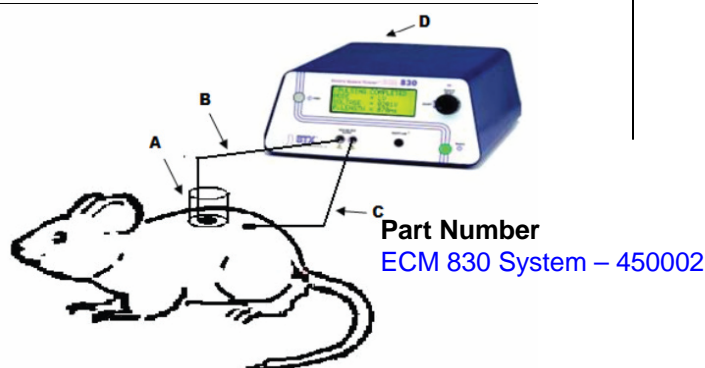
### Noninvasive Transcutaneous Sampling of Glucose by Electroporation

**Background:** In people with diabetes, blood glucose levels should be monitored regularly to prevent serious complications associated with diabetes. This involves the invasive method of withdrawing blood, which causes inconvenience to patients. The objective of this study was to investigate the efficiency of the noninvasive electroporation and transcutaneous sampling (ETS) technique for predicting blood glucose levels.

**Methods:** *In vitro* studies were carried out in Franz diffusion cells using porcine epidermis to assess the feasibility of transcutaneous sampling of glucose. *In vivo*, the ETS technique was assessed in the diabetes-induced Sprague–Dawley rat model. Glucose was sampled following the application of 30 electrical pulses of 1 ms duration at 120 V/cm<sup>2</sup>, 1 Hz. Clarke error grid analysis was carried out for the venous blood glucose levels that were determined by the ETS with reference to those measured by a glucose meter.

**Results:** The amount of glucose sampled by the ETS method both *in vitro* and *in vivo* was proportional to the dermal glucose concentration. All data points from *in vivo* studies were in A and B zones of Clarke error grid analysis, and the mean absolute relative error was 12.8%.

**Conclusion:** Results of the present study demonstrate that ETS technique could be developed as a noninvasive method of predicting venous blood glucose levels in people with diabetes.



**Figure 1.** Diagram representing the *in vivo* experimental setup. A sampling chamber (A) was glued on the skin surface of a Sprague–Dawley rat. Ag/AgCl electrodes (B and C) were placed in the sampling chamber and secured on the skin surface, respectively, and 0.4 ml of sampling buffer was placed in the chamber. The two electrodes were connected to the BTX 830M electrosquare porator and electrical pulses were applied. The sampling buffer was collected after 15 minutes and the amount of glucose present was measured.

#### ECM® 830 In Vivo Electroporation Protocol

##### Tissue preparation:

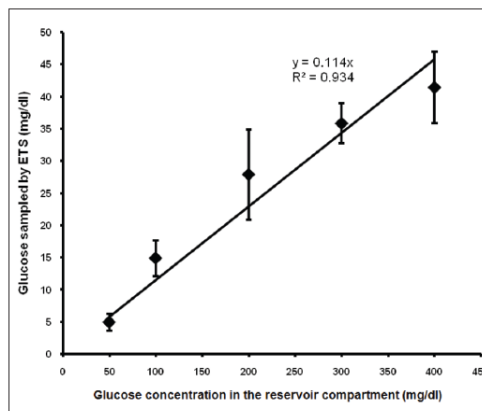
Sprague-Dawley rats were anesthetized with ketamine (80mg/kg) and xylazine (10mg/kg). The back portion of the rats were shaved, and a custom-made *in vivo* electroporation cell was fixed using an adhesive. The cell contains a sample collection chamber in which one of the Ag/AgCl electrodes was placed and the other electrode, which acts as a counterelectrode, was fixed just adjacent to the cell on the surface of the skin using micropore surgical tape (Figure 1). The skin was hydrated with 100ul of saline for 5 minutes before each sampling and was replaced with 400ul of sampling buffer.

##### Electroporation Settings:

Field Strength:	120 V/cm
Pulse length:	1 ms
Number of pulses:	30
Electrode	Custom

##### Reference;

Murthy, Srinivasa S, Siva Ram Kiran, Mathur, S. K., Murthy S. Narasimha. Noninvasive Transcutaneous Sampling of Glucose by Electroporation *J Diabetes Sci Tech* (2008) 2(2)



**Figure 2.** Relationship between glucose concentration in the reservoir compartment and glucose sampled by ETS across porcine epidermis *in vitro*.

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