

BACKGROUND

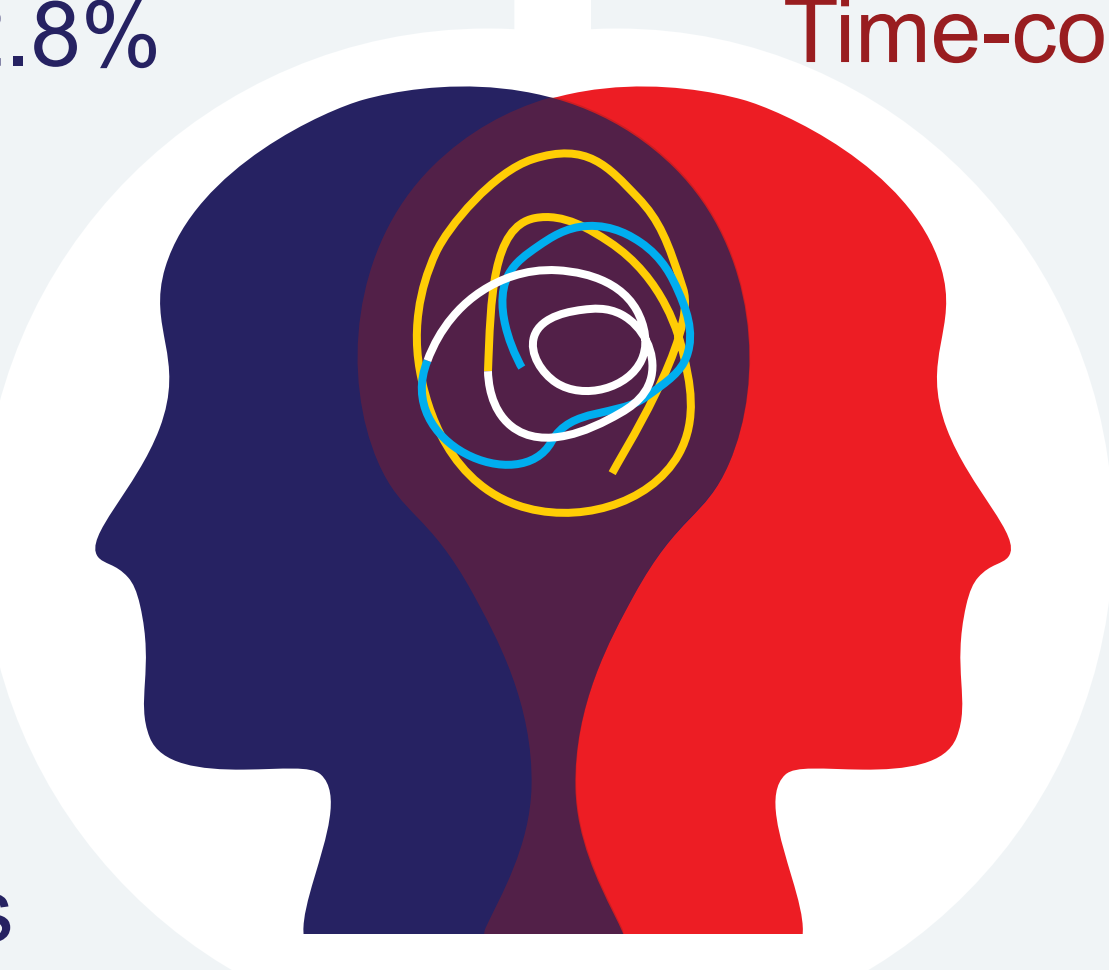
Bipolar disorder is considered the sixth cause of disability globally by causing radical mood disorder. Lithium (Li) is the primary compound in the antimanic drug used for mood disorder treatments. Lithium's narrow effective therapeutic range in serum, 0.4–1.0 mM, and risk of acute toxicity associated with the higher levels indicate the significance of real-time monitoring of lithium levels.

Epidemiology

- Annual diagnosis rate is 2.8%
- Equal among all genders
- Impacting 4.4% adults
- Average onset is 25 years
- 83% of patients with severe symptoms

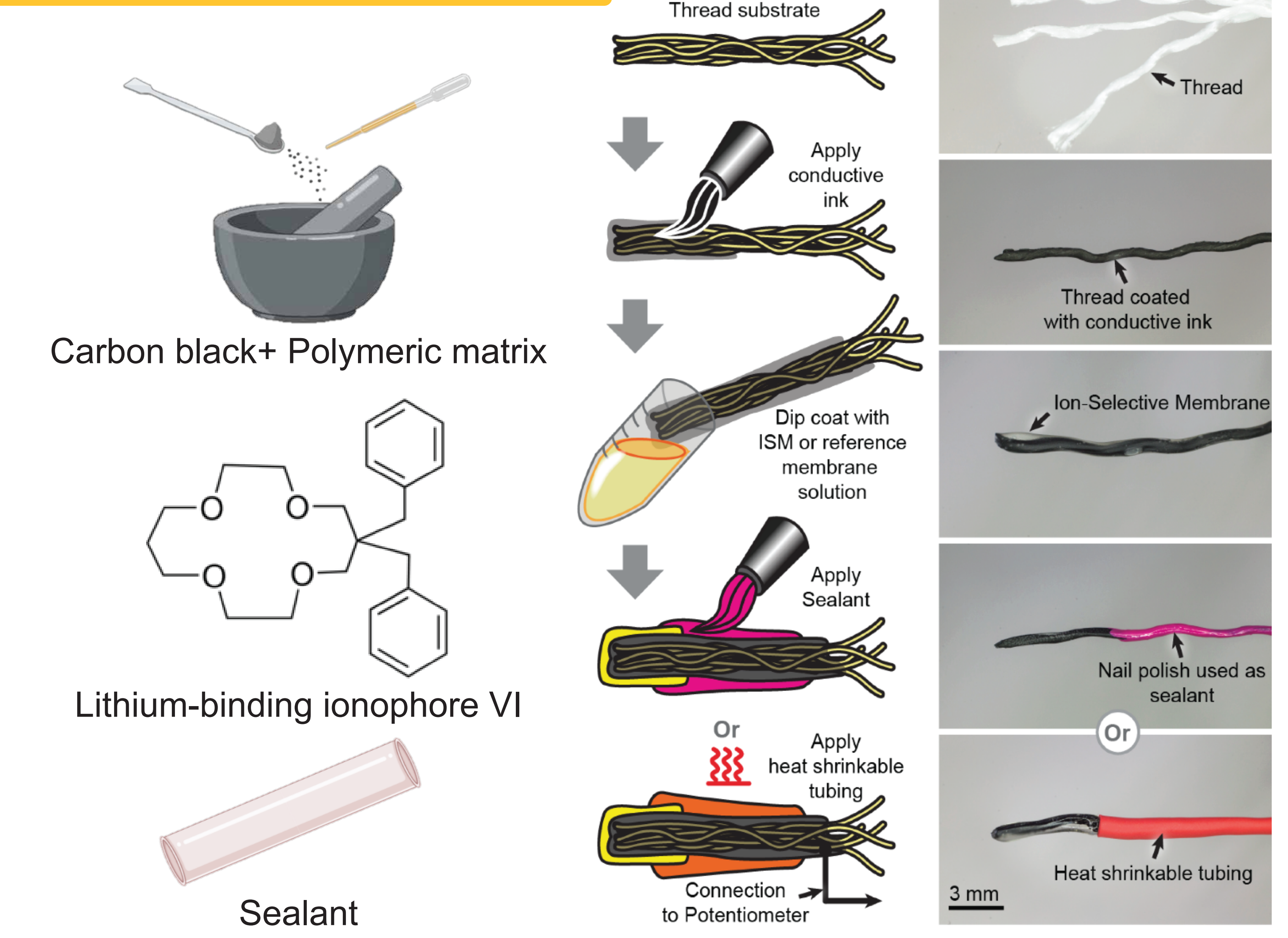
Current Limitations

- Time-consuming laboratory tests
- Real-time monitoring
- Drug interactions
- Possible comorbidities
- Screening for substance abuse



An **inexpensive** and **disposable** thread-based Li⁺ ion-sensing electrode (Li-ISE) was developed. The Li-ISE functions based on the potential difference generated due to the charge separation at the interface of the ion-selective membrane, through the selective binding of ions with the specific sites of the membrane, with respect to a reference electrode (RE) maintaining stable and constant potential.

METHODS



RESULTS

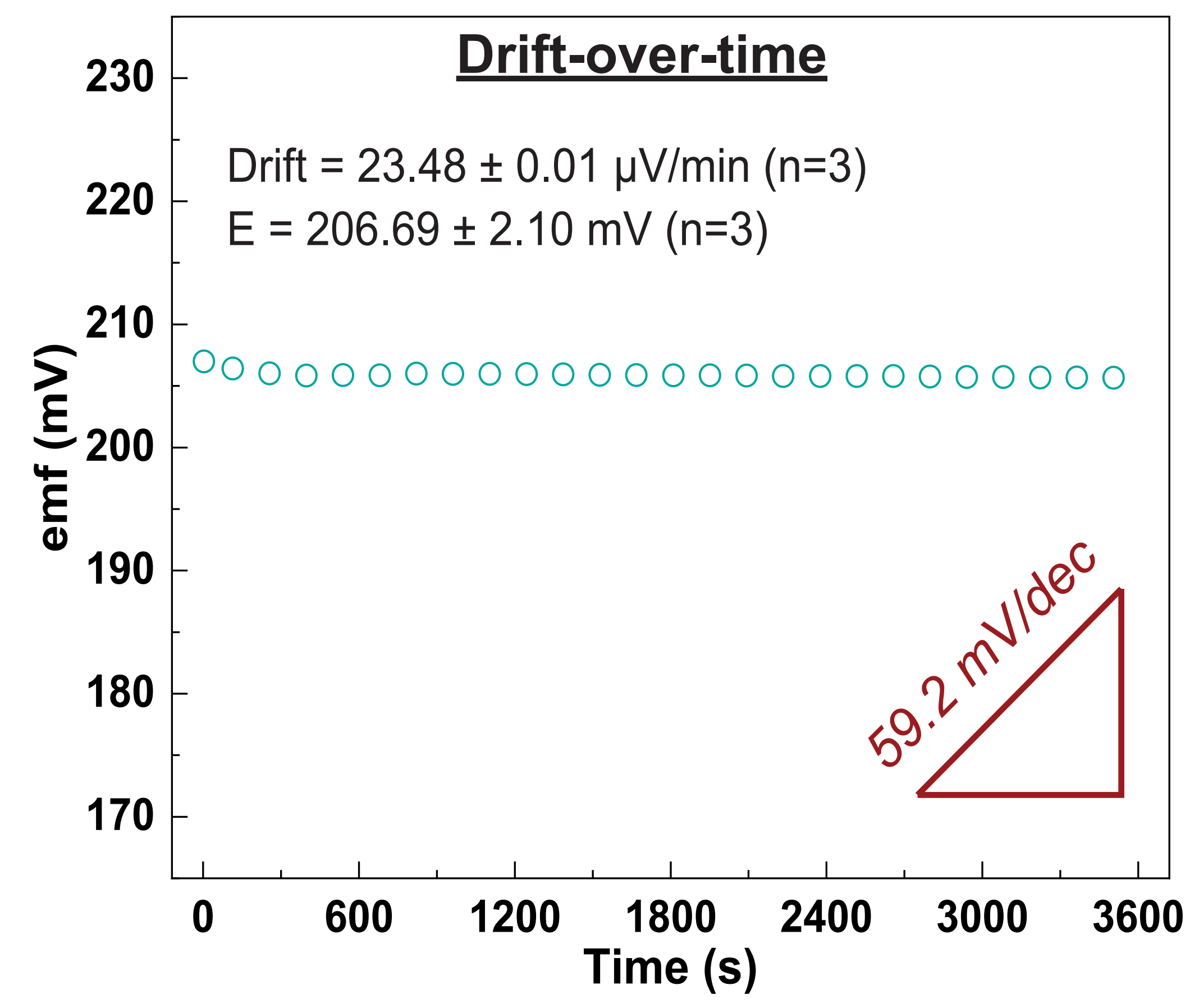
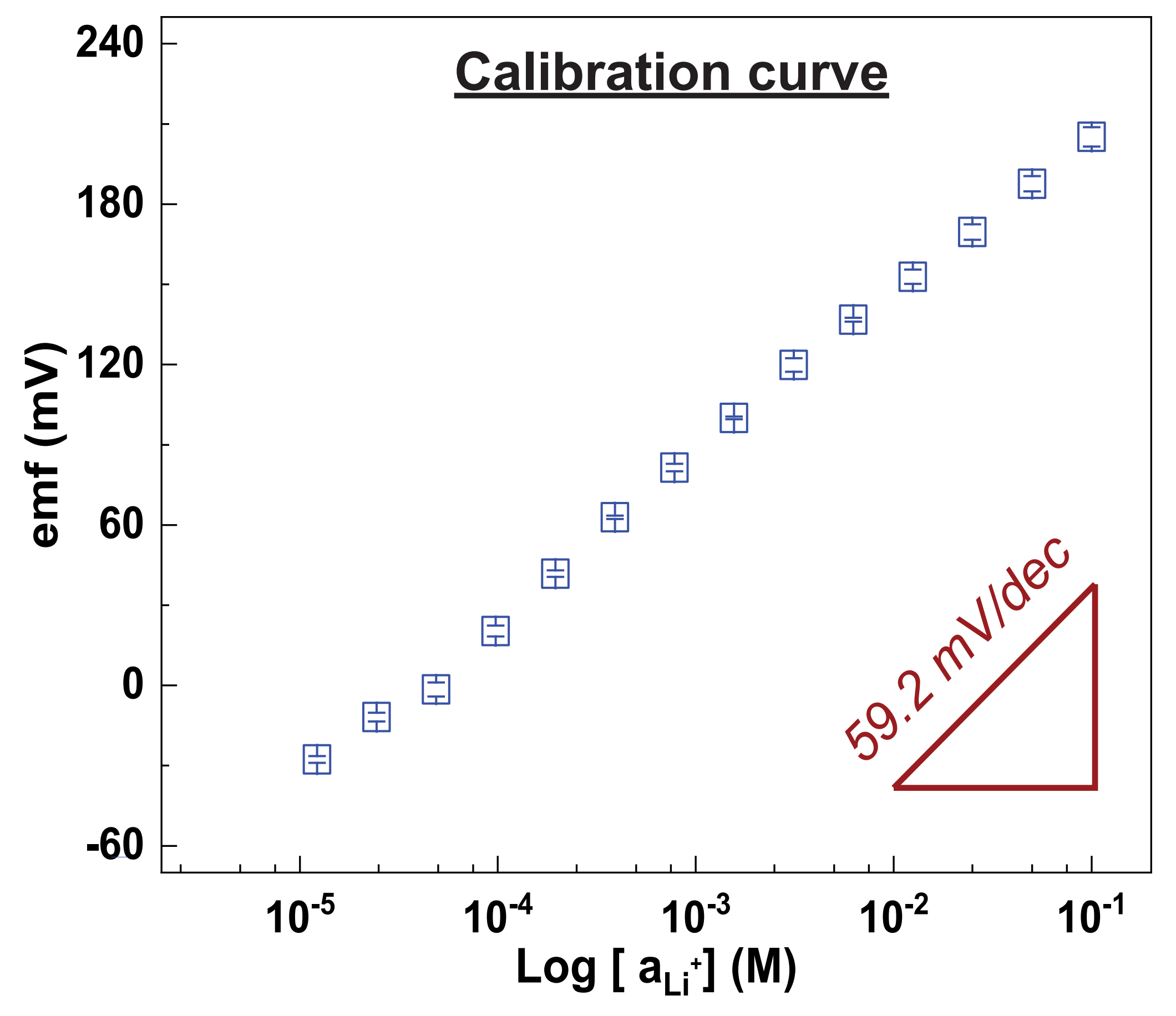
Calibration Analysis

The performance of the fabricated Li-ISEs (n=3) was evaluated by measuring their emf response, where an ideal Nernstian response observed.

Slope= 60.88 ± 0.47 mV/dec

Linear working range covering the serum's ineffective, clinically relevant, and toxic concentrations of lithium.

LWR= 10⁻¹ M — 10⁻⁵ M



Feasibility Analysis

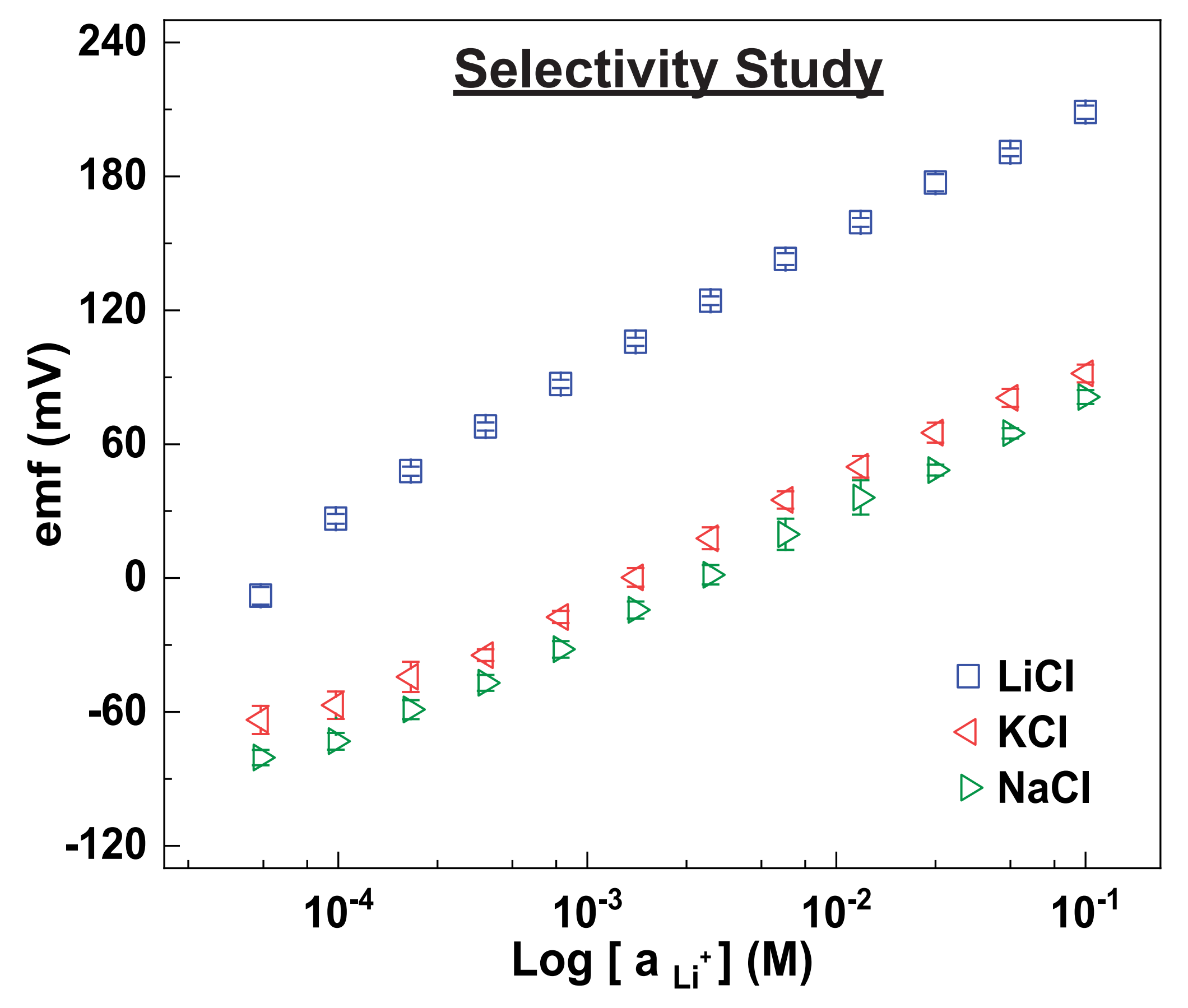
The stability of the fabricated Li-ISEs (n=3) was evaluated by monitoring the emf response over one hour period, where emf change was less than **23.48 μV/min**

Fabricated Li-ISEs (n=3) demonstrated good electrode-to-electrode reproducibility of **± 2.10 mV**

Selectivity Analysis

The selectivity of Li-ISEs were investigated using the separate solution method. Clearly, the Li-ISEs illustrated a satisfactory selectivity toward interfering ions.

Interfering ions.	Log K ^{pot} _{Li, J}
K ⁺	-2.06
Na ⁺	-2.32

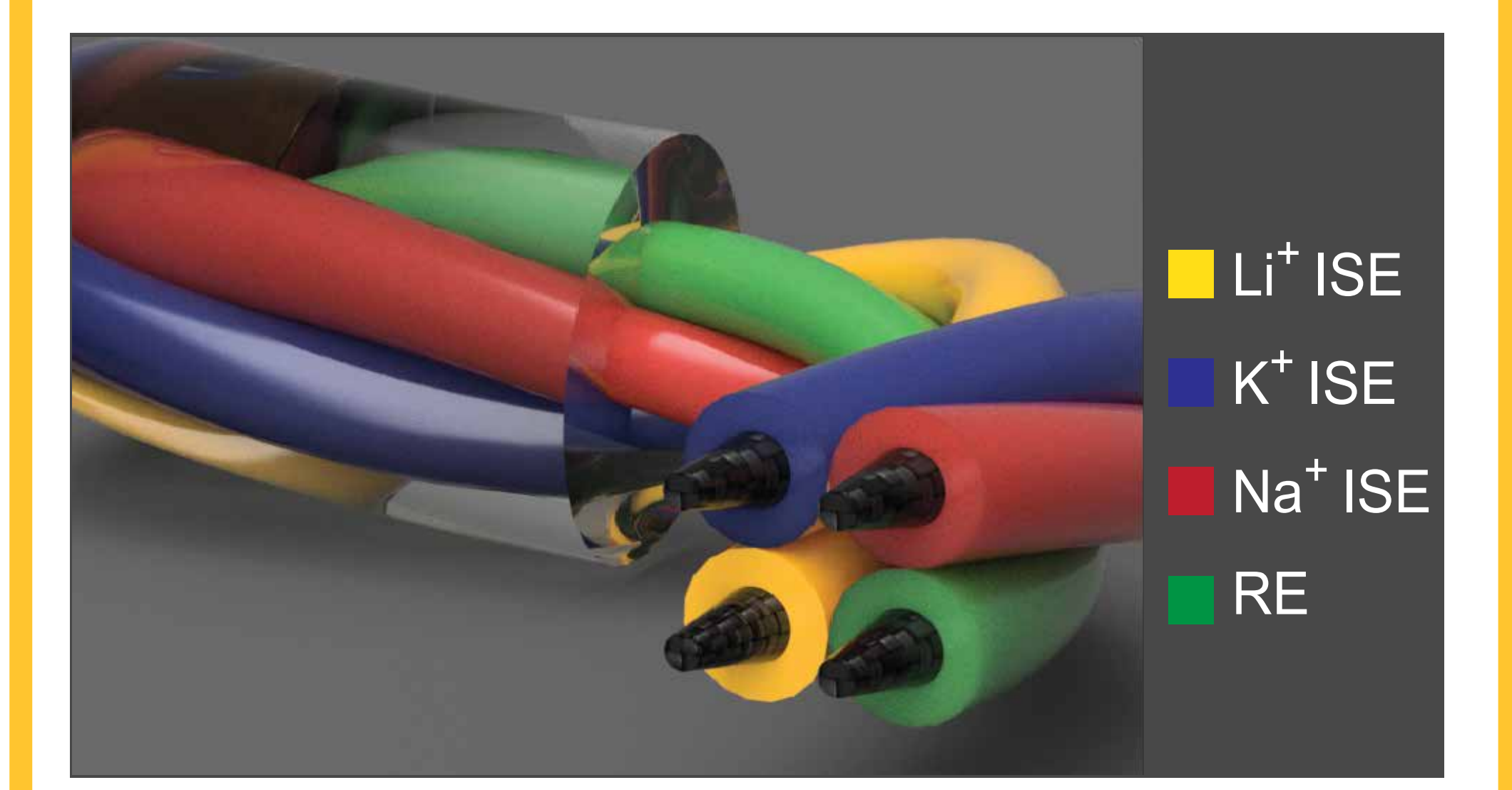


CONCLUSION

- ◇ Fabricated lithium selective electrode is compact, portable, inexpensive, disposable, and can be used simply by positioning it on the surface of body or sample solution.
- ◇ Developed miniaturized lithium selective electrodes showed an excellent reproducibility with a few second response time.
- ◇ The miniaturized concept has a promising potential to be incorporated into point-of-care potentiometric sensors for real-time electrolyte sensing and personalized health monitoring.

FUTURE WORK

The miniaturized thread-based Li-ISE will be incorporated into a dermal patch to form a bundle of point-of-care potentiometric sensors in for real-time monitoring of sodium, potassium, lithium in interstitial fluids.



ACKNOWLEDGEMENT

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