PhD Thesis proposal[1]

General Information		
PhD Thesis Title	***Development of Electrochemical microfluidics techniques for metal ion analysis in biofluids. Validation by capillary electrophoresis analysis***	
USEK Doctoral Degree	PhD in Chemistry	
Research Unit	NA	
Laboratory	NA	
Axis	Axis: Equilibrium Between Phases and Advanced Analyses-EBPAA Theme: Development and validation of analytical procedures for xenobiotic compounds	
PhD Supervisor	Name & Title: Joseph Saab, Professor Email : josephsaab@usek.edu.lb	University Address: Holy Spirit University of Kaslik- USEK
Co-supervisor (if applicable)	Name & Title : Abdelhamid Errachid, professor Email:abdelhamid.errachid-el-salhi@univ-lyon1.fr	University Address : Claude Bernard University Lyon 1- UCB Lyon1
Location (s)	Location 1: Holy Spirit University of Kaslik, USEK	Work shift calendar /per year (%): 40-50
	Location 2: Claude Bernard University Lyon 1- UCB Lyon1	Work shift calendar /per year (%): 50-60
Potential funding and scholarship	Currently in fundraising; in progress	

Applicant Profile and/or Special Requirements	Applicant profile: Master of Sciences: Master's degree in chemistry, Master's degree in Biochemistry. Special requirements: practical knowledge in HPLC-DAD, electrochemical Analysis, Microfluidic systems, Capillary Electrophoresis analysis

Subject's national or worldwide Context, Objectives & Research lines
Word count limit : 300 words The main objective of this project is to develop a miniaturized platform based on flexible substrates for the separation, analysis and detection of metal ions in biological or other aqueous matrices for biomedical purposes. This approach requires the development of new electrochemical functionalities. As part of this program (Short-term objective), we will evaluate theoretically and experimentally the capabilities of an approach combining microfluidics and electrochemical analysis techniques

[1] Thesis proposal should not exceed two pages

(potentiometry, impedancemetry) for selective detection of inorganic cation, in our case lithium*, contained in an aqueous matrix (lithemia or level of lithium in a biological aqueous medium). In fact, we will develop steps or tools that allow (1) the elimination of interfering species from solutions during analyte detection and allow (2) the independent quantification based on differential measurement.
This platform for inorganic cations analysis requires analytical validation (3) of the protocol of quantification. This step should be done by comparing the analytical results from the developed microsystem with those from the standard chemical analysis using capillary electrophoresis in reverse detection mode.
This lab-on-chip could also serve as a precedent for a similar development of other inorganic cation analysis platforms (food interest, biomedical, etc.) or to measure the concentrations of certain elements in blood or biological tissues, as they provide a common basis for biosensors and only biochemical recognition changes from one detection to another.
Finally, we intend in the long term for a fast, simple, low-cost, and high-sensitivity analysis. This platform will be built with modern microfabrication techniques and should offer the possibility to monitor in real time the selective cation content of an aqueous matrix for biomedical targets.

Outcomes (OCs) : What do we wish to achieve?	
OC1:	Fabrication of the microplatform with arrays of microelectrodes using simple and low-cost processes
OC2:	Chemical functionalization of receptors for high specificity assay of cation or analyte
OC3 :	The assay development, validation by Electrophoresis Chemical analysis, and performance for detecting selective cations in buffer samples
OC4 :	

References (R) (5 most recent peer-reviewed publications)	
R1:	B. Bansod et al., 2017, A review on various electrochemical techniques for heavy metal ions detection with different sensing platforms, Biosensors and Bioelectronics 94 (2017) 443–455
R2:	S. Li et al., 2018, Electrochemical microfluidics techniques for heavy metal ion detection, Analyst, 143, 4230
R3 :	P. Jothimuthu et al., 2011, Lab-on-a-chip sensor for detection of highly electronegative heavy metals by anodic stripping voltammetry, Biomed Microdevices 13:695–703
R4 :	Megi Kamenica et al., 2017, Lithium Ion Sensors, Sensors, 17, 2430; doi:10.3390/s17102430
R5 :	L. Cui, et al. 2015, Electrochemical Sensor for Lead Cation Sensitized with a DNA Functionalized Porphyrinic Metal–Organic Framework, Anal. Chem., 87, 10635−10641