Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy 264 (2022) 120216

Contents lists available at ScienceDirect

Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy

journal homepage: www.elsevier.com/locate/saa

SERS-based DNA methylation profiling allows the differential diagnosis of malignant lymphadenopathy

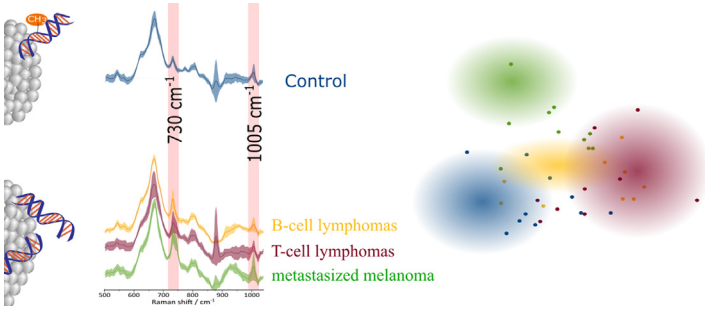
Andrei Stefancu [a,1], Vlad Moisoiu [a,1,2], Minodora Desmirean [b,c,1], Stefania D. Iancu [a], Adrian B. Tigu [d], Bobe Petrushev [e], Ancuta Jurj [f], Ramona G. Cozan [a], Liviuta Budisan [f], Bogdan Fetica [g], Andrei Roman [h,i], Gina Dobie [b], Cristina Turcas [b], Mihnea Zdrenghea [b,j], Patric Teodorescu [b,j], Sergiu Pasca [b,j], Doina Piciu [k], Delia Dima [j], Zoltán Bálint [a], Nicolae Leopold [a,l,*], Ciprian Tomuleasa [b,d,j]

[a] Faculty of Physics, Babeş-Bolyai University, Cluj-Napoca, Romania
[b] Department of Hematology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[c] Department of Pathology, Constantin Papilian Military Hospital, Cluj-Napoca, Romania
[d] Medfuture Research Center for Advanced Medicine, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj Napoca, Romania
[e] Department of Pathology, Octavian Fodor Gastroenterology Institute, Cluj-Napoca, Romania
[f] Research Center for Functional Genomics, Biomedicine and Translational Medicine, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[g] Department of Pathology, "Prof. Dr. Ion Chiricuță" Institute of Oncology, Cluj-Napoca, Romania
[h] Department of Radiology, Iuliu Hatieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania
[i] Department of Radiology, "Prof. Dr. Ion Chiricuță" Institute of Oncology, Cluj-Napoca, Romania
[j] Department of Hematology, "Prof. Dr. Ion Chiricuță" Institute of Oncology, Cluj-Napoca, Romania
[k] Department of Nuclear Medicine, "Prof. Dr. Ion Chiricuță" Institute of Oncology, Cluj-Napoca, Romania
[l] Biomed Data Analytics SRL, Cluj-Napoca, Romania

HIGHLIGHTS

- SERS of lymph node DNA enables the discrimination of malignant and benign DNA.
- SERS of genomic DNA allows the univariate discrimination of B- and T-cell lymphoma.
- SERS allows the classification of lymphoma, melanoma and control genomic DNA samples.

GRAPHICAL ABSTRACT



ARTICLE INFO

Article history:
Received 24 April 2021
Received in revised form 12 July 2021
Accepted 17 July 2021
Available online 21 July 2021

Keywords:
SERS
DNA
Non-Hodgkin lymphoma

ABSTRACT

This study highlights the potential of surface-enhanced Raman scattering (SERS) to differentiate between B-cell lymphoma (BCL), T-cell lymphoma (TCL), lymph node metastasis of melanoma (Met) and control (Ctr) samples based on the specific SERS signal of DNA extracted from lymph node tissue biopsy. Differences in the methylation profiles as well as the specific interaction of malignant and non-malignant DNA with the metal nanostructure are captured in specific variations of the band at 1005 cm^{-1}, attributed to 5-methylcytosine and the band at 730 cm^{-1}, attributed to adenine. Thus, using the area ratio of these two SERS marker bands as input for univariate classification, an area under the curve (AUC) of 0.70 was achieved in differentiating between malignant and non-malignant DNA. In addition, DNA from the BCL and TCL groups exhibited differences in the area of the SERS band at 730 cm^{-1},

* Corresponding author at: Faculty of Physics, Babeş-Bolyai University, Cluj-Napoca, Romania.
E-mail address: nicolae.leopold@ubbcluj.ro (N. Leopold).
[1] Andrei Stefancu, Vlad Moisoiu, Minodora Desmirean contributed equally to this research and should be considered first authors.
[2] Present address: Department of Neurology, Zürich University Hospital, Zürich, Switzerland.

https://doi.org/10.1016/j.saa.2021.120216
1386-1425/© 2021 Elsevier B.V. All rights reserved.