Unique Raman Spectroscopic Fingerprints of B-Cell Non-Hodgkin Lymphoma: Implications for Diagnosis, Prognosis and New Therapies

Shiramizu B[1,2*], Oda R[1,3], Kamada N[1,2], Garcia MA[1], Shieh T[1], Maeda TA[4], Choi SY[5], Lim E[5] and Misra A[4]

[1]Department of Tropical Medicine, Medical Microbiology, and Pharmacology, John A. Burns School of Medicine, Hawaii, USA

[2]Department of Paediatrics, John A. Burns School of Medicine, Hawaii, USA

[3]Department of Molecular Biosciences and Bioengineering, John A. Burns School of Medicine, Hawaii, USA

[4]Hawaii Institute of Geophysics and Planetology, University of Hawaii, Hawaii, USA

[5]Biostatistics Core, Department of Complementary and Integrative Medicine, John A. Burns School of Medicine; University of Hawaii, Hawaii, USA

[*]**Corresponding author:** Bruce Shiramizu, Department of Tropical Medicine, Medical Microbiology, and Pharmacology, John A. Burns School of Medicine, 651 Ilalo Street, BSB 325AA, Honolulu, HI 96822, Hawaii, USA, Tel: +808-692-1677; E-mail: bshirami@hawaii.edu

Received date: December 29, 2017; **Accepted date:** January 17, 2018; **Published date:** January 18, 2018

Abstract

Objective: Raman spectroscopy is a non-invasive laser-based technique that identifies molecular chemical composition of tissues and cells. The objective of the work was to demonstrate that unique Raman spectroscopic fingerprints of B-cell non-Hodgkin lymphoma cells could be distinguished from normal B-cells.

Methods: Normal B-cells and B-cell non-Hodgkin lymphoma cells were mounted on aluminum slides and analyzed by Raman spectroscopy using Asymmetric Least Squares and Principal Component Analysis.

Results: Clustering by Principal Component Analysis differentiated normal B-cells from B-cell non-Hodgkin lymphoma cells as well as between the different B-cell non-Hodgkin lymphoma cell types.

Conclusions: Raman spectroscopy technology provided a different paradigm in analyzing tumor cells which

most common in children thus will provide the initial background as the foundation for future studies if unique RS are discovered [1].

Methods

Cells and specimen preparation

study was approved in accordance with the University of Hawaii Institutional Review Board. B-NHL cell lines (Ramos and CA46) were obtained from American Type Culture Collection (ATCC, Manassa, VA) and cultured with RPMI 1640 medium and fetal calf serum. cells were washed and re-suspended in 0.9% saline solution. Normal B-cells were isolated from peripheral blood using a negative selection Robosep kit (EasySep Human B-Cell Isolation Kit, Stemcell Technologies, Cambridge, MA) and re-suspended in saline solution as noted above.

Raman spectroscopy of cells

RS was measured using a micro-Raman RXN system (KOSI, Inc., Ann Arbor, MI) utilizing a 785 nm laser and automated xyz microscope stage with cells mounted on aluminum slides [7,9]. Polished aluminum sheets (Anomet. Inc., Ontario, Canada) of 0.5 mm thickness were cut and cleaned with methanol [16]. Cells were placed directly on the aluminum substrates for RS analysis. A 50 μm slit width was used for measuring the RS of cells. Each RS was collected for 60 seconds with 10mW laser power. Raman images were created by

by the scree plot showing clear clusters amongst the distinct cells. KNN was then used to

17. Kong K, Kendall C, Stone N, Notingher I (2015) Raman spectroscopy for medical diagnostics-From in-vitro assays to in-vivo cancer detection. Adv Drug Deliv Rev 89: 121-134.
18. Beebe KR, Pell RJ, Seasholtz MB (1998) Chemometrics: A Practical Guide. Wiley-Interscience Series, New York, USA.
19. Boelens HF, Dijkstra RJ, Eilers PH, Fitzpatrick F, Westerhuis JA (2004) New background correction method for liquid chromatography with diode array detection, infrared spectroscopic detection and Raman spectroscopic detection. J Chromatogr A 1057: 21-30.
20. IT (2002) Principal Component Analysis, 2nd Edn. Springer, New York, USA.
21. Jansen AM, Kortum RRR (1996) Raman spectroscopy for the detection of cancers and precancers. J Biomed Opt 1: 31-70.
22. Kortum RR, Muraca ES (1996) Quantitative optical spectroscopy for tissue diagnosis. Annu Rev Phys Chem 47: 555-606.
23. Uzunbajakava N, Lenferink A, Kraan Y, Willekens B, Vrensen G, et al. (2003) Nonresonant Raman imaging of protein distribution in single human cells. Biopolymers 72: 1-9.