Classification of brain glioma tumours using the Renishaw Biological Analyser

Life sciences

The genetic sub-classification of primary brain tumours, gliomas, is essential for pathological diagnosis, clinical decision-making and prognostication. Current methods for genetic classification, such as immunohistochemistry, take several days to complete.

Raman spectroscopy provides a chemical fingerprint and has been shown in numerous publications to have the potential to provide accurate diagnostics for a range of cancer and non-cancer diseases, within minutes. Repeatable protocols and easy to use hardware are necessary to aid adoption of Raman spectroscopy into a clinical environment.

Case study

In a study conducted with the University of Oxford Neuropathology Department in the United Kingdom, we demonstrated discrimination between diseased and healthy brain tissue using the Renishaw Biological Analyser - RA816.

In this study we were able to:

- Distinguish tissue types by their overall chemical signatures – fluorescent or colorimetric labelling were not required

- Differentiate diseased and healthy tissues without the need for disease marker discovery and targeting

This study demonstrated how the system can support pathology decision making by:

- Building and testing glioma classification models (from fresh, frozen and fixed tissue, as well as brain cancer cell lines), in clinical environments, for research purposes

- Discriminating the glioma cancer subtypes, in a number of tissue and cell types, with high sensitivity and specificity

- Identifying biochemical changes associated with cancer formation and progression

- The potential to aid in defining tumour margins

- Generating hi-resolution images from unstained sections that can be correlated with clinical H&E and IHC stained slide images

- Using grooved mirror stainless steel slides for optimised sample measurements with brain tissue samples
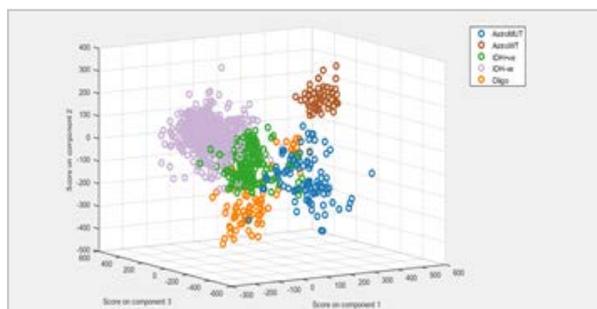

The Renishaw Biological Analyser - RA816
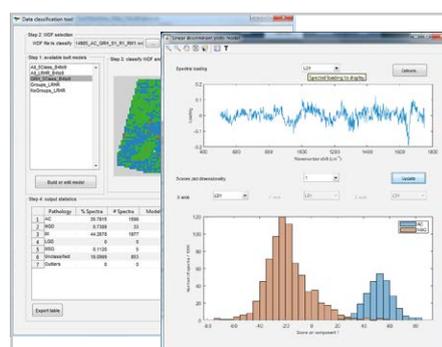
Renishaw Data Classification application developed for building, testing and validating cancer classification models

Results

Principal component-linear discriminant analysis (PCA-LDA) was used to build a supervised classification model. The model demonstrated 80% to 95% sensitivity and specificity for predicting the five glioma genetic subtypes.
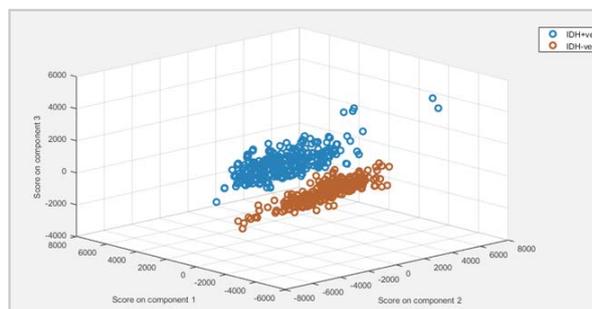
Principle component-linear discriminant analysis (PCA-LDA) modelling demonstrated 100% sensitivity and 99% specificity for predicting the presence of IDH mutations
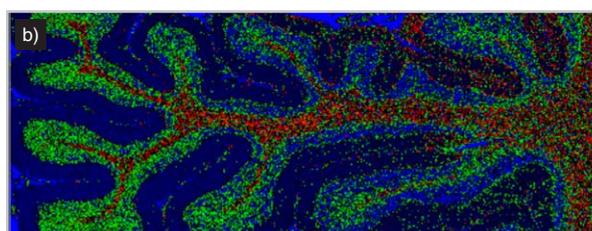
Imaging of human brain tissue. Comparison of (a) white light and (b) Raman-false-coloured composite score image of cerebellum whole follicle showing arbor vitae/white matter (red), granule cell layer (green), molecular layer (dark blue) and meninges (pia, arachnoid and dura mater) (cyan)

The Renishaw Biological Analyser; the ideal tissue imaging tool to meet the specific challenges of the clinical research environment

- Easy to use hardware and accessories targeted for bio-samples

- Optimal light microscopy performance for both macro and high magnification

- Compact and transportable

- Optimised hardware for stable, repeatable, and reliable, high quality data acquisition

- Supports model and data transferability for disease and pathology classification on different systems

- Easy to use software that makes measurements accessible to all users without comprising performance

- StreamLine™ technology allows high speed mapping without causing sample damage

The Renishaw Biological Analyser is designed for Research Use Only (RUO) and not for use in diagnostic procedures.

A range of related Renishaw literature is available. Please ask your local Renishaw representative for more information.

Renishaw. The Raman innovators

Renishaw manufactures a wide range of high performance optical spectroscopy products, including confocal Raman microscopes with high speed chemical imaging technology, dedicated Raman analysers, interfaces for scanning electron and atomic force microscopes, solid state lasers for spectroscopy and state-of-the-art cooled CCD detectors.

Offering the highest levels of performance, sensitivity and reliability across a diverse range of fields and applications, the instruments are designed to meet your needs, so you can tackle even the most challenging analytical problems with confidence.

A worldwide network of subsidiary companies and distributors provides exceptional service and support for its customers.

Please visit www.renishaw.com/bio for more information.