J Cancer Sci Ther 2014, 6:10
http://dx.doi.org/10.4172/1948-5956.S1.035

OMICS Group Conferences
Accelerating Scientific Discovery

4th World Congress on
Cancer Science & Therapy
October 20-22, 2014 DoubleTree by Hilton Hotel Chicago-North Shore Conference Center, USA

Diagnosis of cancer: A molecular approach

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Cancer that has a reputation of a deadly disease all around the world is a broad group of diseases that involves uncontrolled cell growth and proliferation. The best method for its prevention and control is its early diagnosis and treatment. Before molecular diagnostics, scientists relied on the results obtained from biopsies and microscopic examination of affected tissue samples but nowadays molecular diagnosis is emerging as a new and eye opening approach that merges genomics and proteomics for early detection and diagnosis of cancer. Genomics and proteomics tools are used to detect different molecular signatures like genetic and epigenetic signatures, changes in gene expressions, protein biomarker profiles and other metabolite profile changes, which in turn allows to identify the combinations of biomarkers which may detect best the presence or risk of cancer or monitor cancer therapies. Molecular diagnosis uncovers the different changes that occur during the transformation of a normal cell to a tumour cell and capture this information as expression patterns. Robotically printed microarrays, Real time PCR and mi RNAs are widely used techniques for measuring these expression pattern and help researchers to differentiate between a normal and a cancer cell. Molecular diagnosis through proteomics make use of surface enhanced laser desorption/ionization time of flight mass spectrometry and peptide receptors in mapping of protein patterns that are involved in malignant growth. Nanotechnology is an evolving science that can be successfully used for cancer diagnosis in future. Nanoscale devices quantum dots and carbon nano-tubes can be promising nano-tools for effective measurement of malignancy. All these techniques offer great promise for revolutionizing the diagnosis of cancer. This article recaps some scientific considerations about different relevant molecular diagnostics of cancer and consideration about future challenges.

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A new approach to the diagnosis of cervical, oesophageal and prostate cancer based on a combination of infrared and terahertz techniques

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This lecture will describe a recently funded program designed to advance the diagnosis of cervical, oesophageal and prostate cancers through the application of infrared, Raman and terahertz techniques. The programme will also clarify the potential of these techniques for the characterisation of cancerous tissue since conventional approaches appear to have reached the limit of their predictivity and none of these promising techniques have reached the stage of clinical trials. A key role is played by the 4th generation light source, ALICE, at the Daresbury laboratory in the UK that has unique capabilities for research in this field. Research using the infrared free electron laser driven by ALICE has already lead to a novel technique with the potential to diagnose adenocarcinoma from tissue extracted by endoscopy from patients with the precursor condition Barretts oesophagus. The programme will also progress the development of two portable terahertz instruments, of novel design, with the potential for use in cancer diagnosis and explore the use of terahertz radiation as a new therapy for cancer.

Biography

Peter Weightman is an experimental physicist with a track record in developing novel instruments. He was a co-applicant on the proposal to construct the ALICE machine which is an energy recovery linear accelerator, the first of its kind in Europe and the only one in the world equipped with a terahertz beamline designed for studies of cancer. ALICE is now operational and he is leading a collaborative programme involving academic scientists and clinicians in exploiting the potential of ALICE for cancer research.