Anton Amann, J Cancer Sci Ther 2014, 6:10
http://dx.doi.org/10.4172/1948-5956.S1.033

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

Lung cancer screening by analysis of exhaled breath

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Volatile compounds released through exhaled breath, the nasal cavity, oral cavity, urine or sweat play an important role in the human metabolism. Typical techniques used for their analysis are gas chromatography with mass spectrometric detection (GCMS) and proton-transfer-reaction time-of-flight mass spectrometry (PTR-TOF). A most interesting possibility is real-time analysis of exhaled breath, during exertion of an effort on a stationary bicycle or during sleep. This has been done for a few compounds like isoprene, acetone, 2-pentanone or dimethylsulfide. The investigation of exhaled breath of cancer patients is a particular focus of research. Some compounds (e.g., pentanal, hexanal, octanal and nonanal) appear in higher concentrations in cancer patients as compared to healthy volunteers, whereas other compounds (like isoprene) show lower concentration in exhaled breath of cancer patients. During the past decade about 115 different volatile biomarkers have been published in regard to cancer. For all these compounds careful validation studies will be necessary. Cancer cell culture investigations reveal that different cell types can release or consume different volatile compounds. Compounds released are hydrocarbons (e.g. 2, 3, 4-trimethylpentane, octane or 4-methylheptane), alcohols (e.g., 3-methyl-1-butanol, ethanol or 2-methyl-1-propanol), esters, acetone and 2-pentanone. The use of endogenously produced volatiles in different fields of research is still at its very beginning. The use of isotopically labeled compounds for measurement of enzyme activity with breath tests based on exhaled $^{13}CO_2$ is already very near to clinical application. This offers the possibility of non-invasive phenotyping, thereby complementing genetic tests and opening up the way to a "personalized" medicine.

Biography

Anton Amann is Head of the Breath Research Institute of the University of Innsbruck. He has worked on volatiles released through exhaled breath, skin emanations and urine and has studied volatile compounds released by cell and bacterial cultures. A specific focus of his work is on real-time analysis of exhaled breath. He has coordinated the EU-project BAMOD and was awarded the Marie-Curie medal of the Polish Chemical Society in 2010. He is Editor-in-Chief of the *Journal of Breath Research* and Chairman of the International Association for Breath Research (IABR).

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