

DNA damage as a result of intensive impulse noise

Siegmann, S*, Prisack, HB**, Burchardt, T*, Siegmund, K*, Bauer, M*, Borsch-Galetke, E*, Bojar, H**

*Institute of Occupational Medicine and Social Medicine, Heinrich-Heine University, Duesseldorf, Germany

**Institute of Oncological Chemistry, Heinrich-Heine University, Duesseldorf, Germany

e-mail: siegmann@uni-duesseldorf.de

Introduction

Employees of numerous industries are exposed to intensive impulse noise. Impulse noise may cause changes to isolated cell cultures through temporary compression and decompression.

The effects of impulse noise to isolated lymphocytes and lung cells were analyzed.

Method

These cells were exposed to 3 impulse levels within 30 minutes ($L_{max} \sim 170$ dB). Total RNA was isolated, amplified, and labeled by an Enzo® BioArray™ HighYield™ RNA Transkript Labeling Kit. Labeled probes were analyzed by Affymetrix chips and the expression was compared with the RNA-profile of PHA-stimulated, unexposed probes.



Fig. 3: Probes in the PzH.

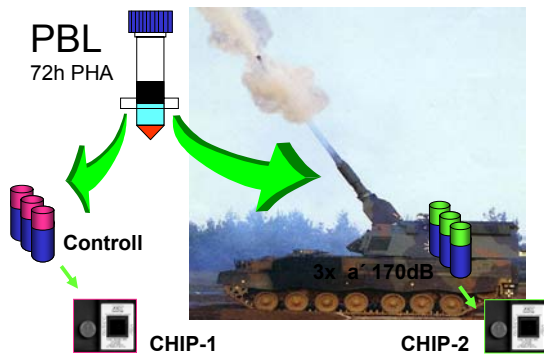


Fig. 1: Cells were exposed to 3 impulse levels within 30 minutes ($L_{max} \sim 170$ dB).

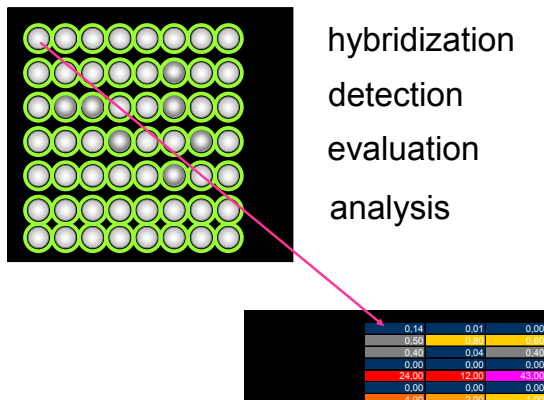


Fig. 2: Hybridization, detection, evaluation and analyzation of the probes with Affymetrix-Standardsoftware.

Results

41.9 % of 12.625 known lymphocytal genes were detected. 7.6 % of these genes were upregulated, 1.8 % were downregulated. Only 22 genes were 2x upregulated and 4 genes more than 2x downregulated like isoforms of the Cytochrome P₄₅₀ and the Metallothionin-Gen.

41.9 % of 12.625 known lymphocytal genes were detected

•Chip Affymetrix U95

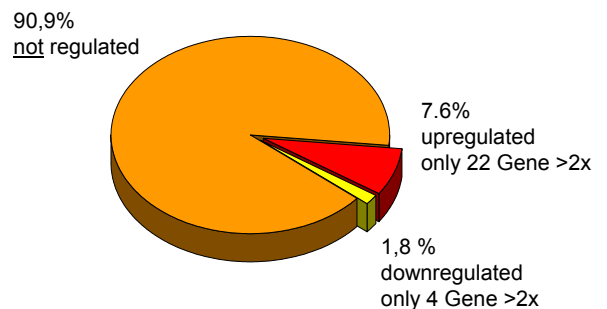


Fig. 4: Detected lymphocytal genes.

44.2 % of 22.283 known genes of the lung cells (distal located human epithelial cells) were detected significantly. 1.3 % of these genes were upregulated, whereas 2.7 % were downregulated. 7 genes were 2x upregulated and 33 genes more than 2x downregulated. Interestingly, these genes belong to the isoforms of the Cytochrome P450 and the Metallothionin gene as well.

Gene in Small Airway Epithelial Cells

•Chip Affymetrix U133A

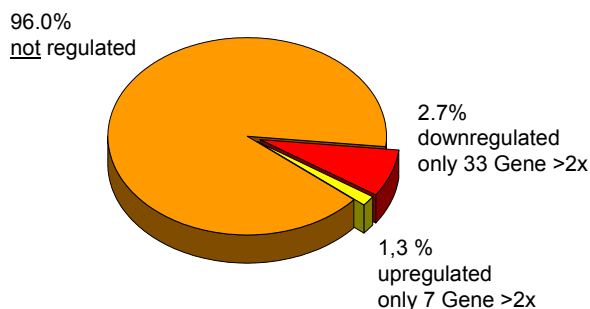


Fig. 5: Detected genes in small airway epithelial cells.

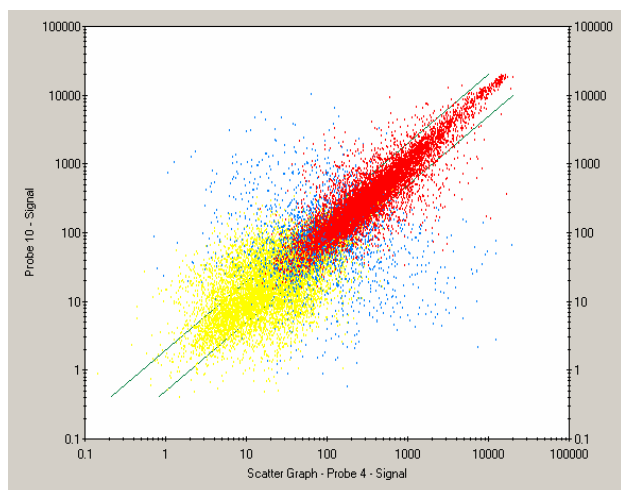


Fig. 6: Normal human lung vascular endothel cells vs. small airway epithelial cells.

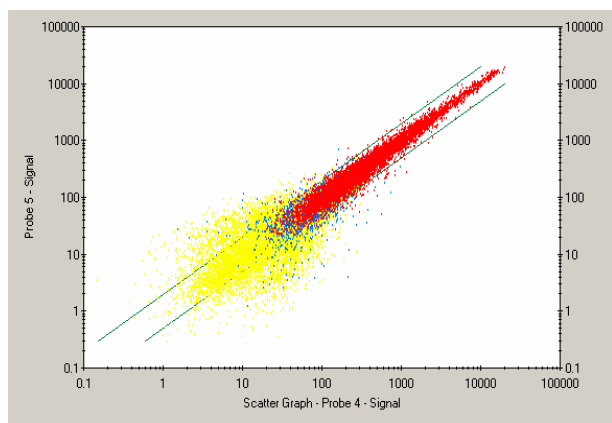


Fig. 7: Small airway epithelial cells (stressed) vs. small airway epithelial cells (control).

Discussion

In conclusion, impulse noise induces cellular reactions comparable to oxidative stress reaction. In the future, evaluation of impulse noise working environment e.g. in the metal processing industry or by weapon noise in the German federal army should consider potential reactions on the cellular level.

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For the Authors:

S. Siegmann
Institut für Arbeitsmedizin und Sozialmedizin
Universitätsklinikum Düsseldorf
Heinrich-Heine-Universität Düsseldorf
Universitätsstr. 1
D-40225 Düsseldorf
e-mail: siegmann@uni-duesseldorf.de
homepage: www.uni-duesseldorf.de