

The Biomonitoring Team at the Alpine Institute of Chemistry and Toxicology (AICT)

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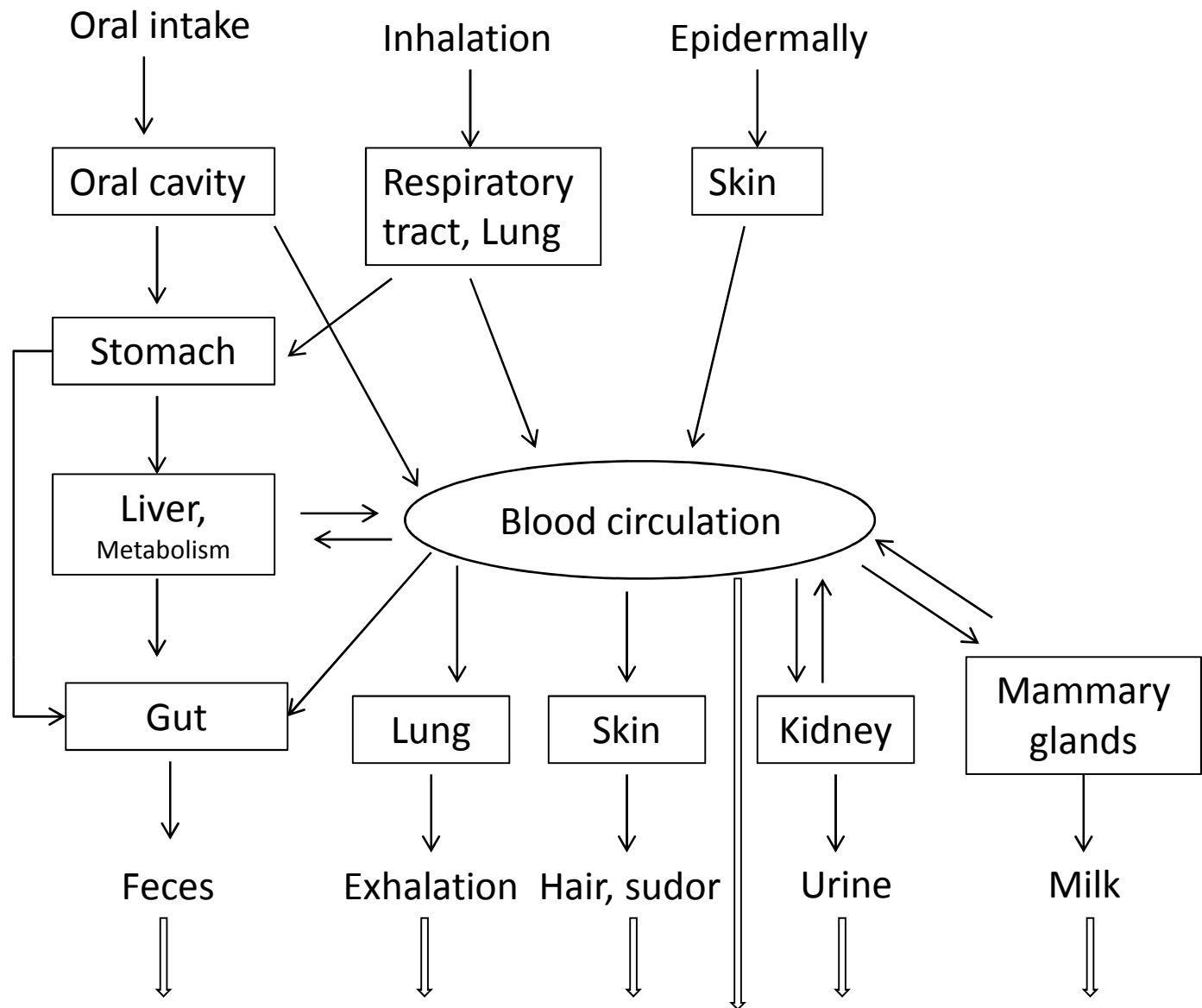
Nahyeli Mottini

AICT will be part of the Human Biomonitoring program of the European Union: 2017-2021.

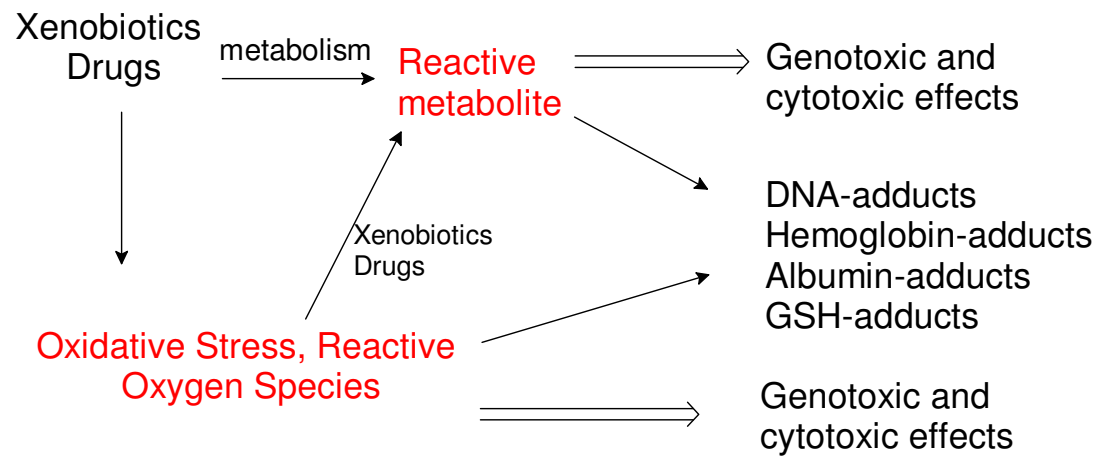
<http://www.eea.europa.eu/themes/human/human-biomonitoring>

<http://www.eea.europa.eu/themes/human/human-biomonitoring/organisations-participating-in-the-consortium>

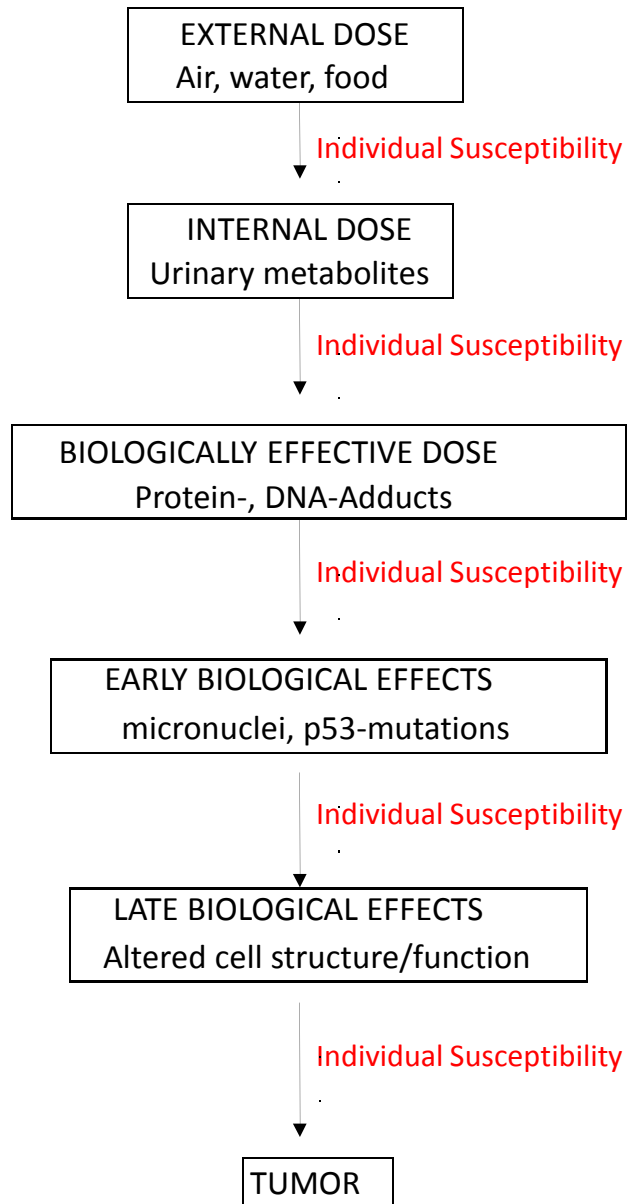
Exposure of humans to xenobiotics



Biomonitoring: LC-MS-, GC-MS-, QTOF-MS-analysis of the xenobiotics or their metabolites



Biomonitoring paradigm for carcinogenic compounds



Humans are exposed to xenobiotics through air, food and the environment. The parent compound or their metabolites can be measured for example in urine, blood, and hair. Urinary and blood levels reflect the exposure to chemicals of the last 24-48h. Hair levels of xenobiotics describe the exposure to xenobiotics over a larger time frame.

Many chemicals become toxic only after metabolism. The reactive metabolites form covalent adducts with biomolecules (proteins, DNA). This can lead to genotoxic and cytotoxic effects.

It is important for the risk assessment of chemicals to quantify the presence of reactive metabolites in human body. Forty years ago it has been shown that ethylene oxide reacts with hemoglobin and with the DNA of the target organ in a dose dependent matter.

Therefore, hemoglobin-adducts or albumin-adducts of xenobiotics are important dosimeters to monitor the presence of toxic metabolites in the human body.

Blood protein adducts reflect the exposure history over a larger period of time than urinary metabolites, or than metabolites present in blood.

Hemoglobin adducts have a lifetime of 120 days and albumin adducts a half-life of 20–25 days. Reaction products with Hemoglobin accumulate up to 60 times a single dose and albumin adducts up to 29 times a single dose. Blood protein adducts are excellent markers of exposure.

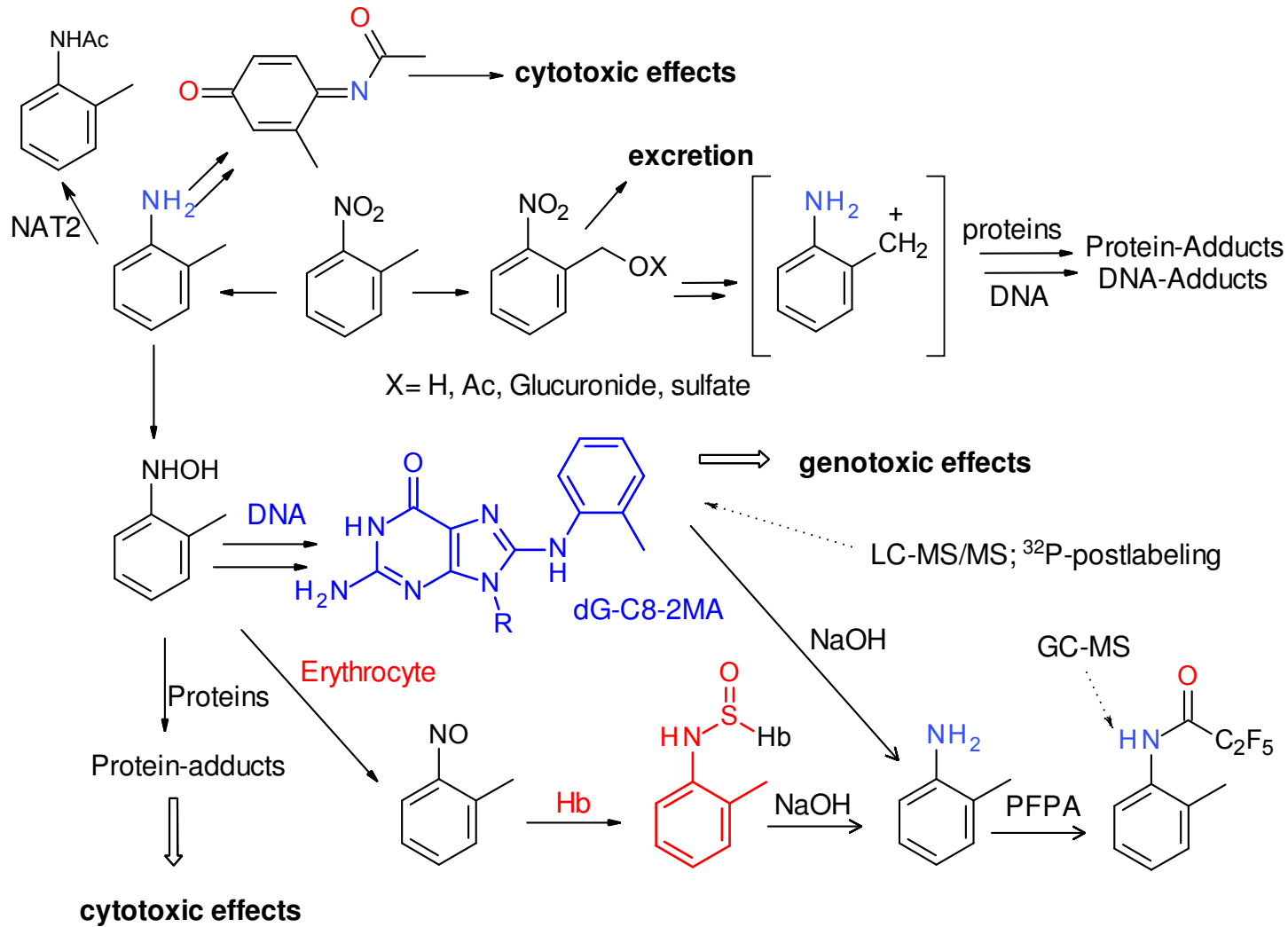
During their career, researchers at the Alpine Institute of Chemistry and Toxicology have determined albumin adducts of isocyanates, aflatoxin B1, and hemoglobin adducts of aromatic amines, nitroarenes and polyaromatic hydrocarbons.

Furthermore DNA-adducts of aromatic amines have been synthesized and found in animals exposed to aromatic amines or to the corresponding nitroaromatic compounds.

The results of animal experiments with aromatic amines and nitroaromatic compounds were rationalized with quantitative structure and activity relationships.

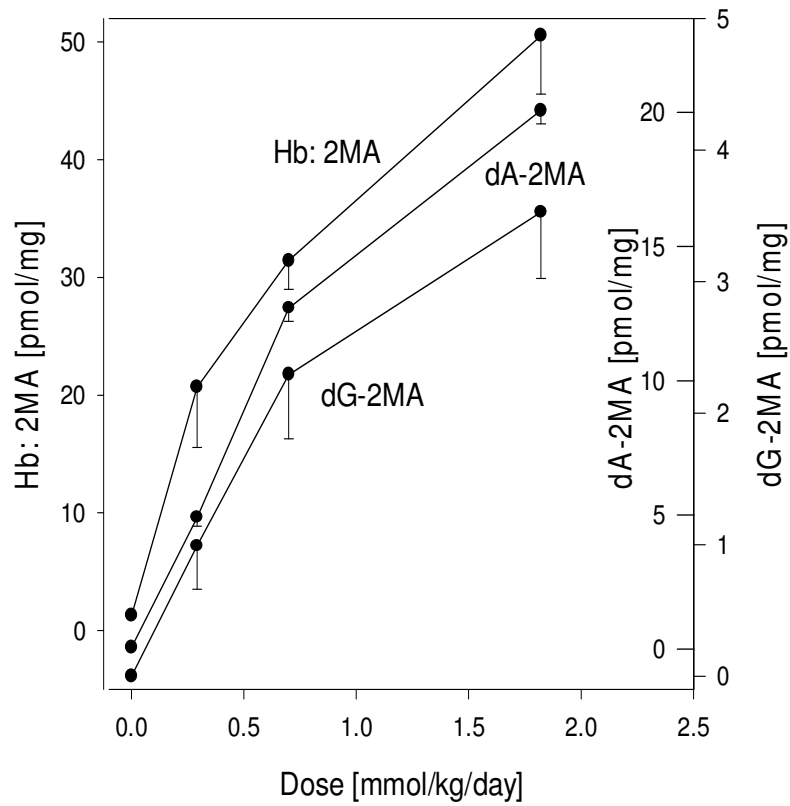
BIOLOGICALLY EFFECTIVE DOSE

Possible DNA-adducts and protein-adducts of 2-nitrotoluene

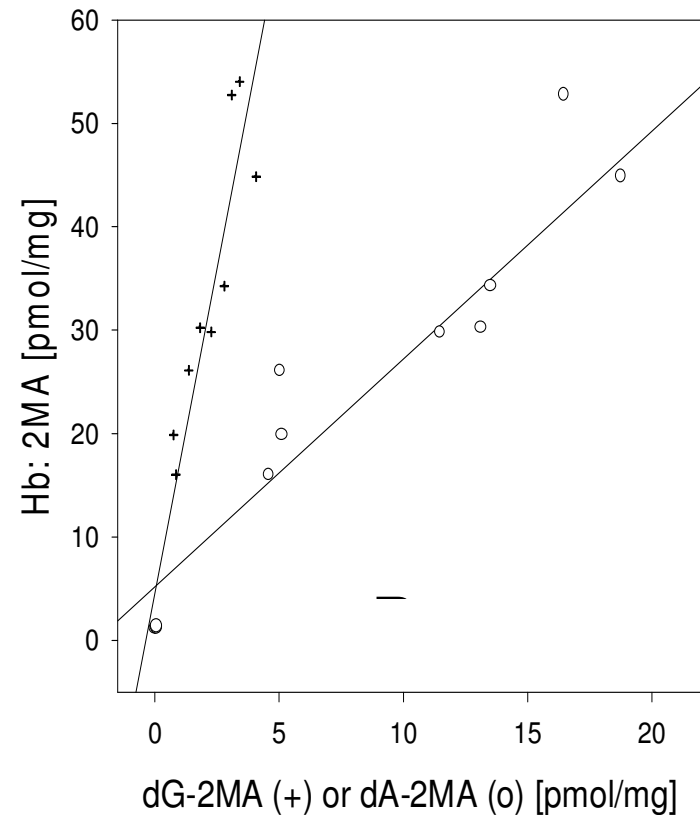


→ := in vivo reactions ⇌ := biological effects → := in vitro reactions

Dose vs Hb- and DNA-Adducts in rats



DNA- vs Hb-Adducts in rats



Carcinogenesis 2003, 24:779-87.

Potential stakeholders for biomonitoring studies in the Canton Ticino (Southern Switzerland)

The group „Health and Environment“ at the department of health of the Canton Ticino

<http://www4.ti.ch/dss/dsp/gosa/chi-siamo/presentazione/>

Tumor register of the Canton Ticino:

<http://www4.ti.ch/dss/dsp/icp/registro-cantonale-dei-tumori/registro-cantonale-dei-tumori/presentazione/>

Expert in clinical Toxicology: PD Dr.med. Ceschi: <http://www.eoc.ch/Dettagli/Medico.Ceschi-Alessandro.9677.html>

Medical Doctors from the Canton Ticino who are concerned about the effects of pollution on human health:

www.alpeninitiative.ch/dms/alpeninitiative/documents/pdf_it/120625_Appello-Medici/120625%20Appello%20Medici%20al%20CF%20con%20firme.pdf

Useful Links

Biomonitoring

http://www.cdc.gov/biomonitoring/nutritional_indicators.html

http://www.cdc.gov/biomonitoring/environmental_chemicals.html

<http://www.umweltbundesamt.de/themen/gesundheit/belastung-des-menschen-ermitteln/human-biomonitoring>

<http://www.bfr.bund.de/de/start.html>

Cancer

<http://www.insidecancer.org/>

<http://www.iarc.fr>

Environmental Toxicology

<http://www.umweltbundesamt.de/themen/chemikalien/arzneimittel/arzneimittel-umwelt>

<https://www.epa.gov/iris>

<http://toxtown.nlm.nih.gov/>

<http://sis.nlm.nih.gov/enviro/toxtutor.html>

Toxicogenetics, pharmacogenetics

<http://nat.mbg.duth.gr/>

<http://medicine.iupui.edu/clinpharm/ddis/>

Metabolomics

<http://www.metabolomicscentre.ca/software> ; <http://www.hmdb.ca/>

<http://foodb.ca/> ; <http://www.t3db.ca/> ; <http://www.smpdb.ca/>

<http://www.urinemetabolome.ca/> ; <http://www.serummetabolome.ca/>