NRC for Laboratory Diagnostic in Human Biomonitoring

Regional Authority of Public Health,

Banská Bystrica

- **The National Reference Centre for the Laboratory Diagnosis of Human Biomonitoring**

was established by the

- Ministry of Health pursuant to the Article 8(2) of the Act No. 355/2007 Z.z. on the protection, support and development of public health

and has been a part of the

- Regional Authority of Public Health in Banská Bystrica since 1 July 2013.

Staff

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  E. Fabiánová, Assoc. Prof., M.D., PhD.
  Zuzana Vassányi, Ing.
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  Martin Frič, Ing., PhD.
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No matter where we live, we are surrounded by environmental substances. They are in the air we breathe, in the water we drink, in the food we eat, the products we use, and in the clothes we wear. Most of these substances occur naturally in the environment, but others are produced by men. Their presence in our bodies and the interactions they create remain, to a large extent, unknown.

http://www.eu-hbm.info/cophes/human-biomonitoring#sthash.VpjI6mir.dpuf

Definition

- **Biomonitoring**

  is a scientific technique for assessing human exposures to natural and synthetic compounds in the environment.

  It is based on analysis of human tissues and fluids and provides the direct method of determining if people have been exposed to particular substances, what the magnitudes of their exposures are, and how these may be changing over time.

www.cdc.gov/biomonitoring/ - accessed March 2011.

The main areas of NRC activities are:

- laboratory diagnostic of hazardous chemical substances and their metabolites in human biological specimen (blood, urine, hair, nails)
- introduction of new laboratory test methods and diagnostic procedures
- participation in international proficiency testing
- collaboration in national and international projects, research studies
- establishment of biobank for long term storage of biological samples
- establishment and administration the databank of collected biomonitoring data
- methodological consultations
- organising meetings, workshops, training courses
- publication of results

RAPH
REGIONAL AUTHORITY OF PUBLIC HEALTH BANSKÁ BYSTRICA

Areas of interest are focused

- Determination
  - ❑ **of elements**
  - ❑ **of hazardous organic substances and their metabolites**
  - ❑ **of persistent organic pollutants**

Determination of elements:

- toxic and essential elements
- arsenic (hair, nails), antimony by ETA AAS and HG AAS

- lead, cadmium, chromium, nickel in hair by ETA AAS

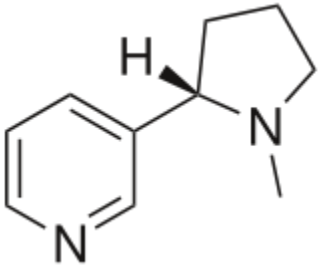
- mercury in hair by CV AAS

- lead in blood and urine by ETA AAS

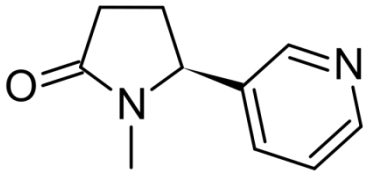
- calcium is breast milk by AES

Determination of hazardous organic substances and their metabolites:

- **nicotine in hair by HPLC-DAD**

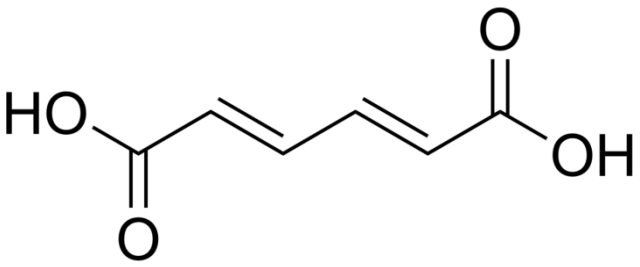


- **cotinine (nicotine metabolite) in urine by HPLC-DAD**

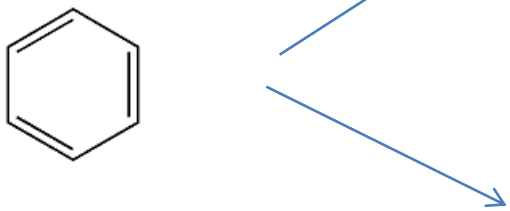


- **t,t-muconic acid (benzene metabolite) in urine by HPLC-DAD**

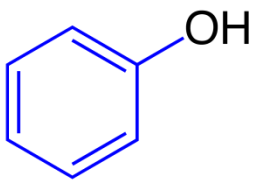
- **Phenol (benzene metabolite) in urine by spectrophotometry and HPLC-FLD**



t,t-Muconic acid

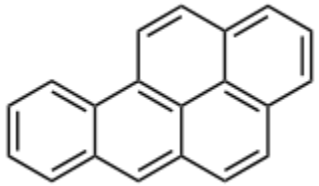


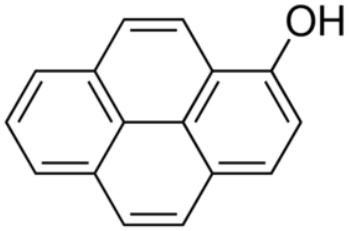
Benzene



Phenol

- **1-hydroxypyrene (marker of PAHs exposure) in urine by HPLC-FLD**

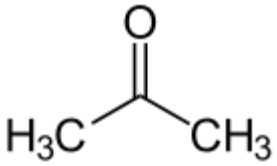




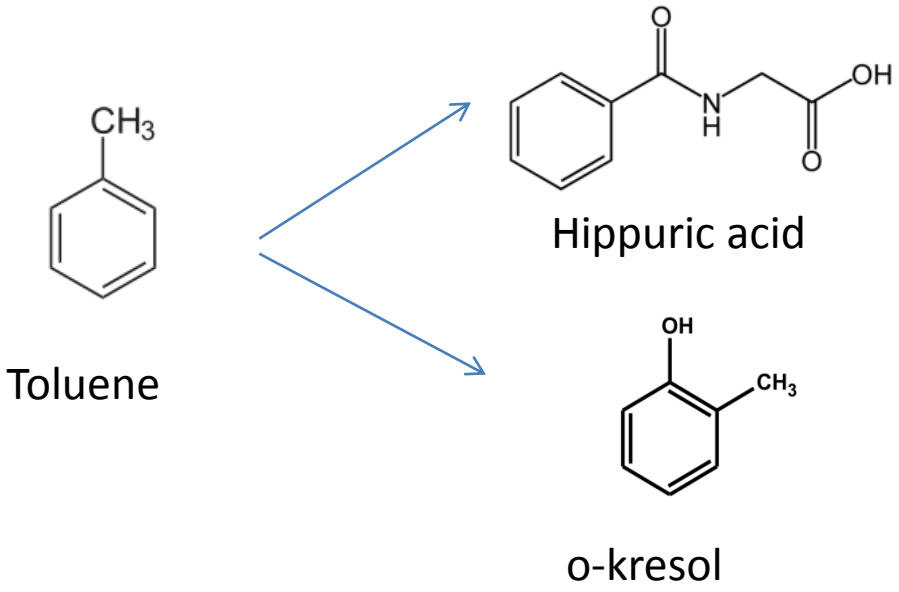
Example of PAH - Benzo[*a*]pyrene
PAHs may contain four-, five-, six- or seven-member rings

1-hydroxypyrene

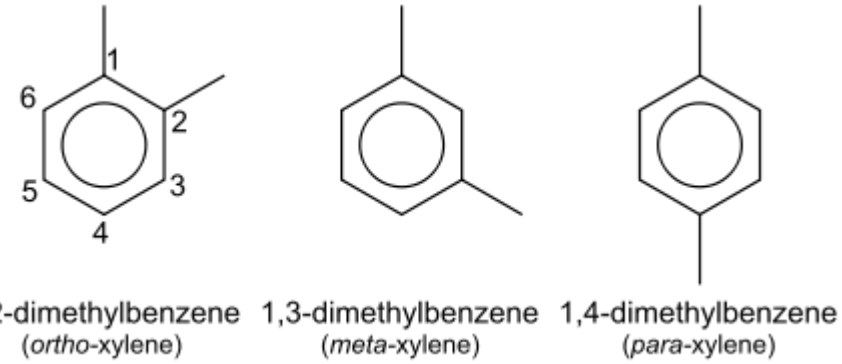
- **acetone in urine by GC-FID**



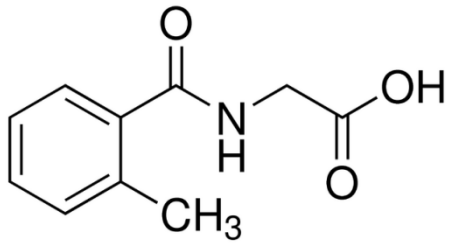
- **hippuric acid (toluene metabolite) in urine by HPLC-DAD**
- **o-kresol (toluene metabolite) in urine by HPLC-DAD**



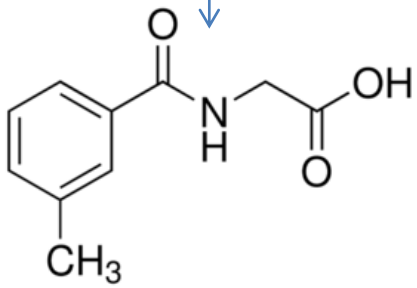
➢**(2-,3-,4-)-methylhippuric acids (xylene metabolites) in urine by HPLC-DAD**



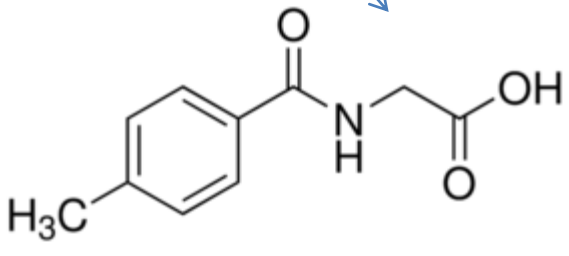
1,2-dimethylbenzene (*ortho*-xylene) 1,3-dimethylbenzene (*meta*-xylene) 1,4-dimethylbenzene (*para*-xylene)



2-Methylhippuric acid



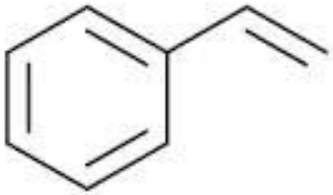
3-Methylhippuric acid



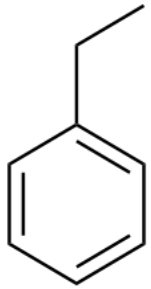
4-Methylhippuric acid

➢ **mandelic acid (styrene, ethylbenzene metabolite) in urine by HPLC-DAD**

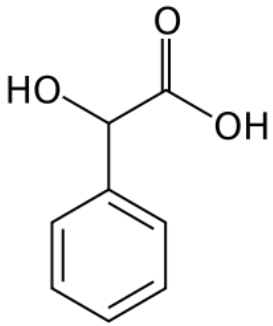
➢ **phenylglyoxylic acid (styrene, ethylbenzene metabolite) in urine by HPLC-DAD**



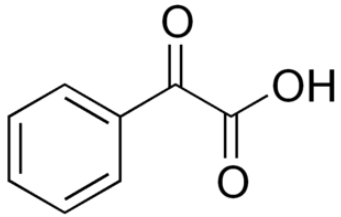
Styrene



Ethylbenzene

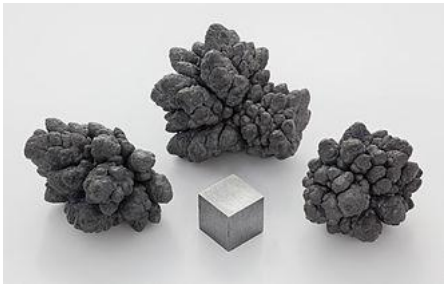


Mandelic acid

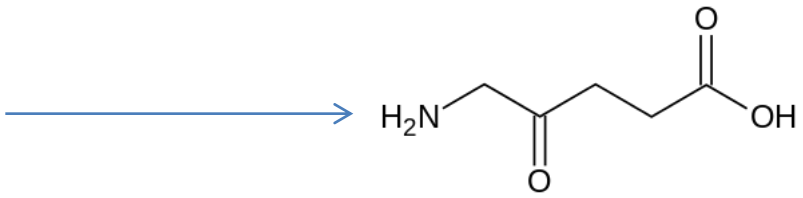


Phenylglyoxylic acid

➢ δ-aminolevulinic acid (lead exposure marker) in urine by spectrophotometry



Lead

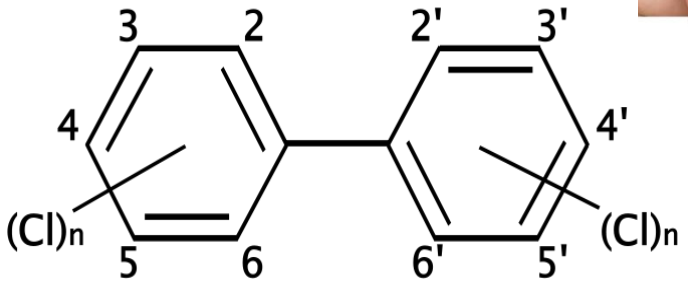


δ-Aminolevulinic acid

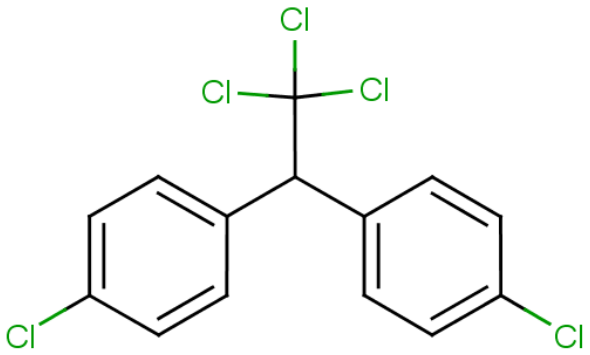
Determination of persistent organic pollutants:

- **PCB congeners (PCB 28, 52, 101, 138, 153, 180) in breast milk by GC-ECD**

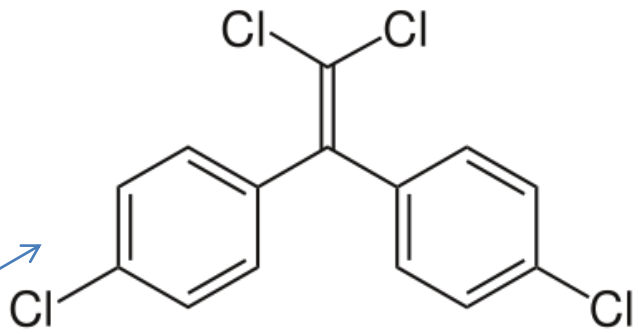
- **28: 2,4,4'-Trichlorobiphenyl**
- **52: 2,2',5,5'-Tetrachlorobiphenyl**
- **101: 2,2',4,5,5'-Pentachlorobiphenyl**
- **138: 2,2',3,4,4',5'-Hexachlorobiphenyl**
- **153: 2,2',4,4',5,5'-Hexachlorobiphenyl**
- **180: 2,2',3,4,4',5,5'-Heptachlorobiphenyl**



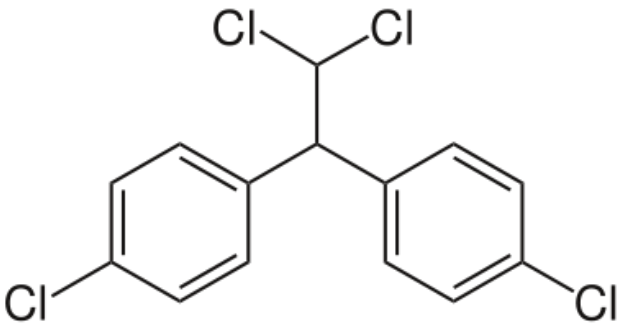
➢**chlorinated insecticides (DDT and degradation products DDE, DDD) in breast milk by GC-ECD**



DDT - Dichlordifenyltrichlorethan



DDE- Dichlordifenyldichloroethylene



DDD - Dichlorodiphenyldichloroethane

- Most of the laboratory tests is carried out by accredited procedures in accordance with the requirements of EN ISO/IEC 17025:2005.
- Quality of laboratory analysis is regularly verified by participation in international and national proficiency testing schemes (PTS). The recent PTS for biological specimen analysis are: G-EQUAS Erlangen, ICI DEMOCOPHES, NRC for the exposure tests at the Authority of Public Health of Slovak Republic.

COPHES
Consortium to Perform Human Biomonitoring on a European Scale

HUMAN BIOMONITORING FOR EUROPE
a harmonised approach

Projektu EÚ COPHES *DG Research – No. 244237*

DEMOCOPHES (r. 2007-2013), *-LIFE09 ENV/BE/000410*

financed by the European Commission LIFE+ programme (50%) and partners from 21 countries

grant of commision EÚ no. FP7-ENV-2009-1-CSA

coordinator

FPS Health, Food Chain Safety and Environment, Brusel, Belgium

4 human biomarkers: mercury in hair, cadmium, cotinine and some metabolites of phthalates in urine.

Thank you for your attention.

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