

# BIOLOGICAL EXPOSURE TESTS

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# Biological exposure tests

- Means of evaluation of exposure in workers exposed to some chemicals
- Markers in biological material are measured mostly in urine or blood
- Collection must be performed



in appropriate timing (depending on the half-life and speed of elimination)



# Detect

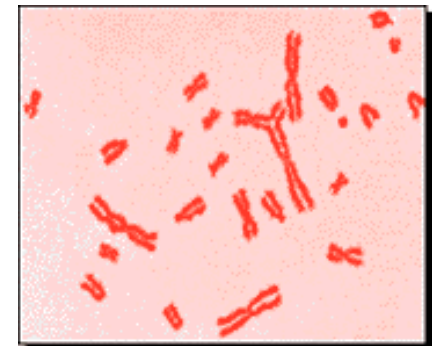


1) **noxa** (Pb, Hg in blood or urine)

2) **its metabolite** (hippuric acid in toluene exposure)

3) **biochemical changes caused by noxa** -

- **Lead**: increased 5-ALA and coproporphyrins in urine
- **Organophosphates**: decreased acetylcholinesterase activity in blood
- **Methemoglobinaemia** in amino- and nitro-compounds,
- **Carcinogens**: chromosomal aberrations in peripheral lymphocytes
  - Chemical carcinogens: breaks of one chromatide
  - Ionizing radiation: double breaks -dicentrics, rings



# Biological exposure tests

## Metals



## Organ. solvents, Organophosphates



- Available only for few compounds - in agreement with **maximum allowed levels of chemicals** in the workplace air in kinetic studies and on long-term follow-up of **exposed subjects**

# A. Limit URINE levels of markers for working subjects (selection)



Agent	Marker in urine	Limit values	Limit values	Time of collection
<b>Benzene</b>	<b>S-phenylmercapturic acid (or phenol)</b>	0,05 mg/g creatinine	0,024 $\mu\text{mol}$ /mmol creatinine	End of the shift
<b>Phenol</b>	<b>Phenol</b>	300 mg/g creatinine	360 $\mu\text{mol}$ /mmol creatinine	End of the shift
<b>Lead</b>	<b>5-Aminolaevulinic acid</b>	15 mg/g creatinine	13 $\mu\text{mol}$ /mmol creatinine	Any
	<b>Coproporphyrin</b>	0,2 mg/g creatinine	0,035 $\mu\text{mol}$ /mmol creatinine	
<b>Mercury</b>	<b>Mercury</b>	0,1 mg/g creatinine	0,056 $\mu\text{mol}$ /mmol Creatinine	Any
<b>Toluene</b>	<b>Hippuric acid</b>	1600 mg/g creatinine	1000 $\mu\text{mol}$ /mmol creatinine	End of the shift
	<b>o-Cresol</b>	0,5 mg/l	4,6 $\mu\text{mol}$ /l	End of the shift
<b>Trichlorethylene</b>	<b>Trichloroacetic acid</b>	100 mg/g Creatinine	70 $\mu\text{mol}$ /mmol creatinine	End of the shift
	<b>Trichlorethanol</b>	200 mg/g creatinine	150 $\mu\text{mol}$ /mmol creatinine	End of the shift

## B. Limit levels of MARKERS IN BLOOD for working subjects (selection)



Agent	Marker in blood	Limit values	Time of collection
Aniline	Methemoglobin	1,5 %	End of the shift
Cadmium	Cadmium	0,005 mg/l 0,045 µmol/l	Any time
Organophosphates and carbamates	Activity of acetylcholinesterase	Decrease by 20 % comparing with pre- exposure level	End of the shift
Nitrobenzene	Methemoglobin	1,5 %	End of the shift
Carbon monoxide	Carboxyhemoglobin	5 %	End of the shift
Lead	Blood lead	0,4 mg/l	Any time

# Limit values

- levels at which a damage of the workers is not probable.
- Exceeding of the levels does not automatically mean a health damage, only a warning!

# Advantage

- **COMPLEX** evaluation of the sum of exposure by all ways of entering the body:
- + inhalation exposure
- + skin absorption (in some organic solvents),
- + GIT absorption (Pb exposure – smoking and eating at the workplace may play a role in this cumulative toxic metal exposure)