Toxicology of High Priority Substances
Part 3: Cd, Cr, Dioxin and TCE

Cadmium
- Forms
  - Inorganic: cadmium salts
  - Elemental: calcium fume and dust
- Bound by metallothionein in liver and kidney; saturation leads to appearance of toxicity
- Half-life: 8-30 years; poorly excreted
  - Chelation techniques increase the toxic effect
  - Toxic effects progressive
  - Not susceptible to intervention

Cadmium: Toxic Responses
- Cell injury: mechanism not known
- Physiologic: none
- Allergenic: not known
- Mutagenic: poorly
  - Carcinogenic: lung cancer
- Teratogenic: no information

Cadmium: Target Tissues
- Lungs:
  - Acute chemical pneumonia
  - Emphysema, fibrosis
  - Lung cancer
- Kidneys: renal tubular dysfunction
  - Bone disease, kidney stones

Measuring and Managing Cadmium Exposure
- OSHA Standard
  - Blood and urine cadmium levels
  - Urine β2-microglobulin
    - Evidence of renal tubular toxicity
  - Medical removal depending on monitoring results
Chromium

- **Forms**
  - Inorganic
    - Chromium III: insoluble, but toxic
    - Chromium VI
      - Soluble, easily absorbed
      - Converted to Cr V-IV-III in cells
  - Elemental and organic forms are not known toxins
  - Half-life: 1-2 months

Chromium: Toxic Responses

- Cell injury: interferes with cellular respiration
- Physiologic: none
- Allergenic: allergic dermatitis, asthma
- Mutagenic: yes
  - Carcinogenic: lung cancer
- Teratogenic: probable, little data

Chromium: Target Tissues

- Lung:
  - Acute irritation
  - Asthma
  - Fibrosis, lung cancer
- Upper respiratory tract
  - Sinusitis, septal perforation
- Skin
  - Dermatitis: irritant, allergic

Measurement and Management of Chromium Exposure

- **Measurement**
  - Blood and urine levels
- **Management**
  - Removal
  - Ascorbic acid to reduce conversion from VI-III
  - Topical EDTA for chromium ulcers
  - Chelation has not proven to be helpful

Dioxins

- Family of chlorinated organic compounds
  - Chlorinated Dibenzo-p-dioxins(CDDs)
    - 2,3,7,8-tetrachlorodibenzop-dioxin
  - Persistent: half-life 7-12 years
  - Lipophilic: reside in fat
  - Ubiquitous
**Dioxins: Toxic Responses**
- Cell Injury: upper respiratory irritation, chloracne, immunotoxicity
- Physiologic: none known
- Allergic: none known
- Mutagenic: not seen
  - Carcinogenic: increased overall incidence
  - Teratogenic: changed sex ratio

**Trichloroethylene (TCE)**
- Long use as a solvent and anesthetic
- Short half life: ~hours to a day
  - Metabolites: few days

**TCE: Toxic Responses**
- Cell injury: via reactive metabolites, liver, peripheral nerves
- Physiologic: brain, heart
- Allergic: none
- Mutagenic: no
  - Carcinogenic: probably
  - Teratogenic: probably

**TCE: Target tissues**
- Brain: headache, depression, coma
- Heart: irritability, sudden death
- Liver:
  - acute chemical hepatitis
  - Cirrhosis
- Kidney: tubular injury
- Skin: dermatitis
Thanks for listening