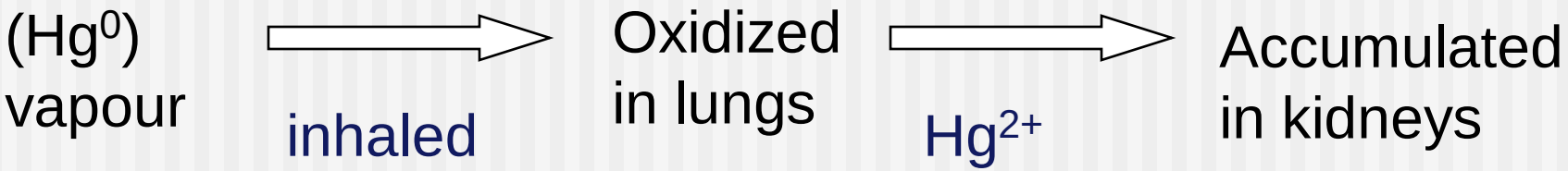
Mercury Toxicity

Mercury

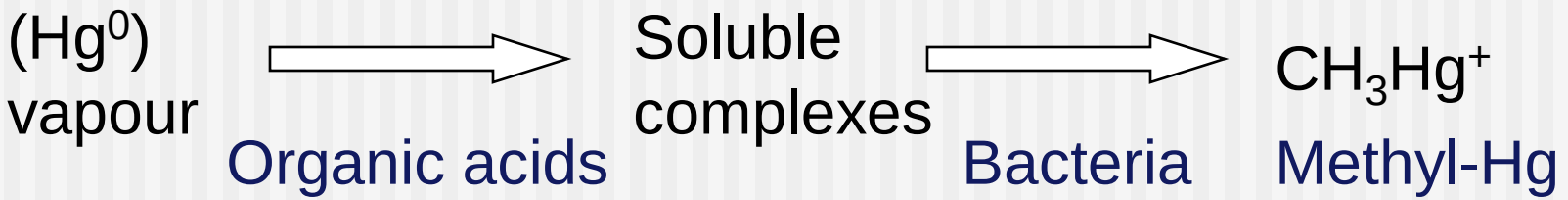
USES	Red ink, thermometers, batteries, fluorescent tubes, electrical appliances, biocides, medications
FORMS	Elemental, metallic Hg (Hg^0), divalent inorganic Hg (Hg^{2+}) methylmercury (CH_3Hg^+ and $(CH_3)_2$)
SPECIES	Monomethyl-Hg is the worst!
NATURE	Soils/rocks, Cinnabar (HgS), food (fish)
HUMAN RELEASE	Combustion of coal and oil, mining/smelting mercury, Cu/Pb smelting, chlor-alkali plants, dental amalgam, fluorescent lamp manufacturing

Mercury - in the body



- Hg^{2+} binds to proteins (affinity for proteins)
- Kidney mistakes protein w/Hg as glutathione (a good guy), and retains it
- Hg is concentrated in the kidneys
- Leads to kidney failure and/or death, can also damage central nervous system

Mercury - in the environment



- Hg^0 is oxidized and transformed to Methyl-Hg @ the water-sediment interface
- Methyl-Hg is the most soluble, persistent, and toxic form of Hg (bio 1/2 life of 70 days in humans - vs 6 days for inorganic Hg)

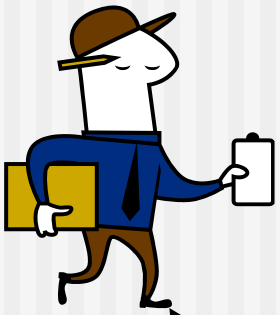
Factors Affecting Methylation

- Low pH = stimulates CH_3Hg^+ production, increases total Hg available for methylation (increased binding to particulates and decreased evaporation)
- High DOC (leads to methylmercury in fish even in pristine locations - eg. N.pike in LaGrande reservoir, Quebec)

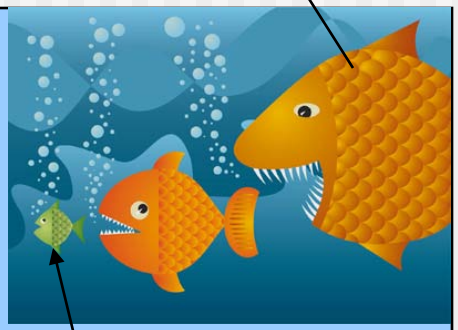
CH_3Hg^+

- Affinity for proteins, moves readily across bio membranes, bioaccumulates in fish muscle tissue, and biomagnifies up the food chain
- Fish are tolerant (10x more so than humans) b/c they store Hg in muscles
- Bad news for those that eat the fish!
- Causes decrease egg hatching/growth, and death in fish when levels are very high

The Process….



Hg^0



CH_3Hg^+

Colloid

Bacteria

Water

Sediment

Metallic Hg

Organic Acids

Soluble Complexes

CH_3Hg^+

Bacteria

Effects on Humans

- Impaired hand-eye coordination
- Memory/ Speech loss
- Lowers IQ
- Blurred vision, blindness
- Teratogen (babies born w/twisted limbs)
- Kidney damage
- Cancer
- Death
- ……

Mercury

- Kidneys = affected organs w/ moderate duration exposure to moderate levels
- Brain = receptor in long-term exposure to moderate levels