Chemicals in the Diet

Objectives:
Recognize chemicals in the diet associated with adverse health outcomes from:
• Fish & Seafood
• Synthetic Chemicals
• Natural Toxins

Review common chemicals found in drinking water:
• Arsenic
• Nitrates

CHEMICALS IN FISH & SEAFOOD
Fish consumption advisories are important tools to reduce exposure to persistent pollutants. They also exemplify the interface between environmental health, chemistry, and policy.

**Benefits of fish consumption**
- Seafood is nutritious, high-quality protein, low in saturated fat, rich in polyunsaturated fats
- Benefit cited: reduced risk in heart disease
- Potential additional benefits: higher cognitive abilities in fetal period and visual acuity
Health effects of concern:

**Mercury:** neurotoxicity including impaired vision, sensory abnormalities, tremors, impairment in speech/hearing and learning

**PCBs:** adverse effects in children and developing fetuses (reduced IQ, birth weight, behavior), immune system effects, and possibly cancer

**Organochlorine pesticides:** reproductive effects, cancer, organ and neurological effects

Examples of fish that may have high mercury in Oregon*:

- **CARP**
- **BASS**
- **BROWN TROUT**

Examples of fish that tend to have low mercury in Oregon*:

- **SALMON**
- **PANFISH**
- **RAINBOW TROUT**

*See state fish advisories

Store bought seafood typically low in mercury:

- **Shellfish**
- **Canned Salmon***
- **Anchovies***
- **Dungeness Crab**
- **Trout**
- **Frozen/fresh salmon**
- **Pacific Cod**
- **Tilapia**
- **Herring***
- **Sardines***

*high in D-3 fatty acids (that’s good!)*
Store bought seafood typically high in mercury:

- Tuna
- Shark
- Swordfish
- Orange Roughy
- Chilean Bass
- King Mackerel
- Grouper
- Marlin

Results:

Mean mercury levels in white tuna = 0.215 ppm;
Mean mercury levels in light tuna = 0.057 ppm.
**Bisphenol-A (BPA)**

What is it?
A large volume chemical used in producing polycarbonate plastics and epoxy resins.

Should we be concerned?
(National Toxicology Program)

Expert panel expressed some concern about fetal, infant and child exposures based on limited evidence of developmental changes from animal studies.

**Sources of BPA**

Metal-lining of cans that contain epoxy lacquer for foods and bottle tops. This is the major exposure source for most adults and many children.

Polycarbonate plastics in water/infant bottles, as well as other consumer products.

**Reducing exposure to BPA**

Reduce amount of canned food you consume.
Don’t microwave using polycarbonate plastics.
Avoid #7 containers, particularly for baby bottles and hot liquids.

**Brominated Flame Retardants**

Many upholstery, electronics and other products contain brominated flame retardants. They can leach from products and accumulate in some foods (particularly fish and meat), breast milk and house dust.

The West Coast tends to have higher levels of brominated flame retardants in our homes due to California fire standards (TB 117).

Recently, Oregon banned two common types of flame retardants that accumulate in wildlife.
Agricultural Residues

Fruits and vegetables can contain residues from pesticides, including organic produce. Produce that tends to have higher levels of pesticide residue include:

-soft produce
-produce with waxy layers
-produce with lots of pests

Ways to minimize exposure to residues include washing fruits and vegetables under running water, peeling the skin and baking. A balanced diet that is rich in fruits and vegetables is important.

Natural Toxins in the Food

PAHs

Levels in food depend on preparation of food

- BBQ & char-broiling increase PAH development
  - Temp > 300 degrees C
- Less PAH generation from oven-baking
- Higher fat content = higher PAH levels
- Distance from heating source is important

PAH’s are found in charred, blackened areas of foods (burnt toast, charred, grilled meats, fish, poultry); avoid forming and eating blackened areas.
Amnesic Shellfish Poisoning

Discovered in 1987
Epidemic of human illness traced to consumption of mussels (>100 cases) – 3 deaths & 19 hospitalized

Domoic acid is the responsible toxin. The chemical is heat stable.

Rapid onset of GI effects (nausea, vomiting, diarrhea)
Central nervous symptoms (dizziness, disorientation, memory loss)
Common to detect elevated domoic acid levels in razor clams above 20 ppm (advisory level).

Razor clamming is frequently closed on Oregon coast due to domoic acid.

Chemicals in Drinking Water
Arsenic Exposure Considerations:

Private wells are not regulated by the state and may have issues with both chemical and biological contamination.

Nitrates: shallow and leaky wells in agricultural areas
Arsenic: deep wells in certain areas that pull from aquifers in volcanic geology

In 2009, Oregon passed SB 739 which added arsenic to nitrates and fecal coliforms when a property containing a well is sold.

Why are Infants More Susceptible?

Gastric pH in infants is less acidic, thus more bacteria can grow (conversion of nitrates $\rightarrow$ nitrites)

Bacteria colonize the entire length of the gut, allowing for more conversion of nitrates to nitrite

Infants have not yet developed a blood cell enzyme that destroys nitrates and protects hemoglobin
The biggest risk of long-term arsenic ingestion is to various types of cancer, particularly bladder and skin cancers.

Inorganic arsenic will not off gas while showering or cooking. It will not cross the skin.

Inorganic arsenic will be taken up by some foods during the cooking process, such as rice. Seafood has high levels of organic arsenic, which are less harmful compared to the inorganic form.

Resources for Chemicals in the Diet

Fish Advisories
Oregon Health Authority
http://public.health.oregon.gov/HealthyEnvironments/Recreation/Pages/fishadvisories.aspx
877-290-6767

Drinking Water Contaminants
Oregon Drinking Water Protection Program
http://www.deq.state.or.us/wq/dwp/dwp.htm
971-673-0405