# Pathology 438 Final Examination due: 15 June 2015

Spring 2015

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Within group A through C, choose ONE of any of the choices answer.  
Choose between D or E, and within D, choose ONE of any of the choices

* 1. Environmental Toxicants. Pick one from the three class of substances below and discuss exposure (places where it might be encountered), its toxicokinetics (ADME) and toxicodynamics (acute, chronic toxicity, effects on physiology and eliciting pathologies. You are allowed to focus on one compound in the class or discuss the toxicology of the class generally
     1. Polyaromatic hydrocarbons (PAHs)

Polyaromatic Hydrocarbons are found all around us. They are found in the air we breathe, the food that we eat and in the environment that we live in. Polyaromatic hydrocarbons are found on the tar for roads and people that work in this environment are at a risk of high levels of polyaromatic hydrocarbon exposure.

Polyaromatic hydrocarbons have a concentration in humans that is proportional to the exposure levels to that chemical. The most common way to become exposed is in the air we breathe and lifestyle like smoking or drinking. In order to eliminate the polyaromatic hydrocarbon it must first be oxidized through a reaction that involves NADH or NADPH. Once this oxidation occurs than the chemical is processed by the liver and kidneys and eliminated in feces and urine.

Short term exposure to polyaromatic hydrocarbons is typically found by inhalation or direct contact with the skin as seen with roofing or tarring. When the PAH's are combined with direct sunlight it can be an irritant on the skin and cause redness, blistering, and peeling.

Chronic Exposure to the polyaromatic hydrocarbons can lead to more serious illness such as cancer or organ failure. The organs that are more exposed are the lungs, those with large amounts of adipose tissue, or liver and kidneys which eliminate the toxicant. Organ failure is found with exposure to high levels of PAH's. Studies done on animals showed that exposure to Polyaromatic hydrocarbons can cause birth defects or other problems in unborn babies.

<https://www.dhs.wisconsin.gov/chemical/pah.htm>

<http://www.crios.be/PAHs/toxicology.htm>

* 1. Food Toxicants.

1. Sulfur dioxide (SO2) is added to wine during its production. Discuss what is known about acute and chronic toxicity and other toxicodynamic features. Can wine be produced without using it? Are there are alternatives

Sulfur dioxide is a chemical that can be inhaled. It is also commonly found in foods and can be ingested. The molecular weight of sulfur dioxide is heavier than water and it can be encountered as a gas. People that inhale sulfur dioxide will experience a reaction with their mucus membranes in the throat. Long term exposure to high levels of sulfur dioxide can cause suffocation by blockage of the airways from the mucus production. 5 ppm and healthy will experience airway restriction, at 10 ppm coughing sneezing, and 20 ppm bronchospasm. If a healthy person is exposed to sulfur dioxide of 50-100 ppm for over 30 minutes they can die from airway obstruction.

Sulfur dioxide is not commonly found in foods because it is a gas at room temperature. However it is used as a preservative in wine. Healthy people may experience bronchospasm as a side effect of drinking wine that has sulfur dioxide in it. Sulfur dioxide turns into sulfurous acid when it reacts with the mucus membrane of the throat and gut. After ingestion it is processed and eliminated from the body by the liver and kidneys.

Chronic exposure to sulfur dioxide can lead to more serious conditions such as chronic bronchitis or a decrease in pulmonary function.

<http://www.atsdr.cdc.gov/mmg/mmg.asp?id=249&tid=46>

* 1. Drug-Nutrient Interactions. Select any of the drugs or drug classes below and explain how it affects diet (nutrient absorption). Either suggest an alternative drug and/or explain how an individual can compensate for any effect on nutrition

1. Antacids

Antacids are given to reduce GERD and inflammatory bowel pathologies in sick individuals. Unfortunately stomach acid is viewed as something that makes our lives miserable and doesn't allow us the luxury of eating the unhealthiest foods with no consequence. Antacids are proton pump inhibitors and they lead to a cascade of issues related to the stomach and the GI tract.

The problem with taking antacids to reduce heartburn is that the macronutrients will not be absorbed in the stomach. By lowering the acid concentration in the stomach, bacteria will begin to proliferate and can lead to more serious infections further along the GI tract. On top of that low acidity in the stomach will lead to undigested carbohydrates and protein, this will increase the gaseous production from the undigested macronutrients in the stomach and it puts a stress on the LES and pyloric sphincter. When these sphincters fail due to the prolonged stress GERD will occur along with undigested food particles, and bacteria that find their way into the small intestine

Lower stomach acid concentration will push undigested macronutrients into the small intenstine. Many of the digestive enzymes found in the duodenum need acidic chyme in order to become active. This will further increase the change or proper nutrient absorption. People that take antacids for Heartburn will continue down a path of sickness and disease.

Healthy alternatives for antacid drugs are yogurt (with probiotics), ginger, peppermint. wheatgrass, aloe vera, papaya, pineapple, apple cider vinegar.

<http://chriskresser.com/how-your-antacid-drug-is-making-you-sick-part-a/>

**You can do either D or E below**

* 1. Personal Care Products . Select one of the product types and the named compound usually contained in it. Discuss any facts on acute and chronic toxicity through dermal exposure, and discuss alternatives to
     1. Antiperspirants: aluminum chlorohydrate

Aluminum is know to be a pro-oxidant. Using personal care products that contain high levels of aluminum will increased the oxidative stress load on the body. Breast cancer is one area where aluminum toxicity is being investigated. There is a correlation between anti-perspirant use and breast cancer levels that are diagnosed early. There is also a higher incidence of breast cancer near the axilla. There have been studies that have linked the incidence of anti-perspirant use to breast cancer nodes in areas that are higher and more later on the breast. This can be a direct result of the oxidative stress put on the lymphatic system from constant aluminum chorohydrate use to prevent underarm sweat.

Cancerous breast tissue has been shown to have higher amounts of aluminum which has an effect on estrogen receptors in breast tissue and the aluminum acts as a metalloestrogen. Further studies have shown that aluminum is not directly mutagenic but it induces a proliferative stress leading to higher rates of breast cancer in women.

Studies have also shown that anti-perspirant use with poor kidney function can lead to Alzheimer's disease or fatal encephalopathy.

<http://www.sciencedirect.com/science/article/pii/S0946672X13002034>