# Pathology 438 Final Examination Due: 15 June 2015

Spring 2015

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**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**

**Polyaromatic hydrocarbons (PAHs)**

Exposure: air contaminated by wildfires or coal tar, grilled foods, tobacco

Absorption: lungs (aerosolized PAH), gastro-intestinal tract )food and water), skin (direct contact)

Distribution: levels detectable in most organs, especially those rich in fat. Highest levels detected in the gastrointestinal tract.

Metabolism: mixed function oxidase system is the enzyme system responsible for metabolizing PAHs, it requires NADH and NADPH to convert too polar hydroxy derivatives and arene oxides.

1) Epoxidation turns PAHs into stereoisomeric dihydrodiols

2) cytochrome P450 produces 4 stereoisomeric forms (bezo(a)pyrene-r-7,t-8-diol-

t-9,10-epoxide is the most carcinogenic form)

3) true detoxification: glutathione conjugates the stereoisomeric forms

Excretion: feces and urine

Carcinogenic: associated with increased risks of lung, skin, and bladder cancer.

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**Food Coloring Dyes. FD&C Blue No. 1, Red No. 40, Yellow No. 5, and Yellow No. 6 are common additives to food. Pick TWO of these and discuss what is known about the effect on health and name one alternative to using the dye, comparing financial costs and effect on health.**

**Yellow No. 5 aka tartrazine aka E102**

Sources: potato chips, jams, candy, drinks, pet food, shampoo, vitamins, medications

Banned in Austria and Norway, FDA approved.

Associations with allergies, asthma, and aspirin hypersensitivity. Hyperactivity in children,

Alternative dyes: annatto, beta carotene

**Yellow No. 6 aka sunset yellow aka E110**

Sources: medications (tablets, capsules), orange-flavoured foods

Banned in Norway, Finland, and Sweden. FDA approved for intake up to 3.75 mg/kg.

Associations with allergies, hyperactivity in children, increased risk of cancer

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**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.**

**Antacids**

Antacids are typically used by individuals experiencing heartburn. Antacids neutralize hydrochloric acid in the stomach, and consequently block the absorption of vitamins and minerals that require acidity in the stomach. Hydrochloric acid is responsible for activating pepsinogen 🡪 pepsin in the stomach, hypochlorhydria (low stomach acid) therefore affects the body’s ability to digest proteins. And can contribute to leaky gut. HCl is also involved in the metabolism of calcium, zinc, Vitamins B9 and B12, and iron.

Chiropractic and Alternative Therapies:

Chiropractic adjustments to address subluxation and support optimal homeostasis.

Supplementation with HCl and/or digestive enzymes.

Dietary support: ACV, Lemon juice, reduce protein consumption, reduce (cold) liquid consumption during meals, implementation of food combining (see attachment).

Hydrochloric acid is associated with stimulating peristalsis and the closing of the sphincters of the stomach, therefore hypochlorhydria could reduce the movement in the intestinal tract (inducing constipation) and leave the cardiac sphincter incompletely closed resulting in heartburn. For this reason, there is a common misdiagnosis of hyperchlorhydria resulting in the prescription of antacids or proton pump inhibitors further establishing the state of inadequate stomach acid.

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**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**

**Lipstick: lead acetate**

Lead is a cumulative toxicant, and therefore can cause poisoning through chronic or acute exposure. Approximately 143,000 deaths per year are due to lead poisoning, more commonly in developing countries.

“FDA analyzed hundreds of lipsticks on the market and found that levels of lead were too low to pose a health risk, especially considering the tiny amounts of lipstick that a consumer might ingest.”

Amount of lead in cosmetics is not regulated by the FDA, but it is regulated in the colourants used in the cosmetics (maximum of 20 ppm).

Symptoms of lead poisoning in children: developmental delays, learning difficulties, irritability, loss of apetite, weight loss, sluggishness/fatigue, abdominal pain, vomiting, constipation, hearing loss.

Symptoms of lead poisoning in adults: high blood pressure, abdominal pain, constipation, joint pains, muscle pain, declines in mental function, pain/numbness/tingling, headache, memory loss, mood disorders, reduced sperm count, miscarriage.

Poisoning is determined by a blood titre of 20 mcg/dL in adults and 10 mcg/dL in children. Treatment options include chelation therapy and EDTA.

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**FDA Analyses of Lead in Lipsticks – Initial Survey**

The following results for lead content in a selection of lipsticks were obtained by scientists at the U.S. Food and Drug Administration (FDA) and reported in the *Journal of Cosmetic Science***1** [](http://www.fda.gov/FDAgov/AboutFDA/AboutThisWebsite/WebsitePolicies/Disclaimers/default.htm). FDA purchased lipsticks from retail stores between October and December 2007.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Sample #** | **Brand** | **Parent company** | **Lipstick line**  **Shade #**  **Shadea** | **Lot #b** | **Lead (Pb)c**  **(ppm)d** |
| 1a | Cover Girl | Procter & Gamble | Incredifull Lipcolor  964  Maximum Red | 7241S1 | 3.06 |
| 1b | 5188S1 | 3.05 |
|  | Revlon | Revlon | ColorStay Lipcolor  345  Red Velvet | Compositee | 2.91f |
| 2 | 07298 | 2.38 |
| 3 | Cover Girl | Procter & Gamble | Queen Collection  Q580  Ruby Remix | 7136 | 2.24 |
| 4 | Body Shop | L'Oréal | Lip Colour  22  Garnet | C274EA | 1.79 |
| 5 | Cover Girl | Procter & Gamble | Continuous Color  435  Cherry Brandy | 7228 | 1.76 |
| 6 | L'Oréal | L'Oréal | Colour Riche  315  True Red | FD261 | 1.47 |
| 7 | Revlon | Revlon | Super Lustrous  660  Bed of Roses | 07208 1508  53 | 1.37 |
| 8 | Maybelline | L'Oréal | Moisture Extreme  F315  Cocoa Plum | WD2891 | 1.21 |
| 9 | Revlon | Revlon | Super Lustrous  725  Love That Red | 07284 1508  59 | 1.04 |
| 10a | L'Oréal | L'Oréal | Colour Riche  752  Classic Wine | FD064 | 0.79 |
| 10b | FD234 | 0.67 |
| 11 | Clinique | Estée Lauder | Long Last  FJ  Merlot | AA7 | 0.55 |
| 12 | Clinique | Estée Lauder | Long Last  F9  Paprika | A87 | 0.48 |
| 13 | Estée Lauder | Estée Lauder | Pure Color  1A3  Maraschino | B55 | 0.43 |
| 14 | Burt's Bees | Clorox Company | Lip Shimmer  g  Merlot | 1840701 | 0.33 |
| 15 | Maybelline | L'Oréal | Moisture Extreme  E215  Midnight Red | WD3041 | 0.23 |
| 16 | PeaceKeeper | PeaceKeeper | Lipstick  g  Paint Me Compassionate | h | 0.17 |
| 17 | Dior | LVMH | Replenishing Lipcolor  752  Red Premiere | 7A01 | 0.15 |
| 18 | Dior | LVMH | Addict Ultra-Shine  750  Shiniest Sexiness | 7D01 | 0.12 |
| 19 | M.A.C | Estée Lauder | Matte  g  Viva Glam I | A67 | 0.10 |
| 20 | Avon | Avon | Ultra Color Rich  U250  Cherry Jubilee | h | 0.09 |
|  |  |  |  | Average | 1.07 |