The Excretory System (Review of Systems)
Anatomy & Physiology

I. Introduction—This is just a basic overview of excretion. We have touched on aspects of it in our studies of the integumentary system (1st semester) and the digestive system and metabolism (1st and 2nd semesters). The following are basic questions you will address when considering excretion and its relationship to the integumentary system, the digestive system, metabolism, the respiratory system and the urinary system. You will expand on these through this outline. You may find it helpful to review your past notes and/or earlier chapters—if you know it, don’t bother going back. This should help you bring systems and concepts together.

A. What is excretion?
B. What are excretory substances and give examples?
C. Name various ions and give their importance
D. What are the organs of excretion and what is their function in excretion?
E. What is the relationship between the excretory and urinary systems?

Excretion—the elimination of waste products from the body. It can refer to the expulsion of any product, whether from a single cell or from the entire body, or to the matter excreted. Secretion is sometimes used interchangeably (perhaps incorrectly) with excretion, so be careful when you use these terms because there are important differences.

- Compare/contrast excretion and secretion. What are the fundamental differences?

III. Excretory Substances

A. Include the end products of metabolism
   1. Definition of metabolism: The physical and chemical changes or processes by which living substance is maintained, producing energy for the use of the organism.

- What are the end products of cellular respiration? What are the “waste” products? How do we get rid of them?

   2. Nitrogenous wastes (see chart)—they are waste products formed from the breakdown of ____________________.

B. Also include water and other substances (including ions)

C. Examples of excretory substances
   1. Ammonia
   2. Urea
   3. Uric Acid
   4. Creatinine
   5. Bile pigments
   6. Carbon dioxide

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7. Ions (salts)
   a. Concentrations in blood are important for maintaining normal
      (1) pH of blood (7.35-7.45)
      (2) osmotic pressure of blood
      (3) electrolyte balance of blood
      (4) normal functioning of many body tissues
   
   b. Kidneys rely primarily on excretion of the following for the
      regulation of pH and osmotic pressure of blood
      (1) H\(^+\) (hydrogen ion)
      (2) Na\(^+\) (sodium ion)
      (3) NH\(_3\) (ammonia)
      (4) NH\(_4^+\) (ammonium ion)
      (5) HCO\(_3^-\) (bicarbonate ion)
   
   c. Also important are
      (1) K\(^+\) (potassium) - electrolyte balance of blood
      (2) K\(^+\) and Na\(^+\) - nerve conduction
      (3) Ca\(^{++}\) - Muscle contraction
      (4) Fe\(^{++}\) (ion) - hemoglobin metabolism
      (5) Mg\(^{++}\) - proper enzyme functioning

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**METABOLIC END PRODUCTS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>END PRODUCT OF</th>
<th>PRIMARILY EXCRETED BY</th>
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<tbody>
<tr>
<td>Nitrogenous Wastes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Ammonia</td>
<td>Amino Acid Metabolism</td>
<td>Kidneys</td>
</tr>
<tr>
<td>- Urea</td>
<td>Ammonia Metabolism</td>
<td>Kidneys</td>
</tr>
<tr>
<td>- Uric Acid</td>
<td>Nucleotide Metabolism</td>
<td>Kidneys</td>
</tr>
<tr>
<td>- Creatinine</td>
<td>Creatine phosphate</td>
<td>Kidneys</td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Bile Pigments</td>
<td>Hemoglobin Metabolism</td>
<td>Liver</td>
</tr>
<tr>
<td>- CO(_2)</td>
<td>Cellular Respiration</td>
<td>Lungs</td>
</tr>
</tbody>
</table>

**IONS (SALTS) IN PLASMA**

<table>
<thead>
<tr>
<th>METALLIC IONS</th>
<th>NONMETALLIC IONS</th>
<th>EXCRETORY ORGAN</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium</td>
<td>Chloride</td>
<td>Kidneys</td>
</tr>
<tr>
<td>Potassium</td>
<td>Sulfate</td>
<td>Skin</td>
</tr>
<tr>
<td>Magnesium</td>
<td>Phosphate</td>
<td>Large Intestine</td>
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<td>Calcium</td>
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<td>Iron</td>
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IV. Organs of Excretion
   A. Skin (Review Integumentary System, 1st semester)
      1. Perspiration
      2. Temperature regulation
      3. Rid body of wastes (minor function) - Urea Frost

   B. Liver (Review Blood)
      1. Bile pigments/bile salts/bilirubin (remember—bile is both an excretory
         product and a digestive secretion)
      2. Liver also detoxifies products and excretes them through bile (drugs, alcohol)
         and urine (deamination of amino acids → NH₂ → NH₃ → urea (excreted in
         urine).

   C. Lungs (expiration)
      1. CO₂
      2. H₂O

   D. Intestine
      1. Urobilinogen (excreted or secreted?)
      2. Stercobilinogen (excreted or secreted?)
      2. Certain salts (Fe, Ca) excreted directly into intestine by epithelial cells that
         line the intestine.
      3. Contrast excretion and defecation
      4. Feces/excrement

   E. Kidneys
      1. Primary organ of excretion
      3. Excrete urine that contains a combination of end products of metabolism
         (urea, uric acid, creatinine) and various ions (Na⁺, Cl⁻, HCO₃⁻, K⁺), pigments
         (urobilin) and varying amounts of water.
      4. At the same time, there may be products excreted in the urine that should not
         be there (or are in higher than normal levels) and suggest an
         abnormality/disease/disorder (glucose, protein, albumin, ketones, bilirubin).