1. Kidneys produce urine.
2. Ureters transport urine.
3. Urinary bladder stores urine.
4. Urethra passes urine to outside.
The Urinary System

- Excretion

- are the primary organ of excretion

- Four functions essential to homeostasis:
  - Excretion of
  - Preservation of
  - Maintenance of
  - Secretion of
Excretion of metabolic wastes

- **Urea-By-product**
  - Carbon dioxide combines with ________________ to produce urea
  - Less ____________ than ammonia

- **Creatinine – result of**

- **_________** - Result from the breakdown of nucleotides
  - Insoluble
  - Gout occurs ________________
Preservation of water-salt balance –

- Blood volume is closely associated with ________________
  - Salts have the ability _________________________________
  - The more salts there are in the blood, ________________
  - Kidneys also maintain other ____________________________
    - Potassium
    - Bicarbonate
    - Calcium

- Maintenance of blood pressure - results from ________________
  - Kidneys influence _________________________________
    - ________________angiotensin
    - Angiotensin ________________________________
Functions of the kidney

- **Maintenance of**
  - Kidneys excrete ______ from the ______ into ______________________
  - Kidneys reabsorb _______________ and return them __________________________

- **Secretion of**
  - Release renin when ______________________
  - **Erythropoietin**
    - Released when the ______________________ of the blood is reduced
    - Stimulates _____________________________
  - Kidneys help activate ______________________
    - Precursor to calcitrol
    - Promotes _____________________________
Organs of the urinary system

- primary organs of excretion
  - Paired organs
  - Located in the lumbar region
  - Held in place by ________
  - Covered by the renal capsule-__________

1. Kidneys produce urine.
2. Ureters transport urine.
3. Urinary bladder stores urine.
4. Urethra passes urine to outside.
Ureters & Urinary Bladder

- **Ureters-**
  - Extend from the ___________ to the bladder

- **Urinary Bladder-**
  - Three openings:
    - Two for the ______________________
    - One for the ______________________
  - **Detrusor muscle**
    - Middle layer of ______________________
    - Two layers of ______________________
  - Mucosa of transitional epithelium
  - **Rugae-**
  - **Sphincters-**
    - Internal sphincter around the opening to the urethra
    - External sphincter composed of skeletal muscle
The urethra-

- **Tube**
  - Averages ___________ when penis is not erect
  - Encircled by the ____________________
  - Carries _______________________________

- **In males**
  - About _______________ long
  - Prone to _______________________
Urination -

- are stimulated when the bladder is full
- cause the bladder to contract and the sphincters to relax
Nephron-
3 stages of urine formation

#1 Glomerular Filtration
- Enters the afferent arteriole and the glomerulus
- Causes blood to be filtered
  - Wastes
  - Leave the glomerulus by the efferent arteriole
#2. Tubular reabsorption

- **Molecules and ions are** ________
  - __________
  - __________
  - (i.e. glucose and amino acids)
  - __________

Every substance has a maximum ________
#3. Tubular secretion

- Substances are removed_________________________
  
  ▪ ______________________ ions
  ▪ ______________________ ions
  ▪ ______________________
  ▪ ______________________
Regulatory Functions of the Kidneys

1. ______ and __________
   Balance
   • Total water intake should ___
     __________________________
   • How water enters the body
     □ __________________________
     □ __________________________
     □ __________________________
     □ __________________________
   • How water exits the body
     □ __________________________
     □ __________________________
     □ __________________________
     □ __________________________
2. Reabsorption of water through

- Reabsorption of salt leads to

- Most reabsorbed in

- Excretion of is dependent on the
  - The
  - The duct

- Antidiuretic Hormone (ADH)
  - Causes water
  - Decreases
3. Reabsorption of ________________

- The __________________
  - Sodium
  - Potassium
  - Bicarbonate ion
  - Calcium
  - Phosphate ions
  - The kidneys
    - Greater than 99% of ________________ is ________________
    - 67% is ________________ at the PCT
    - 25% is reabsorbed at the ________________
    - The rest is reabsorbed from the ________________
Diuretics—

• *By ____________________________*
  
  • Examples:
    • __________________________________
    • __________________________________
    • __________________________________
    • Diuretic drugs - developed to ________________
    • ____________________________cause ________________to diminish & ____________________________
Acid-base balance

0) Acid-Base Buffer Systems

- Buffer – a chemical _________________
- An important buffer in the blood is a combination of _________________ and _________________
- _________________ neutral
- Normal blood _________________
- pH @ _________________
- acidosis ______________________
Renal regulation of acid-base balance

• Can rid the body of ____________________________
• ________________________than other two systems
• Have a more ____________________________
• Reabsorb ______________________and excrete ____________as needed to maintain a normal pH
• _________ and _________________ are buffers for hydrogen ions in the urine
Problems with Kidney Function

- Water accounts ________________________________
- Remaining 5% consists ________________________________
- Urine usually does not contain _________________
- Urinalysis ________________________________
- Composition of urine changes if ________________
# Problems with Kidney Function

<table>
<thead>
<tr>
<th>TABLE 16.3 Composition of Urine</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Water</strong></td>
</tr>
<tr>
<td><strong>Solids</strong></td>
</tr>
<tr>
<td><strong>Organic nitrogenous wastes</strong></td>
</tr>
<tr>
<td>(per 1,500 ml of urine)</td>
</tr>
<tr>
<td><strong>Urea</strong></td>
</tr>
<tr>
<td><strong>Creatinine</strong></td>
</tr>
<tr>
<td><strong>Ammonia</strong></td>
</tr>
<tr>
<td><strong>Uric acid</strong></td>
</tr>
<tr>
<td><strong>Electrolytes</strong></td>
</tr>
<tr>
<td><strong>Positive</strong></td>
</tr>
<tr>
<td>Sodium (Na(^+))</td>
</tr>
<tr>
<td>Potassium (K(^+))</td>
</tr>
<tr>
<td>Magnesium (Mg(^{2+}))</td>
</tr>
<tr>
<td>Calcium (Ca(^{2+}))</td>
</tr>
</tbody>
</table>
Problems with Kidney Function

- **Infections**
  - Urethritis-
  - Cystitis-
  - Pyelonephritis-

- **Glomerular damage**
  - May allow ______________
    - __________, ____________, and possibly __________
    - Detected by a ______________
  - Extensive damage can ______________
Hemodialysis -

- Dialysate – 
  - Used to extract __________________ from patient’s blood
  - Used to ______________________ to the patient’s blood

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Replacing a kidney

• A functioning kidney from a donor ________________

• Possibility of ____________________

• One-year survival rate is 97% if the kidney is from a relative and 90% if it is from a nonrelative

• Patient must take ________________________________ for the rest of his or her life
Effects of Aging

- Total renal function may _______.

- Kidneys _______________ and have _____________________.

- ________________ are more common

- ________________ are more common

- ________________ in males
Homeostasis

- **Excretion**
  - _________________
  - _________________
  - _________________
  - _________________
  - __________ are the primary organ of excretion

- **Kidneys are the ________________________**
  - ______________ balance
  - ______________ balance

- **The kidneys assist the ______________ and ______________ by producing erythropoietin**

- **Regulation of _________________ assist the skeletal, nervous, and muscular systems**