Part I. Clinical Applications

1. Mr. Bud Weiser is very drunk when he is brought to the emergency room after falling down the steps at the local football game. He is complaining about his dry mouth, being very thirsty and his excessive trips to the bathroom to urinate. Knowing the relationship between alcohol and ADH’s action, what is your explanation for why he is so thirsty and his excessive urination?

   Alcohol is a diuretic. It inhibits ADH secretion from the posterior pituitary causing the distal convoluted tubule and the collecting duct to be relatively impermeable to water. Inhibiting the reabsorption of water from the tubule along with increased fluid intake results in an increase in urine production and an increase in thirst because he is urinating more fluid out than he is taking in.

2. Cindy falls from her motorcycle and experiences a tremendous blow to her back. She comes to the emergency room complaining of extreme back pain. X-rays reveal that her right kidney has come loose. What is this condition called, why is this dangerous, and what is the treatment?

   Condition is called Nephroptosis (floating kidney) and is when the Kidney slips from its normal position. The renal fascia and adipose capsule are the normal structures the hold the kidney in position. The condition is particularly dangerous because the it can result in a kinked ureter that may result in blocked urine and retrograde pressure that damages the kidney. Treatment would be Nephropexy - Surgical fixation of kidney

3. What are urinary tract infections and what are the symptoms? What is the UTI infection called if it causes inflammation within the urethra; urinary bladder; or kidneys? Why do women tend to get UTI’s more than men?

   The term urinary tract infection (UTI) is used to describe either an infection of a part of the urinary system or the presence of large number of microbes in urine.

   Symptoms include painful or burning urination, urgent and frequent urination, low back pain, and bed-wetting.

   Inflammation within the urethra is called urethritis; inflammation within the urinary bladder is cystitis; and inflammation within the kidneys is nephritis.

   UTIs are more common in females due to the shorter length of the urethra.
4. Mrs Rodriques is breathing rapidly and is slurring her speech when her husband calls the clinic in a panic. Shortly after, she becomes comatose. Tests show that her blood glucose and ketone levels are high, and her husband said that she was urinating every few minutes before she became lethargic. What is Mrs. Rodrique’s problem? Would you expect her blood pH to be acidic or Alkaline? What is the significance of her rapid breathing? Are her kidneys reabsorbing or secreting bicarbonate ions during this crisis?

Mrs. Rodriques is in a diabetic coma due to a lack of insulin. Her blood is acidic, and her respiratory system is attempting to compensate by blowing off carbon dioxide (hence, the elevated breathing rate). Her kidneys are reabsorbing bicarbonate.

5. You just find out that you have kidney stones. Your little sister (age 12) is worried that kidney stones are contagious and runs away from you screaming each time you are near her. Although funny at first, after a week of hearing her scream you feel that she is just becoming too annoying and decide to explain to her the medical explanation of kidney stones. What is your explanation? Be sure to include what kidney stones are, their composition, cause for getting stones and possible treatment.

Kidney stones (calculi) are insoluble salt crystals that can form anywhere within the kidney tubules, ureters, urinary bladder, or urethra.

- **Types of stones/composition:**
  - Calcium oxalate (70%), calcium phosphate (5-10%), struvite (10%), uric acid (10%) and cystine (1%).
- **Cause:** Components of urine (minerals and acids) are out of balance, become concentrated and then crystallize.
  - Most caused from not drinking enough water.
  - Some from anatomical malformations of the urinary tract or may have a genetic predisposition, or due to diet.
- **Treatment:**
  - Drink lots of water: May be able to move a stone through your urinary tract simply by drinking plenty of water — as much as 2 to 3 quarts (1.9 to 2.8 liters) a day — and by staying physically active.
  - Shock wave lithotripsy: Uses shock waves to break the stones into tiny pieces that are then passed in your urine.
  - Surgery: Stones removed through a small incision in your back using an instrument called a nephroscope.

6. Mr. I. P. Freely has had a series of laboratory tests including a CBC, lipid profile series, and urinalysis. The urinalysis revealed the presence of an abnormal amount of plasma proteins and white blood cells. (a) What is our diagnosis? (b) What effect does her condition have on her urine output?

- **(a) Plasma proteins and numerous WBCs appearing in the urine indicates increased permeability of the filtration membrane. This condition usually results from inflammation of the filtration membrane within the renal corpuscle. If the condition is temporary it is probably an acute glomerular nephritis usually associated with a bacterial infection such as streptococcal sore throat. If the condition is long term, resulting in a nonfunctional kidney, it is referred to as chronic glomerular nephritis.**
Part II
1. nitrogenous
2. water
3. acid-base
4. kidneys
5. ureters
6. peristalsis
7. urinary bladder
8. urethra
9. 8
10. 1 \(\frac{1}{2}\)

Part III
1. micturition
2. stretch receptors
3. contract
4. internal urethra
5. external urethral
6. voluntarily
7. \(\sim 600 \text{ ml}\)
8. incontinence
9. infants and toddlers
10. emotional/neural problems
11. pregnancy
12. urinary retention
13. prostate

Part IV
1. Afferent
2. efferent
3. blood plasma
4. diffusion
5. active transport
6. microvilli
7. secretion
8. diet
9. cellular metabolism
10. urine output
11. 1-1.8
12. urochrome / bilirubin
13. urea
14. uric acid
15. creatinine
16. lungs
17. evaporation of perspiration
18. decreases
19. dialysis
20. A
21. B
22. A
23. A
24. B

Part V
1. Glomerular capsule
2. afferent arteriole
3. efferent arteriole
4. interlobular artery
5. interlobular vein
6. arcuate artery
7. arcuate vein
8. interlobar artery
9. interlobar vein
10. loop of Henle
11. collecting duct
12. distal convoluted tubule
13. proximal convoluted tubule
14. peritubular capillaries
15. glomerulus
16. All is reabsorbed by the cells of the proximal convoluted tubule
17. Usually does not pass through the glomerular filter

Part VI
1. urethra
2. bladder
3. bladder
4. urethra
5. urethra and ureter
6. urethra
7. ureter
8. bladder and ureter
9. urethra
10. glomerular filtration rate
11. 120; 180,000; 180
12. decreases; constriction; stones
13. Most; proteins and blood cells and platelets
14. higher, smaller
15. angiotensin II
16. aldosterone
17. atrial natriuretic peptide
18. antidiuretic hormone
19. opposite effect to; increase; decrease; decrease; caffeine drinks such as coffee, tea, and cola, as well as alcohol since it inhibits ADH production.

20.
   a. Glycosuria: The amount of glucose in the tubular fluid exceeds the amount that can be absorbed, so some glucose remains in the urine.
   b. Polyuria: Glucose exerts an osmotic effect, pulling more water into the urine and increasing urine volume.

21.
   a. Women; the urethra is much shorter so microbes only have to travel a small distance from the outside of the body to the urinary bladder.
   b. Escherichia coli; candida
   c. Burning and painful urination, urinary urgency and frequency, cloudy or blood-tinged urine, urethral discharge, fever, chills, nausea, and back pain (if infection reaches kidneys)
   d. Drink plenty of fluids; wipe from front to back (so fecal matter microbes or vaginal microbes do not move into the urethra); protection against STDs.

Part VII

Part VIII
1. decrease; nephritis; renal calculi; hematuria
2. increase; dysuria; pyuria
3. nocturia
4. skeletal, muscular, nervous, cardiovascular
5. reproductive; cardiovascular; respiratory
6. 7. uremia; end-stage renal failure; dialysis
8. polycystic renal disease
9. oliguria; anuria
10. diuresis; polyuria
11. enuresis; intravenous pyelogram (IVP)

Part IX

Part X
1. tubule 10. reabsorption 18. antidiuretic hormone
2. renal 11. glucose 19. collecting duct
3. afferent 12. amino acids 20. pelvis
4. glomerulus 13. 7.4 (7.35 – 7.45) 21. peristalsis
5. glomerular capsule 14. nitrogen 22. urine
6. plasma 15. sodium 23. micturition
7. proteins 16. potassium 24. urethra
8. loop of Henle 17. urochrome and bilirubin
9. microvilli
Part XI
1. L 5. L 9. G
2. G 6. A 10. A

Part XII
1. Hematuria; bleeding in urinary tract
2. ketonuria; diabetes mellitus, starvation
3. albuminuria; glomerulonephritis, pregnancy
4. pyuria; urinary tract infection
5. bilirubinuria; liver disease
6. no official terminology; kidney stones
7. glycosuria or glucosuria; diabetes mellitus

Part XIII
1. proximal 7. active transport 13. urine
2. glomerulus 8. ions 14. ureters; urinary bladder
3. protein 9. distal 10. aldosterone
4. descending limb 11. ADH 15. urethra
5. filtrate 12. collecting
6. ascending