**The Urinary System: Functional Anatomy and Urine Formation by the Kidneys**

**34 hours**

**Overall objectives:**

√Acquiring advance knowledge and information about renal system in human for medical students

**Specific objectives:**

√MULTIPLE FUNCTIONS OF THE KIDNEYS

√PHYSIOLOGICAL ANATOMY OF THE KIDNEYS

√RENAL BLOOD SUPPLY

√THE NEPHRON IS THE FUNCTIONAL UNIT OF THE KIDNEY

√**URINE FORMATION RESULTS FROM GLOMERULAR FILTRATION, TUBULAR REABSORPTION, AND TUBULAR SECRETION**

√Glomerular Filtration, Renal Blood Flow, and Their Control

√GLOMERULAR FILTRATION—THE FIRST STEP IN URINE FORMATION

√COMPOSITION OF THE GLOMERULAR FILTRATE

√GLOMERULAR CAPILLARY MEMBRANE

√DETERMINANTS OF THE GLOMERULAR FILTRATE

√**RENAL BLOOD FLOW**

√HORMONAL AND AUTACOID CONTROL OF RENAL CIRCULATION

√AUTOREGULATION OF GLOMERULAR FILTRATE AND RENAL BLOOD FLOW

√**TUBULOGLOMERULAR FEEDBACK AND AUTOREGULATION OF GFR**

√**MYOGENIC AUTOREGULATION OF RENAL BLOOD FLOW AND GFR**

√**Renal Tubular Reabsorption and Secretion**

√TUBULAR REABSORPTION AND SECRETION INCLUDES PASSIVE AND ACTIVE MECHANISMS

 √REABSORPTION AND SECRETION ALONG DIFFERENT PARTS

OF THE NEPHRON

√Proximal tubule reabsorption and secretion

√**SOLUTE AND WATER TRANSPORT IN THE LOOP OF HENLE**

√Distal tubule reabsorption and secretion

√**LATE DISTAL TUBULE AND CORTICAL COLLECTING TUBULE**

√REGULATION OF TUBULAR REABSORPTION

√**GLOMERULOTUBULAR BALANCE—THE REABSORPTION RATE INCREASES**

 **IN RESPONSE TO INCREASED TUBULAR LOAD**

√**PERITUBULAR CAPILLARY AND RENAL INTERSTITIAL FLUID PHYSICAL**

 **FORCES**

√**HORMONAL AND NEURAL CONTROL OF TUBULAR REABSORPTION**

√**USE OF CLEARANCE METHODS TO QUANTIFY KIDNEY FUNCTION**

√**Urine Concentration and Dilution; Regulation of Extracellular Fluid**

**Osmolarity and Sodium Concentration**

√KIDNEYS EXCRETE EXCESS WATER BY FORMING DILUTE URINE

RENAL MECHANISMS FOR EXCRETING DILUTE URINE

√KIDNEYS CONSERVE WATER BY EXCRETING CONCENTRATED URINE

√**COUNTERCURRENT MULTIPLIER MECHANISM PRODUCES**

**A HYPEROSMOTIC RENAL MEDULLARY INTERSTITIUM**

√SPECIAL CHARACTERISTICS OF THE LOOP OF HENLE THAT CAUSE

SOLUTES TO BE TRAPPED IN THE RENAL MEDULLA

√**ROLE OF DISTAL TUBULE AND COLLECTING DUCTS IN EXCRETING**

**CONCENTRATED URINE**

√**UREA CONTRIBUTES TO HYPEROSMOTIC RENAL MEDULLARY INTERSTITIUM AND FORMATION OF CONCENTRATED URINE**

√**Acid-Base Regulation**

√ACIDS AND BASES—THEIR DEFINITIONS AND MEANINGS

√DEFENDING AGAINST CHANGES IN H**+** CONCENTRATION: BUFFERS,

LUNGS, AND KIDNEYS

√BUFFERING OF H**+** IN THE BODY FLUIDS

√RENAL CONTROL OF ACID-BASE BALANCE

√SECRETION OF H**+** AND REABSORPTION OF HCO3 **−** BY THE RENAL TUBULES

√**FILTERED HCO3 − IS REABSORBED BY INTERACTION WITH H+ IN THE TUBULES**

√COMBINATION OF EXCESS H**+** WITH PHOSPHATE AND AMMONIA

BUFFERS IN THE TUBULE GENERATES “NEW” HCO3**−**

√**PHOSPHATE BUFFER SYSTEM CARRIES EXCESS H+ INTO THE URINE AND**

**GENERATES NEW HCO3**

√**EXCRETION OF EXCESS H+ AND GENERATION OF NEW HCO3**

**− BY THE AMMONIA BUFFER SYSTEM**

√RENAL CORRECTION OF ACIDOSIS—INCREASED EXCRETION OF H**+** AND ADDITION OF HCO3 **−** TO THE EXTRACELLULAR FLUID

√RENAL CORRECTION OF ALKALOSIS—DECREASED TUBULAR SECRETION OF H**+** AND INCREASED EXCRETION OF HCO3**−**