	[Note: All PowerPoint slides are on UVM Blackboard]
Urine Transport, Storage & Elimination	[ON SCREEN] URINE TRANSPORT, STORAGE AND ELIMINATION (see Blackboard) • Dye introduced into urinary system can show any blockage to the pelvis and urinary bladder.
Male Urinary Bladder	[ON SCREEN] CLOSE-UP OF URINARY BLADDER IN MALE (see Blackboard) • Two sensors control urine elimination 1. Internal urethral sphincter o no control 2. external urethral o sphincter (in urogenital diaphragm) o most of the muscles making up wall of bladder (detrusor muscle) • Urine does not black flow into the kidneys because of the one-way valve system of the ureters that connect the kidneys to the bladder.
Female urinary bladder	[ON SCREEN] CLOSE-UP OF URINARY BLADDER IN FEMALE (see Blackboard) • The location of the female urinary system sometimes leads to acute cystitis. • If taking antibiotics, continue medicating until the medicine is completely finished. Stopping early only reduces the symptoms. • The vagina sits right on top of the urinary bladder so during pregnancy pressure from a growing fetus increases the need to urinate frequently.
Images of urinary system	[ON SCREEN]| 4 IMAGES OF URINARY SYSTEM (see Blackboard) [ON SCREEN] CLOSE-UP OF URETER (see Blackboard)

Process of urination	[ON SCREEN] PROCESS OF URINATION (see Blackboard) • It is possible to delay urination through external control but you cannot influence internal urinary controls. • Once a certain volume of urine is reached, the bladder signals the brain if it can urinate. If the brain says yes, voluntary controls relax and allow urination.
Terminology for common conditions affecting the urinary system:	[ON SCREEN] TERMINOLOGY FOR EXAM COMMON CONDITIONS AFFECTING THE URINARY SYSTEM • **Glomerulonephritis**: Group of diseases damaging kidneys' blood filtering abilities. Waste and extra body fluid cannot exit. Kidneys can stop working completely if ignored. Other terms used: nephritis and nephrotic syndrome. • **Diuresis** (large discharge of urine) o **osmotic diuresis** resulting from the presence of non-absorbable or poorly absorbable osmotically active substances in the renal tubules. o **pressure diuresis** increased urinary excretion of water when arterial pressure increases, a compensatory mechanism to maintain blood pressure within the normal range. • **Diuretics** (reduction of the amount of water in the body) Drugs act on the kidneys to increase urine output. This reduces the amount of fluid in the bloodstream which then lowers blood pressure. • **Urinary obstruction** (*renal calculi*): kidney stones • **Pyelogram** (an x-ray of the kidneys and ureters after injection of a dye) • **Hematuria**: blood in the urine • **Proteinuri** (excess protein in the urine, as in renal disease or after strenuous exercise) o marathon runners experience significant loss of blood into urine • **Urinalysis**: (testing of the urine) o for methadone or other drugs in users or professional athletes

	• **Renal failure**: deterioration of kidney functions
	• **Hemodialysis**: removal of certain elements from the blood usually twice a week
	• **Transplantation**: Organ replacement
	  o presently, over 100,000 await transplants which depend on acceptable match of surface antigens
	• **Glucosuria**: Excretion of high levels of glucose in the urine
	• **Incontinence**: Inability to control excretory functions
	  o can be caused by sensor stimulation from nearby tissues, abscesses, or trauma

Acid-base balance: Why do we care?	[ON SCREEN ACID-BASE BALANCE: WHY DO WE CARE? • Body is happy if pH IS between 7.35-7.45 • We can live with pH between 7.0-7.8 • 3 dimensional protein structure depends on Hydrogen Bonds • Functional proteins can become denatured causing impaired ATP production, hormone function, immune function, O_2 transport
Acid basics	[ON SCREEN] (see Blackboard) ACID BASICS
pH Explained	pH EXPLAINED • Drawing of pH scale listing different foods and high acidity, neutral acidity and high acidity levels). • This gives you an overview of the spectrum of pH. • What you eat can reduce acidity of urine.

	[ON SCREEN] WHERE DOES H+ COME FROM?
Equation you HAVE to know [check for accuracy]	• EQUATION YOU **HAVE** TO KNOW *[Notetaker comment: double-check equation on Blackboard for accuracy]* $H_2O + CO_2 \rightleftharpoons H_2CO_3$ N $\rightleftharpoons$ H+ plus HCO_3
Mass action	[ON SCREEN] MASS ACTION • CO_2 levels are very important as they increase or decrease pH levels.
Respiratory regulation	[ON SCREEN] RESPIRATORY REGULATION • CO_2 drives the exchange of air to the body. • The medulla is sensitive to CO_2 in cerebrospinal fluid. • If you hold your breath you won't die because when you can't hold your breath any longer, the body will automatically take air in. • The respiratory system is important to keep balance to the change rate of respiration that expels CO_2 . • CRITICAL: Be extremely alert to anyone who has a respiratory problem or impaired breathing ability as this depletes CO_2 levels in the body. • Build-up of CO_2 in the bloodstream causes acidosis of body fluids.
Renal regulation	[ON SCREEN] RENAL REGULATION • Urine is usually acidic due to H+ secreted in the renal tubule through the Na+/H+ antiporter • HCO3 can either be secreted or manufactured in the kidney for long-term regulation of pH. o Some people ingest it to change body pH in the bloodstream.

H+ secretion & HCO3 production	[ON SCREEN] H+ SECRETION & HCO_3 PRODUCTION (see Blackboard)
Buffers	[ON SCREEN] BUFFERS (see Blackboard) • We don't have rapid changes of pH. • Usually it is maintained in the normal range by binding to or releasing H+ • 3 major buffer systems: HCO_3, hemoglobin, plasma proteins (i.e. albumin) o E.g., Baking soda loading: some athletes take bicarbonate of soda to regulate body fluids and get a competitive edge over other athletes. o This causes diarrhea and really does not work that well. [Notetaker comment: Urinary System breakdown at **http://www.harford.edu/faculty/SSchaeffer/BIO%20108-116/dis%2015%20Notes.pd**
Worksheet	[ON SCREEN] WORKSHEET (see Blackboard) • Look at the formula with the double arrows and fill out the worksheet: H_2O+ CO_2 ⟷ H_2CO_3 N ⟷ H+ plus HCO_3 • There is an inverse relationship between CO2 levels o If CO2 goes up, H+ goes up, pH goes down o If CO2 goes down, H+ decreases and pH goes up o If HCO3 goes up, then H+ goes down and pH goes up o If HCO3 down, the H+ increases and pH decreases
Acidosis & Alkalosis	[ON SCREEN] ACIDOSIS & ALKALOSIS • The chart gives a feeling of what is going to happen with raised or low levels. • It is **CRITICAL** that acidosis and alkalosis be diagnosed properly. o If you don't correct problems in the right way you can cause great harm.

	• Be sure you rely on several warning measurements when you diagnose.
	  o A pH of blood lower than7.35 for **acidosis**
	  o A pH of blood greater than 7.45 for **alkalosis**
	
	• Ask questions about patient pH: Is it acidic or basic, respiratory or metabolic?
	
	• Respiratory malfunction occurs if CO_2 (bicarbonate levels in blood) is greater than 40.
	
	• Symptoms are sometimes borderline for acidosis and alkalosis (breathing problems, change in respiration rate)
	
	• Example of metabolic acidosis:
	  o When you vomit you expel a lot stomach acid (pH)
	  o Body fluid pH rises, hydrogen concentration increases
	  o This has nothing to do with respiration
	
	• Study this chart and the numbers as the exam will ask about respiratory or metabolic acidosis and alkalosis

Integration of acid-based control	[ON SCREEN] INTEGRATION OF ACID-BASED CONTROL (see Blackboard]
Questions?	ON SCREEN QUESTIONS? • Go through today's PowerPoint slides • Bring your questions • We will review during class time on Wednesday [CLASS ENDS]