Course Description

Therapeutic and drug product selection, including issues of efficacy, potential toxicities, side effects, compliance, monitoring parameters, drug interactions, and cost will be studied. Pathophysiology will be presented as it relates to disease states and the therapeutic mechanisms of treatment. The student will develop a rational approach to the selection of medications to be prescribed, and studies of medications used in the treatment of acute and chronic illnesses across the lifespan. Pharmacotherapy and Pathophysiology I runs concurrently with Clinical Medicine I and focuses on the therapeutics associated with disease states presented in Clinical Medicine. Some information will be presented in a case study format using patient scenarios to develop clinical pharmacology knowledge. Prerequisites: Successful completion of Pharmacotherapy and Pathophysiology I.

Course Content

This course is designed to provide the learner with a strong foundational knowledge in pharmacology. The student will actively engage in applying information within the classroom and study setting. Lecture, power point, and case learning activities will be employed throughout the course. The specific objectives for this course are to be used as a guide for
reading, studying, and preparing for the course examinations, quizzes, and cases. Students are expected to be independent, self-directed learners.

**Student Expectations**

- demonstrates a positive attitude toward learning
- is on time for all scheduled classes, including timely return from breaks
- completes readings and assignments prior to class
- asks relevant and understandable questions
- takes full responsibility for learning and self-directed learning activities
- shows respect for self, other students, and faculty
- refrains from revealing negative feelings through tone of voice or body language
- refrains from disruptive activities during class including eating, talking, getting up and down, use of cell phone, etc.
- relies on personal resources before approaching others for help
- demonstrates cooperation with and mutual respect for peers
- responds to faculty, staff and peers readily and appropriately

**Instructor Expectations**

- demonstrates a positive attitude towards the facilitation of learning
- is on time for all scheduled classes
- should the need arise, reschedules class time with appropriate and timely notification to students, faculty, and staff
- provides appropriate course materials for class preparation prior to class
- is available for office hours or appointments to assist with questions; responds to faculty, staff, and students readily and appropriately
- listens attentively and initiates communication which is appropriate and timely
- identifies limitations in knowledge and provides appropriate resources for student learning
- provides timely and constructive feedback for assignments and assessments
- shows respect for self, students, and other faculty
- refrains from revealing negative feelings through tone of voice or body language
- demonstrates cooperation with and mutual respect for students, faculty, and staff

**Required Text and Reading**


**Grading**

The course grade for the fall semester will be based upon the following:
Grades will be based on the following:

<table>
<thead>
<tr>
<th>Component</th>
<th>Points</th>
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<tbody>
<tr>
<td>Exams (3 exams x 100 points each)</td>
<td>300</td>
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<tr>
<td>Weekly quizzes and cases</td>
<td>100</td>
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<td><strong>Total Points</strong></td>
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**Letter Conversion Scale**

<table>
<thead>
<tr>
<th>Letter</th>
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<tr>
<td>A</td>
<td>100-93%</td>
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<tr>
<td>AB</td>
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<td>89.99 – 83%</td>
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<tr>
<td>BC</td>
<td>82.99 – 80%</td>
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<td>C</td>
<td>79.99 – 70%</td>
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<tr>
<td>D</td>
<td>69.99 – 60%</td>
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<tr>
<td>F</td>
<td>59% and below</td>
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</table>

**Attendance and Professionalism**

Attendance at all class periods, laboratories, and practical experiences are mandatory unless otherwise indicated. Poor attendance (unexcused absences, tardiness, and unauthorized early departures), lack of preparation, and unprofessional behavior may result in a lower or failing grade and/or be reported to the program progression committee. If you will be absent, tardy, or need to be excused early you must notify the course director via e-mail or phone prior to the scheduled meeting time. Tardiness and unauthorized early departures will be considered unexcused absences unless prior notification is submitted. Unexcused absences of more than 10% of class time may result in a failing grade. Absences are excused only at the discretion of the course director and/or the PA Program Director. Students may be required to make up missed laboratory time (excused or unexcused) at the discretion of the course director.

**Examinations**

There will be 3 exams during the semester. Please refer to the schedule for details. Exams are multiple choice exams and matching and are closed-book. Challenges to examination questions will be accepted for 1 week after the return of scores. Challenges must be submitted in writing via e-mail with two written sources, at least one from recommended course readings.

No books, papers, notebooks, cellphones, smartphones, I-pods, I–pads, blackberry, etc. or backpacks/bookbags will be allowed on/near your desk during an examination. Recommend keeping personal belongings in the back of the room or in lockers. Hats are prohibited during an exam. Cellphones, smartphones, I-pods, I–pads, blackberry, etc must be turned off during an examination.

**Assignments**

Assignments and cases will be required and will be outlined on the LMS course site.

**Statement on Academic Integrity**

The Carroll University Academic Integrity Policy is located in the Carroll University Student Handbook. Students are encouraged to familiarize themselves with it. If a student violates this
policy in any way, the instructor(s) reserve the right to impose a sanction of failure on the assignment/assessment or failure in the course. If you have questions about appropriate citations, please ask your instructor.

**Accommodation for Disabilities**

Any requests for accommodation for physical or cognitive disability must be made through the Walter Young Disability Services Coordinator at Carroll University. Appropriate accommodations will be evaluated based on the program technical standards once notification has been received from the Walter Young coordinator. If an individual student has special needs or concerns about course requirements related to religious beliefs, cultural issues, or other issues, the student must contact the Program Director with a request for accommodation.

**Modifications to the Syllabus**

The instructor and the University reserve the right to modify, amend, or change the syllabus (schedule, course requirements, grading policy, etc.) as the curriculum and/or program require(s).

**Remediation**

Students who receive a D or an F in this or any physician assistant year 1 course will be placed on academic probation.

During the course, a student who scores more than 2 SD below the mean on an exam/assessment may be required to complete additional work. The student will be contacted by the course instructor and asked to meet to discuss the remediation requirements for that particular assessment. Remediation requirements will be determined by the course instructor. When an instructor requires remediation of a student it does not affect the exam/assessment grade, nor does it improve the semester or course grade. Remediation is required to ensure that course objectives are met. It is expected that assigned work for the purpose of remediation be completed in a thorough, professional and timely manner. Satisfactory completion of remediated work will be determined by the course instructor. Students may be required to complete additional work if the original remediation is deemed unsatisfactory.

Students should make every effort to resolve remediation issues with the course director. If a student is unable to resolve such issues s/he may request a review by the Didactic Subcommittee. All decisions made by the subcommittee are final. If remediation is not successfully completed by the end of the course/semester a grade of “Incomplete” will be given until the work is successfully completed. Please note that an incomplete course grade may delay program progression and/or graduation. Information regarding incomplete grades is available in the Graduate Catalog.

**Course Goals**

The goal of pharmacology is to educate physician assistants to provide comprehensive quality health care to all, respectful of patient/client values, committed to ethical principles and grounded in evidence-based practice and clinical reasoning. Graduates will contribute to the profession and communities and be prepared to practice medicine in a variety of primary care
settings under the supervision of physicians. Graduates will be prepared to provide services to medically underserved communities and diverse patient populations.

**Learning Objectives**

**A. Pain Management**
1. Explain how to assess pain
2. Outline which side effects should you monitor when treating a patient for pain (opioid vs non-opioid)
3. Convert one opioid to another via dose conversion chart
4. Calculate an oral dose from an IV dose of opioid and vise versa
5. Prescribe common agents used to treat back pain
6. Differentiate between sedating and non-sedating muscle relaxants
7. Identify common side effects associated with muscle relaxants
8. Summarize medications used for procedural sedation
9. Identify mechanism and pharmacokinetics behind procedural sedation medications

**B. Psychiatric Disorders**

**Schizophrenia**
1. Formulate an initial therapy choice when treating schizophrenia
2. Compare and contrast between a first or second generation antipsychotic medications
3. Recognize positive, negative, and cognitive side effects from antipsychotic medications
4. Describe common side effects associated with first and second generation antipsychotics
5. Name commonly used injectable antipsychotics medications

**Bipolar Disorder**
1. Identify medication used to treat bipolar disorder
2. List common labs used to monitor patients on bipolar medications
3. State common side effect associated with bipolar medications

**Major Depressive Disorder**
1. Name the initial therapy choice when treating depression
2. Differentiate between the classes of antidepressants (i.e. SSRI, SNRI, TCA, etc.)
3. Summarize common side effects of antidepressants
4. Explain the reason antidepressants should be tapered and list common signs and symptoms associated with rapid discontinuation of an antidepressant
5. Identify common drug interactions with MAOi’s
6. Diagnose and identify serotonin syndrome

**Anxiety Disorder**
1. Order a treatment plan for a patient diagnosed with generalized anxiety disorder
2. Monitor side effects associated with medications prescribed to treat anxiety
3. Compare and contrast between different benzodiazepines
4. Describe the abuse potential with benzodiazepines as it relates to other classes of medications
Sleep Disorders
1. Prescribe a safe agent to help in the event of insomnia
2. Adjust sleep medications appropriately in patients that are older
3. Compare and contrast the difference between benzodiazepines and nonbenzodiazepines for the help with insomnia

C. Neurologic Disorders

Multiple Sclerosis
1. Discuss pathophysiology of multiple sclerosis
2. Diagnosis a patient with multiple sclerosis
3. Formulate a treatment option for a patient with multiple sclerosis
4. Outline disease modification
5. Compare different drug options to treat multiple sclerosis
6. Identify controversies with therapy and monitoring needed
7. Compose a treatment plan to provide symptom relief

Epilepsy
1. Select first line treatments for epilepsy
2. Recognize side effects associated with antiepileptic drugs
3. Identify antiepileptic drugs with drug interactions

Headache Disorders
1. Describe the pathophysiology behind headaches/migraines
2. Discuss where specific treatments effect this pathophysiology
3. Compare and contrast the various types of headaches
4. Compose a treatment plan for a basic headache
5. Explain treatment options for:
   a. Abortive / acute treatment
   b. Preventive treatment
   c. Rescue medications
   d. Symptomatic medications
6. Provide evidence for first or second line therapy for each treatment phase

Alzheimer’s Disease
1. Discuss pathophysiology of Alzheimer’s disease
2. Focus on where medications may help
3. Discuss symptom relief

Parkinson’s Disease
1. Discuss Parkinson’s disease mechanism of action
2. Show where medications effect this mechanism
3. Present standard treatment options
4. Elude to best practice
5. Highlight treatment adverse effects
6. Complications that arise from Carbidopa/Levodopa treatment
D. Novel Oral Anticoagulants

1. Compare and contrast between different anticoagulant
2. Describe the potential benefits and different routes with the newer anticoagulants

E. Cardiovascular Disorders

Vasopressors and Inotropes in the Pharmacotherapy of Shock and Hypovolemic Shock

2. List factors affecting blood pressure and cardiac output.
3. Discuss the physiologic basis for lactate and venous oxygen saturation as measures of global perfusion.
4. Describe the oxygen delivery and consumption relationship as it they pertain to perfusion principles and apply to the care of critically ill patients.
5. Describe the effects of catecholamine vasopressors and inotropes on adrenergic receptors and vasopressin on vasopressin receptors and relate these effects to clinical end points.
6. Compare and contrast vasopressors, inotropes, and vasopressin in terms of clinical end points and adverse effects.

F. Rheumatological Disorders

Osteoporosis and other Bone Diseases

1. Identify first line, second line, third line, and forth line treatment options for osteoporosis
2. Describe common side effects and monitoring associated with treatment options
3. Identify medications that can be associated with osteoporosis
4. Prescribe treatment medication for patients who have osteoarthritis
5. Identify contraindications to medications for osteoarthritis
6. Know the differences between NSAIDs and COX-2 inhibitors

Rheumatoid Arthritis

1. Prescribe an initial treatment for a patient with rheumatoid arthritis
2. Identify the role of NSAIDs and corticosteroids in the treatment of rheumatoid arthritis
3. Monitor patients on rheumatoid arthritis treatment
4. Identify cautions and contraindications to therapy

Osteoarthritis

1. Be able to prescribe treatment medication for patients who has osteoarthritis
2. Identify contraindications to medications for osteoarthritis
3. Know the differences between NSAIDs and COX-2 inhibitors

Gout and Hyperuricemia

1. Be able to come up with a treatment plan for a patient with acute gout
2. Differentiate between drug therapy for an acute gout attack and treatment for hyperuricemia
3. Identify when to start treatment for hyperuricemia and an acute gout attack
4. Monitor patients on chronic gout therapy

G. Infectious Disease

Antimicrobial Regimen Selection
1. Identify the need to obtain cultures
2. Understand empirical antibiotic therapy
3. Identify which antibiotics to use safely in a penicillin allergic patient

Antimicrobial Prophylaxis in Surgery
1. Explain the goals behind surgical antibiotic prophylaxis
2. Name organisms associated with common surgical site infections
3. Identify the appropriate antibiotic for pre-op surgical prophylaxis

Bone and Joint Infections
1. Describe the length of therapy associated with osteomyelitis treatment
2. Name common organisms that cause osteomyelitis and joint infections
3. Name antibiotics associated with osteomyelitis treatment

Gastrointestinal Infections and Enterotoxigenic Poisonings
1. Recall and understand the types and causes of infectious diarrhea
   a. Secretory diarrhea
   b. Inflammatory diarrhea
2. Describe when an anti-diarrheal agent (anti-motility agent) can be used
3. Understand and explain under what circumstances antibiotics should be used
4. Prescribe different antibiotics for gastrointestinal infections and enterotoxigenic poisonings

Intraabdominal Infections
1. Introduce the various disease associated with peritonitis
2. Look at common pathogens
3. Discuss empiric antibiotic therapy for each disease

Infective Endocarditis
1. Present risk factors associated with the disease
2. Discuss the various forms
3. Describe treatment
   a. Agents used
   b. Length of treatment

Central Nervous System Infections
1. Identify the need to obtain cultures
2. Understand empirical antibiotic therapy
3. Identify which antibiotics to use safely in a penicillin allergic patient
4. Identify the causes of CNS infections
5. Name treatments for CNS infections  
6. Understand the pharmacology of the blood brain barrier  
7. Know the current data on using dexamethasone in the treatment of CNS infections

**Infections in Immunocompromised**
1. Identify antibiotic choices for neutropenic patients  
2. Choose appropriate antibiotic therapy against a specific organism for causing febrile neutropenia  
3. Prescribe appropriate antimicrobial agents for the prophalaxis of infection in patients with HSCT or organ transplantation

**Sepsis and Septic Shock**
1. Understand the types of organisms responsible for causing severe sepsis and septic shock  
2. Name the antibiotic used to treat severe sepsis based off the suspected cause of infection  
3. Explain why Drotrecogin Alpha is not used to treat sepsis  
4. Apply the principles of cardiopulmonary physiology to hemodynamic monitoring of the septic shock patient.  
5. Compare and contrast methods for assessing intravascular volume status and cardiac function of critically ill patients.  
6. List factors affecting blood pressure and cardiac output.  
7. Discuss the physiologic basis for lactate and venous oxygen saturation as measures of global perfusion.  
8. Describe the oxygen delivery and consumption relationship as it they pertain to perfusion principles and apply to the care of critically ill patients.  
9. Describe the effects of catecholamine vasopressors and inotropes on adrenergic receptors and vasopressin on vasopressin receptors and relate these effects to clinical end points.  
10. Compare and contrast vasopressors, inotropes, and vasopressin in terms of clinical end points and adverse effects.

**Vaccines, Toxoids, and Other Immunobiologics**
1. Differentiate between live and inactivated vaccines  
2. Identify which patient populations need to avoid live vaccines

**Human Immunodeficiency Virus Infection**
1. Match the drug to the class / mechanism of action  
2. Understand management and drug interactions with HIV medications  
3. Identify opportunistic infections associated with HIV infections

**Tuberculosis**
1. Describe the disease and explain why special populations are at risk  
2. Discuss treatment options  
3. Be able to prescribe appropriate treatment to various populations at risk  
4. Be able to prescribe appropriate treatment for the different disease presentations  
5. Know side effects to watch for

**Parasitic Diseases**
1. Describe commonly used antibiotics to treat commonly occurring parasitic diseases
2. Describe monitoring and understand when treatment may require the entire family

**Invasive Fungal Infections**
1. Identify treatments for invasive fungal infections
2. Name, treat, and avoid common side effects to antifungal therapies
3. Understand resistance patterns with different therapies
4. Identify which anti-fungal therapies can cross the blood-brain-barrier

**H. Renal Disorders**

**Acute Kidney Injury and Chronic Kidney Disease**
1. Cover renal disease from acute to chronic presentation
2. Gloss-over lab values associated with renal disease
3. Discuss kidney function and elude to medications needed for renal failure treatment
4. Introduce creatinine clearance calculations and disease states that effect reliability
5. Address causes for acute renal failure with a focus for drug related concerns
6. Consider possible approaches for the prevention of acute renal failure
7. Touch on treatment of acute renal failure
8. Go into chronic renal disease and discuss treatment to prevent progression
9. Explain the treatments needed for the complications of chronic kidney disease

**Hemodialysis and Peritoneal Dialysis**
1. Describe the three primary treatment options for patients with end-stage renal disease
2. Explain the advantages to peritoneal dialysis and hemodialysis
3. List disadvantage of peritoneal dialysis and hemodialysis

**Drug Therapy Individualization for Patients with Renal Insufficiency, Glomerulonephritis, and Drug-Induced Kidney Disease**
1. Cover renal disease from acute to chronic presentation
2. Gloss-over lab values associated with renal disease
3. Discuss kidney function and elude to medications needed for renal failure treatment
4. Introduce creatinine clearance calculations and disease states that effect reliability
5. Address causes for acute renal failure with a focus for drug related concerns
6. Consider possible approaches for the prevention of acute renal failure
7. Touch on treatment of acute renal failure
8. Go into chronic renal disease and discuss treatment to prevent progression
9. Explain the treatments needed for the complications of chronic kidney disease

**Disorders of Sodium and Water**
1. Discuss sodium and water homeostasis
2. Describe hyponatremia and causes
3. Introduce treatment options for hyponatremia
4. Describe hypernatremia and causes
5. Introduce treatment options for hypernatremia
**Disorders of Calcium and Phosphorus Homeostasis**
1. Know the different types of oral calcium tabs for treatment of hyperphosphatemia
2. Identify the noncalcium phosphate binders
3. Compare the different types of calcium that is available in IV formulation
4. Prescribe a phosphate supplementation based off lab values

**Disorders of Potassium and Magnesium Homeostasis**
1. Describe hypo and hyperkalemia
2. Describe ways to treat these condition and point out the type of patients that could be at risk
3. Describe hypo and hypermagnesemia
4. Describe ways to treat these conditions and point out the type of patients that could be at risk

**I. Endocrinologic Disorders**

**Diabetes Mellitus**
1. Be able to identify the onset and duration of action of different types of insulin
2. Name the mechanism of action associated with different diabetes medications
3. Know which medications can be combined together and which combinations to avoid
4. Identify side effects associated with treatment of DM
5. Know the approximate reduction in HbA1C for different agents
6. Name the mechanism of actions for different agents used to treat hyperthyroidism
7. Identify side effects of treatment
8. Be able to identify a treatment timeline

**Thyroid Disorders**
1. Name the mechanism of actions for different agents used to treat hyperthyroidism
2. Identify side effects of treatment
3. Be able to identify a treatment timeline

**J. Ophthalmic and Otolaryngological Disorders**

**Glaucoma**
1. Explain treatment differences between open angle glaucoma and closed angle glaucoma
2. Be able to name mechanisms of action of selected agents
3. Identify side effects associated with glaucoma treatment
4. Be able to prescribe a treatment plan for a patient who has open angle glaucoma

**Allergic Rhinitis**
1. Be able to identify classes of antihistamines
2. Name common side effects for treatments used in allergic rhinitis
3. Be able to tailor therapy based off signs and symptoms of allergic rhinitis
4. Name common agents and their mechanism of action in treating allergic rhinitis
<table>
<thead>
<tr>
<th>DATE</th>
<th>Topic/System</th>
<th>Presenter</th>
<th>READINGS</th>
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<tbody>
<tr>
<td>Tuesday 1/24</td>
<td>Alzheimer’s Disease, Parkinson’s Disease, Headache Disorders</td>
<td>Schmitt</td>
<td>Chapter 38, 43, 45</td>
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<tr>
<td>Tuesday 1/31</td>
<td>Pain Management, Schizophrenia, Bipolar Disorder, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 44, 50, 52</td>
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<tr>
<td>Tuesday 2/7</td>
<td>Multiple Sclerosis, Epilepsy, Status Epilepticus,</td>
<td>Schmitt</td>
<td>Chapter 64, 65, 66</td>
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<tr>
<td>Tuesday 2/14</td>
<td>Major Depressive Disorder, Anxiety Disorder, Sleep Disorders, New oral</td>
<td>Williams</td>
<td>Chapter 51, 53, 55</td>
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<td>anticoagulation therapy, Plus new drug approvals</td>
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<td>Tuesday 2/21</td>
<td><strong>Exam 1 from noon-2pm</strong>&lt;br&gt;Infecive Endocarditis, Tuberculosis, Gastrointestinal Infections and Enterotoxigenic Poisonings, Intraabdominal Infections</td>
<td>Schmitt</td>
<td>Chapter 89, 90, 91, 92</td>
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<tr>
<td>Tuesday 2/28</td>
<td>Antimicrobial Regimen Selection, Central Nervous System Infections, Infections in Immunocompromised, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 83, 84, 100</td>
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<td>Tuesday 3/7</td>
<td>Use of Vasopressors and Inotropes in the Pharmacotherapy of Shock, Hypovolemic Shock, Sepsis and Septic Shock Chapter</td>
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<td>Chapter 13, 14, 97</td>
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<td>Tuesday 3/14</td>
<td>Spring Break</td>
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<td>Tuesday 3/21</td>
<td>Quantification of Renal Function, Acute Kidney Injury, Chronic Kidney Disease, Hemodialysis and Peritoneal Dialysis</td>
<td>Schmitt</td>
<td>Chapter 28, 29, 30</td>
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<tr>
<td>Tuesday 3/28</td>
<td>Antimicrobial Prophylaxis in Surgery, Vaccines, Toxoids, and Other Immunobiologics, Human Immunodeficiency Virus Infection, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 101, 102, 103</td>
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<td>Tuesday 4/4</td>
<td><strong>Exam 2 from noon-2pm</strong>&lt;br&gt;Drug-Induced Kidney Disease, Glomerulonephritis, Drug Therapy Individualization for Patients with Renal Insufficiency</td>
<td>Schmitt</td>
<td>Chapter 31, 32, 33</td>
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<td>Tuesday 4/11</td>
<td>Diabetes Mellitus, Thyroid Disorders, Glaucoma, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 57, 58, 75</td>
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<td>Tuesday 4/18</td>
<td>Disorders of Sodium and Water, Disorders of Calcium and Phosphorus Homeostasis, Disorders of Potassium and Magnesium Homeostasis</td>
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<td>Chapter 34, 35, 36,</td>
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<tr>
<td>Tuesday 4/25</td>
<td>Osteoarthritis, Rheumatoid Arthritis, Osteoporosis and other Bone Diseases, Gout and Hyperuricemia, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 71, 72, 73, 74</td>
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<td>Friday morning</td>
<td>Parasitic Diseases, Bone and Joint Infections, Invasive Fungal Infections, Allergic Rhinitis, Plus new drug approvals</td>
<td>Williams</td>
<td>Chapter 76, 93, 96, 99</td>
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<td>Monday 5/8</td>
<td>Exam 3 Final exam – 9am-10:50</td>
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