Phar 6756 Kidney, Fluid, and Electrolytes

Course Syllabus Spring 2020
2.1 Credits

Day	Time	Duluth Room*	Twin Cities Room*
Monday	1:25-3:20p	LSci 165	Moos 1-450
Wednesday	10:10a-12:05p	Lib 410	WDH 7-135

Course Website: canvas.umn.edu

Instructional Team

If you need assistance with the course, contact one of the Teaching Assistants.

Technology Help, Duluth: 218-726-8847 itsshelp@d.umn.edu
Technology Help, Twin Cities: 612-301-4357 help@umn.edu

Faculty Office Hours: by appointment

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Welcome to Kidney Fluids and Electrolyte Course! **Drs St. Peter and Muster are excited to participate in your learning this semester!** This course is a combination of team-based learning (TBL), lectures and case-based learning. We know you have had TBL in other courses, but there are some differences between TBL in our course and other courses. We use CANVAS for all components of TBL (iRAT, tRAT and case justifications).

Course Content:
About 75% of new cases of chronic kidney disease (CKD) are due to diabetes and hypertension. Patients with CKD oftentimes experience chronic heart failure and anemia. In addition, the kidney is the main excretory route for many drugs. Thus, this course offers a large opportunity to integrate material learned in previous and concurrent courses. This course will build on knowledge of basic kidney function assessment that students gain in their first year in Applied Pharmaceutical Care. It will also build on basic knowledge and clinical application of CV, diabetes and endocrine agents from Medicinal and Pharmacology of CV Agents module, CV, Diabetes/Metabolic Syndrome and Endocrine modules as well as content from Pharmacokinetics and Applied Pharmacokinetics. The topics of electrolyte disorders and CKD anemia integrates knowledge gained from Molecular Metabolism and Nutrition module in regards to mineral deficiencies and supplementation, folate, B-12 and iron metabolism, utilization and management of deficiency anemias. This course also links with the PCLC lab where students will have a more complex integrated case, which encompasses several of the following areas: hypertension, diabetes, dyslipidemia, CKD progression, congestive heart failure or volume overload, acute kidney injury, electrolyte disorders.

This course will also connect with upstream courses. Knowledge gained in this module regarding application of pharmacokinetic principles in patients on intermittent hemodialysis will be expanded in the third year Acute Care module to patients on continuous renal replacement therapies. In addition, knowledge gained regarding aminoglycoside, vancomycin, phenytoin pharmacokinetics and therapeutic drug monitoring across the spectrum of kidney disease will dovetail nicely with Infectious disease and neurology modules in third year. The Kidney and Fluid-Electrolyte module is designed to allow students to learn key concepts and develop specific skills in the management of common fluid and electrolyte and single acid/base disorders and in prevention and management of chronic kidney disease and associated conditions.

The main concepts that students will learn in this course are:

1. Fluid and electrolyte and acid/base balance and maintenance is crucial for health. Disorders must be managed appropriately in adult and pediatric patients to avoid serious complications and death. However, calculations are always estimates and thus monitoring for effectiveness and safety is critical.
2. Estimating kidney function for purposes of drug dosing is just that—an estimation. There is no single formula that is both accurate and unbiased for all patients. Thus, dosing that is based on results from these formulas may not be the right dose for an individual patient and does not take the place of follow-up assessment and monitoring.
3. Drugs are a major cause of acute kidney injury (AKI); but some drugs, such as ACEI, ARBs and RI can work as double-edged swords—used to prevent progression of kidney disease, but used inappropriately can cause AKI.
4. Kidney disease not only affects kidney clearance of drugs, but can also affect absorption, distribution, metabolism processes as well.
5. The Food and Drug Administration Act of 2007 gives the FDA authority to require a Risk, Evaluation and Mitigation Strategy (REMS) for manufacturers of some drugs to ensure that benefits of a drug or biologic product outweighs its risk.
6. Many organizations and regulatory bodies are advocating the use of patient-reported outcomes (PRO) in routine clinical care, population-health and research.

7. Pharmacists can play a critical role in identifying patients at risk for chronic kidney disease (CKD), reducing progression and improving efficacy and safety of medication use in this population.

Course format:
This clinical module is a highly interactive course that will center around team-based learning (TBL). The TBL format will stimulate self-learning, increase experience in working with teams and help develop critical thinking skills that we hope will improve your retention of knowledge and skills necessary to improve patient care and outcomes. There will be eight 2 hour TBL session over the course of the semester. You will be expected to spend about 3 hours (on average) out of class in preparation prior to each TBL. (e.g. YouTube presentations, readings, study guides or cases from Applied Therapeutics textbook). The faculty will "guide from the side", during in-class TBL sessions. There will typically be 3 graded assessments for each TBL session (individual readiness assessment test (iRAT), team readiness assessment test (tRAT) and a graded case-based application exercise. CANVAS will be utilized to capture iRAT, tRAT answers and case-based application answers and appeals.

It is key to understand the difference between TBL and other group-learning strategies. There are five key tenets of TBL.

1. Teams must be formed and held accountable
2. Preparation for class happens before class
3. A Readiness Assurance Process is in place
4. Application of content happens in class
5. Peer evaluation exists

Information on TBL grading can be found below under Grading Information.

An additional 2 hour in-class session each week will be comprised of faculty lectures and faculty-led case-based learning. Students will be expected to spend about 2 hours (on average) out-of-class in preparation for those sessions. No graded assessments will be done during these low-stake learning sessions. Feedback will be given verbally to students by faculty during session. Participoll will be used to assess student knowledge and learning during some of these sessions. Faculty will use class lists to call on individual students and groups during these learning sessions.

Most of the teaching within this course will be guided by Drs. St. Peter, Dr. Muster. But, we will also utilize recognized clinical experts and PGY2 residents as guest teachers for some topics.

In summary, students will be expected to spend about 5 hours a week in outside class preparation prior to TBL, lecture and case-based learning sessions. Students will have 4 hours in-class each week (one 2 hour TBL session, one 2 hour lecture/case based session).

Prerequisites

Applied Pharmaceutical Care, Foundations of Social and Administrative Pharmacy, Medicinal Chemistry and Pharmacology of Cardiovascular Agents, Pharmacokinetics and Applied Pharmacokinetics, Cardiovascular Pharmacotherapy, Molecular Metabolism and Nutrition

Pre-requisite Topics:
Physiology: Kidney clearance, kidney handling of water, Na/K/Mg/Cl/Ca/P and bicarbonate recycling, urine concentration and dilution, RAAS system, ADH and ANF, osmolality and fluid compartments, normal physiology of albumin and blood

Biochemistry, molecular metabolism: Acid/Base chemistry, Citric Acid Cycle, Glucose and glycogen metabolism, Biosynthesis and pathways for lipids; fatty acid metabolism; amino acid degradation, Electrolytes (Na, K, Mg, Phos, Cl, bicarbonate, Ca), theory of nuclear receptor action including Vitamin D

Nutrition: deficiency anemias (iron, Vit B12, folate), potassium and magnesium supplements

Pharmacokinetics: Concepts: ADME, 1 and 2 compartment models, 1st order PKs, LD (concept of why LD needed, weight selection and use of intermittent and bolus equations), MD (calculating dosing interval, use and manipulation of bolus and intermittent infusion equations (e.g aminoglycosides) capacity-limited metabolism, kidney drug clearance, PPB and issues with highly PPB drugs, how albumin binding changes affects Vdtotal, Vdfree (e.g. phenytoin), tissue binding and how tissue binding affects Vdtotal (e.g. digoxin), how dose adjustment strategies (change dose vs change dosage interval) affects Cpmax, Cpavg, Cpmin, concept of therapeutic drug monitoring and applications with common drugs (vancomycin, digoxin, phenytoin), sampling strategies (when to draw drug concentrations); steady-state vs non-steady state

Pharmacogenomics: P-450 System

Applied Pharmaceutical Care: MICs, concentration-dependent killing, time-dependent killing

Pharmacology/Medicinal Agents: Antihypertensives; in particular RAAS agents, beta-blockers, calcium channel blockers, central alpha agonists, hydralazine, differential effect of ACEI/ARBs/RI and dihydropyridine CCB on renal hemodynamics, diuretics: carbonic anhydrase inhibitors, loop, thiazide-like, K+ sparing, insulin, and all oral and parenteral diabetes agents, NSAIDs and kidney related toxicities, corticosteroids, and kidney related toxicities, vasopressin receptor antagonists, bisphosphonates, vitamin D, calcitonin

Cardiovascular module: hypertension, congestive heart failure, dyslipidemia, atrial fibrillation and pharmacotherapy for those conditions, normal EKG

Diabetes and metabolic syndrome module: pharmacotherapy for those conditions

Endocrinology module: Ca/Phos/PTH Axis, primary hyperparathyroidism, pharmacotherapy for osteoporosis

Requirements

Course Materials

Required

- ***Applied Therapeutics: The Clinical Use of Drugs*** (11th ed.), 2018. Baltimore, MD: Lippincott Williams & Wilkins. eTextbook link is on course website home page.
- ***Pharmacotherapy: A Pathophysiologic Approach*** (10th ed.), 2017. McGraw-Hill Education. eTextbook link is on course website home page.
- Eaton DC, Pooler JP. ***Vander's Renal Physiology***, 9th edition. eTextbook link is on course website home page.

Other Materials

- Calculator that can handle log functions
- Laptop, notebook or ipad (device) to access internet during TBL and case sessions

- At least one person at each table has a wired connection to screen so TBL team answers can be displayed to instructors
- We will use ParticiPoll for polling in class.
- CANVAS: This course will use CANVAS to distribute resources and host course activities. We will also be using CANVAS for iRAT assessments and to submit appeals and TBL case justifications.
- Email: Course instructors will communicate through email about course administrative issues. We suggest that you check your U of M email daily.

Attendance Policy

Students are expected to attend class on the campus where they are enrolled. Details for acceptable absences and make-up exams and TBL sessions listed below.

Goals & Objectives

Learning Objectives

Apply knowledge of kidney anatomy and physiology to relevant fluid and electrolyte disorders, and acid/base disorders, changes in glomerular hemodynamics with decreased kidney perfusion states (heart failure, dehydration, overdiuresis, sepsis), effect on glomerular and/or tubular function with diuretics, ACE-Is, ARBs, renin inhibitors, mineralocorticoid receptor blockers, vaptans and mechanisms of kidney injury with drug-induced causes.

Practice using the Pharmacists' Patient Care Process to collect relevant patient information, assess therapy in the context of patient's health and medication history and health goals, develop an individualized patient-centered care plan, implement the plan and follow-up.

Assess adult and pediatric patients with fluid-electrolyte (hypo- or hypervolemia, hypo- or hypernatremia, kalemia, magnesemia, calcemia, phosphatemia) and acid/base disorders; provide safe, effective and convenient plan for management of these disorders given patient demographic factors and clinical characteristics.

Describe mechanisms of action for common drugs that cause drug-induced acute kidney injury (AKI). Assess adult and pediatric patients for drug-induced AKI and develop a safe, effective and convenient plan for prevention and management of drug-induced AKI given patient demographic and clinical characteristics. Utilize evidence-based KDIGO guidelines on AKI to form plan.

Assess risk of progression of kidney disease in adult patients with chronic kidney disease. Develop a safe, effective and convenient plan to reduce risk of kidney disease progression in CKD patients with hypertension and/or diabetes. Utilize guidelines to form plan. Interpret epidemiologic evidence from key studies on effect diabetes treatment has on CKD progression in patients with diabetes.

Assess patients with CKD, congestive heart failure (CHF) and/or hypertension for need for diuretic therapy. Develop a safe, effective and convenient plan for diuretic use across care settings in patients with CKD, CHF and/or hypertension who require diuretics.

Assess patients with CKD-related anemia. Develop a safe, effective and convenient plan for erthyropoiesis stimulating agents (ESAs) and iron therapy in patient with CKD. Incorporate KDIGO guidelines, FDA Risk Mitigation Strategy for ESAs and use of patient-reported outcomes in care plan

development. Describe how the Dialysis Prospective Payment System (capitated payment model) has affected erythropoietin stimulating agent (ESA) and intravenous iron use in dialysis patients.

Assess patients with CKD-related Mineral and Bone Disorder (CKD-MBD). Develop a safe, effective and convenient plan for phosphate binders, nutritional vitamin D and active vitamin D analogs and calcimimetics in patients with CKD.

Apply appropriate kidney function estimating formulas to estimate kidney function for purposes drug dosage adjustment in special patient populations with chronic kidney disease (obesity, geriatric and pediatric patients)

Utilize appropriate drug resources and pharmacokinetic equations to develop safe, effective and convenient regimens for aminoglycosides, vancomycin, digoxin, phenytoin and other key drugs in ambulatory and hospitalized patients with CKD.

Assessments and Grading

Assignments and learning activities

Multiple graded and non-graded assessments will be used in this course.

Individual Assessment: Student individual readiness for team-based learning (TBL) will be assessed at beginning of each TBL session through an individual readiness assurance test (iRAT). Individual assessment will also be accomplished through 2 multiple choice exams (mid-term and comprehensive final exam) as well as through an individual oral comprehensive exam mid-semester that integrates learnings from this course as well as endocrine, diabetes and metabolic syndrome. All of these assessments will be graded. In addition, non-graded Participoll questions will be used throughout lectures to assess student's grasp of concepts to guide instructor teaching and facilitation as well as provide ongoing formative assessment to students.

Team assessments: Team readiness assurance test (tRAT) and team case justification will be graded for each TBL.

Learning Activities: Team-based learning (TBL) will be used consistently throughout the course to encourage individual readiness and preparation before class. Teamwork and communication skills will be honed during TBL activities (tRAT and case-based sessions) and non-TBL case-based learning. Participoll questions and cases will be used to engage students and allow them to practice their knowledge and skills without being graded. Real-life cases will be utilized for both TBL and non-TBL case sessions throughout course to simulate real-world pharmacy practice.

Why TBL?
TBL is an active learning teaching strategy that assists students in learning how to apply course concepts. Students are given readings or other background materials to be completed outside of class, prior to the class session. Students are expected to come to class prepared and will be held accountable for that preparation via the Readiness Assurance Process (RAP) and peer evaluations. The RAP includes an individual test (iRAT) and a re-taking of the same test as a student team (tRAT).

Student teams are formed through a randomization process based on a survey completed before the beginning of the semester. The goal of the survey is to create diverse groups considering experiences, strengths, and professional involvement. Following completion of the iRAT and tRAT, the majority of class time involves the use

of application exercises in teams (e.g. patient cases). These application exercises are designed to help prepare you for real-life pharmacy practice where team-based care is becoming the standard.

Assessing your team members' strengths and weaknesses is a critical piece of TBL. Peer assessment helps you prepare to assess peer pharmacists, technicians or others who you will manage. Giving a peer a perfect score when their contribution does not merit it does not help that person change behavior and harms the team. Anonymous peer evaluations will be conducted **twice during the semester in the PCLC**. Students will earn the grades from each peer evaluation: Midsemester: 10 pts for completion of evaluation for self and peers, 10 pts for proper completion of the evaluation(unique comments for each individual and different scores for each person on team for Q5)m; End-of-semester: 5 pts for proper completion of the evaluation for self and peers; up to 15 pts for peer-reviewed team contribution15 pts for S+, 12 pts for S, 9 pts for S-); these points may be adjusted upward or downward by instructor discretion based on Phar 6756 KFE-specific comments provided by peer-reviewers), for a total of 20 points for each peer evaluation. These grades will be added together for a possible score of 40 points (~10%) of total class grade). Thus, when you complete the peer-evaluation, you need to consider your team-member's contributions in all Spring 2020 courses that use PCLC teams. If team-member's action/behavior is different in KFE course vs other courses (e.g. classmate comes prepared for PCLC but not for KFE), please use comment section to specify KFE and the behavior/action (good or bad) that you want to highlight.

Because we feel so strongly that the team-based approach is valuable to your professional development, **it will be considered an Honor Code Violation if the iRAT is completed and submitted outside of class or if you are absent from class and take credit for team-portions of TBL sessions**. You need to be present to participate in team activities. In order to create excellent TBL learning materials, we use materials from year-to-year. Thus, **it will also be considered an Honor Code Violation if you copy any TBL materials**.

Graded Assessments

Assessment	Points	% of Grade*
7 TBL Sessions	15 points each 105 points total	27.3%
Midterm Exam	100	26.0%
Comprehensive Final Exam	120	31.1%
TBL Peer Review	20 points mid-term 20 points end-of-semester 40 points total	10.4%
Oral Exam	20	5.2%
Total	**385 points**	**100%**
Completing Final Course Eval (Optional)	+4 Extra Credit points	+1.0%

*Approximate percentage. Will be determined at end-of-course. Total points may change if some graded assessments are dropped.

Course Letter Grades

Grade	A	A-	B+	B	B-	C+	C	C-	D	F
%	100-93	92-90	89-87	86-83	82-80	79-77	76-73	72-70	69-60	59-0

Grading Information
The grade for this course will be determined by the points obtained from TBL sessions, 1 mid-course written exam, 1 final comprehensive written exam, 2 peer-review evaluations and 1 integrated oral exam. A maximum of 385 (expected) points may be earned over the semester. 105 points will be determined through TBL assessments, 100 points will be allotted to the mid-course exam, 120 points will be allotted to the comprehensive final exam, 40 points for team-based peer evaluation and 20 points for kidney-related portion of comprehensive oral exam.. A final grade for the course will be obtained by adding up the points gained for each graded assessment and dividing by 385, the total possible. We will give you an extra 4 points if you complete the course evaluation. See graded assessments table above.

Exam grading: The exams will not be graded on a curve. Challenges to specific exam questions need to be emailed to course directors within 7 days of post-exam review session. Requests beyond 7 days post-exam review will not be evaluated.

TBL Grading: Each TBL session will be allotted 15 points. Individual and team readiness assessments (iRATs and tRATs) will be worth 5 points each. After the tRAT, a team may appeal an answer by writing down reason and support for their answer choice and submitting on CANVAS. This must occur and be given to the instructor before any large group discussion of tRAT questions occurs. **Only teams which appeal will be granted credit for successful appeals**. Case portion of TBL will be worth 5 points. Student teams will be asked to justify why they feel their case answer choice is correct (best) and why other answers are not correct (or not the best answer). You will also be graded by your peers on how well you performed as a team member. See "**Assessing your team members' strengths and weaknesses is a critical piece of TBL."**

CANVAS Gradebook: It is your responsibility to monitor your CANVAS gradebook on a weekly basis. You must notify grading TA within one week of a grade posting in CANVAS, if you think the grade is incorrect or if your grade is missing. Requests to evaluate missing or possible incorrect grades will not be considered after that point.

Statement on Penalties for Late Work
Late work will not be accepted. See information below regarding absence from Exams, TBL or case sessions.

Exam Policy
Mid-Course and Final Exam: There will be 2 exams (1 mid-course and 1 comprehensive final exam) consisting of multiple-choice questions of which the majority will be case-based. Each question will be weighted equally in determining your grade for the course. Exams will be given in-class and will be proctored. Exams are not open-book; key laboratory values and some formulas will be supplied on exam. Some questions may require mathematical calculations. Tablets, iPads, IPods, computers or cell phones are not allowed during exams. You will need a calculator that can do log functions. A programmable calculator is acceptable assuming no data are stored that would advantage the test taker over others. Exam dates will not be changed from those printed in the course schedule. Should the University be closed due to an unforeseen event, the exam will be rescheduled. Seats will be assigned in the classroom for each exam. Instructors will provide seating instructions as you enter the room.

Review of Exams: Exams are updated and reused from year to year and are therefore not returned to the student. Post-mid-term exam review session with faculty and TAs will be scheduled within 2 weeks of mid-term. Students will be given the opportunity to review their exams at this time. Thus, students desiring to review their exams need to attend the scheduled review sessions. If you have extenuating circumstances which preclude participating in reviews at the scheduled time, you may request an appointment with a TA to review the exam outside of those set times. Faculty discretion will be used to determine if the extenuating circumstance is reasonable. Any questions regarding exams should be referred to the course directors by email.

Absence from Exams or TBL or Case sessions
Exams: MAKE-UP EXAMINATIONS WILL NOT be offered except under circumstances as allowed by University and College of Pharmacy Attendance Policy (see University of Minnesota and College of Pharmacy Central Syllabus link at end of syllabus). Additional circumstances will be considered at the discretion of the course or section director, but are not likely to be granted. If a student is unable to attend the scheduled exam, both Drs St. Peter and Muster must be notified (by email AND phone) at least 24 hours in advance of the exam time (where possible). If you do not receive a reply to your request prior to the exam time, do NOT assume that your request has been granted; contact us again to confirm that your request was received and processed. If an acceptable circumstance or adequate documentation is not provided to course directors, a grade of zero on the exam will be assigned. Unless there are extenuating circumstances, students must contact the course director within 24 hours before the missed scheduled exam in order to be considered for a make-up exam; the make-up exam date is generally not more than one week after the original exam date.

Team-Based Learning (TBL) Sessions**: *TBL sessions will not be recorded*.** If you are absent for a TBL session, you will receive 0 points for that session. TBL sessions can't be made up. *Regardless of excused absence unexcused absence or no absence your lowest TBL session score will be dropped and your total TBL score (out of 105 points) will be adjusted for the dropped score*. If you are late to a TBL session, notify the TA immediately upon arrival so that you receive points for parts of the TBL session you participated in. If you wait until after class to notify TA, you will receive 0 points for the TBL session.

Case sessions are excellent learning opportunities and you are expected to attend. No formal assessments will be done during case sessions, but material from case (and TBL) sessions will be assessed on exams.

Course Grade and Minimum Passing Level
In order to pass this course you need to have a mean grade of 60% or more on both exams (at least 132 points out of 220 total exam points) and a mean grade of 60% or more over the entire course (240 points out of a course total of 385 points). Common rounding rules will be applied to the final letter grade only where 0.5 and higher will be rounded up to the next whole number. **Failure will require the student to re-take the entire course in the next year.**

Statement on Extra Credit
No extra credit work/projects will be given to students.

Course Evaluation
We would appreciate you taking the time to fill out the course evaluation at the end of the semester. We take these evaluations seriously and modify our course to better meet student needs. In appreciation of your time, we will give you 4 'extra-credit' points (1% course total) for filling out the course evaluation.

Schedule: Mondays 1:25 pm to 3:20 pm in LSci 165 and Moos 1-450 and Wednesdays 10:10 am to 12:05 pm in WDH 7-135 and Lib 410

Note: See Pre-course folder on CANVAS for objectives and Pre-class assignments for each session.

Week 1	
Wednesday January 22 **Dr. St. Peter** **Dr. Muster**	**Course Introduction and Mock TBL iRAT/tRAT** **Kidney Anatomy and Physiology**
Week 2	
Monday January 27 **Dr. Muster** Dr. St. Peter	**Kidney Physiology and Drug Effects**
Wednesday January 29 **Dr. Muster** **Dr. Jensen** Dr. St. Peter	**Kidney Physiology and Drug Effects, cont. (1st 0.5 hr)** **Pediatric Fluid and Electrolyte Disorders (1.5 hr)**
Week 3	
Monday February 3 **Dr. Skaar** Dr. Muster Dr. St. Peter	**Fluid Compartments and Management** **Sodium Disorders**
Wednesday February 5 **Dr. Skaar** Dr. Muster Dr. St. Peter	**Sodium Disorders, cont.** **Potassium Disorders**
Week 4	
Monday February 10 **Dr. Skaar** Dr. Muster	**Potassium, cont.** **Magnesium Disorders**
Wednesday February 12 **Dr. Muster** Dr. St. Peter	**TBL Session 1: Acid-Base Disorders**
Week 5	
Monday February 17 **Dr. St. Peter** Dr. Muster	**Introduction to Chronic Kidney Disease (CKD), Epidemiology, Pathophysiology and Management** **Assessment of Kidney Function in Special Populations for Staging and for Purposes of Drug Dosing (obese, pediatrics, elderly)**

Wednesday February 19 **Dr. St. Peter** Dr. Muster	**Assessment of Kidney Function in Special Populations for Staging and for Purposes of Drug Dosing (obese, pediatrics, elderly), cont. (1st hour)** **Acute Kidney Injury (2nd hour)**
Week 6	
Monday February 24 **Dr. St. Peter** Dr. Muster	**CKD Progression**
Wednesday February 26 **Dr. Lindsay Laird** Dr. St. Peter Dr. Muster	**TBL Session 2: Drug-Induced Kidney Disease**
Week 7	
Monday March 2 **Dr. St. Peter** Dr. Muster	**CKD Progression cont… (1st hour)** **Diuretic therapy (2nd hour)**
Wednesday March 4 **Dr. Muster** Dr. St. Peter	**TBL Session 3: Diuretic Therapy for Volume and Hypertension Management in CKD, and CHF**
	Spring Break March 9th to 13th
Week 8	
Monday March 16	**NO CLASS CPF Day (1:25-4:30p)**
Wednesday March 18 **Dr. St. Peter** Dr. Muster	**Calcium Disorders**
Week 9	
Monday March 23 **Dr. St. Peter** Dr. Muster	**Phosphorus Disorders (1st hour)** **Case session: Prep for Mid-Term exam (2nd hour)**
Wednesday March 25 **Dr. Sam Hsu** **Dr. Muster**	**Mid-term Exam: Covers through diuretic therapy**
Week 10	
Monday March 30 **Dr. St. Peter** Dr. Muster	**Anemia of CKD**

Deleted:

Wednesday April 1 **Dr. Walburg** **Dr. Massey** Drs. St. Peter & Muster	**TBL Session 4: FDA Risk-Mitigation Strategy, Patient-Reported Outcomes (SAPh topic)**
Wednesday April 1 **Dr. St. Peter** **Dr. Muster**	**Post-Mid-Term exam review 1:25 to 2:15 pm (Rooms TBD)** **(optional; review won't be recorded)**
Week 11	
Monday April 6 **Dr. St. Peter** Dr. Muster	**Pharmacokinetic Alterations in CKD (1st hour)** **Pharmacokinetics Primer Relating to CKD Drug Dosing—Focus on Aminoglycosides (2nd hour)**
Wednesday April 8 **Dr. St. Peter** Dr. Muster	**TBL Session 5: Pharmacokinetic Alterations in CKD (ADME); Drug Dosing in CKD Stages 3-5 Non-Dialysis**
Week 12	
Monday April 13 **Dr. Muster** **Dr. St. Peter**	**Case Session-Pharmacokinetic Alterations in CKD (ADME); Drug Dosing in CKD Stages 3-5 Non-Dialysis**
Wednesday April 15 **Dr. St. Peter** Dr. Muster	**TBL Session 6: Therapeutic Drug Monitoring (TDM) in CKD Patients with Focus on Digoxin and Phenytoin**
Week 13	
Monday April 20 **Dr. St. Peter** Dr. Muster	**Altered Pharmacokinetics in CKD with Focus on Vancomycin (1st hour)** **Introduction to Intermittent Hemodialysis (2nd hour)**
Wednesday April 22 **Dr. St. Peter** Dr. Muster	**TBL Session 7: Vancomycin and Aminoglycoside PKs and Dosing in CKD**
Week 14	
Monday April 27	**In Class Pre-Final Exam Case Review (optional)**
Wednesday April 29 **Dr. St. Peter** **Dr. Muster**	**FINAL EXAM 1:25 to 4:25 pm (Moos and LSci rooms TBD)**
Final Exam: Wed April 29 from 1:25 to 4:25 pm (Rooms TBD)	

University of Minnesota and College of Pharmacy Central Syllabus - Google Docs [This page includes all required UMN and CoP policies, e.g., Academic Freedom; Copyright; Course Evaluations; Disability Accommodations; FERPA, etc.]