Course Outline and Syllabus for Students

Name: Peter G. Wells

Course Number: PHM340 (formerly PHM325)

Course Title: Introductory Toxicology

Course Description:

Concerned primarily with drug-induced diseases, this lecture course provides students with a conceptual framework for understanding the broad spectrum of toxicological problems encountered in clinical practice, in drug development and regulation, and in medical research. Central biochemical mechanisms and the relevance of clinical factors to toxicological expression will be integrated and applied to illustrative models of drug-related diseases in humans.

Required: Yes

1. Course Learning Objectives:

Upon completion of this course, students will have achieved all of the following levels of learning objectives:

- **Introductory** = knowledge and comprehension of concepts, definitions
- **Intermediate** = application of concepts to simple situations
- **Advanced** = application of concepts to more complex situations with ability to synthesize and evaluate

**Knowledge**

In the first half of the course, the student will acquire a basic knowledge of the nature and magnitude of drug toxicity, diagnostic complications, mechanisms of drug toxicity, how individual risk is modulated by pharmacological, physiological and pathophysiological factors, and basic approaches for the evaluation of drug toxicities. Emphasis is placed upon toxicities due to electrophilic and free radical reactive intermediates and oxidative stress, while overlap with receptor-mediated mechanisms covered in courses in pharmacology and therapeutics is minimal.

In the second half of the course, principles learned in the first half are applied in detail to a limited number of clinically relevant examples of serious drug toxicities, including liver and kidney damage, neurodegeneration, teratogenesis, carcinogenesis and immune-mediated hypersensitivity reactions.

**Skills**

To facilitate the development of an advanced level of learning, essay format examinations are employed for two midterm examinations and a final examination. Exam essay questions require students to use a detailed knowledge of concepts and underlying mechanisms to provide comprehensive answers to complex toxicological questions similar to those encountered in clinical practice and careers in government, the pharmaceutical industry and academia. To develop the student’s ability to employ information from multiple sources in synthesizing comprehensive answers, tutorials are provided before and after each midterm examination showing the breadth and depth of approach required.

**Attitudes/Values**

Students are acquainted with the relevance of toxicological expertise in health care and society, along with issues of professional responsibility and associated ethical issues, by the regular presentation of current news reports from the print and television media at the beginning of lectures, and several movies covering major issues in drug toxicity.

2. Rationale for Inclusion in the Curriculum:

Adverse effects are a potential complication all drug therapy, including the use of non-prescription products. An informed knowledge of toxicological mechanisms, the determinants of individual risk, and the application of this knowledge to clinical
problems, drug product development, the regulatory process and improved drug safety are essential for Pharmacists in clinical practice and in careers in the pharmaceutical industry, government and academia.

3. Pre-requisites:
Pathobiology & Pathology, Anatomy, Metabolic Biochemistry, Molecular Pharmacology, Pharmacokinetics, Physiology

4. Statement of agreement from course coordinators of courses for which this course is a pre-requisite:
N.A.

5. Co-requisites: (for the current and subsequent year)
N.A.

6. Statement of agreement from coordinators of courses for which this course is a co-requisite:
N.A.

7. Course Contact Hours and Teaching Methodologies:

<table>
<thead>
<tr>
<th>Didactic (lecture)</th>
<th>26 hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large Group Size</td>
<td>240 persons</td>
</tr>
<tr>
<td>Tutorials (four, voluntary, in scheduled lecture times)</td>
<td>(4 hours)</td>
</tr>
<tr>
<td>Midterm examinations (two, in scheduled lecture times)</td>
<td>(2 hours)</td>
</tr>
<tr>
<td>Total course contact hours (Excluding tutorials &amp; midterm exams)</td>
<td>26 hours</td>
</tr>
</tbody>
</table>

8. Estimate and description of student's weekly out-of-class preparation time excluding exam preparation:
Students are expected to review the handouts prior to class, and may read supplementary papers posted on Blackboard or recommended textbooks for clarification of principles or application.

9. Course Coordinator and contact information:
Peter G. Wells: pg.wells@utoronto.ca

10. Course Instructors and contact information: Contact information provided in course schedule
Peter Wells
Rebecca Laposa
Jack Uetrecht
Grazyna Kalabis

11. Required Resources/Textbooks/Readings:
Required material is provided in the course handouts posted on Blackboard

12. Recommended Resources/Textbooks/Readings:
Recommended references are listed in the course information posted on Blackboard
13. Topic Outline/Schedule: For each, indicate level of knowledge, skills and attitudes learning objectives

**Weeks 1-6**

**Topic/Lesson Objectives:**
- **Knowledge:** As discussed above, for the basic principles listed below.
- **Skills/Attitudes:** As discussed above.

**BASIC PRINCIPLES**
- Introduction to toxicology
- Pharmacological principles
- Mechanisms:
  - Receptor-mediated vs. reactive intermediate-mediated toxicity
  - Reactive oxygen species
- Modulators of toxicity:
  - Pharmacological factors
  - Physiological factors
  - Pathophysiological factors
- Toxicological evaluation

**Preparation/Readings:** Course handouts

**Pre-requisite/Co-requisite knowledge and skills:** Course pre-requisites listed above.

**Weeks 7-13**

**Topic/Lesson Objectives:**
- **Knowledge:** As discussed above, for the model drug-induced diseases listed below.
- **Skills/Attitudes:** As discussed above.

**DRUG-INDUCED DISEASES**
- Hepatic toxicity: mechanisms and clinical consequences
- Drug-induced neurodegenerative disease
- Renal toxicity
- Chemical teratogenesis: mechanisms and clinical consequence
- Chemical carcinogenesis
- Immunological toxicity

**Preparation/Readings:** Course handouts

**Pre-requisite/Co-requisite knowledge and skills:** Course pre-requisites listed above.

14. Assessment Methodologies Used:

**Essay examinations**
- 1st Midterm exam 1 hour 25%
- 2nd Midterm exam 1 hour 25%
- Final examination 2 hours 50%

Although some course material covered by each successive examination is not cumulative, knowledge of a number of basic principles must be retained for all examinations. The cumulative principles are specified to the students and repeatedly emphasized and reinforced in the lectures throughout the course.

*Expectation for pass grades for all Pharmacy courses is 60%.*

15. Policy and procedure regarding make-up examinations:

As described in the Faculty Calendar.

16. Policy and procedure regarding supplemental examinations:

As described in the Faculty Calendar.