2021 Course Syllabus:

Drug Development Course: From Molecule to Prescription

Weill Cornell Graduate School - Tri-Institutional Therapeutics Discovery Institute

ABOUT THIS COURSE

This course has been designed in collaboration with drug development experts from Roche and provides a foundation of integrated knowledge of the multi-disciplined process of developing a new medication. It includes real world challenges encountered in the areas of discovery, development, manufacturing, global regulatory approval and commercialization of new medicines. In addition, the impact of emerging technologies to healthcare and the development process will be considered.

While each lecture could be a topic for one (or more) graduate course, the goal of this integrated program is to provide an introduction to the whole drug development process, to raise awareness of all the different aspects that need to be considered to bring new medicines to patients, and to elicit interest for young investigators.

WHO IT IS FOR

Graduate students in the life sciences who are future researchers, prescribers or potential participants in the development process will benefit from this comprehensive view of how drugs are developed.

FACULTY

The lectures will be given by professionals with expertise and long experience in drug development most of whom work at Roche or have worked at Roche. The current list of instructors is draft and will be defined based on recommendations and approval by Roche senior management for each specific subject matter

STRUCTURE

12 Lectures (1.5 - 2 hr. each) including real world case studies
Target size: approximately 40 students
Students will be divided in 6 - 8 groups, at the beginning of the course a “research problem’ will be assigned to each group. It is expected that at the end of the course each group will present their assignment and proposed solutions (i.e. 20 min presentation and 10 min for Q&A)
Assessment: Mid Term and Final Exams (multiple choice), plus evaluation of the research exercise

TIME and LOCATION

Thursdays starting on **January 7 2020** (3 – 5 pm)
Auditorium A-250 (2nd Floor), 1300 York Ave, New York, NY 10065 unless otherwise indicated

Session 1 – Jan 7

Overview of the Discovery and Development Process
Instructor: Ignacio Rodriguez, MD, Head Patient Safety - Immunology, Hepatology & Dermatology, Novartis Pharmaceuticals

- Drug Development Pathway: how to go from molecule to medicine
- target product profile
- types of compounds (small molecules - biologics - antibody / drug conjugates, vaccines)
- different phases in development, approval, and life cycle management
- current and future drug development process
- success metrics, timelines, costs

Session 2 – Jan 14

Overview of the Discovery Process
Instructor: Peter Dragovich PhD. Staff Scientist, Medicinal Chemistry, Genentech, South San Francisco, California

- Target identification and validation
- assay development and screening
- animal models of disease
- Lead identification, lead optimization and clinical candidate selection

Session 3 – Jan 21

Non-Clinical safety and DMPK considerations

Instructors: Gaurav Tyagi, BVSc, PhD, DACVP, DABT Principal Scientist Pharmaceutical Sciences; Li Yu, Ph.D., Pharmaceutical Sciences, Expert Scientist Pharmacokinetics, Dynamics and Metabolism Leader, Roche Innovation Center New York

- What are desirable ADME properties?
- Points-to-consider in DMPK at different stages for drug discovery and development
- Translational PK/PD modeling
- Early in vitro tests to screen and predict toxicity
- Regulatory Toxicology (including ICH guidelines)
    - GLP vs non-GLP studies
    - Acute vs Chronic studies (selection of species, duration and evaluation)
    - Safety Pharmacology
    - Mutagenicity and Carcinogenicity studies
    - Reproductive and Developmental Toxicology studies
- Mechanistic Toxicology (including biomarkers)
- New trends in preclinical evaluation (integrated assessments, organ on a chip, stem cells, etc)
- Differences between evaluation of small molecules & biotherapeutics

Session 4 – Jan 28

Transforming Novel Molecules to Medicines: Technical Perspective

Instructor: Hitesh Chokshi PhD. Senior Leader, Pharma Technical Development, Roche Innovation Center New York

- CMC activities, partners, and deliverables
- How “drug like” is molecule?
    - Developability alerts
    - Target drug product profile
    - Scalability of API and drug product to meet clinic / market demand
    - Process and product quality attributes --> Robust product
- Drug Delivery – Past, Present and Future
- Future drug modalities – Challenges and Opportunities

Session 5 – Feb 4

Use of Emerging Technologies to Address Industry Challenges

Instructor: James Cai PhD. Head of Data Science, Roche Innovation Center New York

- Emerging Technologies and approaches in drug development
- Use of biomarkers and diagnostics
- PHC
- Real world data
- Use of electronic medical records

Session 6 – Feb 11

Drug Development is a Tightly Regulated Science

Instructor: Megan Zoschg Canniere, Pharm.D. Head of Regulatory Affairs, Spark Therapeutics, Inc., Philadelphia, PA

- History of Regulation
- Regulatory requirements in different countries (focus on FDA and EMA)
- Regulatory interactions at different phases of development
- CTA - IND - NDA
- Tools for expedited review and approval
- Safety database
- Regulatory compliance and post approval commitments
- Pediatrics

Session 7 – Feb 18

Biostatistics in drug development

Instructor: Steven Blotner, Senior Statistical Scientist. Biometrics Roche Innovation Center New York

- role in the different phases
- novel designs (example: CRM vs. 3+3)
- Types of Endpoints in Clinical Trials
- Blinding, Randomization, and Stratification
- Hypothesis Testing and Error Probabilities
- Multiple Testing
- Interim Analyses
- Sample Size and Trial Duration
- Minimum Detectable Difference
- Confidence Intervals
- P-Values

Session 8 – MID-TERM EXAM – Feb 25

Spring Break – Mar4

Session 9 – Mar 11

Overview of the Early Clinical Process (from First in Humans to Proof of Concept)

Instructor: Joseph, Grippo, PhD, Expert Scientist, Clinical Pharmacology, xxxx

- Key goals in early clinical development
- How to design and conduct EIH studies
  - Translating preclinical data to clinical
  - Study design questions: Study Design options- parallel group, crossover, adaptive, randomized, blinding, etc
  - Dose selection, dose progression (safety and PD/efficacy considerations)- small molecule vs biologic
  - Population (HVs vs. patients)
- Phase II Studies
  - Patient selection
  - Designs (e.g. adaptive, dose range finding, open-label vs blinded, dose selection)
  - Exposure response analysis: Biomarkers/surrogate efficacy measurements and the role of modeling and simulation
  - Proof of Mechanism / Proof of Concept
  - Dose selection
- Supporting Studies (DDI, Special Populations, Abuse Liability, TQT)

Session 10 – Mar 18

Key Concepts in Clinical Pharmacology

Instructor: Joseph, Grippo, PhD, Expert Scientist, Clinical Pharmacology, xxxx

- Ultimate goal is a useful prescribing information
- Absorption, Bioavailability, Distribution, Metabolism, and Elimination
- Dose-Exposure relationships
- Quantitative Pharmacology/Pharmacometrics
- Clinical Pharmacodynamics
- Disease models
- Principles of PK/PD modeling and simulation

Session 11 – Mar 25

Clinical Safety and Pharmacovigilance

Instructor: Felix Aarellano, MD, Global Head Safety Management, F.Hoffmann-La-Roche, Basel, Switzerland

- What is expected at each phase
- Principles of Pharmacovigilance
- Expected and Unexpected AE in clinical trials
- SUSAR and Reference Safety Information
- Safety Signals and Signal Detection Plan
- Risk Management Plans
- Post approval safety commitments

Session 12 – Apr 1

Confirmatory Phase and Post Approval Activities

Instructor: Mark Eisner, MD, Senior Vice President, Global Head of Immunology, Infectious Disease, and Ophthalmology Clinical Development, Genentech, South San Francisco, California

- Pivotal Phase 3 studies
  - Key objectives
  - Logistical considerations
  - Choice of controls
  - Subgroup analysis
  - Interim Analyses (early stops for futility, safety or efficacy)
- Safety database
- What else is needed in this phase
- Regulatory submission for approval
- Post Approval Activities (surveillance, post approval safety studies, new indications)

Session 13 – Apr 8

Strategic & Tactical Considerations and Business Models

Instructor: Patrick Schleck, Pharm D, MBA, Global Head Business Development, Immunology, Infectious Diseases, and Specialty Care at Roche

- Indication Selection
- Risk Tolerance
- Target Product Profile
- Global Product Strategy
- Team Structure
- Roles and Functions
- Partners: Investigator Sites, CROs, Patient Advocacy Organizations, Disease Foundations
- Overview of business models in drug development
  - How to get funding
  - Commercial aspects of the TPP
  - Return on investment
  - Patent life

Session 14 & 15 – Apr 15 and Apr 22

Project Presentations (class)

- Each group will present their case study and the recommendations
- Sessions will be graded by a panel of experts from the lecturers and experts from the academic institution

Session 16 FINAL EXAM – April 29