Planning and Implementation of Pharmacogenomics into the UIC College of Pharmacy PharmD Curriculum

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Goals and Objectives

- To review the integration of pharmacogenetics/genomics (PGx) in the University of Illinois at Chicago (UIC) PharmD curriculum
  - Background/History
  - "Process"
  - Where we are
  - Moving forward

Overview

- UIC PharmD program has an "integrated" curriculum
  - Vs. stand alone pharmacology, therapeutics, medicinal chemistry courses
- UIC Research Mission has identified pharmacogenomics as an area of focus
- Integrated course structure + faculty with research interests in PGx = PGx throughout the curriculum
  - PGx integration a result of this organization and mission structure vs. integrated via a predefined plan

UIC College of Pharmacy

- Professional Students: 643
  - ~70% with bachelor degree+
- Graduate students: 138
- Residents/fellows: 29
- Faculty: 90
- Pharmacy Programs: 6 (5 doctoral)

Background: UIC Curriculum

- Prerequisites (basic science)
  - General Biology with lab (8hrs)
  - General Chemistry with lab (8hrs)
  - Organic Chemistry (8hrs)
  - General Physics with lab (8hrs)
  - Human Anatomy with lab (4hrs)

Background: UIC Curriculum

- Total core hours (excluding clerkships): 85
- Total professional elective hours: 12
- Total introductory pharmacy practice experiences (IPPE): 12
- Total advanced pharmacy practice experiences (APPE): 24
- Total required for PharmD: 133

Historical Perspective

- Curriculum
  - ~1997 – last full curricular revision – integrated curriculum development
    - PGx identified as a general content area of importance but NOT as a formally integrated area
  - 2000, 2003 – update to fix course cycles
  - 2007 – update to add IPPE
  - 2008 – ACPE accreditation
- Research
  - ~2000 – identification of translational research/PGx as one research focus area
  - 2000-present – strategic hires of PGx/genomics-based faculty
    - Cardiology
    - Psychiatry
    - Oncology
    - PK/PD/PG – molecular pharmacology

UIC College of Pharmacy

- PGx in the required PharmD curriculum
  - Genetic basis for disease and drug action
  - Genetic basis for alteration of drug metabolism
  - Genome and proteomic principles in relation to disease and drug development
  - Genetic basis for individualizing drug doses
- PGx content
  - ~11/30 required courses report *some* PGx-associated content taught
  - Occurs in lectures + selected recitations

PGx in Required Didactic Courses at UIC

Year	Course Name	Content
P1	PHAR400	Clinical PK
P1	PHAR401	Renal, endocrine
P1	PHAR321	Drug Delivery I
P1	PHAR332	Fundamentals of Drug Action II
P2	PHAR402	Cardiology/ Autonomic
P2	PHAR323	Drug Delivery III
P2	PHAR333	Fundamentals of Drug Action III
P2	PHAR403	Infectious Disease
P3	PHAR405	Neurology
P3	PHAR406	Psych/pain
P3	PHAR408	Heme/Onc/Rheumatology

PGx Elective Experiences at UIC

Year	Course Name	Content
Misc (PharmD or PhD)	BPS555	Principles of Pharmacogenomics
Misc (PharmD or PhD)	PMMP412	Pharmaceutical Applications of Genomics and Bioinformatics
Misc (PharmD)	PHAR380/390	Psychiatric Pharmacogenomics (independent study)
Misc (PharmD)	PHAR380/390	Cardiovascular Pharmacogenomics (independent study)
Misc (undergraduate honors)	HONORS/BIOS399	Introduction to Laboratory Psychiatric Pharmacogenomics
P4	PHAR388	Advanced Specialty Clerkship (Psych PGx/Cardio PGx)

PGx Elective Experiences

- UIC Pharmacogenomics Lab
  - Undergraduate honors
    - E.g. targeting guaranteed admission students
  - PHAR380/390 Independent Study/Research
  - Advanced Specialty Clerkships
  - Summer PharmD Fellowship Experience
  - ~2 independent study students/semester
  - ~6 rotation students/year
  - ~1-2 PharmD student fellows/summer

PharmD/PhD Didactic Electives

- BPS555 Cont'd – Principles of Pharmacogenomics
  - **Objectives**
    - Introduce genetic concepts
    - Explain the molecular basis for genetic variability in humans
    - Identify methods to determine genetic variability
    - Identify clinical applications of PGx
    - Demonstrate the power and challenge of applying PGx in new drug research and development
    - Develop skills to be able to understand, evaluate and design PGx studies
    - Identify potential ethical issues relating to PGx

Moving Forward

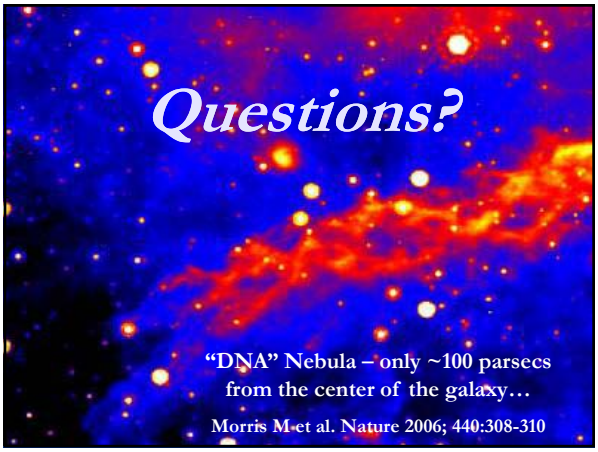
- How do we prepare students to utilize technologies currently not used clinically
  - Counseling?
  - Implementing testing recommendations?
- We want PGx to be *Pharmacy's* area
- We want to foster an environment of learning and research in translational and personalized medicine/care

Moving Forward

- New curricular revision soon
  - Formalization of PGx content – beyond faculty-driven areas?
  - How? PDATs vs. elective vs. required course
    - What do we do for courses where PGx is important but faculty are not familiar/comfortable with the material?
  - When? – Throughout vs. early vs. later
  - What? – At least include information for drugs with PI recommendations
  - Where? – New/updated elective
- Revision of PharmD PGx elective?
  - Increase interest
  - Increase exposure
- Continue to develop PGx focus area for pharmacy
- Forward thinking –beyond the NAPLEX

Challenges

- PGx seems to be now where PK was 20yrs ago
- Incorporating new and innovative technologies to an already packed PharmD curriculum
- Difficult to quantify PGx integration
  - Some "stand alone" lectures needed for foundation
  - Genetic variability treated like another "monitoring" parameter or marker of response
- Integration into therapeutics courses dependent on expertise and/or interest of faculty
- Applied experiences dependent on lab-based faculty with resources and existing/ongoing projects appropriate for PharmD students

Opportunities for Growth

- Ethical issues
  - Informed consent issues surrounding testing
  - Patient counseling
  - Implications of genetic testing for self, family, employment, insurance, etc.
- Standardization of integration
- "Real life" application
  - Will increase as more drugs have PGx labeling requirements