OBJECTIVES

• To describe the implementation of personalized medicine coursework at Virginia Commonwealth University (VCU) School of Pharmacy (SOP).1
• To discuss the use of pharmacometabolomics, natural language processing and data visualization in precision pharmacy education.

BACKGROUND

• The Accreditation Council for Pharmacy Education Standards 2016 include pharmacogenomics/genetics as a required element of the didactic Doctor of Pharmacy curriculum.2
• Rapid technological advances are fast enabling the personalization of medicine and the approach to pharmacy education must adapt to include these technologies.
• Current structure of personalized medicine coursework at VCU SOP.

Intro Personalized Medicine Course

2010: Required 1-credit introductory Personalized Medicine Course
2015: Implemented active-learning laboratory session
2017: Creation of 2-credit Advanced elective in Personalized Medicine

A required 1-credit, introductory class in personalized medicine has been offered for the past eight years.

Early efforts were focused on providing students with an understanding of pharmacogenetics and pharmacogenomics.

In 2015, the course was expanded to include other topics related to personalized medicine including pharmacometabolomics and pharmacolipidomics.

The same year, an active-learning laboratory session was implemented to provide the students with a deeper understanding of the principles of pharmacogenetics.

In 2017, an advanced elective was created where the students learned how to collect buccal cells and how to critically evaluate pharmacogenetics results. Additional topics were also covered.

Active-Learning Laboratory

A two hour active learning laboratory session to teach pharmacy students about clinical pharmacogenomics was implemented to run in sequence with their required Personalized Medicine lecture on Clinical Pharmacogenomics.

The laboratory exercise includes:

• Three team cases where students evaluate genetic profiles and make drug therapy recommendations to providers
• Counsel a patient on their genetic profile and corresponding drug therapy

Based on assessments, students knowledge and confidence increased after participating in the laboratory session.3

Elective Personalized Medicine Course

To better train pharmacy students who intend to pursue personalized medicine as a career, we created a 2-credit, advanced elective on personalized medicine in fall 2017.

The elective expanded on the course material covered in the 1 credit class. This course also emphasized the importance of understanding the effects of one or more pharmaceutical agents on the overall metabolism of the body at an individual level.

Understanding the relevance of multi-metabolite changes with respect to possible complications often requires an exhaustive literature search, a task that is becoming impossible due to the sheer volume of scientific literature. Thus, the topic of literature based discovery approaches via automated natural language processing was included in the elective.

Elective Personalized Medicine Course

New advances in natural language processing (NLP) has enabled intelligent machine driven information summarization to enable literature based discoveries (LBD). Output from LBD approaches are best visualized as networks, where the relationships among the identified information are easily comprehensible. As such, the students were also introduced to how AR/VR/MR can be used to visualize results from text mining as networks in an immersive, interactive and explorable environment.

In summary: The advanced personalized medicine elective combined pharmacometabolomics, natural language processing and AR/VR/MR based data visualization to enable a comprehensive understanding of the metabolic perturbations resulting from an individual's response to a drug regimen.

FUTURE DIRECTIONS

Our ultimate goal is to create the next generation of pharmacists who are able to harness the advances from modern computing and integrate them to their practice. We are currently developing natural language processing algorithms that allow the merger of personalized medicine for polypharmacy patients. This knowledge will be included in our curriculum for the advanced elective this year.

REFERENCES


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