

# Equipping Residents and Fellows to Deliver the Future of Precision Medicine

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# Relevant Financial Relationships

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## Speaker(s)

- There are no relevant financial interests in the last 24 months to disclose for any person with control over the content of this presentation.





## Learning Objective

**Discuss the differences in outcomes, goals and objectives of pharmacogenomics residencies, fellowships, and certificate programs.**



# Audience Response

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**Have you completed formal training in the field of pharmacogenomics?**

**Are you involved in training trainees in pharmacogenomics?**

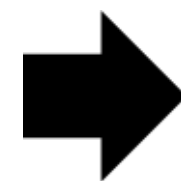


**To continue to advance the field of precision medicine, it will be crucial to train the next generation of clinicians and translational scientists to be leaders, innovators, and advocates.**

# American Society of Health-System Pharmacists Statement on the Role of Pharmacists in Delivering Personalized Medicine

“Pharmacists’ responsibilities for pharmacogenomics include promoting the optimal use and timing of pharmacogenomic tests; interpreting pharmacogenomic test results; and educating healthcare professionals, patients, and the public about the field of pharmacogenomics.”

The front-line  
Precision Medicine  
experts?



Clinical  
pharmacists

Haidar CE, Petry N, Oxencis C, *et al.* Am J Health Syst Pharm. 2022;79(8):704-707



# There are three major categories of post-graduate training opportunities in pharmacogenomics

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**Specialty  
Residencies  
(Post-  
Graduate  
Year 2)**



**Clinical  
Research  
Fellowships**



**Certificate  
Programs**



# **Post-Graduate Year 2 Pharmacy Residencies**



# ASHP: the accrediting body for pharmacy residencies

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- Pharmacy residency training is an essential advancement as pharmacists help lead increasingly complicated drug therapy decisions in hospitals and clinics around the nation.
- We continue to see strong interest in pharmacy residencies:
- This year, 5,872 individuals matched with 2,200 pharmacy residency programs in Phase I of the National Match.
- A higher share of graduating pharmacy students (46%) applied to the 2024 Match than did last year (44%).



# Post-Graduate Year 1 Residency



# Post-Graduate Year 2 Residency



**PGY1 residency programs build upon Doctor of Pharmacy (PharmD) education to develop pharmacist practitioners with knowledge, skills, and abilities. Residents who successfully complete PGY1 residency programs will be skilled in diverse patient care, practice management, leadership, and education, and be prepared to provide patient care, seek board certification in pharmacotherapy (i.e., BCPS), and pursue advanced education and training opportunities.**

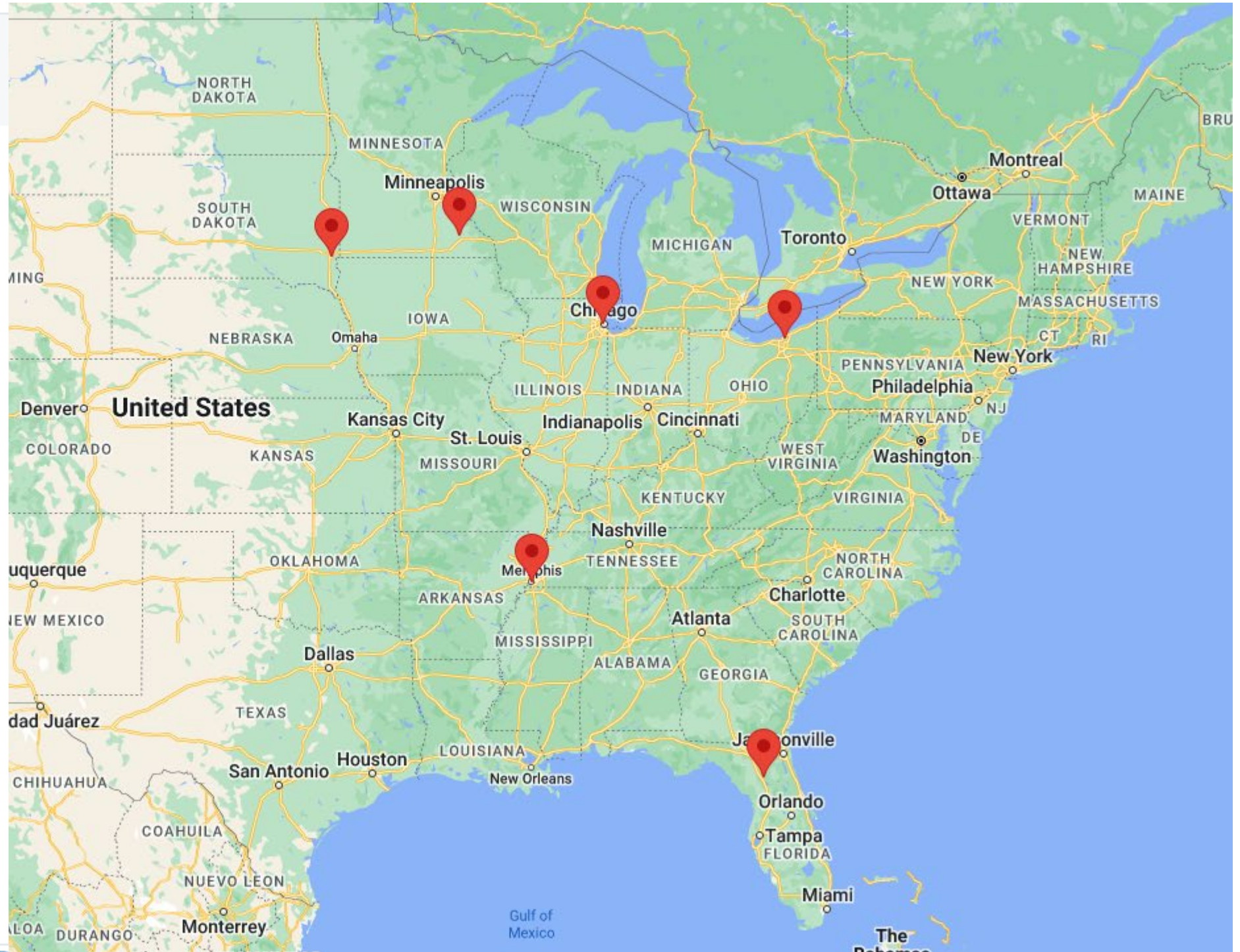


**PGY2 residency programs build upon PharmD education and PGY1 pharmacy residency training to develop pharmacist practitioners with knowledge, skills, and abilities in advanced practice areas. Residents who successfully complete PGY2 residency programs are prepared for advanced patient care or other specialized positions, and board certification in the advanced practice area, if available.**



# There are currently 7 PGY2 Clinical Pharmacogenomics residencies accredited by ASHP or in candidate or pre-candidate status

Program Name	Type	Code	State	Accreditation Status
Cleveland Clinic	(PGY2) Clinical Pharmacogenomics	44926	OH	Candidate
Mayo Clinic	(PGY2) Clinical Pharmacogenomics	63059	MN	Accredited
Sanford Imagenetics	(PGY2) Clinical Pharmacogenomics	67103	SD	Accredited
St. Elizabeth Healthcare	(PGY2) Clinical Pharmacogenomics	52714	KY	Pre-candidate
St. Jude Children's Research Hospital	(PGY2) Clinical Pharmacogenomics	54022	TN	Accredited
University of Florida College of Pharmacy	(PGY2) Clinical Pharmacogenomics	33063	FL	Accredited
University of Illinois at Chicago College of Pharmacy & Northshore University Health System	(PGY2) Clinical Pharmacogenomics	41909	IL	Accredited



<https://accreditation.ashp.org/directory/#/program/residency> (accessed Jun 10, 2024)



# The 2023 Accreditation Standard for Residency Programs identifies best practices for accredited programs

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- Standard 1- Recruitment and Selection of Residents
- Standard 2 – Program Requirements and Policies
- Standard 3- Structure, Design and Conduct of the Residency Program
  - **Two-thirds** of program must be focused on patient care activities
  - Includes required Competency Areas, Goals and Objectives to be met
- Standard 4- Requirements of the Residency Program Director and Preceptors
  - Requires a sufficient complement of eligible and qualified preceptors
- Standard 5 – Pharmacy Services Infrastructure
  - Pharmacists provide comprehensive care inclusive of all medication-related issues
  - Recruitment process identifies and engages individuals underrepresented in the profession of pharmacy



<https://www.ashp.org/professional-development/residency-information/residency-program-resources/residency-accreditation/pgy2-competency-areas>

The required competency areas and all of the goals and objectives they encompass must be included in all accredited programs.

Each of the objectives for the residency are classified according to educational taxonomy (cognitive, affective, or psychomotor) and level of learning.

## Postgraduate Year Two Pharmacy Residency Training in Advanced Areas of Pharmacy Practice - Competency Areas, Goals, and Objectives (CAGO)

- Ambulatory Care - Effective 2017
- Cardiology - Effective 2017
- Clinical Pharmacogenomics - Effective 2018
- Critical Care - Effective 2017
- Emergency Medicine - Effective 2018
- Geriatric - Effective 2017
- Health-System Pharmacy Administration and Leadership (HSPAL) - Effective 2019
  - Community-Based Pharmacy Administration and Leadership - Effective 2019
  - Specialty Pharmacy Administration and Leadership - Effective 2019
  - Corporate Pharmacy Administration and Leadership - Effective 2021
- Infectious Diseases - Effective 2017
- Informatics - Effective 2017
- Internal Medicine - Effective 2017
- Investigational Drugs and Research - Effective 2020
- Medication-Use Safety and Policy - Effective 2019
- Neurology - Effective 2018
- Oncology - Effective 2016
- Pain Management and Palliative Care - Effective 2018
- Pediatric - Effective 2016
  - Pediatric Specialty Pathways - Effective 2023



# 5 Required Competency Areas and Related Goals for all accredited residencies in Clinical Pharmacogenomics (and 3 Elective Areas)

## R1 Patient Care

R1.1 In collaboration with the health care team, provide comprehensive medication management to patients following a consistent patient care process.

R1.2 Ensure continuity of care during patient transitions between care settings.

## R2 Advancing Practice and Improving Patient Care

R2.1 Demonstrate ability to manage formulary and medication-use processes, as applicable to the organization.

R2.2 Demonstrate ability to conduct a quality improvement or research project in pharmacogenomics with appropriate mentorship/guidance.

## R3 Leadership and Management

R3.1 Demonstrate leadership skills for successful self-development.

R3.2 Demonstrate management skills.

## R4 Teaching, Education, and Dissemination of Knowledge Related to Clinical Pharmacogenomics

R4.1 Provide effective medication and practice-related education to patients, caregivers, health care professionals, students, and the public (individuals and groups) related to pharmacogenomics.

R4.2 Effectively employ appropriate preceptor roles when engaged in teaching students, pharmacy technicians, or fellow health care professionals in pharmacogenomics.

## R5 Pharmacogenomics Resource

Goal: to establish independence as

R5.1 Establish oneself as an organizational expert in the implementation of pharmacogenomics.



# 3 Elective Competency Areas for accredited residencies in Clinical Pharmacogenomics

**E1 Academia**

**E2 Initiating a Clinical Pharmacogenomics Pharmacy-Related Service**

**E3 Medication-Use Evaluations**



# Clinical content areas required to be covered in a PGY2 Clinical Pharmacogenomics residency (AKA the Appendix)

## Required Content Area

GI Pharmacogenomics

Oncology Pharmacogenomics

Pain Pharmacogenomics

Cardiology Pharmacogenomics

Infectious Disease Pharmacogenomics

Neurology Pharmacogenomics

Psychiatry Pharmacogenomics

Transplant Pharmacogenomics

Other areas

REQUIRED Content Areas			
Content Area	Direct Patient Care Experience Required	Case-Based Application Acceptable	Date Covered/ Comment
GI Pharmacogenomics	<ul style="list-style-type: none"> <li>CYP2C19- proton pump inhibitors</li> <li>CYP2D6- ondansetron</li> <li>TPMT- thiopurines</li> </ul>		CYP2C19/PPI: <b>8/3/2023</b> CYP2D6/Ondansetron: <b>7/31/2023</b> TPMT + NUDT15/Thiopurines: <b>8/7/2023</b>
Oncology Pharmacogenomics	<ul style="list-style-type: none"> <li>CYP2D6- ondansetron</li> <li>TPMT- thiopurines</li> </ul>	<ul style="list-style-type: none"> <li>CYP2D6- tamoxifen</li> <li>DPYD- 5-fluorouracil (5-FU), capecitabine</li> <li>G6PD- rasburicase</li> <li>UGT1A1- irinotecan</li> </ul>	CYP2D6/Ondansetron: <b>7/31/2023</b> CYP2D6/Tamoxifen: <b>7/31/2023</b> DPYD/Fluoropyrimidines: <b>8/7/2023</b> G6PD: <b>8/10/23</b> TPMT + NUDT15/Thiopurines: <b>8/7/2023</b> UGT1A1: <b>8/7/2023</b>
Pain Pharmacogenomics	<ul style="list-style-type: none"> <li>CYP2C19, CYP2D6- tricyclic antidepressants (TCAs)</li> <li>CYP2D6- codeine, tramadol, hydrocodone, oxycodone</li> </ul>		CYP2C19, CYP2D6/TCA: <b>9/13/2023</b> CYP2C9/NSAIDS: <b>8/3/2023</b> CYP2D6/codeine, tramadol, hydrocodone, oxycodone: <b>8/3/2023</b>





# Where are St. Jude's PGY2 Clinical Pharmacogenomics residency graduates practicing?

Clinical pharmacogenomics position: 7  
Fellowship: 3  
Academic position: 1  
PhD student: 1



★ Denotes residency graduate started a pharmacist-run pharmacogenomics clinic  
★ Denotes residency graduate started a pharmacist-run pharmacogenomics service



# Fellowship Training

# American College of Clinical Pharmacy Guidelines for Clinical Research Fellowship Training Programs



The purpose of fellowship training programs is to develop competency and expertise in the scientific research process, including hypothesis generation and development, study design, protocol development, grantsmanship, study coordination, data collection, analysis and interpretation, technical skills development, presentation of results, and manuscript preparation and publication. A fellowship candidate is expected to possess appropriate clinical practice skills such as may be obtained through prior practice experience or completion of a residency program.

A fellowship graduate should be capable of conducting independent and collaborative research and functioning as principal investigator.



# ACCP Training Program Requirements

A minimum of 3,000 hours of the fellowship training time devoted to research-related activities over a minimum period of two years (i.e., 70% of activity).

**Fellowship Experiences.** Ideally, a research fellow should obtain extensive experience in:

1. Development of at least one scientific hypothesis
2. Development of experimental methods to test the developed hypothesis
3. Preparation of a protocol and submission of the protocol to the appropriate institutional review committee
4. Grantsmanship, including identification of appropriate funding sources for specific projects and preparation and submission of a grant for extramural funding consideration
5. Study design and coordination and data collection
6. Statistical analysis of data
7. Data analysis and interpretation
8. Development of clinical, laboratory, and/or computer-based research skills as appropriate to the specific training program
9. Abstract preparation and submission
10. Presentation of research at peer-reviewed scientific meetings
11. Manuscript preparation and submission for publication in peer-reviewed journals
12. Participation in journal clubs, research workshops, and/or seminar series
13. Instruction in biomedical science ethics



# There are currently 4 Clinical Pharmacogenomics fellowships listed in the ACCCP fellowship directory

## SEARCH DIRECTORY

POSITIONS

★ FAVORITES

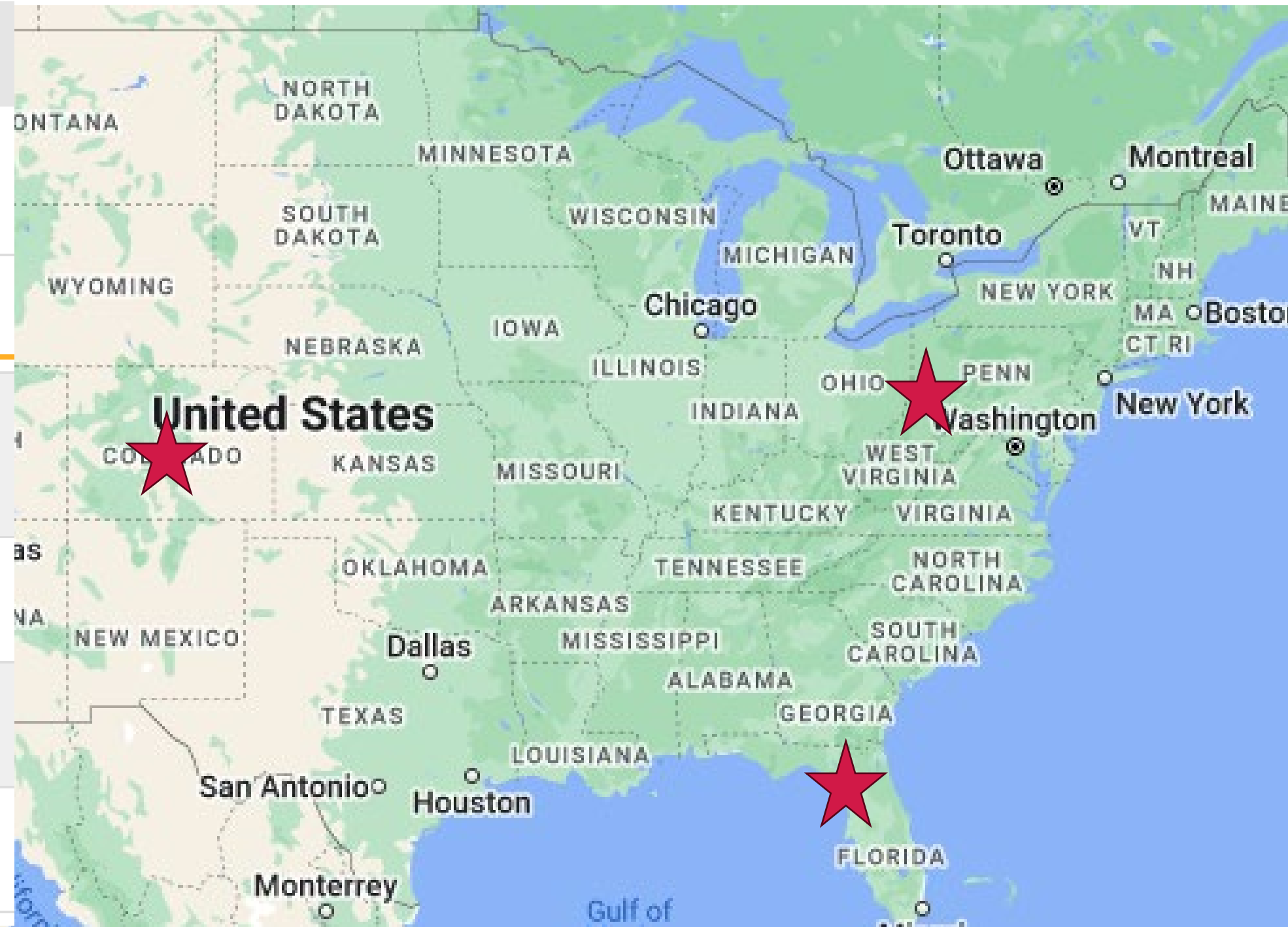
### Fellowship Clinical Pharmacogenomics

University of Colorado Skaggs School of Pharmacy and Pharmaceutical Sciences - CO

University of Florida College of Pharmacy - FL

University of Florida - FL

University of Pittsburgh/UPMC - PA



<https://www.accp.com/resandfel/search.aspx> (accessed Jun 10, 2024)



**Certificate Programs  
in  
Pharmacogenomics**

# Professional Certificate Programs in Pharmacogenomics are available

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- Purpose: Designed for clinicians to increase the knowledge and skills necessary to use pharmacogenomics to improve medication use in a patient care setting.
- Typically, 20 credit hours or fewer, online or hybrid



# Examples of Professional Certificate Programs



## Pharmacogenomics Certificate

Designed for participants to increase the knowledge and skills necessary to use pharmacogenomics in a variety of patient care settings.

- Refreshed!
- 19.5 CE hours
- 8 Modules
- Content released on Apr. 24, 2024
- Completion required by Apr. 24, 2027



## Online Graduate Certificates

PROGRAM DETAILS

We offer four tailored online graduate certificates within the Clinical Pharmacogenomics & Precision Medicine program. See which one is right for you.

CLINICAL PHARMACOGENOMICS ONLINE GRADUATE CERTIFICATE... →

PRECIS

COMPREHENSIVE MEDICATION MANAGEMENT ONLINE GRADUATE... →

\*NEW!\* ARTIF



About How it Works Programs Out

## The Test2Learn™ Pharmacogenomics Certificate Program

The Test2Learn™ Pharmacogenomics Certificate Program teaches the principles of pharmacogenomics as well as its practical application. It uniquely provides a platform for learners to decipher genetic tests, translate that information, and make appropriate recommendations for the patient. It uniquely provides a platform for learners to decipher genetic tests, translate that information, and make appropriate recommendations for the patient. It uniquely provides a platform for learners to decipher genetic tests, translate that information, and make appropriate recommendations for the patient. It uniquely provides a platform for learners to decipher genetic tests, translate that information, and make appropriate recommendations for the patient.

### Certificate Program Features

- 20 credit hours of ACPE/CME continuing education (pharmacists & physicians)
- Unique dual home study and live training via Zoom or in-person
- Optional personal genomic testing kit and processing



<https://www.ashp.org/professional-development/professional-certificates>

<https://www.test2learn.org/pgxcertificate/>

<https://onlinepim.pharmacy.ufl.edu/programs/degrees-and-certificates/graduate-certificate/>

Finding cures. Saving children.





# Is there a role for board certification in pharmacogenomics?

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## BPS Pharmacogenomics Job Analysis

The Board of Pharmacy Specialties (BPS) is seeking subject matter experts in pharmacogenomics to participate in a job analysis (also known as a role delineation study), which will take place in the second half of 2024.

Job analysis panelists are responsible for:

- Establishing the scope of the pharmacogenomics specialty practice area
- Identifying the tasks performed by practitioners in pharmacogenomics
- Identifying the competencies required by practitioners in pharmacogenomics
- Evaluating the feasibility of a specialty certification in pharmacogenomics



# Conclusions

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There are several training options for post-graduate training in clinical pharmacogenomics for pharmacists



The purpose and timeframe of residencies, fellowships, and certificate programs varies by program type



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