

# Nuclear Education Online

---

## Introduction

The faculty and staff of Nuclear Education Online (NEO) welcome you to a new and exciting educational opportunity for nuclear pharmacy training. The goal is to provide the best learning experience within your local community. Experienced faculty, combined with the active learning environment provided by a problem-driven curriculum, together with the ready access of the Internet, will expand the horizons for radiopharmacist education. We hope that you will become a life-long learner with us.



University of Arkansas for Medical Sciences  
College of Pharmacy  
College of Health Related Professions  
Little Rock, Arkansas 72205



**The University of New Mexico**

*UNM College of Pharmacy*

AT THE UNM HEALTH SCIENCES CENTER

The University of New Mexico  
College of Pharmacy  
Albuquerque, New Mexico 87131

[www.nuclearonline.org](http://www.nuclearonline.org)

Nuclear Education Online  
4301 W. Markham, Slot 522  
Little Rock, AR 72205  
501-686-6398



# Table of Contents

Introduction	i		
		C H A P T E R 3	
C H A P T E R 1		Curriculum	11
Nuclear Education Goes Online	1	Calendar	12
How Does The Program Operate?	1	Program Timeline	12
NEO History	2	College of Pharmacy Program	13
NEO Faculty	3	APhA Syllabus for Nuclear Training	13
Student Eligibility	3	ACPE Continuing Education Credit	13
Finding a Preceptor	3	Corporate Confidentiality	14
Preceptor Qualifications	4	Copyright Notice	14
Site Requirements	4		
Computer Requirements	5		
Textbooks and Reference Materials	6	C H A P T E R 4	
Tuition	7	Summer Internship Opportunities	15
		Career Opportunities	16
C H A P T E R 2			
What is Student-Centered Learning?	9	E N R O L L M E N T F O R M	
WebCT	9		
Problem-Based-Learning	10		
Are You Ready for Distance Learning?	10		



## Nuclear Education Goes Online

*The radiopharmacy education and training program is open to pharmacy students, pharmacists, and technologists across the country and throughout the world.*

The Nuclear Education Online (NEO) program is designed to provide the education and training required by the Nuclear Regulatory Commission to be an Authorized Nuclear Pharmacist or an “authorized user” of radioactive materials. The program consists of 10 weeks of didactic coursework combined with structured experiential training. Before and after completing this didactic coursework, students will be required to complete 8 additional weeks of structured experiential training, bringing the length of the entire program to 18 weeks. The program is geared toward pharmacy students interested in a career as a radiopharmacist, pharmacists interested in a career change, as well as others seeking this education and training.

---

### ICON KEY

 Valuable information

 Contact Us

 Internet Resources

### How Does the Program Operate?

The NEO program has been designed to include traditional educational and student-centered, problem-based learning (PBL) environments. The student is largely “in charge” of the learning process. Students have access to lecture notes, reading assignments, group discussions, exams, and homework, similar to a traditional classroom, as well as a student-centered, problem-driven framework to apply didactic knowledge to real-life situations. The online learning environment puts more responsibility on the student and requires self-discipline, but it also provides rewards through increased

interactivity and scheduling flexibility. Yes, you may come to class in your pajamas at 10:00 AM or 10:00 PM! While this program utilizes asynchronous learning, students will be required to finish the curriculum within the prescribed timeframe. Students will proceed through the curriculum together, often working in a group. The group consists of colleagues throughout the country, who are concurrently enrolled in the program. The interactions between students who are progressing through the program together provide an important learning opportunity. Weekly conference calls are used to define learning issues and case discussions and help keep the students on-track. Of course, hands-on experiential training is very important as well. This component will use local, practicing radiopharmacists as preceptors, to supervise and guide students through a highly structured experiential training program. Each student has access to faculty content experts, PBL facilitators, and instructors online, as well as a local preceptor on-site. Preceptors are required to complete the NEO Preceptor Training Program in order to familiarize themselves with the program. The faculty will have overall responsibility for developing the student knowledge and skill base and for providing feedback to individual students and preceptors. Preceptors serve as role models for the practical application of the skill base to the practice of radiopharmacy. Preceptors supervise the practical training of students using the highly structured, experiential training component of the program.

## Nuclear Education Online History

In 1972, the University of New Mexico began teaching radiopharmacy courses and established the first commercial radiopharmacy, which then became the model for an entire industry. The University of New Mexico and the University of Arkansas College of Pharmacy are two of just a handful of pharmacy schools nationwide that now offer nuclear pharmacy education and training. The University of Arkansas College of Health Related Professions (CHRP) has been offering a Nuclear Medicine Technology distance education program via the Internet since 1998. Faculty from these three colleges came together in 1999 to form an educational consortium to expand specialty education and training beyond the walls of the universities in order to help meet the demand for pharmacists, and other professionals, with specialty education and training in radiopharmacy. Each university and faculty member brings valuable experience and expertise to our program.



## NEO Faculty

We are proud to have excellent core teaching faculty members drawn from three colleges, the Colleges of Pharmacy and Health Related Professions at UAMS and the College of Pharmacy at UNM. The Nuclear Education Online program is directed by John Pieper, Pharm.D., Dean of UNM College of Pharmacy, Stephanie Gardner, Pharm.D., Ed.D., Interim Dean of the College of Pharmacy at UAMS, and Ronald H. Winters, Ph.D., Dean of the CHRP at UAMS. Faculty members include Nicki Hilliard, Pharm.D., BCNP; Jeff Norenberg, M.S., Pharm.D., BCNP; Martha Pickett, CNMT; Buck Rhodes, Ph.D.; Paul Thaxton, CNMT; Kristina Wittstrom, R.Ph., BCNP; and practicing radiopharmacist preceptors in the field. Biographical sketches and complete CVs of our faculty members may be found on the [www.nuclearonline.org](http://www.nuclearonline.org) website.


## Student Eligibility

While the program is geared toward students who are interested in careers as radiopharmacists, it is also open to other students, pharmacy technicians, nuclear medicine technologists, physicians, and nuclear pharmacists that are seeking additional education and training. You are invited to evaluate the program description to determine if this program will meet your educational needs. It is recommend that pharmacy students complete at least 1 year of a professional pharmacy curriculum and at least 2-4 weeks of experience in a radiopharmacy before entering the program.

## Finding a Preceptor

The preceptors, who are themselves practicing radiopharmacists, are a very important component of the educational experience. NEO preceptors must meet specific qualifications, and complete training in the educational goals and methods used in the program. Before working with NEO students, preceptors are required to complete the NEO Preceptor Training Program. This preceptor workshop is offered live, in coincidence with the APhA Annual Meeting, or through an online program. The NEO Preceptor Training Program helps to assure that preceptors understand their responsibilities and are able to effectively guide students through the experiential training and online learning activities. If you would like to locate a preceptor in your area, call Kristina Wittstrom, Experiential Education Coordinator, at 505-272-3661 or by email at [aaaaa@unm.edu](mailto:aaaaa@unm.edu). If there is not currently a NEO preceptor near you, we

Preceptors  
receive adjunct  
faculty  
appointments  
at UNM

can assist you in locating radiopharmacists in your area and give them more information about our program. 

## Preceptor Qualifications

- Board Certified Nuclear Pharmacist (preferred)
- Minimum of 3 years dispensing experience as a nuclear pharmacist
- Completion of the NEO Preceptor Training Program
- Compliance with the structured experiential training program
- Completion of student evaluations and assessments as requested
- Adequate time to work with student

## Site Requirements

To ensure a high quality training experience the following site requirements have been adopted.

The site must:

- **have adequate pharmacist staffing.**
- **maintain an appropriate nuclear pharmacy reference library .**
- **dispense an average of at least 50 prescriptions per weekday.**
- **handle I-131 NaI (prepares unit doses or capsules from bulk I-131 NaI).**

### EQUIPMENT LIST

Each radiopharmacy preceptor site must have access to, and experience with, the equipment listed below. Equipment must be in use and maintained in accordance with radioactive materials license commitments and with all applicable local, state and federal regulations. Any questions regarding site requirements or equipment should be directed to Kristina Wittstom at 505-272-3661 or [aaaaa@unm.edu](mailto:aaaaa@unm.edu).

Personnel Dosimetry Monitoring Program  
Laminar Airflow Hood  
Dispensing Shield(s)  
Dose Calibrator  
Dose Calibrator Reference Sources  
Other References Sources  
Single Channel Analyzer  
Multi-channel Analyzer  
Survey Meters (preferably of more than one type)  
Ion Chamber or Energy Compensated Probe  
Rate Meters  
Syringe Shields  
Vial Shields  
Unit Dose Shields  
Quality Control and Quality Assurance Systems  
Thin Layer Chromatography and Sep-Pak System (including media and solvents)  
Sterility Testing System (including media)  
Pyrogen Testing System (including media)  
Heating Unit or Device  
Iodine Handling System (fume hood, glove box, etc.)  
Air Monitoring System  
Bioassay Monitoring Program

## Computer Requirements and Recommendations

### **What Computer Equipment Do You Need?**

We do not recommend any particular brand of computer, but we have developed a set of system requirements. It is the responsibility of the student to make sure that they have the necessary computer resources and skills needed to complete the NEO program. Students are not required to purchase their own computer, but **MUST** have access to one that meets these specifications.

#### ■ Internet Access:

The computer must be able to connect to the Internet and allow the student to browse the World Wide Web.

#### ■ Computer (minimum configuration):

Minimum processor speed 200MHz and 32 MB RAM

Modem ( $\geq 28.8$  Kbps) or direct connection (DSL, cable modem, satellite modem, ISDN or T1)

Available disk space:  $\geq 50$  MB

CD ROM drive ( $\geq 8X$  speed), monitor, a sound card and speakers

Email account and email software capable of handling file attachments.

■ Operating System:

Windows 95, Windows 98, Windows ME, Windows NT 4.0, Windows 2000, Windows XP, or Power Macintosh.

### What Browser Do You Need?

You will need the latest full release of a web browser, Netscape (4.05+; version 6.0 not recommended) or Internet Explorer (4.0+), not a “beta” version. AOL subscribers must use either Netscape or Internet Explorer web browser rather than the AOL browser.

### WebCT ID and Password

When you are enrolled in the program you will be given a WebCT username and password that will allow you to access the course material.

## Textbooks and Reference Materials



Much of the educational material is available online for the students. However, there are additional required and recommended textbooks. The list is posted online at [www.nuclearonline.org](http://www.nuclearonline.org) and is included in the material sent to each student. Books may be purchased from an online or local bookstore. Be sure to order your textbooks in time to receive them before instruction begins.

## Tuition

<p>Authorized Nuclear Pharmacist Program, including 250 hours of didactic education, 500 hours of structured experiential training, preceptor training, and the introduction to online learning course</p>	<p><b>\$8000</b></p> <p>Students completing the entire structured program will receive a certificate of completion. Students will continue to have access to the educational material following program completion.</p>
<p>Nuclear physics</p> <p>Instrumentation</p> <p>Radiation safety</p> <p>Radiation biology</p> <p>Radiopharmacy (Radiochemistry and Radiopharmacology)</p> <p>Problem-based learning cases</p>	<p>Individuals may enroll in individual course modules for continuing education, or additional training.</p> <p>Check the <a href="http://www.nuclearonline.org">www.nuclearonline.org</a> website for pricing and availability.</p>

The program fee may be divided into two payments of \$4000 each. The first installment is due prior to the first day of instruction. The second installment is due Monday of week 5. Any student that drops or withdraws from the program after week 4, will be charged for the entire program. There is a \$400 non-refundable deposit required in order to register for the program, which may be applied toward tuition.



## What is Student-Centered Learning?

***The goal is to provide an environment for active student-centered typical of the adult learning environment.***


**T**his chapter gives you additional information about online learning and problem-based learning. You are encouraged to perform an honest self-assessment to determine whether you have the basic computer skills and self-discipline needed to complete this program of study.

### WebCT

WebCT (Web Course Tools) is a set of tools that facilitate the creation of sophisticated World Wide Web-based educational environments in three ways:

1. It provides students with a set of educational tools to facilitate learning, communication and collaboration.
2. It provides instructors with an interface allowing the design of the presentation of the course.
3. It provides a set of administrative tools to assist the instructor in the process of management and continuous improvement of the course.

WebCT provides the tools necessary to facilitate the online learning experience including course material, discussion forums, chat, whiteboard, online testing, and more. For more information about WebCT go to

[www.webct.com](http://www.webct.com) or visit our Nuclear Education Online Demo course found on the NEO website at [www.nuclearonline.org](http://www.nuclearonline.org). 

## Problem-Based Learning



Problem-based learning (PBL) is a total approach to education. PBL is both a curriculum and a process. The curriculum consists of carefully selected and designed problems that demand that the learner acquire critical knowledge, become a proficient problem solver, and develop self-directed learning strategies as well as team participation and communication skills. The process replicates the systematic approach commonly used to resolve problems or meet the challenges that are encountered in life and career.

### Role Changes

In problem-based learning, the traditional teacher and student roles change. The students assume increasing responsibility for their learning, giving them more motivation and a greater sense of accomplishment, setting the pattern for them to become successful life-long learners. The faculty become facilitators, guiding the students in their problem solving efforts.

### Results

Students involved in problem-based learning acquire knowledge and become proficient in problem solving, self-directed learning, and team participation. PBL-based curricula are being used successfully in virtually all fields of healthcare education. The University of New Mexico pioneered the application of PBL to medical education in the U.S., beginning in 1979.

## Are You Ready for Distance Learning?

There are many advantages to learning in the online environment, however a distance education program is not for everyone. You are encouraged to think about your learning style considerations and technical requirements before committing to this program. You can find an example of a self-assessment quiz and “getting started” information in the demo course found on the program website ([www.nuclearonline.org](http://www.nuclearonline.org)) in the “Online Courses” section.

# Nuclear Education Online Curriculum

*The goal is to bring you the best education and experiential training program possible for Authorized Nuclear Pharmacist training.*

Online education and training for radiopharmacists has many advantages over traditional programs. Because this is a student-centered, active learning curriculum the learning process is enhanced. The asynchronous (anytime, anywhere) environment allows a great deal of flexibility for students. Many students may be hesitant to leave home and family for an extended period of time in order to complete the education and training necessary to become practicing radiopharmacists. The NEO program allows the instructors and students to interact online without the inconvenience and expense of travel.

## Program Curriculum

This program is modeled after the radiopharmacist education and training requirements of the NRC and recommendations of the APhA Section of Nuclear Pharmacists. The NEO authorized nuclear pharmacist education and training program consists of the components below. It contains 200 hours of didactic education and 500 hours of structured experiential training. For more program information, including objectives and syllabi, please see the NEO website ([www.nuclearonline.org/courses.htm](http://www.nuclearonline.org/courses.htm)).

### Program Components

- **Preceptor Training**
- **Introduction to Nuclear Education Online**

- **Didactic Program (200+ hours)**
  - Nuclear physics
  - Instrumentation
  - Radiation safety
  - Radiation biology
  - Radiochemistry / Radiopharmacy
  - Problem-based learning cases
  
- **Structured Experiential Education and Training (500 hours)**

## Calendar

The Nuclear Education Online Training Program offers open enrollment. Students can begin the didactic and experiential material at anytime throughout the year. When a group of students is formed we will begin the PBL cases and work through them together as a group. The 10-week PBL curriculum will begin in a timeframe that will not extend the training period. The didactic curriculum, at approximately 20-25 hours/week includes time for experiential training. It will take students approximately 18 weeks to complete the entire program to obtain the 700 hours of training required by the Nuclear Regulatory Commission.

Enrollment in each session is limited. To find out more about the availability of Nuclear Education Online courses contact Nicki Hilliard at [NLHilliard@uams.edu](mailto:NLHilliard@uams.edu) or call 501-686-6398.

## Program Timeline


700 Hours or 18 Weeks											
	← Problem-based learning cases →										
	1	2	3	4	5	6	7	8	9	10	
Student registers for program	Nuclear Physics and Instrumentation			Radiation Safety		Radiopharmacy <ul style="list-style-type: none"> <li>▪ Radiopharmaceutical Chemistry</li> <li>▪ Radiopharmacology</li> </ul>					Students complete structured experiential education and training program documenting 500 hours required for ANP.
Preceptor completes NEO Preceptor Training				Radiation Biology							
Students complete Introductory material											
Structured Experiential Education and Training											

## College of Pharmacy Program

One of our goals is to increase the availability and accessibility of nuclear pharmacy education in the colleges of pharmacy across the United States. Pharmacy students can enroll in the 10-week PBL curriculum during the summer with experiential training received during a summer internship, clerkships, or following graduation.

Another option is for pharmacy students to enroll in individual semester based courses for elective credit through their college of pharmacy. Colleges of Pharmacy may contract with NEO to offer these courses, or students can enroll independently. NEO does not offer college credit; the credit may be issued by partnering colleges of pharmacy. For more information contact Nicki Hilliard at [NLHilliard@uams.edu](mailto:NLHilliard@uams.edu) or call 501-686-6398.

## APhA Syllabus for Nuclear Training

The NEO faculty has used the APhA Syllabus for Nuclear Pharmacy Training, developed by the leaders in the field of nuclear pharmacy, as the backbone for the NEO program curriculum. The entire curriculum is mapped to the syllabus to ensure a comprehensive education and training program. You can view the entire APhA Syllabus on our website. 

## ACPE Continuing Education Credit

The Nuclear Education Online program will grant college credit to students enrolled at UNM and UAMS. Students enrolled in other colleges and schools of pharmacy should contact their local officials to request that the NEO curriculum be evaluated to determine the potential for obtaining credit or for applying it toward elective and/or required elements within their curricula. ACPE approved continuing education credit for pharmacists is available.



The University of Arkansas for Medical Sciences College of Pharmacy is approved by the American Council on Pharmaceutical Education as a provider of Continuing Pharmaceutical Education.

Nuclear Instrumentation – 004-039-04-200-H01

Radiation Safety - 004-039-04-203-H01

Nuclear Physics for Radiopharmacy – 004-039-04-201-H-01

Radiation Biology - 004-039-04-202-H-01

Radiopharmacy - 004-039-04-204-H01

Problem Based Learning – 004-039-04-025-H01

## Corporate Confidentiality

Students are encouraged to share ideas and learn from each other, however they must also realize that they may be coming to the Nuclear Education Online program from competing companies. Students are reminded to respect information that would be considered confidential by your employer.

## Copyright Notice

The educational materials used in the Nuclear Education Online program are copyrighted and are not to be used for any purpose without the express, written permission of the faculty.

## Career Opportunities

*Radiopharmacy is a challenging and exciting career choice. There are many opportunities for employment and career advancement.*

**B**ecause of the short supply of trained personnel, there is an ever-increasing demand for people that possess the knowledge and experience that you can gain from the Nuclear Education Online Program. We wish you a long and prosperous career as radiopharmacists or authorized users of radioactive materials.

## Summer Internship Opportunities

The best way to find out if you will like radiopharmacy practice is to try it! Pharmacy students can find summer internship and clerkship opportunities in radiopharmacies throughout the United States. Commercial nuclear pharmacies such as Cardinal Health, Mallinckrodt Medical, Amersham Health, Pharmalogic, Geodax Technologies, Eastern Isotopes, PETNET Pharmaceuticals, and the many independent pharmacies offer employment and training opportunities for pharmacy students. Contact the company websites or radiopharmacies in your area for more information.

The Nuclear Pharmacy website at <http://nuclearpharmacy.uams.edu> has a directory of nuclear pharmacies in the U.S. and a job-posting list.

## Career Opportunities

If you are a pharmacist looking for a career change, there are many employment opportunities for radiopharmacists available across the U.S. and throughout the world. Most employers will pay the costs of education and training expenses for new hires. Visit a radiopharmacy in your area to learn more about this exciting and challenging career opportunity.

[www.nuclearonline.org](http://www.nuclearonline.org)

Nuclear Education Online  
4301 W. Markham, Slot 522  
Little Rock, AR 72205  
501-686-6398