



Otterbein University – OhioHealth Grant Medical Center

Nurse Anesthesia Program – BSN to DNP

Applicant Preparation Guide for Clinical Application

We are excited that you have taken an interest in our program. The application process can be overwhelming and intimidating. We prepared this document to assist you in your quest to become a nurse anesthetist. This is a guide and is not all inclusive. The intention is to get you “on the right track” preparing for an interview process. Please let us know if you have any questions about what is contained in this document.

Clinical Preparation

Basics of Physiology

Physiology is the basis for pharmacology and pathophysiology! Almost all drugs either enhance or block a physiological process. This information can be found in the mechanism of action (MOA) for the drug. If you understand the physiology and how it is influenced by the drug, the understanding of pharmacology becomes much easier. Also, pathophysiology is the study of the disruption of a normal physiological process. If we do not truly understand what is normal, then we cannot fully grasp what is abnormal. Most of our patients that we administer anesthesia for are not ICU patients.

Areas to Explore

- Physiology basics
- Understand what is normal or abnormal in your patients
- Know how each drug interfaces with a physiological process

Homeostasis

Our bodies are in a constant state of self-regulation to maintain an equilibrium. The body has a vast network of sensors that provide feedback and send out signals to maintain this state. When this equilibrium is out of balance, our bodies attempt to bring us back into equilibrium. When the body is not able to adjust further, this is where the patient ends up requiring medical attention and may end up in your ICU! You should look at every ICU that you care for and ask yourself what physiological process has been disrupted and how the body was not able to

maintain homeostasis. This will lead you to understand the cause of their admission and the interventions that you are performing for the patient.

<https://www.frontiersin.org/articles/10.3389/fphys.2020.00200/full>

Area to Explore

- Know basic biofeedback and homeostatic mechanisms in the body related to your patients
- Learn how the breakdown in the homeostatic mechanisms lead to your patient being admitted to the ICU

Becoming a scientist!

You should know what and how all parameters in the ICU are measured!

A struggle for ICU nurses is the ability to understand fully what you are measuring each and every day. During an average shift, you monitor and measure hundreds of variables. It is important for you to understand what you are measuring, how it is being measured and the accuracy of the variable being measured to effectively care for your patients. Is the measurement reliable, valid or accurate? Will I do anything with what I am measuring? Will it affect the treatment of my patient?

Area to Explore

- Learn and understand the science behind each measurement that you acquire in the ICU
- Learn and understand the unit of measurement (and what it means) for each measurement

Physics

Even when the person is at rest, the body is still in motion. Molecules and substances are always moving in and out of cells and in and out of the body. Whether they move by pressure gradients, concentration gradients, or other mechanisms, you should learn these processes. Also, the machines in the ICU room are physics machines, such as the ventilator, balloon pumps, Impela devices, IV pumps, etc. You need to learn and understand these principles.

Area to Explore

- There are physics principles throughout physiology textbooks (Ohm's Law, Fick's Law of Diffusion, Law of Laplace, etc) that you need to know and understand.
- The machines that you work with use physics principles. You need to learn and understand those principles.

Mathematics

Mathematics is an integral part of your daily life in an ICU. We input numbers frequently to make inferences and calculations about treatment for the patient. In recent years, the math has been taken away from nurses through computers in the IV pumps and computerized charting. This has also affected our analytical abilities. As an ICU nurse, you need to be proficient at math and analytical abilities.

<https://healthprofessions.udmercy.edu/academics/na/agm/mathweb09.pdf>

Area to Explore

- Mathematics are utilized throughout physiology, pharmacology and daily calculations in the ICU. If a computer is completing the calculation for you, you still need to be able to do the calculation on your own.
- Some mathematical relationships will not give you specific numbers but an understanding of how variables relate to each other. Are two variables directly related or inversely related. Flow and resistance or cardiac output and SVR are inversely related.

Differential Diagnosis

As an ICU nurse, you usually receive a significant report on your patient along with the main diagnosis of the symptoms. In anesthesia, we usually obtain a brief pre-operative assessment and have clinical conditions or situations arise during the case. We have to diagnose and treat these conditions with limited information. You do not have invasive line, access to radiology or an array of lab work immediately at your disposal for conditions that require sometimes only minutes to correct. Once you determine a list of possibilities, you then will need to prioritize the most likely cause and treat it first based on your patient's condition. This is a key function of a CRNA working in the OR setting.

Area to Explore

- Work on situations where you make educated guesses about the diagnosis or treatment of a patient with limited information. Before you draw a blood gas, try to predict what it will be when it comes back. Look at other patients in the ICU that you are not familiar with and try to guess what their diagnosis is using limited information.

Autonomic Nervous System (ANS)

A significant part of your learning needs to focus on the autonomic nervous system. This will give you significant insight into the pathophysiology of your patient and many of the drugs used to treat your patients. Anesthetists spend a significant portion of their day understanding and manipulating the autonomic nervous system.

Area to Explore

- Know the entire function of the ANS
- Know the pharmacology of drugs that you administer that interface with the ANS

Respiratory system

The respiratory system involves very complex processes that allow molecules of gas or air (primarily oxygen, carbon dioxide and to a lesser extent, nitrogen) to enter the body, diffuse into the blood stream and subsequently travel to the tissue for utilization by the body. Assessment of the function of the respiratory system involves not just looking at one measurement (i.e. oxygen saturation) but a larger view of many measurements (partial pressures, hemoglobin, V/Q, etc.). In order to understand this function, the applicant must be able to trace and measure the movement of the air or gas molecules from outside the body until it reaches the tissue. Measurement of the respiratory system involves volume (amount of a substance in a contained space), flow (amount of volume per a given unit of time), resistance (anything that inhibits flow), pressure (when molecules collide with the sides of a container and influence flow), partial pressures (how much of that volume is taken up by a particular gas), diffusion (how well a substance moves across a membrane) and solubility (how well a substance goes into a solution). When the path of oxygen from the air to the targeted tissue(s) is disrupted, tissue hypoxia occurs and the body attempts to compensate. When compensation fails, the patient needs medical intervention. Your role is to determine where the disruption is occurring and focus interventions to correct the disruption.

Area to Explore

- Oxygen Delivery and Carbon Dioxide Elimination
- Modes of Ventilation
- Arterial Blood Gas (ABG)
 - The ABG has four main parts (for the questions below, we will focus on acidosis):
 - pH - What does pH measure? What are the two main sources of excess hydrogen ions? What are the negative impacts of too many or too little concentration of hydrogen ions? What are the three main buffers (one is not truly a buffer but more of a distractor) of hydrogen ions?
 - paCO_2 - What is the cause of excess CO_2 in the blood? Is the excess CO_2 able to exit the body?
 - HCO_3^- - What is the purpose of HCO_3^- ? Why is it consumed?
 - paO_2 - What is the disruption point that this measures? What is a measure of tissue hypoxia? How do we correct this level?

Cardiac Physiology

The cardiovascular system is a closed loop system utilized to generate pressure gradients (physics). It also has an electrical and chemical system. Anesthetists affect and manipulate this system through fluid administration, pharmacology and other mechanisms.

Area to Explore

- Know basic hemodynamic principles of the cardiovascular system
- Learn and understand how you are measuring the function of the cardiovascular system
- Know the pharmacological intervention and how they interface with the cardiovascular system

Preparation for the interview may also focus on the following areas:

- Lab values/interventions to correct abnormal values
- Shock states
 - Identify the various shock states
 - Interventions to correct
 - Where is disruption of oxygen delivery to the tissues is disrupted
- EKG interpretation and interventions
- Electrolytes
 - Normal values inside and outside of the cell
 - Concentration gradients related neuron and cardiac action potentials

Below are resources for your clinical preparation:

There are two textbooks from the NBCRNA (the company that provides the board exam) bibliography that you can use to prepare for the application/interview process. Older versions that cheaper may be used as the focus below is on pharmacology and physiology and not anesthesia techniques.

Nagelhout, J.J., & Plaus, K.L. Nurse Anesthesia, (6th ed.) Philadelphia: Saunders (Elsevier Health Sciences). 2018.

- Chap. 5 – General Principles, Pharmacodynamics and Drug Receptor Concepts
- Chap. 6 – Pharmacokinetics
- Chap. 13 – Autonomic and Cardiac Pharmacology
- Chap. 14 - Chemistry & Physics in Anesthesia
- Chaps. 16, 17 – Clinical Monitoring of the CV and Respiratory systems
- Chap. 20 – Fluid, Electrolyte and Blood Component Therapy
- Chaps 23, 26 and 28 – the physiology sections only of these chapters (CV, Resp. and Neuro)

Stoelting, R.K., Hiller, S.C. Pharmacology and Physiology in Anesthesia Practice (5th ed.). Philadelphia: Lippincott, Williams, & Wilkins; 2014.

- Chap.2 - Basic Principles of Pharmacology
- Chaps. 1, 11, 14, 15, 24, 25 – Various Physiology Chapters

The following websites may be beneficial in your preparation:

- Khan Academy - www.khanacademy.org
 - Physics
 - Fluids
 - Forces & Newton's Laws of Motion
 - Work & Energy
 - Chemistry
 - Chemical bonds
 - Gases
 - Acids and Bases
 - Health & Medicine
 - Focus on the circulatory, respiratory and nervous systems
- www.cvphysiology.com
- www.cvpharmacology.com

Other Books of Interest:

- [Cardiovascular Physiology Concepts by Dr. Richard Klabunde](#)
- [West's Respiratory Physiology: The Essentials by Dr. John West](#)
- [The ICU Book by Dr. Paul Marino](#)
- [Essentials of Mechanical Ventilation by Dr. Dean Hess](#)
- [Fast Facts for Critical Care \(free eBook\) by Kathy White, RN](#)

We hope that you gained valuable information from this guide. As you can see, preparation to be a student in a nurse anesthesia program is not just about clinical skills and knowledge. During the interview process, we only have a short period of time to assess your clinical abilities and "soft skills". It is up to you to practice communicating and presenting yourself to us during your time in the interview process.