

## PERFUSION EDUCATION



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### The Use of a Patient Simulator in Perfusion Education – the Student’s Point of View

An Interview with students Robert Brown, Nicole Tomasello, and Ashleigh Trew  
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In the fall of 2009, clinical simulation was fully integrated into the clinical courses at the SUNY Upstate perfusion-training program in Syracuse, NY. Cardiopulmonary bypass takes place in a realistic mock O.R. with the Orpheus Perfusion Simulator (ULCO Technologies) providing the simulated patient.

**MOLLY:** How does CPB simulation fit into your typical week at school?

**SUNY STUDENTS:** At the SUNY program, perfusion school consists of five semesters. The curriculum incorporates high fidelity simulation into the first three semesters. Each semester, the simulation component is applied differently as we acquire skills and learn perfusion concepts that directly apply to our training in the real operating room.

*Semester 1:* The focus of this semester is skill development through repetition. The initial five weeks of school we went through a perfusion “boot camp” where we started with the basics. This included learning the components of the CPB circuit and how to work with tubing, tubing clamps and connectors. We progressed into setting up the pump, and then priming the pump. Only after we mastered those low fidelity “wet-lab” skills could we move into the high fidelity environment of the mock O.R. At this time, we were introduced to the Orpheus and its many capabilities. We should note that as students we are not allowed to actually see the hardware of the Orpheus. What we see is a draped patient. In addition, we cannot enter the mock O.R. without scrubs, hat, mask, and gloves. Our faculty says that this helps to maintain a high level of psychological fidelity to the process. Once in the mock O.R., we began learning the interface of the heart-lung machine with the patient. Then we began to learn the elements of a CPB case, initiation, cardioplegia delivery, and termination. It is in the Silverman Hall simulated O.R. that we learn how to control reservoir levels with fine-tuning skills, monitoring pressures, administering drugs, and communicating with the surgical field.

We have been exposed to problems such as venous drainage, cannula disruption, occlusion of cardioplegia lines, and misplacement of cross clamps. We have learned to use vacuum assisted venous drainage as well as hemoconcentration to control hematocrit levels. Hemodynamics can be manipulated to force us to recognize an issue and try to resolve it. For example, if the blood pressure gets too low, we can administer Neosinephrine using the electronic touch screen that communicates with the Orpheus. This electronic touch screen displays blood gas values and allows us to control gases, ACT levels, pH, and drug administration. Concurrently, we are rotating through the actual O.R. at our local hospitals. Every day we are either at the simulation room or in an actual O.R. By the end of the first semester we are evaluated with a standardized CPB case using the Orpheus. We were graded on about 80 individual skills and debriefed on our performance. While the Mock OR is a student-focused environment, we can never let our guard down. We still get nervous when working on simulated patients. Our program director made it clear to us that if we can’t perform in the simulator we will not be going to the real OR. Simulator training is not a game; we have to take it very seriously.



Pictured in the simulation lab are from left to right: Nicole Tomasello, Robert Brown and Ashleigh Trew.

*Semester 2:* The focus of this semester is skill application through simulated surgeries. In this semester we spend alternating three-week blocks either in the hospital or in the simulation room. The lectures are synchronized to compliment the simulation scenarios. For instance, we are given lectures on CABG surgery and then spend a week in the simulator doing progressively more challenging simulated CABG patients, the next week is mitral valves; we also do aortic valve cases, aortic surgeries and combined CABG and valve procedures. For each case, we have to do everything we would do in the real OR. There are 2 students per group. We enter the OR in scrubs and proper personal protective equipment. We start with a patient chart and do the necessary calculations, set up and prime the pump, complete a checklist, draw up drugs, and choose cannulas based on information we are given about patient and surgical procedure. We also interface the circuit with the surgical field and conduct the CPB while interacting with our instructor who plays the role of the surgeon. Cases average about an hour. We each get to pump a case and then shadow our partner. Four days a week are spent in the lab with a gradual progression and difficulty of cases. During cases, we are questioned on our knowledge of the progression of the procedure, and troubleshoot problems that are created to anticipate what needs to be done next, and to communicate with the field in a concise and professional manner. These experiences have really helped our understanding of what is going on in the real O.R., not to mention that we are continuing to refine our technical skills.

*Semester 3:* The focus of this semester is to develop competency of low volume events by practicing them frequently. In this semester the surgical scenarios incorporate emergency and crisis events that normally do not present in the operating room. If we weren’t doing crisis management simulations, we could complete our entire education without ever diagnosing an oxygenator failure or changing out an oxygenator while on CPB. It is reassuring to know that if these crisis events occur in our clinical practice

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in the future, we will have a knowledge and experience base to rely on at that critical moment.

**MOLLY:** What procedures and events can be simulated with the Orpheus simulator?

**SUNY STUDENTS:** The Orpheus device is a simulated patient to which we can connect any heart and lung machine. The hemodynamic pressures that we monitor through the Orpheus are not generated by a computer. The pressures and flows are real hydraulic forces. If you open the clamp on the arterial cannula, the simulated patient will exsanguinate, red fluid will gush out and blood pressure monitoring alarms will sound, and the sense of crisis in the room is palpable. Our instructors like to tell us that since all the equipment that we touch during a simulation is real clinical equipment, and because the pressures and flows are all real, we are not simulating CPB, but we are actually doing CPB - on a simulated patient. With this device we gain experience with a variety of different heart and lung consoles, and practice on both roller-head and centrifugal pumps. Any procedure requiring CPB can be simulated with the Orpheus. There are a few limitations with regard to patient size and ancillary devices. Very small and very large patients are difficult to simulate (< 20 and > 100 Kg) and it is difficult to incorporate IABP and ventricular assist devices into the scenario, as these devices don't interface with the Orpheus very easily. There are also some limitations to simulating ECMO. The hemodynamics of AV ECMO can be easily reproduced for the size of patients described above but the blood gas monitoring provided with the Orpheus does not currently simulate the three standard blood gases of the ECMO patient (pre, post and patient ABGs). Venous-Venous ECMO cannot be simulated with the Orpheus device at this time. The computer interface for the Orpheus provides a menu of built in events that can be simulated with the click of a button. Venous chatter, venous line air, venous line occlusion, arterial line occlusion, gas source failure, power failure, and loss of circuit volume are all integrated in to the system. Additionally, our instructors can manually simulate other events too, such as urine output, vein graft perfusion and bicaval cannulation to name a few.

**MOLLY:** What are the advantages and disadvantages of simulation training for the perfusion student?

**SUNY STUDENTS:**

**Advantages:**

- We can practice skills repeatedly that we would not be able to in a "live" situation.
- Problems and issues can be simulated with the Orpheus to teach us how to react and troubleshoot.
- We get to practice communication with the surgical field.
- We learn to balance blood gases, hemodynamics, and patient's pH.
- We gain experience with cardioplegia delivery, flow down a vein, and initiation and termination.
- We gain confidence in our skills to take with us in an O.R.
- We learn how correlate data with knowledge. Ex. CVP pressure with the right heart filling and emptying.

**Disadvantages:**

None. Because we are still very active clinically, there really are no disadvantages that we found. We will still rotate through at least four different hospitals and perform 150-180 clinical cases in the O.R. on real patients. The simulator augments and compliments our real experience. We will watch about 50 of our classmates' simulation sessions and perform another 50 of our own. We can watch the videos of our simulated cases and review our performance with our instructors. We are very happy to have the opportunity to train with high fidelity simulation!

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## CE SELF-QUIZ ANSWERS

1. True	4. C	7. False	10. A
2. B	5. A	8. C	11. D
3. B	6. D	9. False	

## PLEASE NOTE

At AmSECT's 45th International Conference, the Society erred in presenting the Fellowship in Cardiovascular Perfusion Award to an unqualified presenter. This error was made through no fault of the recipient, and has been corrected. The records reflect that no Fellowship in Cardiovascular Perfusion Award was given in 2007.