Unlocking our Future Medical Careers with STEM

By Jesse and Jeanelle Reyna from NOVA IQ Robotics, Team 99808A

World renowned surgeon, Dr. Pier Cristoforo Giulianotti, once said "in robotics there is a charming revolution... You are modifying reality using virtuality. You are using a virtual environment to interact with reality; the only limit is your mind." (Giulianotti, 2010). Like Guilianotti, we believe that we can shape our reality with robotics. We are Jesse and Jeanelle from NOVA IQ Robotics Team 99808A, and we both want to become medical doctors. We want to become doctors because people that we love are struggling with medical problems. We want to be able to not only save their lives, but hundreds of others. Robotics



is teaching us important things now so we can innovate and thrive as future doctors. We actually got into robotics because of our interest in STEM! While we are both interested in medicine, we want to get into different specialities. Jesse wants to be a radiologist, and Jeanelle would like to be a surgeon. Robotics is a very important part of our lives that will help us achieve our dreams.



This chart represents the minimum training and educational requirements needed to become a medical doctor.

Being a doctor requires many years of education and training. In order to become a doctor you first need your bachelors degree from a university. Then you go to medical school which takes about 4 years. After that you complete your residency and fellowship which takes 4-6 years. Finally you are now certified to become a doctor and can practice medicine. Doctors should also expect career long training to maintain skills. (Scheepers, 2020) Once settled into their careers, surgeons make a median salary of \$396,767 a year, and radiologists make a median salary of \$417,890 a year. (Salary.com, 2020)

Surgeons are medical doctors that perform surgeries on patients to improve their health. Radiologists are doctors that use scans and test results to diagnose patients. There are a lot of skills that a surgeon and radiologist need to have in order to be successful. Surgeons need to have excellent fine motor skills, hand-eye coordination, and patience to perform operations. (Debas, 2002) Radiologists need to be detail oriented and precise in order to spot cancers and tumors on a scan. They also need to work with top of the line technology, to identify problems and diagnose patients. (Kandola, 2019)

People in the medical field need to have a comprehensive understanding of all STEM areas. (Bolin, 2019) Doctors must have a developed understanding of the scientific method to come to conclusions. (Cleophas, 2009) Doctors also use technology to take measurements, complete blood work, perform operations, and take scans. (Brown, 2019) Doctors frequently use engineering to

design robots such as the da Vinci that helps perform surgeries. The da Vinci machine is a robot that is used to perform very complicated teleoperated surgeries, and has better precision than most surgeons. (Jones, 2011) In VEX IQ Robotics we also use engineering to design and control robots that perform specific tasks just like the robots that



This surgeon is using the da Vinci machine for a teleoperated surgery.

doctors design. Doctors use graphs and charts to determine the correct treatment and prescriptions for patients. They also use research, data, and statistics to find out which methods work the best on patients. Like real doctors, we learn these methods in robotics by developing graphs to log driving and programming scores to measure our development over time for analysis. Robotics is helping us become doctors by exposing us to important skills. As we mentioned earlier, being detail oriented is a very important skill for radiologists and surgeons to have. (Kandola, 2019) Through robotics we know how important it is to be very detail oriented; missing small details in our code will affect our programming and making mistakes in our design and blueprinting process can complicate our build. In competitions we are constantly multitasking and prioritizing our time, which is something that doctors need to be able to do fluidly in high risk and high pressure environments. We also learned about using Agile Project Management, Gantt charts, and kanban boards to manage our time and projects. Doctors use these tools to manage their multiple patients and surgeries. In robotics we learn to use deeper analysis like doctors do when we are designing our prototypes, planning, drawing blueprints, problem solving, and working on our engineering notebook.



At competitions, we learn how to explain our robots and strategies to different judges.

Robotics teaches us excellent verbal, visual, and written communication skills through competitions, online challenges, and STEM Research Projects. Like doctors, we build interpersonal communication skills by interviewing with judges at competitions. Having good communication skills is essential when doctors need to communicate with their patients. Building and driving robots develops fine motor skills which surgeons will need when

operating. We learn how to problem solve when driving and building- when we make a mistake, we quickly find a solution. As a surgeon, if something goes wrong during a surgery, you need to be able to fix that mistake under pressure.

As we researched this project we found a leader in the medical field that really resonated with us. Dr. Pier Cristoforo Giulianotti has pioneered robotic assisted surgery by using robots to

perform complex surgical procedures. He has performed over 2,000 robotic surgeries and is

considered the foremost robotic surgeon in the world. (Giulianotti, 2017) He has inspired us to always look at how we can improve outcomes for our patients. He also inspired us to always work hard to find a solution to a problem. When Dr. Giulianotti was a student, he saw an open chest surgery, and he thought it was too violent. He wanted to create a safer and better way to operate on patients, and began to use robots in surgery to improve outcomes and minimize pain and discomfort for his patients. He attributes his revolutionary ideas to wanting to help his patients get better, and have easier and faster recovery times. (Times, 2010) This need pushed him to become one of the first people in the world to use robotics in gastrointestinal, oncological, pancreatic, thoracic, and vascular



Dr. Pier Cristoforo Giulianotti has revolutionized the medical field by integrating robotics into surgery.

surgeries. (Giulianotti, 2017) One day, like Dr. Guilianotti, we hope that we can help create something revolutionary in the medical field using robotics!



Carlos Medina is a biomedical scientist that is working to find cures and treatments to cancer.

We also interviewed Carlos Medina, a biomedical scientist that studies cancer biology and ways to treat tumors. He says that his motivation for attempting to battle cancer is because he realized that his work could potentially save millions of lives. We had the opportunity to interview him in a Zoom meeting. We asked him how important he thinks robotics in medicine is, and he said "Robotics in medicine is very important. I use multiple different types of robotics including machines that scan bones, and machines that scan the body for tumors. I also think that since this generation is so familiar with technology, it will only be a matter of time until the medical and science field completely adapts to robotics." (Medina, 2020) As aspiring doctors, it was extremely fascinating to talk to him about robotics and machines, because we know that radiologists will be using similar machines to diagnose in the future.

The medical field normally progresses rapidly, but because of COVID-19 the medical field is evolving at unprecedented rates. Currently because of the COVID-19 situation, there are plenty of robots being used to interact with, and treat patients from a distance. In 10 years, we think that there will be more robotic usage in the healthcare industry because a lot of patients have



This robot is helping patients receive instructions from their doctors. Other robots like it are delivering items, food, and water to patients in isolation.

illnesses that can be spread easily. Contactless treatment will be the new standard. As a result of COVID-19, robotic treatment will become extremely widespread. We think that in 10 years, the biomedical robotic industry will make robots cheaper and more accessible to more places in the world. By then we think that surgery will be dominated by robotics, as statistics have shown that robotic surgeries typically have better results than when a person is performing it. (Mayo Clinic, 2020)



Jeanelle imagined and drew this robot that can perform contactless treatment for patients in the future.

Robotics has prepared us in so many ways for a career in medicine, specifically as a surgeon and radiologist. By teaching the value of precision, detail orientation, quick thinking, and good motor skills, robotics has prepared us for our future success. With COVID-19, the medical field is evolving right before our eyes, and the future of robotics and medicine will depend on each other more than ever. The close relationship between robotics and medicine proves to us that participating in competitive robotics is a great starting point for our future medical careers.

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