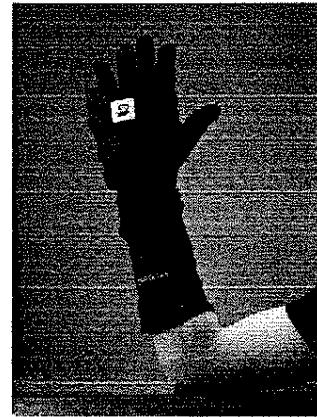


# **Collegiate Inventors Competition®**

## **Sample Abstract**

**Part 1: Abstract – The CPRGlove**

The CPRGlove is a portable, inexpensive device incorporating multiple sensors in a wearable glove. The glove is designed to improve the efficiency and accuracy of CPR. Through audible and visual cues, the CPRGlove guides the user through each phase of CPR. It collects sensory data relevant to CPR including applied pressure, compression depth, compression rate, heart rate, and hand positioning information. This data is then provided back to the user in order to improve the quality of the compressions being delivered. Therefore, the glove can be used in three distinct scenarios: in simulation-based training, in maintaining CPR quality through testing, and in emergencies.



# **Collegiate Inventors Competition®**

## **Sample Student Essay**

## Part 2: Description of Invention

“More than 50 years after the introduction of CPR, survival from cardiac arrest remains low” (MedPageToday.com). According to the journal of the American Medical Association, CPR (Cardiopulmonary Resuscitation) is performed inconsistently and inefficiently resulting in preventable deaths. Months after the completion of standard CPR training and testing, an individual’s competency at performing effective chest compressions deteriorates significantly. Even more startling is that this finding holds true for trained professionals such as paramedics, nurses, and even physicians.

Developed at McMaster University as a final year design project under the supervision of biomedical engineering professor Dr. Hubert de Bruin, the CPRGlove is a portable, inexpensive device incorporating multiple sensors in a wearable glove. The glove is designed to improve the efficiency and accuracy of CPR. It collects sensory data relevant to CPR including applied pressure, compression depth, compression rate, heart rate, and hand positioning information. The glove is to be used in three distinct scenarios: in simulation-based training of individuals, in maintaining CPR quality through testing, and in real life emergencies.

In the case of training, the device is to be worn on one hand of the person performing the CPR. He or she can then proceed to perform CPR unhindered. The glove guides the user (using an attached display) on the proper technique and timing of the phases of the CPR routine. Instructions are displayed to the user as well as data such as how fast the person is performing compressions. After a training session, the data can be downloaded or stored for further analysis. The CPRGlove allows individuals to train themselves or be trained with minimal supervision.



In the case of testing, an individual wears the glove and performs a number of cycles of CPR. After completion of a test, all data can be sent to a computer system. The computer software will then determine if the individual performed CPR correctly and effectively. Therefore, the glove provides an objective, standardized measure of CPR quality.

In real emergencies, the glove is worn during administration of CPR. The glove guides an individual through each phase of CPR. Furthermore, data feedback is provided to the user in real-time so that the CPR is performed effectively and efficiently. These gloves can be

easily stored in first aid kits, pool houses, homes, community centers, restaurants, malls or any other location where it may be needed. It is no larger than a standard glove and is extremely portable and can be taken on trips, hikes, and even carried in a purse or backpack.

The market for CPR training is substantial. In 2006, the Canadian Red Cross trained over 350 000 people. In the United States, the American Heart Association trained over 11.4 million people and aims to train 20 million every year by 2010. The services provided by these organizations alone represent a North American CPR training market of over five hundred million dollars annually. With the inclusion of other smaller CPR training organizations as well as the different levels of first-aid training, this market figure rises to over one billion dollars annually.

Several CPR assist devices currently exist on the market. The most widely used technology in the training environment is the CPR mannequin. One commonly used version is the Resusci-Anne doll manufactured by Laerdal Medical Inc. The Resusci-Anne doll allows an individual to practice his or her CPR while being subjectively monitored by an instructor. This technique relies heavily on the observational skills of the instructor and is prone to human error. Furthermore, for effective training to take place, each student must be observed separately thereby occupying a significant amount of time and decreasing the number of students who can be trained at one time.

A second device is manufactured by Philips Medical inc.: the Q-CPR. The Q-CPR device is an accessory to the QuickStart defibrillator also manufactured by Philips Medical. Although not currently marketed as a training device, the Q-CPR currently exists as a resuscitation aid and has future potential as a training technology. The device is a block that provides compression depth and rate information to a rescuer through the display on the defibrillator. Although this device provides accurate, quantitative data, it must be tethered to a defibrillator and is both awkward and non-intuitive when being used. The device is also expensive at over \$15 000 per unit and appears to be only accessible to the trained professional market. This is not a device that can be purchased by the typical consumer and lacks the portability and practicality of a lightweight, flexible device such as the CPRGlove. In addition, the patient's comfort and safety is a concern when an external, rigid device such as the Q-CPR is being employed. If the user is not familiar with the device, its use could result in injury. Other devices, such as Zoll's D-Padz and the CPR-ez employ similar technologies and thus encounter similar disadvantages when compared to the CPRGlove technology.

Beyond these device specific disparities, the CPRGlove has features unique to its design. For example, the CPRGlove incorporates sensory not possible on other devices such as compression angle information. While performing CPR, the rescuer's arms should be locked perpendicular to the patient's body to maximize the amount of transferred energy and force. This type of sensory will help reduce the energy exerted by the rescuer thereby increasing the duration of effective resuscitation. The CPRGlove's design also allows the incorporation of sensors that promote adaptability. With the use of fingertip and palm based sensors, one glove permits efficient CPR on infants, children and adults.

The CPRGlove has received numerous awards and accolades over the past six months. The device was presented at two competitions in February and March of 2007. In February, the CPRGlove received first place overall in the 'Innovative Design' category at the Ontario Engineering Competition (OEC) held in Ottawa, ON. The following month, the device placed second in the same category nationally at the Canadian Engineering Competition (CEC) held in Saskatoon, SK. Furthermore, the device received the honour of being named one of the 'Top Ten Inventions' of 2007 by Popular Science Magazine in its June 2007 issue. The CPRGlove also had the distinction of being the only Canadian invention awarded the prize. Furthermore, the CPRGlove and its inventors have appeared in over 500 newspapers and on numerous television and radio broadcasts including Canada AM Breakfast TV and CBC Morning Radio.

The CPRGlove was invented at McMaster University and its development prior to incorporation of the startup company Atreo Medical Inc. was carried out on the premises of the university with support from McMaster in the form of laboratory space, equipment and technical expertise. Dr. Hubert de Bruin has and continues to act as a biomedical engineering consultant to the group but retains no equity in Atreo Medical Inc., no share in the patent or any intellectual property. The intellectual property and patent rights are owned entirely by the inventors.