Personal Details
In 2001, I entered the Degree in Applied Sciences at DIT. In first and second year the subjects involved were Maths, Physics, Chemistry, German and Management Studies. Upon completing my second year of the Applied Sciences Degree I chose Physics as my main subject for third and fourth year ahead of Maths and Chemistry. Along with Physics I studied Physics Technology. My main areas of academic interest include Biophysics, Nuclear Physics, Solid State and Material Spectroscopy.

My hobbies include reading, cinema and socialising with friends. I enjoy travelling and have spent summers living in America and travelling around Europe. From next year I hope to travel more while developing my career.

Project Summary
Medical staff use electromedical equipment every day. The aim of this project was to test this equipment and ensure it complied with regulations and standards. The project was carried out in Beaumont Hospital and St Joseph’s Hospital Raheny. The electromedical equipment tested included a dialysis machine, an infusion pump, a tilt table and a hydraulic couch.

Electrical safety is defined as the containment or limitation of hazardous electrical shock, explosion, and fire and the containment or limitation of damage to equipment and buildings. Electrical shock can occur in the forms of either macroshock or microshock:

**Macroshock**
A high current passing through the body with a small component passing through the heart.

**Microshock**
A low value current passing directly through the heart. Microshock can occur through connections made to a patient, such as a saline filled catheter.

All electrical equipment, which is intended for use in medical environments, should comply with certain safety requirements, usually determined by the government of the country in which it is to be used. The International Electrotechnical Commission (IEC) has published certain safety standards, IEC 60601-1, which every piece of electrical equipment should satisfy. In general, these standards concern construction, admissible leakage currents and insulation requirements.

The safety tests performed on the equipment as part of this project included leakage currents, current consumption, insulation resistance and protective earth resistance. These safety tests were performed to ensure the equipment conformed to the standard IEC 60601-1 and were carried out using a piece of equipment called the 601PRO manufactured by Biotek.

The most important of the tests were the leakage current tests. Leakage currents are defined as the currents that flow from or between conductors that are insulated from earth and from each other. They are normally small. However, since the amount of current required to produce adverse physiological effects is also small, such currents must be limited by the design of equipment to safe values. For medical electrical equipment, several different leakage currents are defined according to the paths that the currents take. The various leakage currents for medical equipment are earth leakage current, enclosure leakage current, patient leakage current and patient auxiliary current.

All electrical medical equipment was categorised into classes depending on the method of protection against electric shock that is used (see Figure 1). The equipment was categorised into 3 classes depending on their degree of protection. The
three classes were Class I, Class II and Class III and types B, BF and CF. Class I equipment has a protective earth, Class II equipment has double insulation or reinforced insulation and Class III equipment is equipment which relies on the fact that no voltages higher than safety extra low voltage (SELV) are present, which are defined as a voltage not exceeding 25V AC or 60V DC. The different types of equipment are also categorised depending on their protection against electric shock. Generally on most pieces of equipment one of the symbols will be present to make it easier to classify the equipment. Type B equipment provides a basic degree of protection against electric shock as specified in the standard. The applied part typically has direct earth connection.

Type BF provides a higher degree of protection against electric shock than that provided by Type B. Like Type CF, it is floating (identified by "F") with respect to earth (device ground). The floating circuit provides added protection. The isolation of applied part from earth removes the conduction of functional currents (in the event the patient is earther) of a defibrillator or another applied part through the body.

Type CF: Typically intended for applied parts for cardiac application. Provides a higher degree of protection against electric shock than that provided by Type BF. Much tighter leakage current limits to the patient.

Defibrillation-proof applied parts are an additional consideration for Types BF and CF applied parts if the medical product under test can be used in a situation where the product is connected to the patient while defibrillation is applied. Defibrillation proof equipment symbols are shown here.

The 601PRO was a very helpful and essential tool in carrying out the project. Once the details of the equipment being tested were taken, such as class and type, they were inputted into the 601PRO and a suitable standard was selected. All the equipment tested was done under the IEC 60601-1.

The equipment being tested was plugged into the 601PRO and all applied parts were connected as required. Once the standard was selected and the equipment was classified as the right class and type, the 601PRO carried out all the appropriate tests.

All the electromedical equipment tested passed the electrical safety tests as set out under the IEC 60601-1 regulation.

Finally, upon completing the project it was recommended that electrical safety tests should be carried out on electromedical equipment at regular intervals and a database of results should be kept. This will ensure that all the equipment used in medical environments complies with the required standards and should an error occur subsequent users of the electromedical equipment will know about them and that they have been rectified.