GEORGE CHRYSTAL

Mathematician **George Chrystal** (March 8, 1851 – November 3, 1911), whose greatest contribution was perhaps in championing educational reform in his native Scotland, he proposed *The Universities (Scotland) Act* (1889), which liberalized University constitutions and curricula. It allowed anyone in Scotland, no matter what their social or economic status, to attend college, as long as they were intelligent enough to succeed. Chrystal helped devise a plan to make schooling more uniform by mandating a certain number of course required for graduation with a degree. Four competencies were required: language and literature, mental philosophy, science and law. Chrystal's reforms went so far to allow women into the Arts program. He felt that Scottish society suffered because mathematics was not an integral part of the curriculum in primary, secondary or higher education, and set out to change this unfortunate circumstance.

Chrystal was born in Old Meldrum (near Aberdeen). His record at Aberdeen Grammar School was outstanding, as was his performance at the University of Aberdeen. He won a scholarship to Peterhouse, Cambridge, which he entered in 1872. There he was greatly influenced by the experimental physicist James Clerk Maxwell. Shortly after graduating from Cambridge in 1875, Chrystal was elected a fellow and lecturer of Corpus Christi College. Two years later, he was appointed to the Regius Chair in Mathematics at St. Andrews University. In 1879 he accepted the Chair in Mathematics at the University of Edinburgh, which he held for the rest of his career. He also served as Dean of the university, in which capacity he was able to institute a reform that spread to all Scottish universities ensuring that all graduates would have some form of mathematics education.

In 1880 Chrystal was elected a fellow of the Royal Society of Edinburgh. Most of his papers appeared in publications of the Society. After spending three terms on the Council of the Society, he became its General Secretary in 1901. He was instrumental in finding it a permanent location at 22-24 George Street in Edinburgh, with a grant of £25,000 for the purchase of the building and another £3,000 for repairs and equipment. The Royal Society still occupies this building. Chrystal's mathematical publications were in many fields, including non-Euclidean geometry, conics, determinants, optics and differential equations. However, his most famous book is his classic *Algebra*: *An Elementary Textbook for the Higher Classes of Secondary Schools and Colleges*, published in two volumes (1886, 1889). Generations of students learned algebra from this book.

When Chrystal was appointed Dean of the Faculty of Arts at Edinburgh, in 1891, he carried out important educational reforms, which gave students complete freedom of choice of courses and providing equality of subjects. Chrystal's reforms were not meant to make things easier for students academically. His motto was "Greater freedom and higher standards." He was instrumental in introducing a *Leaving Certificate Examination* (1888) common to all schools. Many of Chrystal's students believed that the professor could have used some reform in his personal teaching methods. His lectures apparently were only for the gifted few and left average students in states of confusion and despair.

According to Howard W. Eves in *Mathematical Circles Squared,* J.M. Barrie, the creator of "Peter Pan," described Chrystal and the students in his first-year mathematics class as "a fine hare for the hounds who keep up with him." One of Barrie's fellow students carved the warning "All hope abandon, ye who enter here," into his desk with a penknife. It was said that Chrystal's lectures were so difficult that very few students willingly took his classes. Legend has it that one day a notice was hung on the

door to Chrystal's lecture room, which read: "There will be no class today, as the student is unwell."

Some may find it strange that Chrystal was considered a major educational reformer even though his students found it difficult to follow or stay current with the material in his lectures. But the reforms Chrystal championed were not reforms of lecturing (let alone teaching which is certainly not the same thing) but of curricula. Novelist James Hilton wrote *Goodbye Mr. Chips* (1934) to honor his father who was a Latin and Greek master in an English public school (which, by the way, is a private school). In 1939 the story was made into a cinematic treat starring the very talented Robert Donat as the shy schoolmaster. Donat won an Oscar for his performance, which was flawless, but Hilton's Mr. Chipping was not a model teacher – he was a terrible bore and martinet. His only interest was drilling his pupils in making precise translations. There didn't appear to be much interest on his part and certainly not by the students in understanding the content of what was being translated. Anyone who could feel nostalgic for the type of instruction given by such a schoolmaster must be a masochist. In a musical remake in 1969, Mr. Chips as played by Peter O'Toole was still appealing as a character but not as a teacher and besides O'Toole can't sing, as he has readily admitted.

Quotation of the Day: "Every mathematical book that is worth reading must be read backwards and forwards if I may use the expression. I would modify Lagrange's advice a little and say, 'Go on, but often return to strengthen your faith.' When you come on a hard or dreary passage, pass it over; and come back to it after you have seen its importance or found the need of it further on." – George Chrystal