

The Value of a Science Education¹

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Nature is wondrous. It never stops to amaze us. This beauty has through the centuries inspired all of man's endeavours, his arts and his science. Of the two, art seems more appreciative of beauty. Indeed, a popularly held opinion among laymen is that the in depth study of a phenomenon that is the essence of the scientific method somehow subtracts from the appreciation of an object's beauty. We who have had the privilege to look at the world through the spectacles of science know that this is not so. On a clear night the starry sky is truly inspiring, yet how much more inspiring is the vision modern astronomy paints of endless vistas of stars young and old, of galaxies rushing away from each other at fantastic velocities, of black holes that rip the very fabric of space-time, of quasars shining with the light of hundreds of billions of stars like our own Sun - the distant messengers of the very edge of creation, of the cold microwave radiation echoing through space to inform us of the very birth of the Universe some twenty billion years ago.

Science has been around for many centuries, however, it is only relatively recently that we began to recognise it as an indispensable part of general education. This happened towards the end of the last century. The famous debate in 1860 between Bishop Wilberforce and Thomas Huxley is often taken as the dawning of this new age. The Bishop concluded his attack on the theory of evolution by asking Huxley whether his descent from the ape was on his father's or mother's side. Huxley replied: "If then the question is put me would I rather have a miserable ape for a grandfather or a man highly endowed by nature and possessing great means and influence and yet who employs those faculties and that influence for the mere purpose of introducing ridicule into a grave scientific discussion - I unhesitatingly affirm my preference for the ape". Huxley remained on the crusade for science until his death in 1895. Although he made substantial contributions to biology and palaeontology through his life, Huxley thought of himself less as a researcher than as a populariser of science. He was lucky in that in his lifetime his vision profoundly changed the system of education, and in so doing transformed the world view of his contemporaries. Already the permanent scientific revolution had set in. Ever since, at an accelerating pace, science has broadened our horizons, and through technology changed our everyday world.

In the 1940's and 1950's the atomic bomb and Sputnik brought a profound change in how the world viewed science and scientists. The realisation that basic research is the foundation on which one must build a technological society brought on a renewed emphasis on the necessity for a better science education. Fuelled by the arms race, the education systems in all developed countries sought to mass-produce new science professionals. The massive funding has brought about a spectacular flowering of many areas of basic science, as well as of applied sciences and technologies. Most probably, when future generations view the Cold War era they will find that this science renaissance was its single most important characteristic. This is one of the ironies that one often sees repeated through all of history.

The objective of scientific and technological domination of one nation over another was a short term goal. For this reason no such push for excellence came at the level of the education of the general populace. Politicians persuaded taxpayers to gladly part with billions for scientific research. At the same time, while glorifying science, the public drifted further and further from understanding its inner character. Today a deep underlying distrust of science runs through the accepted attitudes of the general public in the most advanced nations. Paradoxically, the bubbling retorts, the sparkling wires and the mysterious dials are often regarded as the source of a grave threat. And now, with no warning we are cast into the world of the 1990's. There is no more Cold War, however, as a result of a severe lack of vision in its place we find a vacuum. One of the first effects of this global affliction is a severe cut in funding of both science research and education - the signs of a sick culture.

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We find ourselves living in a world that no longer pursues excellence in education. A world of technology in which most of the people view the products of that technology as a type of magic, using it at a certain level but not understanding it. Because of this a "future shock" sets in. Feeling ever more distant from science people are turning in alarming numbers to the quick fix solutions: astrology, fortune telling, xenophobia, religious and ethnic intolerance. As we see we are no longer in the upbeat romantic days of Huxley. We have now spent more than a century in what will probably be known as the Age of Science. The sciences have been more successful than any one could have dreamed. This success has come at a terrible price - the split of the population into an educated minority and an uneducated majority.

This split is no longer along purely economic lines. In that sense this has been a "democratic" process - one as often finds the scientifically uneducated among the ranks of the well to do, as among the poor. What are we to do in order to turn this process around, in fact can we reverse it? In my opinion we can. What we as a civilisation are going through is a mid life crisis - our problems have come as a result of our successes not our failures. The solution to the problem lies in a renewed emphasis on an improved flexible system of education, particularly in the sciences. A system in which excellence is not a bad word. A system that is flexible enough that it reaches the gifted and the not so gifted. A system that teaches not so much facts as it allows children to share in the beauty that science reveals. This would be a way of teaching in which "by osmosis" children learn how to identify problems and to attempt to solve them using the tools of scientific methodology. It is evident that the new teachers in this program have to be the active scientists themselves - no one else is competent. It is time for this segment of the population to try to tear down the barrier dividing it from the rest of the world.

One hundred years after his death we again need our Huxleys to popularise but not trivialise science. We again need places like the Petnica Science Center in which high school students get to work side by side with researchers. Places where the enthusiasm for science is still alive. Places where the children come not to get better grades - no grades are given - but to enjoy learning. Places where scientists teach and guide research projects not for a salary - there is none - but for the privilege of passing on the gift of knowledge. The final value of science is to foster in us noble ideas, and to lead us to new and larger views of moral and spiritual truths. In doing this the sciences become instruments of pure culture.