UNIVERSITÀ DEGLI STUDI DI TORINO

PRESENTAZIONE E LAUDATIO DI DAVID MUMFOD

by ALBERTO CONTE

David Mumford was born in 1937 in Worth (West Sussex, UK) in an old English farm house. His father, William Mumford, was British,

... a visionary with an international perspective, who started an experimental school in Tanzania based on the idea of appropriate technology...

Mumford's father worked for the United Nations from its foundations in 1945 and this was his job while Mumford was growing up. Mumford's mother was American and the family lived on Long Island Sound in the United States, a semi-enclosed arm of the North Atlantic Ocean with the New York- Connecticut shore on the north and Long Island to the south.

After attending Exeter School, Mumford entered Harvard University. After graduating from Harvard, Mumford was appointed to the staff there. He was appointed professor of mathematics in 1967 and, ten years later, he became Higgins Professor. He was chairman of the Mathematics Department at Harvard from 1981 to 1984 and MacArthur Fellow from 1987 to 1992.

In 1996 Mumford moved to the Division of Applied Mathematics of Brown University where he is now Professor Emeritus.

Mumford has received many honours for his scientific work. First of all, the Fields Medal (1974), the highest distinction for a mathematician. He was awarded the Shaw Prize in 2006, the Steele Prize for Mathematical Exposition by the American Mathematical Society in 2007, and the Wolf Prize in 2008. Upon receiving this award from the hands of Israeli President Shimon Peres he announced that he will donate the money to Bir Zeit University, near Ramallah, and to Gisha, an Israeli organization that advocates for Palestinian freedom of movement, by saying:

I decided to donate my share of the Wolf Prize to enable the academic community in occupied Palestine to survive and thrive. I am very grateful for the prize, but I believe that Palestinian students should have an opportunity to go elsewhere to acquire an education. Students in the West Bank and Gaza today do not have an opportunity to do that.

In 2010, in a White House ceremony, the President of the United States Barack Obama awarded him the National Medal of Science, the nation's highest scientific honour.

He received an honorary D.Sc. from the University of Warwick in 1983, an honorary D.Sc. from the Norwegian University of Science and Technology in 2000, an honorary D.Sc. from Rockefeller University in 2001, an honorary D. Sc. from Brown University in 2011.

He was elected to the National Academy of Sciences in 1975, elected an Honorary Fellow of the Tata Institute of Fundamental Research in 1978, elected a Foreign Member of the Accademia Nazionale dei Lincei in 1991, elected an Honorary Member of London Mathematical Society in 1995, elected to the American Philosophical Society in 1997, elected a Foreign Member of the Accademia delle Scienze di Torino in 2008, elected a Foreign Member of the Royal Society in 2008 and elected a Foreign Member of the Norwegian Academy of Science and Letters in 2010. He was elected VicePresident of the International Mathematical Union for the period 1991-94 and President for the period 1995-98.

It was at Harvard that Mumford first became interested in Algebraic Geometry. In his autobiographycal sketch written in 1996 he writes:

... a classmate said "Come with me to hear Professor Zariski's first lecture, even though we won't understand a word" and Oscar Zariski bewitched me. When he spoke the words "algebraic variety", there was a certain resonance in his voice that said distinctly that he was looking into a secret garden. I immediately wanted to be able to do this too. It led me to 25 *years of struggling to make this world tangible and visible.*

Mumford wrote his Ph. D. thesis under the supervision of Zariski who, after having studied in Kiev, spent the years 1920-27 in Rome to study with Guido Castelnuovo, who had been assistant here in Torino from 1887 to 1891 to Corrado Segre, who in turn taught *Geometria Superiore* (Higher Geometry) in our University from 1888 to 1924. So there is a strong scientific link between David Mumford and the University of Torino!

Mumford's greatest honour was being awarded a Fields Medal at the International Congress of Mathematicians in Vancouver in 1974 for his outstanding contributions to Algebraic Geometry. John Tate described the work that Mumford was awarded the Fields Medal for with these words:

Mumford's major work has been a tremendously successful multi-pronged attack on problems of the existence and structure of varieties of moduli, that is, varieties whose points parameterise isomorphism classes of some type of geometric object. Besides this he has made several important contributions to the theory of algebraic surfaces. ... Mumford has carried forward, after Zariski, the project of making algebraic and rigorous the work of the Italian school on algebraic surfaces. He has done much to extend Enriques' theory of classification to characteristic $p > 0$*, where many new difficulties appear.*

Answering to a question of Piergiorgio Odifreddi about the Italian School of Algebraic Geometry of Castelnuovo, Enriques and Severi, Mumford, rather modestly, said:

Ho amato il loro lavoro, anche se, più che leggrlo, ho cercato di ricrearlo nel nuovo linguaggio introdotto da Zarisk. La cosa meravigliosa è che, con i soli strumenti molto semplici di cui disponevano, i geometri italiani avevano compreso cose molto sottili. Io spesso mi sentivo soltanto come un muratore che aggiungeva cemento alle pietre dell'edificio che quegli architetti avevano costruito. Hanno certamente fatto alcuni errori, lasciandosi prendere la mano dalla loro visione, ma avevano un'intuizione formidabile.

Among the many other outstanding contributions brought by Mumford to Algebraic Geometry,let me just quote his theory of Prym Varieties and his results on the rationality of conic bundles (another link with the University of Torino, where Gino Fano (1871-1952) started a pioneering work on these topics).

In the 1980s however, the direction of Mumford's work changed dramatically. He writes:

... I turned from algebraic geometry to an old love - is there a mathematical approach to understanding thought and the brain? This is applied mathematics and I have to say that I don't think theorems are very important here. I met remarkable people who showed me the crucial role played by statistics, Grenander, Geman and Diaconis.

Mumford describes this new area he has worked on with these words, which give a fascinating insight of the scope of the ideas covered:

The term "Pattern Theory" was introduced by Ulf Grenander in the 70*'s as a name for a field of applied mathematics which gave a theoretical setting for a large number of related ideas, techniques and results from fields such as computer vision, speech recognition, image and acoustic signal processing, pattern recognition and its statistical side, neural nets and parts of artificial intelligence. ... The problem that "Pattern Theory" aims to solve ... may be described as follows "the analysis of the patterns generated by the world in any modularity, with all their naturally occurring complexity and ambiguity, with the goal of reconstructing the processes, objects and events that produced them and of predicting these patterns when they reoccur".*

Also in this area of applied Mathematics Mumford obtained truly outstanding results.

Finally, let me mention three of the many books he wrote: his famous *Red Book* where we all studied modern Algebraic Geometry, the recent (2010) *Pattern Theory: The Stochastic Analysis of Real-World Signals* (written with Agnès Desolneux) and *Indra's Pearls: The Vision of Felix Klein* which he published with Caroline Series and David Wright in 2002. Vasily Chernecky begins a review of this remarkable book as follows:

Felix Klein, one of the great nineteenth-century geometers, discovered in mathematics an idea prefigured in Buddhist mythology: the heaven of Indra contained a net of pearls, each of which was reflected in its neighbour, so that the whole Universe was mirrored in each pearl. Klein studied infinitely repeated reflections and was led to forms with multiple co-existing symmetries, each simple in itself, but whose interactions produce fractals on the edge of chaos. For a century these images, which were practically impossible to draw by hand, barely existed outside the imagination of mathematicians. However in the 1980*s the authors embarked on the first computer exploration of Klein's vision, and in so doing found further extraordinary images of their own. The book is written as a guide to actually coding the algorithms which are used to generate the delicate fractal filigrees, most of which have never appeared in print before.*

In 1996 Mumford wrote a survey article on Pattern Theory saying that it was *meant to convince my mathematical colleagues I hadn't gone mad.* Later he gave a talk whose title was *Is there life after Algebraic Geometry?*

No, David, we don't think you went mad and we believe that you convinced us that there can be an interesting mathematical life even after Algebraic Geometry! And it is exactly because you are one of the very few living mathematicians who brought outstanding contributions both to pure and applied Mathematics that he University of Torino wants to honour you today by awarding you its *Laurea Honoris Causa in Matematica*.