Evariste Galois: The Man Who Never Lived

by Manjil Saikia - Wednesday, October 12, 2011

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Evariste Galois, the famous French mathematician whose life is tragic and inspiring at the same time was born 200 years ago. Gonit Sora *is celebrating his life by bringing forth a series of articles on the life and works of Galois. This is the first of the planned five articles to be published throughout this month and beyond.*

A famous and oft repeated quote is "Whom Gods love, die young!" Although, there seems to be no scientific evidence nor any coherent study confirming or discarding this statement, it has been noticed now and again that great men indeed die young. Not everyone, of course; but there have been some glaring examples in many fields; take for instance the great poet John Keats who died very young. But the field in which such examples are galore is mathematics. Throughout the history of mathematics, there has been many examples of extraordinarily brilliant minds living for a very short span of time. Take for example, the great Indian mathematician S. Ramanujan who died at the young age of 32; the famous Norwegian mathematician Neils Henrick Abel died at the age of 27. Some other notable people who lived for a short span of time are Riemann and Pascal; both geniuses of the first order and both could have achieved a lot had fate been kinder to them. However, no example is as tragic and as hearttouching as that of Evariste Galois, the now famous French mathematician who died at the age of 20!

Evariste Galois (pronounced 'Gelwa') was born in Bourg la-Riene in the then French Empire on 25th of October, 1811. Galois, like many mathematicians before and after him showed a tenacity and zeal for higher mathematics at a very small age that could only be described as hauting. Galois started his formal education at the age of 10 being self tutored at home and later joined the Lycee's school in his hometown. As was expected, Galois showed a tremoundous amount of scholarship in his studies and soon rose to the top of his class. But, such is the tale of genius that at the age of 14, he became bored with the regular school curriculum and started taking an uncanny liking towards mathematics. This was eventful not only for him, but for the whole of mathematics as he did some pioneering work in the fields he touched upon, that even now we are yet to reap the benefits of the seeds that he sowed.

During this period of his life, Galois began studying the masters of mathematics. It is said that he finished the famous mathematician Legendre's book on Geometry in almost 5 days cover to cover and all the while he read it like a novel. It must be mentioned that even now professional mathematicians find this book too difficult to master. At the age of 15, Galois started to follow the original research papers of another great mathematician, Lagrange. This not only fueled his deep passion for mathematics but also encouraged him to unravel the mathematical mysteries on his own. In April, 1829 Galois published his first research paper on continued fractions at the age of only 17. Thus, began the journey of a legend. Galois deep and varied contributions in many different fields of mathematics has earned him the respect and adulation of one and all today. He was the first person to use the word 'group' to define a certain class of mathematicial objects that are today omnipresent not only in almost all branches of mathematics but in fields as varied as physics, chemistry, biology, engineering and even economics.

Galois after completing his school with excellent marks in mathematics decided to try and enter the distinguished Ecole Polytechnique, and so sat in its entrance exam. However, Galois failed to secure a seat in this institute of unique importance and had to enroll in the far inferior Ecole Normale Superior. Here Galois studied for some time, and then again decided to try and enter for the Ecole Polytechnique. Meanwhile, on the personal frontier Galois lost his father who committed suicide by hanging himself in public. This was a major blow to the teenaged Galois and which further fueled his Republican tendencies. The French nation was at that time going through enormous imbalance in its monarchy and system of governance. Galois too decided to join the revolution at the cost of his mathematics. History is testament to tha fact that Galois was even jailed a few times for his revolutionary activities and this got him into trouble even in his institution. All these incidents happened when he was preparing for his entrance exam at the Polytechnique. It was again a surprise when Galois failed a second time to clear it. The genius of Galois was not reccognised at that hallowed institution of learning. Eric Temple Bell, the famous historian of mathematics in his book "Men of Mathematics" quotes

> "People not fit to sharpen his (Galois') pencils sat on judgement of him."

Such failure prompted Galois to almost leave doing mathematics and light the fire of revolution once again, which was later the cause of his death too.

Galois' major contribution to mathematics lies in his theory of equations, where he gave a very novel approach to solve one of the major outstanding problems of his time. He along with Abel showed the impossibility of solving the quintic equation via regular methods. This is regarded as a giant leap in the then 19th century mathematical scene. Galois made fundamental contribution to a new field of mathematics which is now termed as 'Galois Theory'. Galois wrote one paper on Number Theory where he discussed the concept of a 'finite field' for the first time. Galois' entire mathematical research output was a mere 66 pages. This was all that he gave to world mathematics, and this is what made him immortal. It took major advances in group theory to fully understand the implications of the works of Evariste Galois.

Notes from Galois last pages before his death

The story of this great man came to a very cruel end on 31st May, 1832 at Paris when he had just entered his 20th year. Galois was killed in a duel. There have been numerous speculations as to what may have been the cause of his death, and it seems that the most likely explanation could be that he fell in love with his physician's daughter and it was at her instigation that he challenged someone for a duel and was as a result killed. The sadder part of this story is that Galois didn't recive any medical attention for many hours after he was shot, maybe this giant of mathematics could have been saved had helped arrived on time. Galois died a very slow and painful death at the tender age of 20, and the world lost a brilliant mind who was just showing his capabilites. His last words to his brother were

> "Don't cry, Alfred! I need all my courage to die at twenty."

Galois never recived the admiration from his peers that he should have recived in his lifetime. Even his grave is unmarked and he died almost an anonymous person. It was only years after his death when the letters and manuscripts that Galois wrote just before he died were published that the world started revering Galois and his unparralled genius. The night before he died Galois sensing his end was near wrote down many letters, both mathematical and political to his numerous friends and brother. These letters contain some very though provoking mathematical ideas that has forever sealed Galois name in the annals of mathematical wizardry. The famous mathematician Hermann Weyl while describing these letters said

> "This letter judged by the novelty and profundity of ideas it contain, is perhaps the most substantial piece of writing in the whole literature of mankind."

Galois may have died, but his legacy still lingers on. His life shows us what legends are made of, and is a true testament to the fact that whether a man is a legend or not, is determined by history, not fortune tellers. Galois seems to be a perfect man on whom the words of Albert Einstein used to describe Mahatma Gandhi fit perfectly

> "Generations to come and generations to go will scarcely belive that such a one as he ever walked upon this earth in flesh and blood."

[This article is written by our Editor and Co-Founder Manjil P. Saikia*, one of whose heroes is Galois.]*

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