

the evidence for and against the hypothesis that an asteroid impact led to the disappearance of dinosaurs 65 million years ago. It is interesting that an important proponent of this theory was Luis Alvarez, the 1968 Physics Nobel Prize winner for his development of the hydrogen bubble chamber and associated discoveries. Ambastha describes the goings-on in the sun's interior, and the GONG project – a world wide network including the Udaipur observatory to 'listen' carefully to the sun's rumblings. Truly, our sun – it doth shiver as it shines.

Finally, we have reviews of two good quality texts on chemistry and on thermodynamics. And from Gangan Prathap's review, we remind ourselves that in the history of human evolution technology preceded science. We also learn – how apt – that the first use of the word 'engineer' in English was in Shakespeare's phrase – "engineer hoist on his own petard".

Paul Erdős, the Western Ramanujan

That is how his close friend from school days and long time collaborator, Paul Turán refers to Paul Erdős in an article written on the occasion of the 50th birthday of Erdős, (see *Collected Papers of Paul Turán* for an English version of the article which appeared originally in Hungarian).

Paul Erdős was born to Anna and Lajos Erdős on 26th March, 1913 in Budapest, Hungary under tragic circumstances. His two elder sisters, aged 3 and 5 years, contracted scarlet fever and died while his mother was admitted to the hospital during his birth. This resulted in his parents becoming over-protective towards Polko (as Paul Erdős was fondly called by his parents). When World War I broke out in 1914 his father was drafted into the Austro-Hungarian army, and served on the Eastern front. He was taken prisoner by the Russians and sent to Siberia. He returned home in November 1920, surviving malnutrition, extreme cold and a civil war to be greeted by his little son: "Apuka (Hungarian for Daddy), you are really old".

Both his parents were mathematics teachers and they taught him mostly at home as they feared for his health. He was a precocious child and could multiply 4 digit numbers in his head when he was hardly four. He would ask people their age and on being told, would immediately tell them how many seconds they had lived till then!

During his school years he was a regular contributor of solutions to the problems appearing in *KoMaL*, a very successful high school (mathematics and physics) journal; Erdős's photo appeared in *KoMaL* all



the three years he was in high school, 1927–30. This journal, started in 1894, has contributed immensely to the blossoming of young talent in Hungary since its inception. It also resulted in a deep bond of friendship being formed between the regular contributors which continued later into their professional lives.

In 1930, he entered the Science University of Budapest (later renamed Lorand Eotvos University in 1948) as an undergraduate student in mathematics. He discovered a simple proof of Chebyshev's theorem (Bertrand's postulate) which asserts the existence of a prime between n and $2n$. His proof was along lines similar to that of S Ramanujan in 1919. He worked in developing his ideas in this direction and it culminated in his thesis under Leopold Fejer (Main results: elementary proofs of existence of primes in the arithmetic progressions $4k-1$ and $8k+1$ between n and $2n$.) He was awarded the Ph.D degree in 1934. Among other significant results he obtained when he was an undergraduate was an elementary proof of a conjecture of Issai Schur which earned him the title 'wizard from Budapest' from Schur.

In 1934, Erdős went to Manchester; this visit had been arranged by L J Mordell. He spent four years there, coming home to visit his parents three times a year. When he came back to Hungary in July 1938, the situation in Europe was becoming very difficult for Jews and Erdős realised that he had to leave Hungary quickly. He had an offer of a fellowship at the Institute for Advanced Studies, Princeton, and advancing his trip by a few weeks he left for USA in September 1938.

Erdős spent one-and-a-half years at the Institute for Advanced Studies, Princeton. He fondly remembers this period as academically his most successful. He visited several universities in the US before settling down to his first real job with the Notre Dame University in 1942. He obtained his green card in 1948 and soon after made his first visit to Hungary since leaving it in 1938. His father had died in 1942 and his mother had to shift to the Ghetto after her husband's death. Many of his relatives and close friends had been victims of Nazi barbarism.

In 1954, the International Congress of Mathematicians was held in Amsterdam and Erdős planned to participate but the immigration authorities denied him the re-entry permit. Faced with a tough choice between abandoning his plan of going to the ICM and retaining his green card and his job at Notre Dame or going ahead with his plan and lose both, he chose the latter – 'Neither Sam nor Joe can restrict my right to travel'. He never again was to be attached to any one particular place afterwards. Left without a country he was given a passport and a job at the Hebrew University, Jerusalem by the Israeli government. (In 1958, he was permitted to visit USA with a special visa for an A M S meeting and the Immigration authorities revoked the charges against him in 1963 and gave him an 'external visitor' (J-1) visa.)

He was elected a member of the Hungarian Academy of Sciences in 1956 and was affiliated to the Mathematical Institute of the Academy from 1962, from whom he received his salary while in Hungary.

Though there were quite a few places to which he was attached that way (he would receive salary while he was there) he didn't/couldn't stay at any place for more than a couple of months. He travelled widely and frequently around the world: 'if you want to meet Erdős, stay where you are and wait; he will appear there soon'. So much so, his mother realised that to be with her son she would have to travel and began travelling with him in his journeys across the continents in 1964, at the age of 84! – 'I do not travel because I like it but, because I want to be with my son'. Erdős lost his beloved *Anyuka* (Hungarian for 'Mummy') in 1971 while they were visiting Calgary, Canada; she was 91. Her death affected him a great deal and he never fully recovered from the loss.

He visited India in 1974 when he was invited for a conference in the Indian Statistical Institute, Calcutta; after the conference he visited Madras and Bombay. He came back to India a few more times to visit ISI, Calcutta and to take part in the Number Theory conferences organised by The Institute of

Mathematical Sciences, Madras. He has written 23 papers with 15 Indian mathematicians. (He was fascinated that in Hindi the words for 'old-man' ('budda') and 'stupid' ('buddu') – the two things he disliked intensely – sound very similar.)

"Problems have always been an essential part of my mathematical life. A well chosen problem can isolate an essential difficulty in a particular area, serving as bench mark against which progress in this area can be measured. An innocent looking problem often gives no hint as to its true nature. It might be a 'marshmallow', serving as tasty tid-bit supplying a few moments of fleeting enjoyment. Or it might be like an 'acorn' requiring deep and subtle insights from which a mighty oak can develop."

Paul Erdős.

Paul Erdős died on 20th September, 1996, while attending a mini-semester at the Banach Center in Warsaw, Poland. Early morning that day he was taken to a hospital from his hotel room when he suffered a

heart attack and his friends came to know about it only after twelve hours.

Wherever he was, whatever time of the day/night, he was always surrounded by people – mathematicians of different kinds – number theorists, combinatorialists, discrete geometers,... and their spouses and children. He had an extraordinary memory and always remembered the names of the children of his friends and what they were doing. Thus it was sadly ironical that when he died he was alone in an unfamiliar hospital.

His contributions to different areas of mathematics are too vast and varied to be treated here. We will only mention the *elementary* proof of the *prime number theorem* in 1949 (independently A Selberg had obtained the same result in the same year) for which he was awarded the *Cole Prize* in 1951. Among the many prizes and awards he won are the *Wolf Prize* (Israel) in 1984 and the Gold Medal of the Hungarian Academy of Sciences in 1991.

C S Yogananda

