PAUL ERDŐS

One of the most fascinating and charmingly eccentric mathematicians of the modern era is Hungarian-born **Paul Erdős** (March 26, 1913 – September 20, 1996). Those who had the pleasure of meeting him, no matter how briefly could not fail to be impressed with his single-minded devotion to mathematics. Others who became his friends, his collaborators, his hosts know full well that he had little time for anything but mathematics. He was a mathematical gypsy; he belonged to no country, had no wife, no children, no permanent address, nor the comfort of a professorship. Instead Erdős, one of the most published mathematicians, moved about the world to talk to other mathematicians about his one true love, mathematics, and incidentally produce papers for publication. Around 1965, Casper Goffman concocted the idea of an Erdös number. Those who co-authored papers with Erdős, and there were some 485 of them, are said to have an Erdős number 1. Those who have written a joint paper with someone who has Erdős number 1 have Erdős number 2. Those who co-write with someone who has Erdős number 2 have Erdős number 3. And so on. The total number of papers Erdős published in his lifetime, with or without collaborators, is approximately 1,500.

Erdős' long full life is filled with so many interesting incidents that it is impossible to even briefly touch on the highlights in the space here available. Fortunately, several excellent articles and books have been written about this man who though small in stature had enormous talent not only for producing mathematics but for generously sharing his ideas with anyone he felt he could push and cajole into digging deeper into the mysteries of mathematics. Erdős liked to let on that he was absent-minded so people would not expect him to waste his time on mundane things. But he knew where he was and where he wanted to be by what time so he could talk mathematics with his next host. When he

showed up, often unannounced, at the home of a mathematician with whom he planned to stay for some unspecified time, he would announce, "My mind is open," meaning he was ready to do mathematics. Then fortified with coffee and amphetamines he was prepared to do mathematics for 19 hours a day, seven days a week, week after week.

Erdős was born in Budapest, Hungary about a year before the outbreak of WWI. His father Lajos was captured by the Russian army and spent six-years imprisoned in Siberia. Paul's mother Anna, who lost two daughters to scarlet fever before Paul was born, was very protective of her son. She provided for the two of them, until her husband returned, by teaching mathematics, which was also Lajos's profession. She ran afoul of the new fascist government in 1920 and was dismissed from her teaching position, suspected of communistic sympathies. The family were non-practicing Jews, but Hungary introduced anti-Jewish laws long before Hitler instituted them in Germany. Yet Paul, who won a national examination, was allowed to enter the University Pazmany Peter in 1930, from which he was awarded a doctorate in 1934. The next year he left Hungary for a post-doctoral fellowship at Manchester in England. By 1938 Erdős had moved on to the U.S. at the urging of Stanislaw Ulam, who was then at the University of Wisconsin. From then on Erdős was constantly on the move.

In 1943 Erdős held a part-time appointment at Purdue University but the closest he came to taking a permanent position was in 1952 when Arnold Ross of the University of Notre Dame arranged for him to teach one graduate course, with an assistant who could take over for Erdős at a moment's notice if Paul got the urge to go off to talk to some distant colleague. Ross arranged for Erdős to be offered a permanent position at Notre Dame in which he was to have no specific duties. He could do what he wanted when he wanted, and he could travel where he wanted and when he wanted. Erdős' many friends, fearful of a man of his age traipsing all over the world by himself, urged him to accept the generous offer, but Paul, who would traipse for another forty years, felt it would tie him down too

much.

Meantime Erdős, like many others of the period came under suspicion of having communistic leanings by Senator Joe McCarthy and others of his ilk. Those who were around at the time will recall that unconventional behavior was considered evidence of possible disloyalty. Teachers were required to take loyalty oaths. Students were hired to spy on their professors and report any suspicious behavior. Erdős, who had never applied for citizenship anywhere fervently believed in the freedom of individuals and classified all nations as imperialistic. When he attended the International Congress of Mathematicians in Amsterdam in 1954, he was not allowed to return to the United States. His only crimes were naively and truthfully answering questions put to him about Marx and Hungary, having corresponded with a Chinese mathematician in 1941, and innocently blundering into a radar installation in 1942, which left him with an FBI record. Erdős spent much of the next ten years in Israel but finally in 1963 was allowed to return to the United States.

For most of the 1950s Erdős lived pretty much hand-to-mouth, but in 1957 when the Soviets launched Sputnik, the United States government and its proud citizens could not understand how godless Communists could have beaten them so badly in this area of science. Money was poured onto the problem and American friends were able to get Erdős various research stipends. He didn't need very much money because few people were less materialistic than Erdős. In his lifetime he was honored with many awards and prizes including the Wolf Prize of $50,000 in 1983. He didn't feel the need for money so he pocketed $720 of the prize and gave the rest away.

Erdős made his initial mark on mathematics at the age of 18, when he discovered an elegant proof that, for each integer greater than 1, there is always a prime between the number and twice the number. Erdős not only wished to prove things, he wanted always to do so elegantly, which he did. His interests

were mainly in number theory and combinatorics, where he posed and solved many thorny problems. He was always fascinated by relationships among numbers. According to Ronald L. Graham, his "driving force was his desire to understand, to know." Erdős had in mind a perfect death. It would occur just after a lecture in which he had given the proof of a theorem. In Erdős' dream, someone would ask, "What about the general case?" Erdős would reply, "I think I'll leave that to the next generation," at which point he would fall over dead. He didn't fulfill this dream but he was still working on mathematical problems when he "left", his word for "die", after suffering a heart attack while at a mathematics meeting in Warsaw.

Five years after Erdős died, his publications continued to appear. Erdős and Hank Aaron once were present at an event in Atlanta and together signed a baseball, giving the baseball Home Run King an Erdős number of one. In this Aaron bettered Albert Einstein, Erdős 2; Niels Bohr, Erdős 5; Erwin Schrödinger, Erdős 8; Wolfgang Pauli, Erdős 3; Richard P. Feynman, Erdős 4; Paul A. Samuelson, Erdős 5; Francis H.C. Crick, Erdős 7 and James D. Watson, Erdős 8; Nobel Prize winners all.

Erdős had a special vocabulary that he concocted and used consistently in his speech. Some examples are: Husbands were "slaves"; wives were "bosses"; married men were "captured"; divorce was "liberated"; remarried was "recaptured"; children were "epsilons"; the Soviet Union was "Joe"; the United States was "Sam"; God was "the Supreme Fascist"; a non-mathematician was "trivial being"; Giving a mathematics lecture was "preaching"; and to stop doing mathematics was "to die."

Many people consider mathematicians in general to be eccentric people and certainly Paul Erdős lived up to their expectations. The truth is that mathematicians, or at least the best of them, are very much like other people, except they may be a bit brighter, at least in respect to their mathematics. Other than

that, mathematicians have the same strengths, weaknesses, faults, talents, interests, yearnings, etc. as all other people. They are certainly enthusiasts for their subject but then most intelligent people have something that lights their fire that to others, without the same fascination, may consider a bit unusual if not strange. The love of mathematics is not for everyone, but it shouldn't be assumed that there is anything wrong with those for whom it is the biggest thing in their lives.

Quotation of the Day: "If you see a really nice proof, I say it comes straight from the Book … God has a transfinite Book, which contains all theorems and their best proofs, and if He is well intentioned toward those [mathematicians], He shows them the Book for a moment. And you wouldn't even have to believe in God [Erdős did not], but you must believe that the Book exists." – Paul Erdős