Mathematician Paul Erdös: Total Devotion to the Subject

With the possible exception of theoretical physicists, mathematicians are the only scientists who require no equipment for their research, save pencils, paper, and sometimes a library. Most mathematicians, however, do at least have a home base. Their families, worldly possessions, and desire to earn a steady income usually force them to live like other academics.

One mathematician—Paul Erdös—has fully exploited the freedom inherent in the mathematics life-style and has allowed his talent and his drive to do mathematics research to completely dominate his life. Erdös is often described as one of the greatest living mathematicians, no mean tribute since it has been said that more mathematicians are alive today than have ever lived until this time. But what sets him apart from other mathematicians is his total absorption in his subject. He has said that to pursue his "ability to prove and conjecture" is to follow the highest possible calling. He lives his life accordingly.

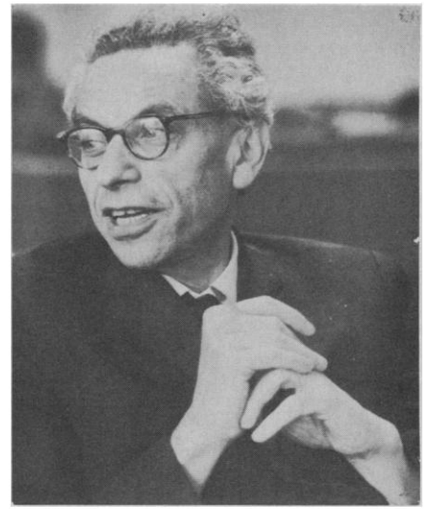
In order to give his entire attention to mathematics, Erdös has eliminated all the normal encumbrances of daily life. He has no property ("Property is a nuisance") and no fixed address; he neither handles his money nor fills out his income tax forms. Ever since he was 21 years old (he is now 64) and left his native Hungary to go to England, Erdös has been constantly traveling around the world. He never married, but for a number of years he traveled with his mother. Since her death a few years ago, he travels alone.

When Erdös travels, he collaborates with other mathematicians and gives lectures at colleges and universities to pick up small honoraria averaging about $100. He has a few standard lectures with such titles as "Child Prodigies" (he was himself a child prodigy) and "Recent Problems and Results in Combinatorics."

Although he says he has never had a regular appointment at a university or research institution, Erdös has a few standing appointments at universities, such as the University of Colorado and the University of Waterloo in Canada, where he may stay for a few months and earn a bit more money. Generally, though, he travels, often visiting as many as 15 places in a month and staying with mathematicians in their homes.

Despite his travels, Erdös has not forsaken his ties with Hungary but, in fact, still retains his Hungarian citizenship and receives a small stipend from the Hungarian Academy of Sciences. About 4 years ago, however, he refused to visit Hungary as a result of an incident associated with a meeting that was planned by the Hungarian Academy of Sciences to commemorate his 60th birthday. Because the Hungarian government has no diplomatic relations with Israel, it refused to allow Israeli mathematicians to attend the meeting. Erdös found this intolerable and said he would never return to Hungary until he received an official apology. Compassion won out over principle, however, and he returned last fall to visit the mathematician Paul Túran, a close friend who was dying. He has since indicated that he feels he has made his point and has received an expression of regret from a Hungarian minister for the incident. For these reasons, according to Ernest Straus of the University of California at Los Angeles, Erdös has renounced his vow to stay away from Hungary.

Erdös' money is sent to Ronald Graham of Bell Laboratories in Murray Hill, New Jersey, who deposits it in a bank and sends checks to those Erdös has borrowed from, those he has promised loans, and various charities and causes he supports. Erdös sometimes offers rewards, ranging from about $5 to $3000, for solutions to outstanding problems, the amount depending on Erdös' assessment of the difficulty of the problem. When one of these problems is solved, Graham sends a check to the person who solved it. Graham also receives Erdös' numerous W-2 forms, but these he ships to Daniel Kleitman of the Massachusetts Institute of Technology, who calculates Erdös' income taxes.



Paul Erdös

Not only has Erdös dispensed with most of the encumbrances of daily life, but he has also dispensed with many of the pleasantries that could take time from his mathematics. For example, Erdös keeps his telephone conversations brief, if not curt, unless he is talking about mathematics. Stanislaw Ulam of the University of Florida writes in his book, *Adventures of a Mathematician*, that Erdös will often walk into a room and immediately begin discussing mathematics, "without even explaining his presence or exchanging greetings first."

According to Ulam, Erdös' letters also dispense with most small talk and launch immediately into mathematics. Ulam describes a typical letter from Erdös as beginning " 'Suppose that x is thus and so . . .' or 'Suppose I have a sequence of numbers . . .' Toward the end, he adds a few personal remarks, mainly about getting old (this started when he was 30) or with hypochondriac or pessimistic observations about our aging friends."

His life-style leaves Erdös free to concentrate fully on mathematics. "He seems driven to do mathematics," Graham says. Erdös is continually active, perhaps because he takes amphetamines each day. According to Graham, he sleeps only about 4 hours a night. After others go to bed, he writes in notebooks he carries with him, notebooks that are mathematics diaries of where he went, to whom he talked, what mathematics was discussed, and what mathematical ideas occurred to him. Erdös' friends worry that he is pushing himself too hard. To this, Erdös replies, "There is plenty of time to rest in the grave."

Erdös' concentration has paid off in a proliferation of ideas and publications. His work, he says, "has a combinatorial flavor" (combinatorics is a branch of mathematics that deals with configurations of finite sets), but it spans a wide range of topics, including probability theory, graph theory, set theory, approximation theory, and number theory, as well as some topics that originated with Erdös, such as partition theory. Any mathematics journal, according to Gra-

ham, will contain references to Erdös' papers. Graham says that Erdös has published more joint papers than anyone in the world and that "They are all solid papers." Erdös says he has worked with more than 200 coauthors and has published more than 700 papers.

Although Erdös' background yields a few clues that might explain his present life-style, other mathematicians, such as Ulam, had similar experiences yet did not devote themselves to mathematics so completely as to drive out of their lives most normal human contacts and usual day-to-day affairs.

Erdös' parents were secondary school teachers of mathematics who provided his early training and encouraged him to develop his mathematical talent. Erdös believes he first exhibited this talent at the age of 4 when he told his mother that "250 subtracted from 100 leaves −150." Erdös says he grew up totally immersed in mathematics and met many of the great Hungarian mathematicians. He published his first paper at the age of 18, and a few years later, in 1934, he left Hungary in part because, as a Jew, he found the political climate extremely inhospitable. Although he knew from an early age that he would be a mathematician, Erdös either cannot or is reluctant to pinpoint why his life came to be so dominated by mathematics.

Erdös was not brought up to take care of himself. Like most middle-class families in Hungary when he was growing up, his had servants. Erdös says he never even buttered his own bread until he was 21 and went to England. He claims he has no trouble taking care of himself now, but his hosts tell a somewhat different story.

Persi Diaconis of Stanford University has been Erdös' host only once so far, but he reports he was a bit surprised by the experience. "When Erdös is with you," Diaconis says, "he demands everything. He expects you to look up telephone numbers, make calls, and drive him everywhere."

Despite his demands, Erdös has no trouble finding mathematicians who will take him in. One reason for this, according to Diaconis, is that a visit from Erdös is intellectually rewarding. "Erdös also gives you everything. He tells you what [mathematics] is on his mind and helps you with your problems."

There is also a certain prestige associated with a visit from Erdös. Ulam writes that one saying about Erdös is, "You are not a real mathematician if you don't know Paul Erdös." Mathematicians have even defined a way to measure their prestige in terms of publications with Erdös. A person is said to have an "Erdös number" of one if he or she published a paper with Erdös, an Erdös number of two if he or she published a paper with someone who published a paper with Erdös, and so on. Graham says that some mathematicians searched the literature to determine the largest Erdös number. It is 12, according to Graham, who explains, "It's hard to get a large Erdös number, because you keep coming back to Erdös."

Mathematicians who know Erdös refer to him affectionately as "Uncle Paul" and tell stories about his eccentricities. Ulam writes that "his peculiarities are so numerous that it is impossible to describe them all." A short, active man who, according to Ulam, jumps up and flaps his arms when he has an amusing thought, Erdös is known for his unusual appearance and habits. He always wears sandals, for example. Graham tells of one memorable hike with Erdös on granite rock in the Canadian Rockies during which Erdös' sandals were a real handicap.

Lipman Bers of Columbia University tells of two mathematicians who were to meet Erdös for dinner and arrived at the restaurant before him. They said to the headwaiter, "Our friend will be joining us. When he arrives, please show him to our table." The headwaiter asked how he would know their friend. "Don't worry, you'll know him, his appearance is unusual," the mathematicians replied. When Erdös arrived, the headwaiter took one look at him and led him immediately to his friends' table.

Erdös himself revels in his eccentricities, and, according to Donald Newman of Temple University, although he does not consider himself silly, he does enjoy the "Erdös stories" that are passed around the mathematics community. Erdös consciously encourages some of these stories. For example, he hastens to tell of his peculiar language. His word for God is S.F. (for Supreme Fascist). Women are called "bosses," men "slaves," marriage "capture," and children "epsilons." (Epsilon is often used to denote small quantities in mathematics.) Erdös explains that his language "began around World War II and grew half as a joke and half seriously." Although his language appears to have a misogynic slant, Erdös insists he makes no distinction between male and female mathematicians.

The other side to Erdös is his extreme generosity. Many people, especially Hungarians, owe him money, and "he is a soft touch for any cause," Graham says. He is also extremely kind to young mathematicians and often proves results but doesn't report them in order to give young mathematicians a chance, according to Graham. Although his income is small, he has established two prizes for young mathematicians—one in Israel and one in Hungary.

A Favorite Erdös Story

When talking about Erdös, most mathematicians who know him emphasize his human qualities and his lack of snobbery as well as his eccentricities and his brilliance. One of the best indications of peoples' opinions of Erdös are their favorite Erdös stories. Newman's favorite has been circulating among mathematicians for more than 30 years. Erdös was visiting the Institute for Advanced Studies at Princeton University and overheard some mathematicians talking about a problem they could not solve. These mathematicians, Newman says, were "super-modern, super-abstract types who were marked by their snobbishness." When Erdös asked them to explain their problem, "they told it to him in full regalia—full of jargon that no one could have understood," according to Newman. Erdös asked them to define their terms, and once they did so, he instantly solved their problem.

In a world of average or only mildly eccentric scientists, most mathematicians find Erdös charming but formidable. He puts most so-called workaholics to shame with his nonstop concentration on mathematics. His role in developing bodies of mathematics research as well as his place in the folklore of mathematics is unique.

—GINA BARI KOLATA

Atkinson to Head NSF?

Richard C. Atkinson has emerged as the leading candidate to serve as director of the National Science Foundation under the Carter Administration. He met recently with President Carter and later described the encounter as "very enjoyable." Such meetings are usually the final step before the White House announcement of a candidate's nomination for high office. Atkinson, 48, former chairman of the psychology department at Stanford University, came to NSF as deputy director in June 1975 and has been serving as acting director since last August. He would be the first behavioral scientist to head NSF, which is traditionally oriented toward support of the natural sciences.—P.M.B.