The Discovery of PKU

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Asbjörn Fölling

The hero of this Norwegian saga was born August 23, 1888, youngest child on a family farm in the middle of Norway. He had 1 older brother, and 3 older sisters. Asbjörn remembered how their farm had many uncles and aunts living there.

It was great fun for a boy like Asbjörn to run around with his brother, sisters, and cousins. In summer, they played in the fields, and in winter they slid down the snow-covered hills bundled up in colorful hand-knit sweaters, caps, and socks. But soon Asbjörn had to work like the rest of the children. He worked as a cowherd, taking the cows out to the pasture up in the hills. After the early morning milking, he would drive them out and watch them all day, while his sisters would make the rich milk into cheese to keep for the winter. In the evening, Asbjörn would drive the cows home and help with the milking. It was a long day.

As Asbjörn grew, he had more time for his studies than his older brother and sisters who were needed to do the work at home. He went to school approximately 2 miles away. He went to the one-room school every other day. Asbjörn liked school and did well in the country school, which went through the ninth grade. Asbjörn was allowed to go on with his studies in Trondheim, where he stayed with his older sister. There he finished the tenth, eleventh, and twelfth grades.

He was never a very strong boy, and about the time he finished high school, he was discovered to have tuberculosis. The doctor said he must rest for a year. At that time, there was no other treatment. There was to be no farm work or studies. For Asbjörn it was a time when he could think about what he wanted to do. He decided that he didn't want to be a farmer. He wanted to go on with his education and become a doctor.

He heard about the new Technical College of Norway that was soon to open in Trondheim and he wanted to go there. When the doctor said that he was well, he talked to his father. His father shook his head and told him the obvious—that he didn't have the money to support a son in college. But Asbjörn was so determined that he asked if he could try to work his way through by tutoring younger students. He would come home in the summer and work on the farm.

Asbjörn majored in chemical engineering and was proud to be a member of the first graduating class. He wanted to further his education in Oslo at the University. It would be expensive to go to the capital. He asked his father for a small loan, which he received, but he did not tell him that he had decided to study medicine. His father thought that he needed the money to get started in the big city.

The next year when he again approached his father for some money, his brother challenged him to tell what he was doing. He then confessed that he was teaching chemistry at the Dental College and studying medicine at the Medical College of the University of Oslo.

Asbjörn Fölling was one of the first physicians in Norway to apply chemistry to the study of medicine. He studied in the United States, receiving several scholarship awards. He returned to Norway and, by 1934, Dr. Fölling and his wife had bought a pleasant apartment in Oslo, where they lived together for 39 years. In 1934, Borgny Egeland contacted Dr. Fölling about her 2 retarded children.

The Egeland Family

Borgny and Harry Egeland were married in 1923, soon after Harry graduated from the dental college in Oslo. They were young, fun loving and very happy. Their happiness grew when a sweet little girl, named Liv, was born. They played with her and walked her in her carriage in the park.

When the little girl was nearly 3 years of age, they wondered why she had not begun to say words. When they told the doctor of their concern, he reassured them that she would talk later.

Their little boy Dag was born 3 years after his sister. He was normal and alert for a few months but then seemed to weaken and lose interest in his surroundings. Liv had walked at 16 months of age, but little Dag never even sat up by himself.

It was when Dag was an infant that the parents became increasingly aware that both of the children had a strange musty odor to their urine and began to think that whatever was causing this odor might also be causing their children to be mentally retarded. Their sympathetic family doctor couldn't offer any explanation for the odor or the children's retardation.

When it was apparent that little Dag was even more affected, the mother began to look for another doctor, and then yet another.

In the dental college, Harry Egeland had taken a course from Professor Asbjörn Fölling and was aware that he was doing research in metabolic diseases. He and Borgny talked about the possibility of having Dr. Fölling see their children. Borgny knew that her sister saw Dr. Fölling occasionally at the house of a relative. Borgny asked her sister if she would speak to Dr. Fölling, when she had an opportunity, and explain about the children and their odor and ask him if he thought there was a link between the odor and the retardation of their children.

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When Borgny Egeland brought a sample of the urine from the older child to his laboratory, Asbjörn Fölling did not know that he would have the chance to discover an unknown disease. The routine urine tests were normal. Then he added a few drops of an iron salt. Usually, this salt will turn the urine a red-brown color. Instead, the little girl's urine turned a dark green color that faded in a few minutes. The little boy's urine gave the same unusual color. Dr. Fölling asked Mrs. Egeland to bring in a urine sample every other day, which she did for approximately 2 months. "She brought me about 20 liters of urine in all,"

Dr. Fölling recalled. Day after day he worked to identify the substance that turned the children's urine dark green. Eventually, he discovered that this substance was phenylpyruvic acid. Phenylpyruvic acid is broken down into phenylacetic acid (also called phenylacetate). Phenylacetic acid is responsible for the musty odor of PKU.

Dr. Fölling contacted institutions in and around Oslo that cared for mentally retarded persons. Among 430 children tested, he found 8 with the same abnormality as the Egeland children. The name "phenylketonuria" was coined by Dr. Lionel Penrose, a geneticist from England, because of the characteristic appearance of a phenylketone (phenylpyruvic acid) in the urine.

Early Detection and Successful Treatment of PKU

For many years, PKU was considered an unfortunate disease of mental retardation for which nothing could be done. But by the mid 1950s, a special diet food had been developed and soon infants were successfully treated to prevent the mental retardation of PKU. To be successful the diet had to be started in early infancy before the onset of mental retardation.

The infants were mostly the young brothers and sisters in families with an older retarded child with PKU. How were newborn infants with PKU to be found when there was no older brother or sister with PKU?

What was needed was a blood test that could be performed while the infant was in the hospital newborn nursery. Such tests were developed in the early 1960s. In the following years one state after another passed laws requiring infants to be tested for PKU before they were discharged from the hospital. Today all 50 of the United States, the District of Columbia, and Puerto Rico have newborn-screening programs for PKU. Every year in the United States, approximately 300 newborn infants with PKU are diagnosed and mental retardation is prevented by diet treatment started soon after birth.

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