Theodor Escherich, who discovered the E. coli bacterium

Theodor Escherich (1857–1911) was born on the 29th of November 1857, in Ansbach, Germany. His father, Dr. Ferdinand Escherich (1810–1880) was the district medical officer of health and a noted medical statistician. His mother, Maria Sophie Frieder was the daughter of a Bavarian army colonel. Theodor’s family moved to Wurzburg, Germany after his mother died when he was 5 years old. Theodor was said to be a prankster as a child and thus was sent to the Jesuit school “Stella Matutina” in Feldkirch, Austria.  

**Early medical career**

Theodor Escherich went on to do his medical studies in Wurzburg in 1876 qualifying with top grades in 1881. His first mentor was Professor Karl C. A. J. Gerhardt who stimulated an interest in pediatrics and under whose guidance he wrote his doctoral thesis, “Marantic Thrombosinusitis in Cholera Infantum,” which was also his first publication. During a two week visit to study a large cholera epidemic in Naples, Italy, Escherich learnt bacteriologic techniques from Rudolf Emmerich from Munich and readily observed Vibrio cholerae in stool samples of affected individuals and published his findings on December 3rd 1884. This two week visit was to serve as an important training period and stimulated his interest in what would be a lifelong interest in microorganisms.  

In 1884, Theodor Escherich moved to Vienna. At the Vienna Pathological Institute, he began to study the bacterial flora of mother’s milk and intestinal microflora and it here that he decided to devote his

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**Important contributions:**

1. Identified and isolated 19 different bacteria that form the intestinal flora in infants. He identified *Bacterium coli commune* (the common colon bacillus now known as *Escherichia coli*) and described in its characteristics in detail.
2. Demonstrated the presence of diphtheria antitoxin in serum samples from children recovering from diphtheria and established the role of diphtheria antitoxin for the treatment of children with diphtheria.
3. Described the clinical signs of idiopathic infantile tetany (in 1890) and showed that hypoparathyroidism played a role in tetany.
4. Recognized the significance of intestinal bacteria in causing urinary tract infections in young girls.
5. Co-investigator and developer of anaerobic culture methods.
6. Identified the hazard of the high sodium content of cow’s milk, emphasized the value of breast-feeding, and developed the volumetric system of infant feeding that involved the weighing of infants before and after nursing.

**Books:** 3 books (*The Bacteria of the Intestines of the Infant, Diphtheria and Serotherapeutics, and Tetany*)  
**Monographs:** “The Intestinal Bacteria of the Infant and Their Relation to the Physiology of Digestion”, and a monograph on the role of hypoparathyroidism in tetany.
E. coli
The common colon bacillus he discovered, Bacillus coli commune, was re-named Escherichia coli (E. coli) in his honour in 1958. E. Coli has become one of the best studied cellular organisms and is well-known as a model organism for research. It is a model organism for studying many of life’s essential processes because it is easy to maintain and breed in a laboratory setting. Several Nobel prizes have been awarded to scientists for their work on this bacillus. These include Joshua Lederberg for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria (1958); Francois Jacob, André Lwoff and Jacques Monod for their discoveries on the genetic control of enzyme and virus synthesis (1965); and Max Delbruck, Alfred Hershey and Salvador Luria for their discoveries relating to the replication mechanism and the genetic structure of viruses (1969).

Career to paediatrics. The same year he moved on to Munich to obtain a degree equivalent to a postdoctoral qualification. In Munich, he focused his bacteriologic studies on three issues: defining the normal bacterial flora of the infant intestinal tract and its changes immediately after birth, assessing the role of bacteria in the physiology of digestion, and characterizing the relation of these findings to pathologic conditions in infants. He also learned the very new basic techniques of pure culture and bacterial characterization from Wilhelm Frobenius, a physician who had learned bacteriology from Robert Koch.

Some of his important contributions during this period were:
1. He showed that meconium was sterile and that colonization of the intestine by bacteria in an infant occurred 3-24 hours after birth, the main source being the mother’s milk.
2. Escherich used the new staining technique developed by Christian Gram and isolated 19 different bacteria, including bacilli and cocci in infant stool samples. These included campylobacter and enterococci, as well as, probably, *Bacillus subtilis* and pseudomonas. He identified *Bacterium coli commune* (the common colon bacillus now known as *Escherichia coli*) and *Bacterium lactis aerogenes* (now known as *Klebsiella pneumonia*) and described in detail their fermentation characteristics.
3. He was among several investigators, who developed anaerobic culture methods.

In 1886, Escherich published his findings in a 177-page monograph entitled; “The Intestinal Bacteria of the Infant and Their Relation to the Physiology of Digestion” which was a seminal work in the field of bacteriology.

Escherich’s driving motivation however was not purely research but how he could use what he learnt to alleviate the morbidity caused by diarrhoeal illnesses in children. He resumed his clinical work at the Children’s Polyclinic of the Reisingerianum and the Hauner Children’s Hospital in Munich by March 1886. His relentless passion led him to study and improve infant nutrition. He identified the hazard of the high sodium content of cow’s milk, emphasized the value of breast-feeding, and developed the volumetric system of infant feeding that involved the weighing of infants before and after nursing. (2)

**Family life and further contributions**
He married Margarete von Pfaundler in 1892 and their two children, Leo and Charlotte-Sonja were born in 1893 and 1895. Escherich made other important research contributions during this time. 1

1. In 1893, along with Rudolf Klemensiewicz, he demonstrated the presence of diphtheria antitoxin in serum samples from children recovering from diphtheria. In 1894, Escherich was able to establish the role of Emil von Behring’s diphtheria antitoxin for the treatment of children with diphtheria.
2. In 1890 Escherich described the clinical signs of idiopathic infantile tetany (in 1890). He described a reflex in infants - pouting of the lips after stimulating the labial mucosa by tapping the lips—often called the snout reflex or Escherich’s reflex. Escherich also showed that hypoparathyroidism played a role in tetany, and in 1909 wrote a monograph on the subject.
3. Escherich found that intestinal coliforms were associated with acute, contagious intestinal infections in infants, and he described “colicystitis.”

4. He also noted that *B. coli commune*(now known as *E. Coli*) was frequently found in urine samples from symptomatic young girls, thus recognizing the significance of intestinal bacteria in urinary tract infections.

Escherich soon became famous as a brilliant teacher, clinician, and researcher and attracted many brilliant minds to the field of pediatrics. One of his well-known students was Ernst Moro (1874–1951), who described the neonatal reflex, studied cutaneous tuberculin reactions, and discovered “bacillus acidophilus.”

He was also an able administrator and took the lead in modernizing the hospital he worked in, building laboratories and establishing a school for training nurses in infant care. He was a pioneer in the use of X-rays as a diagnostic tool in children and championed the importance of prevention in pediatrics. He crusaded to increase awareness of the unacceptably high infant mortality rate in Vienna. He was keenly interested in the social welfare of children, and successfully persuaded important social personalities to contribute to his endeavors.

Escherich was described as ‘impulsive, uncommonly strict, strong-willed, faithful, severe with himself but kindly towards others. That the children, his patients, loved him, is evidence that he loved them and, therefore, had a good heart.’(3,4) He demonstrated tremendous energy in his work and was strenuous yet masterful in his disposition. He died on 15 February 1911 of an apparent cerebrovascular accident at the age of 53 years of age while visiting a ward where he worked.

A master clinician and researcher, a pediatrician and bacteriologist of international repute, Theodor Escherich has left behind a rich legacy of research and clinical discoveries. Through his numerous papers, monographs and books, he has contributed immensely to our knowledge of illnesses in children. The common colon bacillus he discovered, Bacillus coli commune, was re-named Escherichia coli (E. coli) in his honour in 1958. The achievements of Theodor Escherich will remain significant landmarks in the annals of medical history and practice.

References:

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