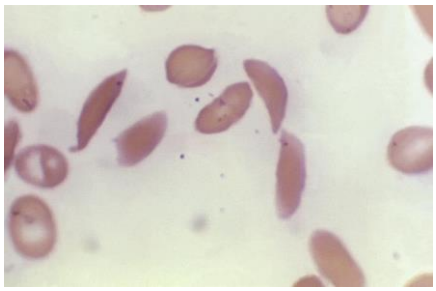
READING PASSAGE

A Look inside the Lab: Microscopes
How the microscope advanced understanding of sickle cell disease

In 1904, Walter Clement Noel was admitted to a Chicago hospital for pain, breathing problems, and other symptoms that suggested a blood-related condition, called anemia. At the time, Noel was a 20-year-old student from Grenada. He was in the U.S. to study dentistry. During his short life, Noel had often suffered from illness, but he was determined to become a dentist.

At the hospital, Noel was treated by Dr. Ernest Irons, a medical intern. Medical interns have finished medical school, but they cannot yet practice medicine without the supervision of a licensed doctor. On this particular day, Iron's supervisor was Dr. James B. Herrick. To figure out what was wrong with Noel, Irons took a blood sample from Noel and looked at it under a microscope. The procedure, called a peripheral blood smear, was something relatively new to medical testing.

When looking at the sample, Irons noticed that Noel's red blood cells had an unusual shape. Instead of the typical round shape, Noel's red blood cells were shaped more like crescent moons. Irons called Dr. Herrick to look at the cells under the microscope. At the time, Irons and Herrick were unable to determine what was causing Noel's red blood cells to have an atypical shape. However, they suspected there was a link between his unusual cells and his symptoms.



Red blood cells (magnified 1000X)
CDC Public Health Image Library/Dr. F. Gilbert

Herrick noted the significance of Iron's observation of "sickle-shaped cells," which was later used in the name — sickle cell disease (SCD). Although people around the globe had been familiar with the disease for centuries, it wasn't until Irons looked at Noel's blood under a microscope that someone realized the shape of the blood cells could be related to the disease.

We now know that SCD is a rare, genetic blood disorder. It most often appears in individuals of certain ethnic groups, including Hispanic-Americans from Central and South America and people of African, Middle Eastern, Asian, and Mediterranean descent. The red blood cells of people with SCD tend to clump together particularly in the capillaries. When this happens, it prevents the regular delivery of necessary amounts of oxygen.

Because SCD is a lifelong condition, Noel's health issues persisted. Irons continued to treat him over the next few years and kept detailed notes that he shared with Herrick. In 1910, Herrick presented a report about Noel's case. This was the first documented case of SCD in the United States. Despite his illness and social prejudices, Noel did well in his studies and became a dentist. Sadly, he died in 1916 at the age of 32.

Herrick's report was not only the first documented case of SCD, but it also stands out for another reason. Herrick did not list Irons as a co-author or give him any credit for the discovery. In science and medicine, anyone who makes a significant contribution to the information in a paper should be included as an author. Indeed, without Irons' keen observation skills, Herrick would not have even known about Noel's sickle-shaped cells. Despite this slight, Irons eventually became a successful rheumatologist, and in the 1940s, he became the president of the American College of Physicians and the American Medical Association.

In 1910, Irons and Herrick would have had access to only two kinds of microscopes: simple microscopes, which use a single lens for magnification, and compound microscopes, which use multiple lenses. Both are types that scientists still use today. However, a variety of other types of microscopes are now available. All microscopes have a common need for proper illumination, but the source of illumination may differ:

- Light – Most microscopes use light to illuminate samples. Examples of different types of light microscopes include simple, compound, inverted, and dissecting (or stereo) microscopes.
- Lasers - Confocal microscopes use lasers to illuminate samples.
- Electrons - Electron microscopes rely on electrons to illuminate samples.

Although compound microscopes produce two-dimensional images, confocal and electron microscopes can produce three-dimensional images. Digital microscopes rely on computers and screens rather than eyepieces to view samples. This allows multiple people to see what is being magnified at the same time. It also allows calculations and photographs to be captured more easily. Some microscopes have additional functionalities. For example, some can be programmed to automatically count the number of cells in a sample. Some of today's microscopes are extremely powerful compared to the types available to Irons and Herrick in the early 1900s. For example, the TEAM 0.5 electron microscope, located at Lawrence Berkeley National Laboratory, can view two points separated by only a half of an angstrom (one ten-millionth of a millimeter), which is less than the width of a hydrogen atom.