

# The Story of Percy Lavon Julian

## Against All Odds

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*The only thing that has enabled me to keep doing the creative work was the constant determination: Take heart! Go farther on.*

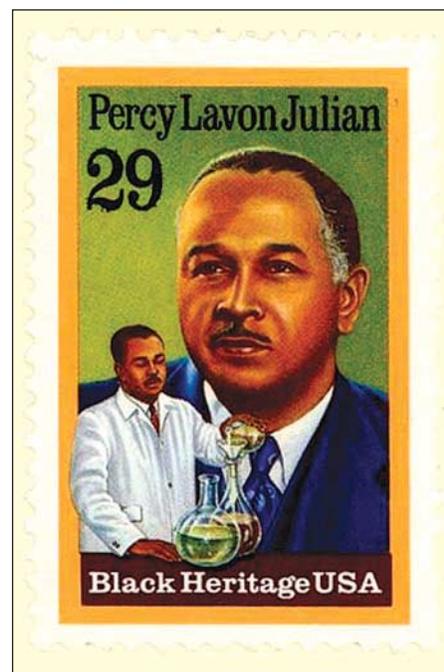
Percy Lavon Julian<sup>1</sup>

**T**he persistent drive to attain a goal, no matter how difficult, has been essential for many discoveries. This straightforward concept is exemplified in the career of the black chemist Percy Lavon Julian, PhD (1899-1975) (**Figure**), whose discoveries had a significant effect on the treatment of persons with glaucoma and inflammatory diseases. Among other achievements, he was the first person to synthesize physostigmine (eserine), which was the first medication that was effective in treating glaucoma, and he constructed a method to mass-produce cortisone.

Physostigmine, which is a cholinesterase inhibitor, was first described in the ophthalmology literature by Laqueur in 1876.<sup>2</sup> Shortly afterward, pilocarpine was shown to be useful in treating persons with glaucoma.<sup>3</sup> These 2 medications, which are botanical in origin, were sometimes combined into a single eye drop formulation. Pilocarpine is derived from a South American shrub and is readily available, but the natural source of physostigmine, the Calabar bean from tropical West Africa, is scarce. Julian's chemical synthesis permitted production of the medication in a large quantity at a reduced cost. Physostigmine and pilocarpine were the mainstays of the medical treatment of glaucoma for more than half a century. (Adrenergic agonists were introduced commercially during the middle of the 1900s.  $\beta$ -Adrenergic blockers, carbonic anhydrase inhibitors, and prostaglandin agonists were more recently developed.)

In recounting his life story, Julian often told friends how he dealt with the obstacles in his path to becoming a respected scientist, inventor, business leader, and champion of human rights. Although he was the grandson of slaves who had been denied formal learning, his parents emphasized education as the best means to success. He was born in Mont-

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**Figure.** Percy Lavon Julian US postal stamp.

gomery, Alabama, where his father worked for the United States Postal Service; government employment gave the family higher social status than most blacks had at the time. His father was a prodigious reader who enjoyed difficult material in mathematics and philosophy. The Julian family was close knit; in his youth, Percy sometimes worked with relatives in his grandfather's cotton fields. When the fam-

ily would sing spirituals, young Julian wanted to understand the lyrics. Once he asked his great-grandfather, Cabe, to explain a song about the prophet Jeremiah; he was told the lesson to be learned from that biblical figure is that there is always a way out of difficulty. The optimism he gained from his great-grandfather and the strong sense of family unity were always important to him. Late in life he would tell audiences that the breakdown of black family life has removed the feeling of hope with which he was reared, a problem that has no simple solution. However, his motto was "There is no such thing as can't."<sup>4</sup>

In the early 1900s, public schooling for black children in Alabama ended with the eighth grade. After 2 years of private education at the State Normal School for Negroes in Montgomery, Julian was admitted to DePauw University, Greencastle, Indiana, as a subfreshman in 1916. Family members who saw him off on the northbound train included a grandfather who waved a hand that was missing 2 fingers, the punishment for learning to read, and a 99-year-old grandmother who had established a record by picking 350 pounds of cotton in 1 day. Julian lived in the attic of a fraternity house at DePauw and was able to earn enough as a waiter to cover his tuition. Later, the entire family followed him to Indiana. Percy was the eldest of 6 children, each of whom graduated from DePauw; his 2 younger brothers became physicians. Despite weaknesses in his elementary education, Julian was an excellent student. He was elected to Phi Beta Kappa, obtained his bachelor's degree in 1920, and was valedictorian of his class. During the next 2 years, he was an instructor in chemistry at Fisk University, Nashville, Tennessee. Then he was awarded a fellowship in biophysics and organic chemistry at Harvard University, Cambridge, Massachusetts, where he obtained a master's degree in 1923. No faculty position was available for a black man at that institution at the time, nor could he obtain a doctoral degree in his field of interest. Instead, he joined the faculty of West Virginia State College in Institute, an all-black institution at the time, as a professor of chemistry. In

1929, he was awarded a Rockefeller Foundation fellowship, which he used to earn a doctoral degree from the University of Vienna, Vienna, Austria. Professor Ernst Späth, his teacher there, said Julian was "an extraordinary student, his like I have not seen before in my career as a teacher."<sup>5(p13)</sup> His doctoral thesis concerned a botanical alkaloid, and this work proved very useful for his later focus on physostigmine.

Two years later he was back at DePauw, working with physostigmine. His coworker Josef Píkl gave this description of him at that time: "Percy generated ideas faster than half a dozen people could critically review and test them. He also did most of the writing, did practically all of the analytical work . . . and helped with much of the dish-washing chores."<sup>5(p15)</sup> Julian and Píkl published 3 articles that were leading to the final step in the synthesis of physostigmine, only to find that a paper on the same subject had been published by a group at The University of Oxford, Oxford, England, under the direction of a Nobel Prize winner, Sir Robert Robinson. Julian was about to come in second in the race for his most important achievement. He was convinced that his method was correct and that the British group's method was flawed. He added a statement to his next paper declaring that Robinson's group had made an error. If Julian were to be shown wrong in his challenge of such a prominent scientist's work, his career would be seriously jeopardized. Another professor wrote him, "I know you realize that you must be right in this cordial polemic or else it might lead to grave doubts concerning the authenticity of your future work."<sup>5(p17)</sup> In his final paper on the subject, "Studies in the Indole Series, V: the Complete Synthesis of Physostigmine (Eserine),"<sup>6</sup> Julian held his ground. His synthesis was confirmed and the scientific community congratulated him. In 1999, the American Chemical Society designated his laboratory a National Historic Chemical Landmark for the "first total synthesis of the anti-glaucoma drug physostigmine." This accomplishment is considered one of the 25 most important achievements in chemistry in the 20th cen-

tury and later led to Julian's election to the National Academy of Sciences in 1973. This distinction is exemplary on its own; however, when one considers that he was only the second black person to achieve this honor, it takes on added importance.

Julian spent 4 years as a research fellow at DePauw, but the trustees of both DePauw and the University of Minnesota, Minneapolis, denied him higher appointments to their faculties on racial grounds. Julian decided to leave academia for industry. He accepted a research position at the Institute of Paper Chemistry in Appleton, Wisconsin, only to learn that a statute in that city stated, "No Negro should be bedded or boarded in Appleton overnight."<sup>5(p18)</sup> The Glidden Company in Chicago, Illinois, hired him as director of research for one of its divisions. Under Julian, the division increased its profits during his 18-year tenure, and he was responsible for filing more than 100 patents. One of the company's most useful products was closely related to his earlier research on physostigmine. He identified a sterol in the Calabar bean that led to the synthesis of progesterone from soybeans. This made the hormone available in large quantities for the first time. Soon afterward, in 1948, cortisone was shown to be useful in treating persons with rheumatoid arthritis. Julian devised a practical method of synthesizing it and other corticosteroids. By developing a cost-effective method to produce cortisone from soybean oil and, later, from yams, the benefits of cortisone treatment could be provided to a greater number of patients. Also while at Glidden, he devised a fire retardant, Aerofoam, which proved very useful for the military; this foam effectively quenched gasoline fires and saved countless lives during World War II. In addition, he developed a soy protein that became an important ingredient in latex house paint.

However, Glidden wanted Julian to continue to concentrate on paint-related products rather than the botanical compounds that really interested him. They parted ways and he established his own company, Julian Laboratories, to pro-

duce hormones in bulk. He sold the company, which had sites in the United States and Mexico, to Smith Kline and French Laboratories in 1961 for \$2.3 million, a vast sum almost 50 years ago.

In 1950, he bought a home in the Chicago suburb of Oak Park, and anti-integrationists tried to burn down the house. The following year, a stick of dynamite that was thrown from a car landed under a bedroom window, but the Julian family was determined to stay. In his words, "The right of a people to live where they want to, without fear, is more important than science." His son, Percy Julian, Jr, an attorney and civil rights leader, says they refused to be intimidated. Fortunately, the family was supported by many neighbors and the Chicago press.

Percy Julian fought for civil rights for more than 50 years. During his lifetime, he received numerous honors, including honorary degrees. In 1993, his image was placed on a US postal stamp (Figure). However, these honors and accolades are less important than his lifetime of extraordinary contributions to society. We are fortunate that he persevered against long odds, saving sight and lives and making corticosteroids available to all.

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### From the Archives of the Archives

Czermak states that the flattening of the anterior chamber usually attributed to glaucoma really exists before the glaucoma, and predisposes to it. The flattening of the chamber he explains as being an excessive degree of the physiological flattening of old age, which is due to a diminished secretion of aqueous humor from the secretory parts, which have undergone senile degenerative changes.

In cases of acute glaucoma there is no inflammatory adhesion between the iris and the ligamentum pectinatum. This condition is brought about, according to Czermak, as follows. In consequence of an excessive dilatation of the pupil when the chamber is shallow, the periphery of the iris becomes thickened until it touches the margin of Descemet's membrane.

The aqueous humor then collecting forces the iris into the chamber angle. This dilatation of the pupil may be relieved naturally or by myotics, but if it remains it leads to a condition of irritation and increased tension; all the subsequent clinical signs and anatomical changes are the result of the increased tension and the consequent venous stasis.

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