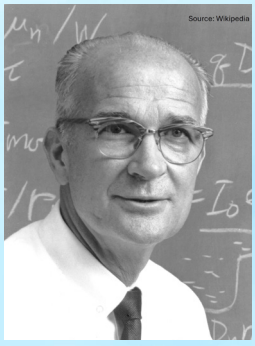
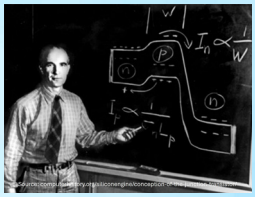
TIME TRAVEL

Eric Higham
Microwave Journal





William Shockley: The Father of a Complicated Legacy

Electronics revenue is forecast to surpass $3 trillion in the next decade. Life without electronic devices is unimaginable, and these devices would not exist without the transistor. This month's Time Travel focuses on the complicated life and contributions of William Shockley, the man who co-invented the bipolar transistor and became the "Father of Silicon Valley."

Born in London in 1910, his family moved to Palo Alto, Calif., when Shockley was three. Shockley developed an interest in physics by absorbing theories from his neighbor, a physics professor, before entering high school. After receiving degrees from Caltech and MIT, Shockley became one of the first Bell Labs recruits to a group seeking to replace vacuum tubes with solid-state semiconductors.

Shockley made progress on transistor development, publishing papers and receiving a patent on electron multipliers. However, World War II interrupted his research and he left Bell Labs for radar activities. His contributions resulted in the Medal for Merit in 1946.

After the war, Shockley rejoined Bell Labs and led a group, including John Bardeen and Walter Brattain, that demonstrated a point-contact transistor design in 1947. Bell Labs patent attorneys determined Shockley's work could be inferred from earlier patents and filed the Bell Labs point-contact transistor patent without Shockley's name. This angered Shockley and he continued to develop a junction-based transistor in secret.

Shockley refined his efforts and the results came quickly. He announced the "sandwich" transistor proof of principle in 1949. He published his foundational "Electrons and Holes in Semiconductors with Applications to Transistor Electronics" in 1950 and announced the bipolar junction transistor in 1951. Shockley's singular involvement in these announcements pushed him to the forefront of transistor development at the expense of Bardeen and Brattain. Despite Shockley, Bardeen and Brattain receiving the Nobel Prize in Physics in 1956 for their transistor development efforts, their relationship was fractured.

Shockley left Bell Labs, ultimately moving closer to his mother. In 1956, Shockley started Shockley Semiconductor Laboratory in Mountain View, Calif. Shockley's company was devoted to a silicon transistor replacement. The design proved difficult to build and Shockley ended silicon transistor research in 1957. This and Shockley's management style caused eight engineers to leave and form Fairchild Semiconductor. Among these employees, Robert Noyce and Gordon Moore went on to found Intel.

William Shockley's importance to the electronics industry is indisputable. The man is a giant in that respect. However, Shockley also adopted some reprehensible views on race, human intelligence and eugenics later in life. So, his legacy is complicated; he should be celebrated for his work on solid-state devices, but he should be denounced for the social views he came to embrace.