2012

Linus Pauling: Scientist of the 20th Century

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Recommended Citation
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Linus Pauling was born in Portland, Oregon, in February of 1931. His father was a self-taught chemist and his family moved to the small town of Condon when he was young so his father could work. Linus was nine years old at the time. Pauling developed a perforated stomach ulcer which resulted in his death. Linus's family moved back to Portland with his mother and two younger sisters. Pauling held several different jobs while in high school, including work as a film projectionist, milkman, and a dishwasher to help support the family.

Linus left home in 1913 to attend Oregon Agricultural College to pursue a degree in Chemical Engineering. Financing his education was a significant problem and Pauling actually had to leave the institution for a short while because he could not afford it. After a year away Pauling was offered the opportunity to return to teach a chemistry class for home economics majors. After returning to college he met Ava Helen Miller, a student in his course; they soon began dating and would marry in 1923. After graduating from Oregon Agricultural College in 1922, Pauling attended the California Institute of Technology where he earned his Ph.D. in chemistry, graduating summa cum laude.

Pauling also devoted much of his life to activism, calling for the reduction of nuclear weapons. Through his efforts Pauling was able to deliver a petition to the United Nations in 1958 calling for the end to nuclear weapons, the petition had been signed by over eleven thousand other scientists from around the world.

Pauling received numerous awards over the course of his career, including two Nobel Prizes. His first Nobel Prize was awarded in 1954 in the area of chemistry, for his work on the structure of chemical bonds. In 1962 Pauling was awarded his Nobel Prize for his many years of humanitarian work and activism in the area of nuclear arms reduction. Pauling is still the only person to earn two unshared Nobel Prizes, although he argued that the peace prize should have been shared with his wife for all of his efforts.

Linus Pauling was the one of the greatest scientists of all time, revolutionizing the worlds understanding of a variety of disciplines including chemistry and molecular biology. Pauling was able to develop many theories on the nature of chemical bonds, including theories on hybridization and resonance which are still used widely today. Pauling focused much of his early career determining the structures of simple compounds through the interpretation of x-ray diffraction patterns and created a set of rules that made it possible to determine the structure of more complex substances as well. Pauling also spent much of his career analyzing the structure such as hemoglobin, and was the first to confirm that certain diseases such as sickle cell anemia are caused by specific chemical changes in the protein structure. Pauling continued his work with proteins and actually discovered the structure of the alpha helix, a structure fundamental to many common proteins.

One of Pauling's most important contributions to the field of molecular biology was the discovery of the alpha helix protein structure. The alpha helix consists of a single chain of amino acids and a main protein secondary structure present in a variety of common substances such as keratin. The alpha helix model also provided a basis for understanding the structure of many common proteins.

Linus Pauling was one of the best in the world when it came to interpreting x-ray diffraction patterns. Early in his career he identified the structure of over 200 different compounds through the use of diffraction. Complex molecules were much more difficult to decipher mathematically so Pauling developed a set of "Pauling Rules" which made their structures much easier to determine. Pauling also used x-ray diffraction later in his career while working on unraveling the structure of different proteins.

Hybridization Overview:
- Atoms often have bonding electrons held in two or more different types of orbitals (s, p, d, etc.), which vary in energy.
- Orbitals are oriented 90° apart, but some molecules such as methane (CH4) have bond angles of 109.5°, all of equal magnitude and length.
- To explain this Pauling theorized that instead of valence electrons being at different energy levels, s and p, that instead some combination of s and p orbitals may form allowing for all valence electrons to be identical in energy.
- In the case of methane, the 2s and three 2p orbitals form four hybrid orbitals, equal in energy and each displaying 25% s and 75% p character.
- Since all of the orbitals are equal in energy they can orient themselves as far apart as possible, explaining the tetrahedral geometry of methane.

Hybridization:
One of Pauling's greatest achievements was the development of hybridization theory which explains the observed geometry of molecules. The model serves as an excellent model for predicting the structure of organic compounds and is still relevant and used extensively today.

X-Ray Diffraction and Crystallography.
Pauling also developed the idea of resonance and used it to explain the structure of compounds with delocalized electrons. Pauling determined that in certain situations multiple Lewis structures may be necessary to describe a compounds structure. Through his research we discovered that compounds true structure is actually the result of the superposition of its Lewis structures.

Conclusion
Linus Pauling was truly one of the greatest scientists of all time, revolutionizing the worlds understanding of a variety of disciplines including chemistry and molecular biology.