In memoriam: Julia Weertman (1926–2018) and Johannes Weertman (1925–2018)

I like the challenge of research—trying to make new materials, then understanding why they behave the way they do. It's a continual puzzle-solving process.

—Julia Weertman

Julia Randall Weertman, Walter P. Murphy Professor Emerita of Materials Science and Engineering at Northwestern University, a towering presence in the field of materials, passed away in Evanston, Ill., in July. Weertman received her bachelor's, master's, and PhD degrees in physics from the Carnegie Institute of Technology (now Carnegie Mellon University in Pittsburgh), where she was the first woman admitted to the College of Science and Engineering.

Julia and her husband, materials scientist and geophysicist Johannes (Hans) Weertman, both completed postdoctoral work at the École Normale Supérieure in Paris. They then moved to Washington, DC, in 1952 to take up jobs at the US Naval Research Laboratory, where Julia worked on problems concerning magnetism. In 1959, Hans took a job as an associate professor at Northwestern, while Julia remained at home to care for her family, later joining Hans in 1972 as an assistant professor of materials science. She was the first female materials science professor on Northwestern's faculty, where she would dedicate her career to the field for 45 years. She also became the first female chair of a materials science department in 1987.

Julia has made many contributions to understanding the basic deformation processes and failure mechanisms in a wide class of materials, from nanocrystalline metals to high-temperature structural alloys. She broke ground by using neutrons to study cavitation and damage during the deformation of metals. These small-angle neutron-scattering techniques offered a new view of cavitation, providing size and shape information on micrometer-sized cavities in a nondestructive manner. Julia subsequently explored nanocrystalline metals—long before "nano" became big in materials science. She explored the unique mechanical behavior of materials where grain boundaries dictate and dominate their strength and deformation characteristics.

Her career was marked with many honors. She received the Materials Research Society (MRS) Von Hippel Award in 2003 (the Society's highest honor; she was the first female recipient), the ASM International Gold Medal in 2005, a Leadership Award from The Minerals, Metals & Materials Society (TMS), and a Distinguished Engineering Educator Award from the Society of Women Engineers. In 2014, the American Association of Engineering Societies awarded Julia the John Fritz Medal for her role in studying materials and for inspiring generations of women to pursue careers in science. In addition, the Materials Science Department at Northwestern created a graduate fellowship in the names of Julia and Hans.

Julia was an inspiration to female graduate students, and her influence in this arena extended well beyond Northwestern to the broader materials community. She also worked on women's issues beyond science, in line with her belief that scientists have a responsibility to improve society.

It was with great sadness that we learned that Hans also passed away recently on October 13, less than three months after Julia's passing. They had been married for more than 68 years. They met in Julia's first year of graduate school when she was a teaching assistant for a physics class in which Hans was a student. Hans also received his bachelor's and PhD degrees from the Carnegie Institute of Technology. Julia has acknowledged Han's enthusiastic support and encouragement throughout her career.

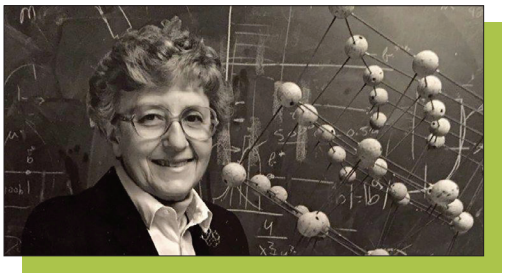
Julia and Hans served as advisors to ~60 PhD students. They were elected to the National Academy of Engineering, and inducted as Fellows of the American Academy of Arts & Sciences and Fellows of the John Simon Guggenheim Memorial Foundation. They were both Fellows of several Societies. The TMS Julia and Johannes Weertman Educator Award was created in their honor. Hans has an island named for him—Weertman Island—in Antarctica in honor of his studies in glaciology. Julia was also an active member of the *MRS Bulletin* Editorial Board for many years.

The Weertmans co-wrote a book, *Elementary Dislocation Theory*, first published in 1964, which was the first book on dislocation theory that specifically focused on educating advanced undergraduate level students. Many in the materials community fondly remember reading this text in their undergraduate or early graduate school years, and it remains on the bookshelves of many.

Julia Weertman represents a rare breed of scientist and engineer—an outstanding materials researcher, scholar, mentor, educator, pioneer, and role model.

Lori A. Wilson and **Gopal R. Rao**

https://doi.org/10.1557/mrs.2018.309 Published online by Cambridge University Press



The following article, titled "What's Keeping Women Out of Technical Careers?" by Julia Weertman, was published in the August 1992 issue of *MRS Bulletin*. It demonstrates her deep interest and passion for promoting women scientists and engineers, especially in materials science and engineering, for which she is remembered today. With her many "firsts" as a female materials researcher, she is the right voice for this article and topic. The article still feels fresh after 26 years, and the issues discussed remain relevant today.

MATERIAL MATTERS

What's Keeping Women Out of Technical Careers?

Julia Weertman

What can I possibly write on the topic of my experiences as a woman working in the field of materials science and engineering? In efforts to explain myself to the Society of Women Engineers recently, I resurrected a small platoon of iron-willed female ancestors and paraded their accomplishments in a male-dominated world. Today the ancestors will be left in peace.

So much has been written about The Woman in Science/Engineering that it is virtually impossible to add anything fresh and new to the subject. Past articles on the subject range from reminiscences by successful women scientists to angry denunciations of painful wrongs, from why-I-became-an-engineer to why so few women choose technical careers. It is the last-mentioned point that I would like to discuss briefly, and in a very intuitive manner (in the best female tradition).

My own observations indicate that blatant discrimination against women professionals or students in the physical science-based professions is comparatively rare now. Legal remedies exist to redress most such cases. Rather, like the situation in civil rights, the nature of the problems faced by technically-minded girls and women have become more subtle in nature, so subtle that frequently neither the originator nor the recipient is consciously aware of what has happened. But the message is there all the same. It is much more difficult to eliminate this form of discrimination and discouragement that is so firmly entrenched in our society than the heavy-handed pats-on-the-behind of chauvinist male colleagues.

From earliest childhood, girls are traditionally socialized into patterns of behavior that are at best orthogonal, often antithetical to scholarly careers, especially those that are mathematically based. Dolls don't teach us much about things mechanical, unless we take them apart to see what makes them wet, and that sort of aggressive, inquisitive activity certainly is discouraged in girls. Many of the early conditioning signals we receive are by no means bad. They engender, for example, nurturing, caring behavior that has tremendous societal and personal value.

> Trite as it sounds, role models of women actually working and succeeding in science or engineering are probably the best weapons to neutralize the anti-science influences.

So the question becomes, how can all these pressures from society that direct girls away from a technical career be counteracted, while not destroying the beneficial humanizing messages? How to offset such mundane but harmful effects as comparatively less attention paid to girls in the class room (including university class rooms), or guidance counselor's advice that selectively steers girls away from math and science, or the practice of allowing boys to run the lab experiments while the girls are left to record the data?

I believe that all these continual anti-science influences can be nullified only by a constant barrage of positive messages. Trite though it sounds, role models of women actually working and succeeding in science or engineering are probably the best weapons to neutralize the anti-science influences. Such models are especially effective if they are young, attractive, and definitely not nerdy. (The image of the science nerd is instantly fatal to any nascent stirrings in the female breast of interest in a technical career.) The exhibit "My Daughter the Scientist" in Chicago's Museum of Science and Industry is especially noteworthy for showing that, apart from their splendid careers, the featured women enjoy normal and full family lives. And they look remarkably normal.

Each outreach effort of a woman scientist to young girls may seem to be a tiny, ineffectual action, but the cumulative effect can be powerful. And then, we never know what one chance encounter can do. My favorite example of an outreach effort that reached a large audience is furnished by a colleague, a distinguished physicist with whom I have had the pleasure of working. She once told me of her experience, a number of years ago, when she agreed to teach a science lab course at her young daughter's private school. She set the students to putting together clocks, and used the opportunity to explain some of the relevant physics. She arranged the teams so that they were all male or all female. Thus the girls were insured of hands-on experience. At first the students, especially the boys, were dubious about this woman science instructor but as weeks went by they all became caught up in the project. The unexpected high point of success came some time later at a parents' night. The mother of one of the boys who had been in the class thanked her for the remarkable changes she had wrought in the young man. The example of this highly competent scientist/mother had given him a new respect for women, a respect that even extended to his own mother. Evidently both sexes can benefit from such outreach activities of women scientists and engineers.

So, how would I describe my own experience in materials science? Certainly it has taken hard work and a willingness to submit to constant fatigue more often than I would like, but the reason I persevered is much more subtle than that. It's the result of a combination of help from many people, strong support from my husband, lots of luck, but primarily the attitude of my parents from my earliest years that I could do anything I wanted to, and their quiet taking it for granted that I would succeed at it.

***Julia Weertman** is the Walter P. Murphy Professor and Chairman of the Department of Materials Science and Engineering at Northwestern University.* □

Material Matters is a forum for expressing personal points of view on issues of interest to the materials community.

https://doi.org/10.1557/mrs.2018.309 Published online by Cambridge University Press