BOOK REVIEW

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I Died for Beauty: Dorothy Wrinch and the Cultures of Science. Marjorie Senechal. Oxford University Press 2013. 312 pages. ISBN: 9780199732593-13.

Reviewer: Sandra Z. Keith, emerita, St. Cloud State University, St. Cloud, MN

In Emily Dickinson's poem, an entombed soul speaks out that she died for beauty; another soul, that he died for truth. The two softly talk until the moss reaches their lips and covers up their names. This book is a biography of Dorothy Wrinch (1894–1976), Oxford's first female science graduate, who invented and held stubbornly to a mathematically based explanation for the structure of protein. The theory had intriguing Platonic beauty, but unfortunately, peripheral truth. And if the author has anything to say about it, neither will moss cover up the name of Dorothy Wrinch. Marjorie Senechal is a Smith professor emerita and the editor of *The Mathematical Intelligencer* but was just a young Smith faculty member contemplating a course in symmetry when she first visited Wrinch, who in her white-haired 70s was lodged in an office above her own, stuffed to bursting with polyhedral models. Thus began a working-together relationship and a friendship that would culminate in this engaging, cheerful and often humorous book, which unravels the life and discoveries of this clever, enterprising, and ornery mathematical scientist in a fascinating time period in science history.

The book opens with the events of a 1938 conference described as if one might have been there, with the momentous question of the times being, what constitutes protein? A tentative floating conjecture by Astbury was that they were stringy fibers. But with X-ray crystallography in its infancy, the explanation would require subtle guesswork, and if correct, would assure the scientist of the Nobel Prize. Enter Dot Wrinch. A young, stiffish but pleasant, woman might not be all that notable as an up and coming student, but if raised in a cultural soup brewing the likes of Bertrand Russell and Hardy at Oxford, she will probably come out of the experience with a great amount of edification and also, backbone. Women in fact did inhabit the terrain of biology—

a fellow friend, Dorothy Crowfoot Hodgkins, credited with advancing protein crystallography, would eventually win a Nobel Prize (1964) and was interviewed by the author. Wrinch on her part had studied enough mathematics, philosophy and chemistry and biology to paddle in the scientific ocean with the greats, although her lack of experimental background was ultimately to be fatal to her ability to garner the experimentalists about her that she needed. "She's a woman—give her something and she would then only ask for more!" to paraphrase one of her superiors. Bringing her mathematical love of symmetry and polyhedral models to the big question (the book has a wonderful quote about Smithies with their models!), her big guess in 1936 was a mathematically simple and pretty one. Proteins are hexagonally laced fabrics, nets comprised of hexagonal cells dubbed "cyclols." These then fold up like origami into blobs. She was wrong, but it was a fair guess. This argument served several other ongoing theories of the time—the hexagon hypothesis seemed to serve the (incorrect) observation that amino acid residues came only in products of 2s and 3s. And her theory held the attention of such players as Niels Bohr. It was the dogged Linus Pauling, using thermodynamics and improved crystallography, who would prove to be Wrinch's nemesis, and their ongoing dispute, in one place humorously and briefly caricatured in this book as acts from an opera, would continue until 1969. Although Wrinch stuck to her guns for too long, many would say that even with his two Nobel Prizes, including one for the correct unraveling of the protein structure, Pauling hung on too long with his Vitamin C as a cure for cancer theory.

Scientifically speaking, what is protein? What we now know is that an actual blob of protein consists of a string of "amino acids" attached by "peptide linkages" in a repeated, rope-like structure. This rope then stickily or magnetically

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NSF-AWM Travel Grants for Women

Mathematics Travel Grants. Enabling women mathematicians to attend conferences in their fields provides them a valuable opportunity to advance their research activities and their visibility in the research community. Having more women attend such meetings also increases the size of the pool from which speakers at subsequent meetings may be drawn and thus addresses the persistent problem of the absence of women speakers at some research conferences. The Mathematics Travel Grants provide full or partial support for travel and subsistence for a meeting or conference in the applicant's field of specialization.

Mathematics Education Travel Grants. There are a variety of reasons to encourage interaction between mathematicians and educational researchers. National reports recommend encouraging collaboration between mathematicians and researchers in education and related fields in order to improve the education of teachers and students. Communication between mathematicians and educational researchers is often poor and second-hand accounts of research in education can be misleading. Particularly relevant to the AWM is the fact that high-profile panels of mathematicians and educational researchers rarely include women mathematicians. The Mathematics Education Research Travel Grants provide full or partial support for travel and subsistence for

- mathematicians attending a research conference in mathematics education or related field.
- researchers in mathematics education or related field attending a mathematics conference.

Selection Procedure. All awards will be determined on a competitive basis by a selection panel consisting of distinguished mathematicians and mathematics education researchers appointed by the AWM. A maximum of $1500 for domestic travel and of $2000 for foreign travel will be funded. For foreign travel, US air carriers must be used (exceptions only per federal grants regulations; prior AWM approval required).

Eligibility and Applications. These travel funds are provided by the Division of Mathematical Sciences (DMS) of the National Science Foundation. The conference or the applicant's research must be in an area supported by DMS. Applicants must be women holding a doctorate (or equivalent) and with a work address in the USA (or home address, in the case of unemployed applicants). Please see the website (http://www.awm-math.org/travelgrants.html) for further details and do not hesitate to contact Jennifer Lewis at 703-934-0163, ext. 213 for guidance.

Deadlines. There are three award periods per year. Applications are due **February 1**, **May 1**, and **October 1**.

folds up into itself to become a blob. The sequence of DNA gives the directions for the sequence of amino acids on the protein's peptide chain to determine the kind of blob it folds into—voila! Proteins explained. Nevertheless, while proteins don't use them, Dorothy's cyclols occur elsewhere in nature, for example in alkaloids. This is not so surprising. Wrinch's major accomplishment was not the structure of the protein but a serious answer to the question: why do proteins fold? She and the scientist Irving Langmuir laid the basis for the hydrophobic effect. Since the ropes don't tie themselves to each other, how can we explain why the rope doesn't just fall apart like a wet noodle and why each rope forms its specific blob? More scientifically, what is the physics that explains why a chain of amino acids always seems to fold into the same shape? That big question took many years to understand (some scientists still work on the margins of this topic) and the answer is: the *hydrophobic* effect—briefly, a protein that lives in a watery background will try to fold its oily parts into its center with its watery parts outside.

At the time, it was written of her, "W is a queer fish, with a kaleidoscopic pattern of ideas, ever shifting and somewhat dizzying. She works, to a considerable extent, in the older English way, with heavy dependence on `models' and intuitive ideas" (p. 144). This book too is kaleidoscopic, and at times almost dizzying, with the plot unfolding like a denatured protein—something I can say with my newly acquired knowledge, some picked up from my frequent trips to Wikipedia as my fascination grew. A denatured protein is what you get when you whip up an egg white. The analogy is not too far off. The book is a palimpsest of Wrinch's complicated life, with details of lantern slides, the British exam system and British dorms, philosophical paradoxes and politics, polyhedral symmetries, quarrels among the sciences, crystals, the life of a college wife, and gossipy tales about that old Mad Hatter Bertrand Russell and the "evolution-is-random" philanderer HG Wells. Who would not want to read such a book, especially one so well-written?

In my own online reading (see, for example, http://www.ch.imperial.ac.uk/rzepa/blog/?p=3746, for a clear picture of a cyclol), I found Dorothy Wrinch mentioned quite frequently: she is often congratulated as a female with persistence. Statistician George Box would remark, "All models are wrong, but some are useful." And perhaps, it was *indeed because she was a woman* that Wrinch managed to magnetize scientists to the topic and energize the field, although Wrinch is admirable in refusing to let herself be ignored.

Conrad said, writing is like peeling an onion—peel away, but don't look for a seed of truth; the truth is in the entire onion. So with this book, about a controversial woman by an author who not only understood her but understood her ways of working, taught with her ways of working, and very much cared. This extremely interesting book would be the perfect fodder for a television series; there are messages here for all of us. *Se non è vero è bene trovato.*