

## Carlene Allen Raper 1925-2019

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Cardy Raper at the 24<sup>th</sup> Fungal Genetics Conference, Asilomar CA, 2007.

The field of fungal genetics and biology lost one of its founding anchors with the death of Carlene Raper. Professor Raper was the intellectual anchor of the *Schizophyllum* research community for over three decades, and a majority of those working on this organism can trace their roots to her lab or her promotion of their work. While many outstanding scientists at the end of their careers could make similar claims, what was unique about Raper was that she carried this off despite serious obstacles and by sheer force of will and personality.

Carlene Allen Raper, whose expertise was the genetics of sexual mating and reproduction in the mushroom-forming fungus *Schizophyllum commune*, had a scientific career spanning more than 60 years. Cardy, as she was known to friends, was born in Plattsburgh, New York on January 9, 1925, and died after a brief illness at her family's summer home on Lake Champlain in Ferrisburgh Vermont on September 5, 2019.

Cardy received her B.S. and M.S. degrees in Biology from the U. of Chicago in 1946 and 1948, respectively. While there, she met faculty member John Robert Raper, known as Red, and married him in 1949. When Red became a faculty member in the Biology Department at Harvard, they moved to Lexington, Massachusetts. Cardy worked on mating type mutants in Red's laboratory as his scientific collaborator in what was a typical model for academic research at that time. She might have remained in this capacity but for the tragic and untimely death of Red, leaving her with two small children, no Ph.D., and no real prospects for continuing her work. She fought for a place in graduate school at Harvard and received her Ph.D. based on her genetic analyses of *Schizophyllum* in 1977. Following a brief postdoc with Professor JGH Wessels at Rijksuniversiteit in Groningen (The Netherlands), she took a position as junior tenure track faculty at Wellesley College in Massachusetts. However, the heavy teaching load and formal atmosphere were not a good fit for the free-spirited full-time scientist that Cardy had become. So she once again set out bravely, accepting a research faculty position at the University of Vermont in 1983. She remained there, running an active research program that garnered support from the NIH, NSF, USDA, and ACS until she retired in 1994 and then afterward as Research Associate Professor Emerita running a fully funded lab until 2004.

Cardy spent her career tirelessly promoting the science of basidiomycete fungi, a highly underserved and under-recognized area of research. Raper's science focused on *Schizophyllum*'s system for governing self-nonsel self recognition and its decision whether to mate and develop, a choice driven by the need to outcross. Cardy used genetics and molecular techniques to identify fungal pheromones and their cognate receptors, the A and B mating-type loci controlling sexual development. This system is comprised of two mating-type loci (A and B), each with two genes (alpha and beta) where a compatible mating could occur with a difference between one allele in each locus. Given the number of described alleles at these loci, this yields more than 23,000 combinations, or "Lots of chances for everyone," as Cardy would often quip.

Dr. Raper transitioned into the molecular biology era by spending time in the mid-1980s with Bill Timberlake's Aspergillus group at the University of California, Davis. By seeing the future of genetics in the molecular cloning of genes, Cardy moved to the forefront of fungal molecular biology, publishing work on fungal plasmids, the chromosomal arrangement of fungal DNA, and the cloning of genes involved in *Schizophyllum* development. A major triumph came shortly after she moved to the University of Vermont (UVM) when her group published the cloning of the B $\alpha$ 1 mating-type gene in 1995. In the end, Raper, colleagues, and associates showed that the A loci encoded homeodomain proteins, whereas the B loci encoded G-protein coupled receptors and their lipopeptide pheromone ligands.

Dr. Raper was known for both her encyclopedic knowledge of *S. commune* biology and her supportive and encouraging personality towards younger scientists. Her enormous enthusiasm for discovery made her an inspirational role model, especially for women scientists with families. Dr. Raper was elected as a Fellow of the American Association for the Advancement of Science in 2012 in recognition of her scientific contributions.

Dr. Raper placed three highly capable scientists into the community. Steve Horton is faculty in Biology at Union College in Schenectady, New York, and has continued the work he began with Dr. Raper on the genetic regulation of mushroom development. Tom Fowler is faculty in the Department of Biological Sciences at Southern Illinois University and studies cell signaling in fungal mating. Lisa Vaillancourt is faculty in the Department of Plant Pathology, University of Kentucky, working on plant rot fungi, including *Colletotrichum graminicola* and *Gibberella zeae*.

After closing her lab and retiring from formal duties at UVM, Dr. Raper remained intellectually active by writing what she called "creative non-fiction." Her first book, a scientific memoir titled *Love, Sex and Mushrooms: Adventures of a Woman in Science*, was published in 2011. It aimed to educate the public on what life was like as a woman scientist of her generation.

Cardy represented the best kind of well-rounded scientist by eagerly pursuing her life-long passions in research and education and transferring that enthusiasm to subsequent generations.

Professor Raper is survived by her children. Linda Carlene Raper is an internationally recognized fabric artist. Jonathan Raper is a developmental neurobiologist and professor at the University of Pennsylvania School of Medicine.