

1154-92-319

**Daniel Fairbanks\*** ([daniel.fairbanks@uvu.edu](mailto:daniel.fairbanks@uvu.edu)) and **Bob Palais** ([bob.palais@uvu.edu](mailto:bob.palais@uvu.edu)).

*How Good is the  $\chi^2$  Goodness-of-Fit test? Revisiting a controversy from the birth of modern statistics and genetics.*

In 1900, the same year that Gregor Mendel's paper that laid the foundations for the science of genetics was rediscovered, Karl Pearson published what is now known as the chi-squared goodness-of-fit test. Two years later, Pearson's colleague, W.F.R. Weldon applied the test to Mendel's data and came to the startling conclusion that they appeared suspiciously close to expectation. Weldon's paper set off a firestorm that pitted the biometricians against the Mendelians. Ronald Fisher entered the fray in 1911, but it was his 1936 paper, based on the same mathematics, that ignited what is still known as the Mendel-Fisher Controversy.

We will describe elementary mathematical transformations and efficient algorithms that eliminate the need for often crude chi-squared approximations of cumulative probability. The ease of achieving greater accuracy offers new perspective on this colorful debate. Our methods extend to larger sample sizes, multiple degrees of freedom, and sampling without replacement. We will also discuss recently published evidence that Darwin's Origin of Species influenced the sections of Mendel's paper that address issues of evolution. (Received August 31, 2019)