Mitochondria are organelles found in each cell that have their own DNA that is distinct from the DNA found in the nucleus. Mitochondrial DNA has 16,569 base pairs arranged in a loop, of which approximately 1122 base pairs found in 2 hypervariable regions (HVR1 and HVR2) don't code for anything. The first woman tested was from England and her sequence became known as the Cambridge Reference Sequence (CRS). Mitochondrial DNA test results are reported as the differences in any one person's mitochondrial DNA with respect to the CRS.

Mitochondrial DNA is always passed down from the mother to her children. Thus, mitochondrial DNA testing provides information about what the mitochondrial DNA sequence was for any given individual's maternal line as far as they can trace it back. Mitochondrial DNA mutates relatively infrequently. On the average there is only a 3% chance that there will be a mutation in any of the bases in the mitochondrial DNA sequence in any given generation. Thus, if two people share the same great grandmother on the maternal line of descent then we would expect that those two people would have identical mitochondrial DNA sequences, or at the most have one base that was different in their mitochondrial DNA if a mutation had occurred somewhere along the line as it was being passed down to each of these two people from their great grandmother.

At this time we have mitochondrial DNA results for 23 people of Low German Mennonite ancestry. Those results are summarized in the accompanying table. Seven haplogroups are represented among these 23 people: A, H, I, J, T, and U. The haplogroups and subclades shown in the haplogroup column are predicted based on the mutations in HVR1, HVR2, and HVR3. The primary resources used to predict the haplogroups were data from the Family Tree DNA mitochondrial DNA projects, the Genographic Project, Mitosearch, and the Argus Biosciences' Phylogetic Tree of Global Mitochondrial DNA. To be absolutely definitive about the assignment of any mitochondrial DNA sample to a haplogroup the entire mitochondrial genome generally needs to be sequenced. None of the mitochondrial DNA samples from people of Mennonite ancestry have yet been sequenced in full.

Of the 23 mitochondrial DNA results available, 17 are unique. The mitochondrial DNA result from the descendent of Helena Kroeker (b. 6 May 1825)(Grandma #163353) matches that of the descendent of Justina Klassen (b. 30 Jul 1826)(Grandma #174332) and that of the descendent of Susanna Fast (b. ca 1840)(Grandma #229435). This indicates that Helena Kroeker, Gertrude Klassen, and Susanna Fast descend from the same woman on the maternal line of descent at some point in the recent past, likely within the past 600 years. The mitochondrial DNA result from the descendent of Elisabeth Dyck (b. 1849)(Grandma #25757) matches that of the descendent of Anna Friesen (b. 1855)(Grandma #528192) as well, suggesting that they share a common maternal ancestor in the recent past. The mitochondrial DNA result from the descendent of Katharina Kaslowsky (b. ca 1850) matches that of the descendent of Margaretha Goosen (Grandma #218588) and the descendent of Helena Dyck (b. 21 Jun 1809)(Grandma #118023) as well, suggesting that they share a common maternal ancestor in the recent past. The mitochondrial DNA result from the descendent of Maria Isaak (b. 1811) also matches that of the descendent of Anna Reimer (b. 3 Dec 1860)(Grandma #358133), suggesting that they share a common maternal ancestor in the recent past. Exactly how these people were related to each other remains to be determined.

Using Doug McDonald's time to most recent common ancestor calculator program at http://dna-project.clan-donald-usa.org/tmrca.htm and setting the mutation rate at 0.00002 and the total number of markers at 1122, it can be calculated that there is a 50% probability that Helena Kroeker, Justina Klassen, and Susanna Fast share a common maternal ancestor within the past

450 years. The same applies for Elisabeth Dyck and Anna Friesen as well as Katharina Kaslowsky and Margaretha Goosen. The results from a number of the people who have been tested are similar to each other, suggesting at least a distant relationship between those people.

The following are some additional references that discuss mitochondrial DNA in greater detail:

1. Deep Ancestry, Inside the Genographic Project, by Spencer Wells, 2006.
2. Trace Your Roots with DNA by Megan Smolenyak and Ann Turner, 2004.
3. http://www.mitomap.org
4. http://en.wikipedia.org/wiki/Mitochondrial_DNA
5. http://www.mitosearch.org
6. http://www.ianlogan.co.uk/mtdna.htm
7. http://www.kerchner.com/dna-info.htm
8. https://www3.nationalgeographic.com/genographic/resources.html
9. http://www.familytreedna.com
10. http://www.smgf.org

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