Rafael Arriaga, a Mexican Father in Michigan: Autosomal DNA Helps Identify Paternity

By Karen Stanbary, CG

Combining DNA test results with documentary research can confirm lineages that meet the Genealogical Proof Standard. This process can be dynamic, nonlinear, and gradual as possibilities narrow to a provable conclusion.

Joanne (Goecke) Gram was born in Kent County, Michigan, on 4 June 1950. Her mother's sister formally adopted infant Joanne, who grew up knowing that her biological and adoptive mothers were sisters. Neither identified the biological father, and no obtainable record names him. Joanne believed he was Hispanic.[1] Her DNA provides clues.

JOANNE'S DNA

Genealogists use three types of DNA tests. Two would not be helpful in Joanne's case:

- Y-chromosome testing does not apply because women have no Y chromosome.
- Mitochondrial DNA (mtDNA) testing does not apply because children inherit mtDNA only from their mothers. Joanne's mtDNA could not identify her father.

The third type of DNA test does apply to Joanne's case:

- Autosomal DNA (atDNA) testing applies because children receive half their atDNA from their fathers. Half of Joanne's atDNA came from her father. Further, atDNA test results usually include X-chromosome results. Daughters—Joanne in this case—receive one X chromosome from their fathers.

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1. Kelly Shoenherr-Gram to author, "Joanne Gram," e-mail, 13 August 2015; author's files. Also, Kelly Shoenherr-Gram, interview by author, 18 September 2015; notes in author's files. Ms. Gram permitted Ms. Shoenherr-Gram to retain a genealogist to seek the man's identity. Both authorized the author to submit the results for publication. See Kelly Shoenherr-Gram to author, client-researcher agreement, 15 September 2015; and Joanne Gram to author, "Permission to Use," 18 November 2015; both in author's files.

DNA TESTING

Joanne and people whose DNA she shares submitted saliva or cheek-cell samples to one of three testing companies—23andMe, AncestryDNA, or FamilyTreeDNA.[2] For initial analyses of the results, the author used *GEDmatch*, an independent website enabling researchers to compare different companies' atDNA test results. Among other statistics, *GEDmatch* reports the total number of shared centiMorgans (cMs) on autosomal and X-chromosome segments larger than 7 cMs. Researchers use the centiMorgan, a measure of genetic linkage based on recombinant frequency, to predict a relationship between test takers.[3]

The recombining of parental atDNA, and its varying reduction by about half in each descending generation, complicate interpreting atDNA test results.[4] For example, the atDNA Joanne inherited from her biological father is a mixture of atDNA he received from each of his parents. Joanne's inherited combination contains approximately 25 percent (1700 cMs) of each of her four grandparents' atDNA and roughly 12.5 percent (850 cMs) of each great-grandparent's atDNA. An individual's atDNA averages 6.25 percent (425 cMs) from each great-great-grandparent, recombined in each generation.[5] Unequal amounts—larger and smaller—can come from each ancestor.

Third cousins descend from the same pair of great-great-grandparents. As cousin relationships become more distant, the range of shared DNA becomes larger. For example, third cousins are expected to share, on average, 53.15 cMs, but actual amounts range between 334 cMs and 0 cMs.[6]

Genetic genealogists study DNA test results and the implied relationships. They look for individuals who share sufficient DNA to suggest a common ancestor or ancestors. Then they consider all potential intersecting ancestral lines of people sharing DNA, taking into account the depth and accuracy of all relevant family trees. They attempt to eliminate all ancestral lines but

2. *23andMe* (23andme.com). Also, *AncestryDNA* (dna.ancestry.com/). Also, *FamilyTreeDNA* (ftdna.com).

3. "'One to one' Compare," *GEDmatch: Tools for DNA and Genealogy Research* (gedmatch.com). Also, "CentiMorgan," *International Society of Genetic Genealogy Wiki* (isogg.org/wiki/Centimorgan).

4. Blaine Bettinger, "How Do DNA Segments Get Smaller?" blog post, 31 January 2015, *The Genetic Genealogist* (thegeneticgenealogist.com/2015/01/31/dna-segments-get-smaller).

5. "Autosomal DNA Statistics," *International Society of Genetic Genealogy Wiki* (isogg.org/wiki/Autosomal_DNA_statistics).

6. Ibid. Also, Blaine Bettinger, "Visualizing Data from the Shared cM Project," blog post, 29 May 2015, *The Genetic Genealogist* (thegeneticgenealogist.com/2015/05/29/visualizing-data-from-the-shared-cm-project/).

Table 1

Selected Autosomal DNA Matches to Joanne Gram

TESTEE'S NAME	TOTAL cMs IN SHARED SEGMENTS LARGER THAN 7 cMs	NUMBER OF SHARED SEGMENTS LARGER THAN 7 cMs	LARGEST SHARED SEGMENT
Roberto Gasca	162.7	11	25.3 cMs
Hugo Jaramillo	131.2	3	60.0 cMs
Ana "Anita" Gasca	108.4	6	32.1 cMs
Maria Teresa Ruiz	65.2	5	15.8 cMs
Alejandro Macías	51.7	3	23.1 cMs
Jorge Zúñiga	35.9	1	35.9 cMs
Evaristo Ruiz	29.1	2	15.3 cMs

For identification of matching kits, see "'One-to-many' matches," *GEDmatch: Tools for DNA and Genealogy Research* (gedmatch.com), for kit A767282 (Joanne Gram). For the tabulated data, see "'One-to-one' compare," *GEDmatch*, kit A767282 compared individually to kits T363242 (Roberto Gasca), M538273 (Hugo Jaramillo), A187233 (Ana "Anita" Gasca), M694610 (Maria Teresa Ruiz), A382232 (Alejandro Macías), A600364 (Jorge Zúñiga), and T472651 (Evaristo Ruiz). The acronym cMs refers to centiMorgans, a measure of genetic linkage based on recombinant frequency. See "CentiMorgan," *International Society of Genetic Genealogy Wiki* (isogg.org/wiki/Centimorgan).

one. Combining DNA test results with documentary research, genealogists can confirm lineages with the Genealogical Proof Standard.[7] This dynamic, nonlinear, and gradual process identified Joanne's father.

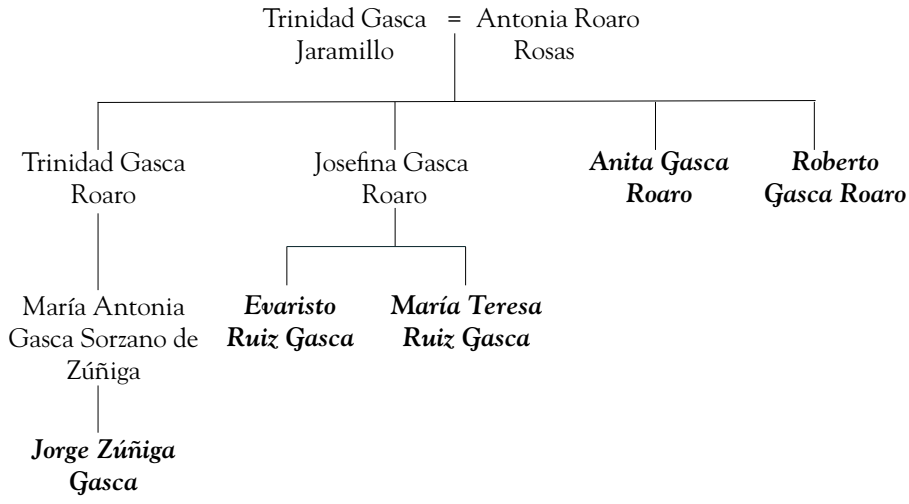
JOANNE'S CLOSEST AUTOSOMAL DNA MATCHES

Initial testing showed that Joanne shares significant amounts of atDNA with seven people with Hispanic surnames. See table 1.

7. Angie Bush, "Triangulation Tools," *Getting More out of Genetic Genealogy Research: Intermediate to Advanced DNA Analysis Techniques*, syllabus (Salt Lake City: Salt Lake Institute of Genealogy 2015), 93. Also, Board for Certification of Genealogists, *Genealogy Standards* (Nashville, Tenn.: Ancestry.com, 2014), 1–3. Also, Blaine Bettinger, "Evaluating a Genetic Genealogy Proof Argument," *Association of Professional Genealogists Quarterly* 30 (September 2015): 162–65. Author Stanbary documented several triangulated matches for this study, which led to a targeted testing plan. Because the targeting testing confirms the conclusion, this article omits the triangulation data.

Figure 1

Selected Descendants of Trinidad Gasca and Antonia Roaro: The Gasca "Clan"



Names of autosomal-DNA test-takers are bolded and italicized. For parents of siblings Trinidad, Josefina, Anita, and Roberto Gasca, see *FamilySearch* (familysearch.org/search/collection/1860831) > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos 1900–1911 > image 374, San José Catholic Church (Cortazar, Guanajuato), Bautismos [baptisms] vol. 15, fol. 349r, no. 4348, J.ª Concepción Trinidad Gasca. Also, ibid. > Bautismos 1911–1916 > image 238, for vol. 18, fol. 23, no. 131, Juana Josefina Gasca. Also, ibid. > Bautismos 1920–1926 > image 315, vol. 22, fol. 89, no. 891, Nicolasa Ignacia Ana Gasca. Also, ibid. > Bautismos 1926–1933 > image 42, vol. 23, fol. 32, no. 306, José Roberto Gasca. For parents of siblings Evaristo and María Teresa Ruiz, see ibid. > Bautismos 1953–1956 > image 120, vol. 35, fol. 114, no. 876, Evaristo Gerardo Ruiz. Also, ibid. > Bautismos 1959–1962 > image 89, vol. 39, fol. 83, no. 401, M.ª Teresa Ruiz. For parents of María Antonia Gasca and her son Jorge Zuñiga, see Celaya, Guanajuato, birth certificate no. 186242, Jorge Felix Zúñiga Gasca (1977), issued in 1982; citing Nacimientos [births] 296, fol. 221r; files of Jorge Zúñiga, St. Paul, Minn.

The Gasca Clan

Five of Joanne's atDNA matches are closely related. They descend from a married couple, Trinidad Gasca Jaramillo and Antonia Roaro Rosas, of Cortazar, in the Mexican state of Guanajuato.[8] For their relationships, see figure 1.

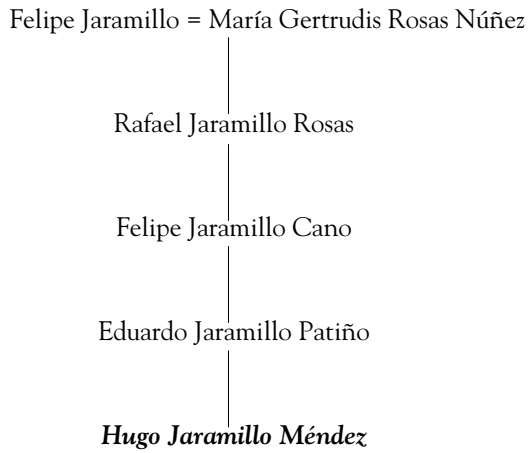
Hugo Jaramillo Méndez

The sixth person with a Hispanic surname who shares significant amounts of Joanne's atDNA is Hugo Jaramillo. For Hugo's lineage, see figure 2. Hugo also shares atDNA with the Gasca clan. See table 2.

8. This article uses conventional Mexican double surnames, when known, for first mentions. Thereafter, it uses daily-use given names, paternal surnames, or both, except where double surnames differentiate people. For Mexican naming conventions, see George R. Ryskamp, *Finding Your Hispanic Roots* (Baltimore: Genealogical Publishing, 1997).

Figure 2

Descent of Hugo Jamarillo Méndez



For Hugo's father and paternal grandfather, see Acayucan, Veracruz, Acta de Nacimiento [birth certificate] no. 79113 (citing Libro [book] 3, fol. 35, no. 535), Hugo Martín Jaramillo Méndez (1962); files of Hugo Jaramillo, Los Angeles, Calif. For Eduardo's father and grandfather, see *FamilySearch* (familysearch .org/search/collection/1922031) > Mexico, Guanajuato, Civil Registration, 1862–1930 > Guanajuato > Cortazar > Nacimientos 1912–1915 > image 69, Cortazar, Guanajuato, Nacimientos [births] vol. 19, fo. 19r, no. 45, Eduardo Jaramillo. For Rafael's parents, see ibid. > Defunciones 1911 > image 141, Cortazar, Defunciones [deaths] vol. 115, fo. 119v, no. 710, Rafael Jaramillo, 13 June 1911.

Table 2

Hugo Jamarillo's Shared Autosomal DNA Segments Shared with the Gasca "Clan"

TESTEE'S NAME	TOTAL cMs IN SHARED SEGMENTS LARGER THAN 7 cMs	NUMBER OF SHARED SEGMENTS LARGER THAN 7 cMs	LARGEST SHARED SEGMENT
Roberto Gasca	58.3	4	20.8 cMs
Ana "Anita" Gasca	78.7	4	36.9 cMs
María Teresa Ruiz	13.7	1	13.7 cMs
Jorge Zúñiga	20.5	1	20.5 cMs
Evaristo Ruiz	40.3	3	14.0 cMs

For the tabulated data, see "'One-to-one' compare," *GEDmatch: Tools for DNA and Genealogy Research* (gedmatch.com), kit M538273 (Hugo Jaramillo) compared individually to kits T363242 (Roberto Gasca), A187233 (Ana "Anita" Gasca), M694610 (Maria Teresa Ruiz), A600364 (Jorge Zúñiga), and T472651 (Evaristo Ruiz). The acronym cMs refers to centiMorgans, a measure of genetic linkage based on recombinant frequency. See "CentiMorgan," *International Society of Genetic Genealogy Wiki* (isogg.org/wiki /Centimorgan).

Table 3

Alejandro Macías's Shared Autosomal DNA Segments Shared with Hugo Jamarillo and the Gasca "Clan"

TESTEE'S NAME	TOTAL cMs IN SHARED SEGMENTS LARGER THAN 7 cMs	NUMBER OF SHARED SEGMENTS LARGER THAN 7 cMs	LARGEST SHARED SEGMENT
Hugo Jamarillo	120.4	5	49.1 cMs
Roberto Gasca	75.2	6	26.4 cMs
Ana "Anita" Gasca	117.0	6	38.4 cMs
María Teresa Ruiz	354.7	18	40.7 cMs
Jorge Zúñiga	34.7	3	16.4 cMs
Evaristo Ruiz	396.4	19	46.4 cMs

For the tabulated data, see "'One-to-one' compare," *GEDmatch: Tools for DNA and Genealogy Research* (gedmatch.com), kit A382232 (Alejandro Macías) compared individually to kits M538273 (Hugo Jaramillo), T363242 (Roberto Gasca), A187233 (Ana "Anita" Gasca), M694610 (Maria Teresa Ruiz), A600364 (Jorge Zúñiga), and T472651 (Evaristo Ruiz). The acronym cMs refers to centiMorgans, a measure of genetic linkage based on recombinant frequency. See "CentiMorgan," *International Society of Genetic Genealogy Wiki* (isogg.org/wiki/Centimorgan). These data show that Alejandro shares more ancestors with María Teresa and Evaristo than he shares with the others. That additional shared ancestry is not relevant to Joanne Gram.

A documented lineage apparently accounts for Hugo's shared atDNA with the Gasca clan. Its patriarch, Trinidad Gasca, was a son of Victor Gasca. Victor's parents were Felipe Jaramillo and Gertrudis Rosas, also Hugo's ancestors.[9] See figure 2.

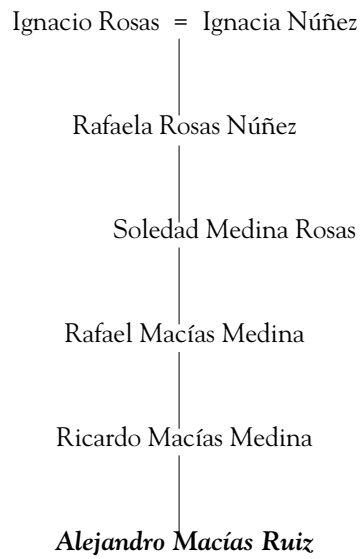
Alejandro Macías

The seventh person with a Hispanic surname who shares identical segments of Joanne's atDNA is Alejandro Macías. He also shares atDNA with Hugo Jaramillo and the Gasca clan. See table 3.

9. *FamilySearch* (familysearch.org/search/collection/1860831) > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Información matrimonial 1904–1906 > images 423–25, for San José Catholic Church (Cortazar, Guanajuato, Mexico), Información Matrimonial [matrimonial information], vol. 10, fols. 199–200, J.é Trinidad Gasca and Antonia Roaro, 26 December 1906. *Información matrimonial* is a marriage prerequisite requiring brides and grooms to declare their nativity, residence, age, marital status, ethnicity, and parents' names. Trinidad's mother, Maria Santos Jaramillo, testified he was the legitimate son of Víctor Gasca, deceased. Also, ibid. > Bautismos 1842–1851 > image 337, Bautismos [baptisms], vol. 4, fol. 113v, Maria Santos Josefa de Jesús Jaramillo Rosas, legitimate daughter of J.e Felipe Jaramillo and M.a [blank] Rosas. Also, ibid. > Información matrimonial 1863–1867 > images 29–30, for San José Catholic Church, Información Matrimonial, vol. 22, fol. 23r–v and fol. 24r, Víctor Gasca and M.a Santos Jaramillo, 12 November 1863.

Figure 3

Descent of Alejandro Macías



For Alejandro's father, see *FamilySearch* (familysearch.org/search/collection/1860831) > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos, [baptisms] 1942–1946 > image 338, San José (Cortazar, Guanajuato), Bautismos vol. 30, fol. 98, no. 968, José Alejandro Manuel Macías, 8 September 1945. For Rafael's children and parents, see *FamilySearch* (familysearch.org/search/collection/1922031) > Mexico, Guanajuato, Civil Registration, 1862–1930 > Guanajuato > Cortazar > Matrimonios [marriages] 1914–1916 > images 177–78, Cortazar, Matrimonios [volume not stated] fols. 11v–12v, no. 14, Rafael Macías Medina and María Flores. For Soledad's mother, see ibid. > Defunciones [deaths] > 1901–1903 > images 258–59, Cortazar, Defunciones vol. 3, fol. 62r–v, no. 408, María Soledad Medina. For Rafaela's mother, see ibid. > Defunciones > 1888–1889 > image 48, Cortazar, Defunciones vol 1, fol. 38r, no. 132, Rafaela Rosas.

Shared ancestry explains Alejandro's shared atDNA. Hugo and the Gasca clan's shared ancestor is Gertrudis Rosas. Gertrudis' sister Rafaela Rosas is one of Alejandro's ancestors. The common ancestors of all are the Rosas sisters' parents, Ignacio Rosas and Ignacia Núñez.[10] See figure 3.

10. *FamilySearch* > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Información matrimonial 1828–1835 > image 242, for San José de Amoles Catholic Church, Información Matrimonial vol. 11, 1828–1835, chronologically arranged, Felipe Xaramillo and Gertrudes Rosas, 18 May 1831. Gertrudes testified she was the legitimate daughter of Ign.º [Ignacio] Rosas and D.ª [Doña] Ygn.ª [Ignacia] Nuñes. San José de Amoles now is Cortazar. See Instituto para el Federalismo y el Desarrollo Municipal, "Estado de Guanajuato—Cortazar," *Enciclopedia de los Municipios y Delegaciones de México* [Encyclopedia of Mexican cities and boroughs] (inafed.gob.mx/work/enciclopedia/EMM11guanajuato/index.html).

ARRIAGA KINSHIPS

Relatives of the Gasca clan identified other relatives in Kent County, Michigan, Joanne's birthplace. The first one known to settle there, Rafael Arriaga Jaramillo, died there on 10 August 2003.[11] He was born in Cortazar on 19 March 1925.[12] Rafael's niece Silvia Arriaga—daughter of his brother Melchor Arriaga Jaramillo—agreed to DNA testing.[13]

The Kent County Arriaga family shares Jaramillo-Rosas ancestry with Hugo Jaramillo and the Gasca clan. Figure 4 documents Silvia's descent from Hugo Jaramillo's great-grandfather. For Silvia's relationships to the people who share Joanne's atDNA, see figure 5.

Silvia and Joanne share 644.2 cMs of atDNA spread across twenty-five chromosomal segments, each larger than 7 cMs. The largest shared segment is 80.6 cMs.[14] Those numbers suggest a first-cousin relationship.[15] It rules out Silvia's father, Melchor Arriaga, as Joanne's biological father. If Melchor were Joanne's biological father, she and Silvia would be half sisters. Half siblings—on average—share about 1700 cMs of atDNA, more than double the amount that Silvia and Joanne share.[16]

Silvia and Joanne also share 159 of 196 possible cMs of X-chromosome DNA.[17] Each inherited one of her two X chromosomes from her respective father. Like all males, each father had one X chromosome, inherited from his mother, to pass to his daughters. Joanne and Silvia's amount of shared X-chromosome DNA suggests they share the same paternal grandmother. This indicates that Joanne's unknown biological father and Silvia's father were brothers.

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11. Kent Co., Mich., certified copy, 12 August 2003, from microfilm of Certificate of Death 1655855, "Rafael Jaramillo Arriaga AKA Ralph J. Arriaga" (2003); files of Darlene Cisler, Cedar Springs, Mich.

12. *FamilySearch* > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos, 1920–1926 > image 349, for San José Catholic Church, Bautismos vol. 22, fol. 123, no. 1233, J.e Luis Rafael Arriaga, 20 April 1925. Also, Cortazar, certified Acta de Nacimiento [birth certificate] no. 128950, issued 4 May 1984, Rafael Arriaga Jaramillo (citing Libro [register] 1:80, no. 200); files of Darlene Cisler.

13. For Silvia's parents and grandparents, see Cortazar, certified Acta de Nacimiento no. 110110167008106, Silvia Arriaga Aboytes, 28 June 1961 (citing Libro 1, act 810, registered 14 June 1967); files of Silvia Arriaga Aboytes, Cortazar.

14. "'One-to-one' compare," *GEDmatch*, kit A767282 (Joanne Gram), compared individually to kit A553145 (Silvia Arriaga).

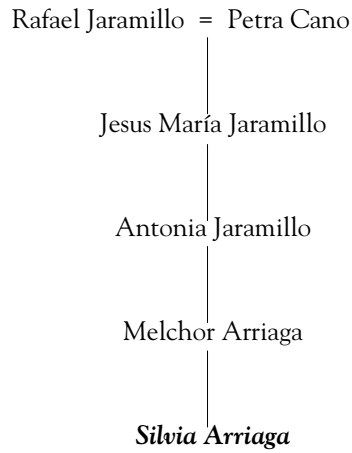
15. Bettinger, "Visualizing Data from the Shared cM Project," blog post, 29 May 2015. Also, "Autosomal DNA Statistics," *International Society of Genetic Genealogy Wiki*.

16. Debbie Parker Wayne, "Quick Ref—Percentage of Shared Autosomal DNA," PDF *Deb's Delvings in Genealogy* (debbiewayne.com/presentations/dna/QuickRef_DNA_inherited_atDNA.pdf) Also, Bettinger, "Visualizing Data from the Shared cM Project," blog post, 29 May 2015. Also, "Autosomal DNA Statistics," *International Society of Genetic Genealogy Wiki*.

17. "X 'One-to-one,'" V2.1.0(a), *GEDmatch*, kits A767282 (Joanne Gram) and A553145 (Silvia Arriaga). The shared segment, starting at location 941,308 and ending at location 139,788,127, contains 14,384 matching single-nucleotide polymorphisms (SNPs).

Figure 4

Descent of Silvia Arriaga



For Silvia's father and grandmother, see Cortazar, Guanajuato, certified Acta de Nacimiento [birth certificate] no. 110110167008106, Silvia Arriaga Aboytes, 28 June 1961 (citing Libro 1, act 810, registered 14 June 1967); files of Silvia Arriaga Aboytes, Cortazar. For Antonia's father, see *FamilySearch* (familysearch .org/search/collection/1922031) > Mexico, Guanajuato, Civil Registration, 1862–1930 > Guanajuato > Cortazar > Matrimonios 1910–1913 > image 446–7, Cortazar, Matrimonios [marriages] vol. 20, fol. 25r–v, Juvencio Arriaga and Antonia Jaramillo. For Jesus's father, see ibid. > Nacimientos [births] 1898–1900 > image 439, Cortazar, Gto., Nacimientos vol. 27, fol. 39r, no. 242, Asunción Jaramillo. Asunción (Antonia's sister) is also the daughter of Jesus Jaramillo and Teodora Tovar. Her paternal grandparents are named Rafael Jaramillo and Petra Cano.

Rafael and Melchor's parents had seven sons. Silvia and Joanne's shared DNA indicates that one of them, other than Melchor, was Joanne's father:

i. Juvencio Arriaga Jaramillo, born at Cortazar on 2 April 1914[18]
ii. Guillermo Arriaga Jaramillo, born at Cortazar on 15 January 1916[19]
iii. Justino Arriaga Jaramillo, born at Cortazar on 22 September 1920[20]
iv. Mario Arriaga Jaramillo, born on an unknown date[21]

18. *FamilySearch* > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos, 1911–1916 > image 244, for San José Catholic Church, Bautismos vol. 18, fol. 28v, no. 167, Anastasio Juvencio Arriaga, 15 April 1914.

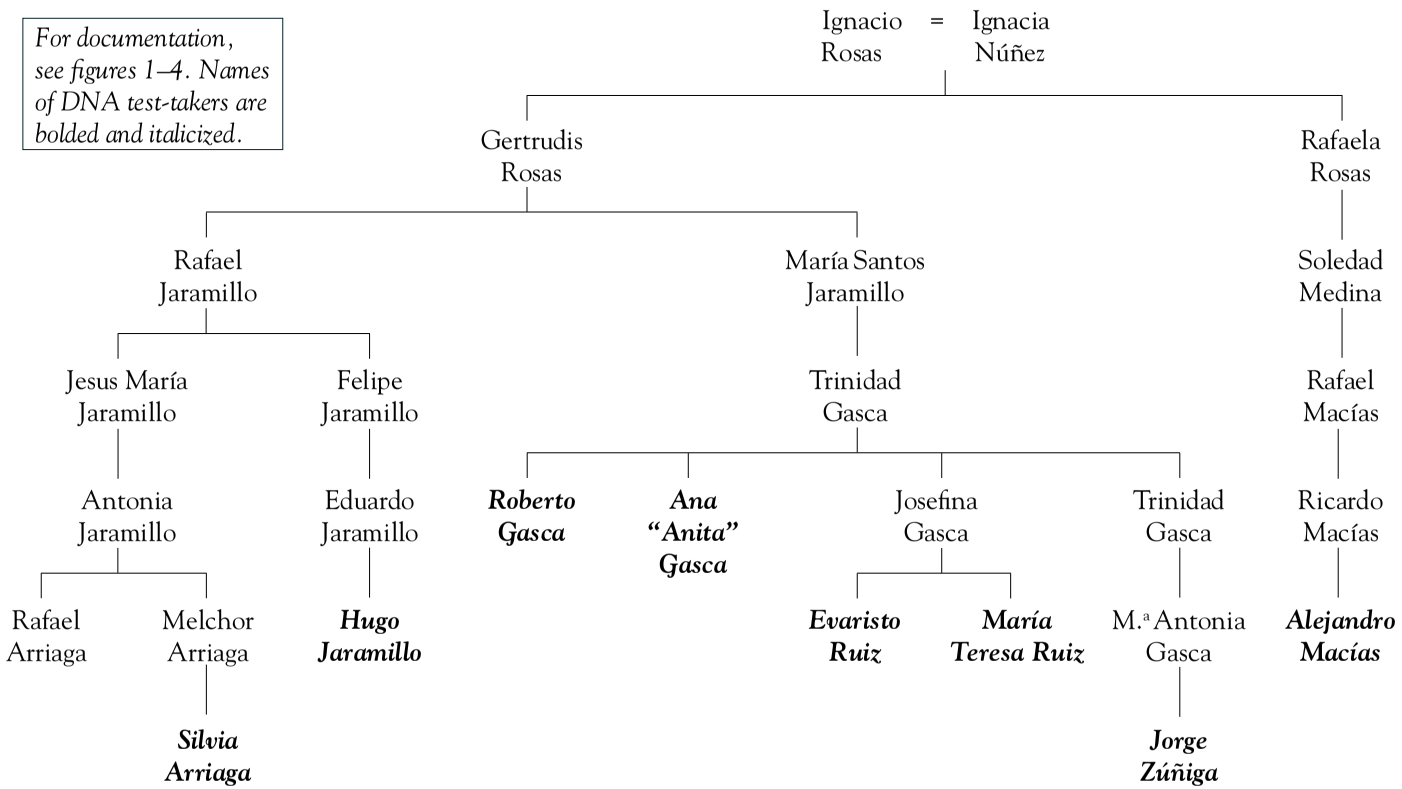
19. *FamilySearch* (familysearch.org/search/collection/1922031) > Mexico, Guanajuato, Civil Registration, 1862–1930 > Guanajuato > Cortazar> Nacimientos 1916–1918 > image 34, for Cortazar, Nacimientos [births] vol. 29, fol. 30r, no. 257, Guillermo Arriaga.

20. Ibid. > Nacimientos 1919–1920 > image 515, for Cortazar, Nacimientos vol. 38, fols. 63v–64r, no. 164, Justino Arriaga.

21. Angelica Aboytes de Arriaga, Silvia Arriaga, and Laura Arriaga, interview by author, Cedar Springs, Mich., 18 September 2015; notes in author's files. The interviewees are Melchor's wife and daughters. The birth-order placement is approximate because no associated birth or baptismal record can be located within FamilySearch's imaged records.

Figure 5

Relationships Among People Sharing Significant Amounts of Autosomal DNA with Joanne Gram



v. Roberto Arriaga Jaramillo, born at Cortazar on 29 April 1923[22]
vi. Rafael "Ralph" Arriaga, born at Cortazar on 19 March 1925[23]
vii. Melchor Arriaga, born at Celaya, Guanajuato, on 25 November 1932[24]

A FATHER CANDIDATE

Joanne, born in Michigan on 4 June 1950, was conceived in August or September 1949. Family lore suggests that, by elimination, Rafael was Joanne's biological father, but it does not convincingly eliminate all his brothers:

- Three Arriaga sons—Juvencio, Justino, and Roberto—never visited the United States.
- Mario first visited in the 1980s.
- Guillermo, who visited the United States with his wife, reportedly was sterile.
- Melchor first visited in 1958 or 1959.
- Rafael immigrated to the United States in the 1940s.[25]

Rafael first arrived in the United States in 1947. For nearly two years he worked for a mink farmer in Traverse City, Michigan.[26] He then returned to Mexico, and on 10 July 1948 he married Raquel González in San Luis Potosí.[27] In 1949 they lived in Grand Rapids at 218 Lafayette Avenue Southeast.[28] Rafael lived and worked in Kent County until his death, in 2003.[29]

Joanne's biological mother, Effie McIntyre, married Lionel F. Sims at Reed City, Michigan, on 9 November 1937. Filing for divorce on 24 October 1947, she petitioned for a restraining order banning him from her home. The court decreed them divorced on 7 December 1948, when Effie lived at 1750 Monroe

22. *FamilySearch* > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos, 1920–1926 > image 240, for San José Catholic Church, Bautismos vol. 22, fol. 20, no. 196, Quinrino Roberto Arriaga, 4 June 1923.

23. Ibid. > image 349, San José Catholic Church, Bautismos vol. 22, fol. 123, no. 1233, J.^{e} Luis Rafael Arriaga, 20 April 1925.

24. Ibid. > Celaya > El Sagrario > Bautismos, 1915–1933 > image 2890, for El Sagrario (Celaya, Guanajuato), Bautismos vol. 70, fol. 154, no. 1541, J. Melchor Arriaga, 6 January 1933.

25. Angélica Aboytes de Arriaga, Silvia Arriaga, and Laura Arriaga, interview by author, 18 September 2015.

26. Richard O. Wright, "Fiesta Café to Open on Plainfield," *Grand Rapids News* (Grand Rapids, Mich.), 5 July 1967, page 1, cols. 4–5, and page 16, cols. 1–3.

27. Kent Co., Mich., divorce 76-28368-DO, Raquel Arriaga and Rafael Arriaga, Complaint for Divorce, 20 February 1976; Clerk's Office, Grand Rapids.

28. *Polk's Grand Rapids (Kent County, Mich.) City Directory 1949* (Detroit: Grand Rapids Directory Company, 1950), 57, "Rolphe" (Rachel) Arriaga.

29. Wright, "Fiesta Café to Open on Plainfield," *Grand Rapids News*, 5 July 1967, page 1, cols. 4–5, and page 16, cols. 1–3. Also, *Polk's Grand Rapids (Kent County, Mich.) City Directory 1951* (Detroit: Grand Rapids Directory Company, 1952), p. 57, Ralph (Rachel) Arriaga. Also, *Polk's Grand Rapids (Kent County, Mich.) City Directory 1954* (Detroit: R.L. Polk, 1954), 33, Ralph J. (Rachel) Arriaga. Also, Kent Co., certified copy of Certificate of Death 1655855, Rafael Jaramillo Arriaga a.k.a. Ralph J. Arriaga (2003).

Avenue Northwest in Grand Rapids.[30] She and Rafael lived about three miles from each other.[31]

TARGETED ARRIAGA TESTING

Rafael Arriaga likely was Joanne's biological father. DNA testing targeted at Rafael's descendants provides further evidence. It eliminates his brothers, strengthening the case for Rafael, who reportedly had three children:

- A daughter born to his marriage, whose location is unknown
- A son born in 1983, who is unavailable for DNA testing
- A son whom Rafael recognized as his own, Paul Arriaga, born to unmarried parents[32]

Paul died on 27 December 2006.[33] His son, Abel Arriaga, agreed to DNA testing.[34]

If Rafael was Joanne's biological father, Rafael's son Paul was her half brother. In that case, Paul's son, Abel, would be Joanne's half nephew. If, however, another Arriaga brother were Joanne's biological father, Rafael's son Paul would be her first cousin. Thus, his son, Abel, would be Joanne's first cousin once-removed. See figure 6. On average, an aunt and half nephew would share 850 cMs of atDNA, and first cousins once-removed would share far less—425 cMs.[35]

Joanne and Abel share 942.3 cMs of atDNA on thirty segments larger than 7 cMs. The largest segment is 118.2 cMs.[36] They share too much atDNA to be first cousins once-removed. Therefore, Abel is Joanne's half nephew and his father, Paul, was her half brother. If Rafael was Paul's father, this DNA result rules out Rafael's other brothers as Joanne's biological father. Only Rafael remains.

A CONFLICT RESOLVED

Joanne's shared atDNA with Abel, Silvia, and Hugo support the theory that they were, respectively, her half nephew, first cousin, and second cousin once-removed. If so, Rafael was her biological father.

30. Kent Co., divorce 41-15587, docket 50617, Lionel F. Sims and Effie M. Sims, Interlocutory Decree of Divorce, 7 December 1948.

31. *Search Google Maps* (google.com/maps), for 1750 Monroe Ave. NW to 218 Lafayette Ave. SE, both in Grand Rapids, Mich.

32. Angelica Aboytes de Arriaga, Silvia Arriaga, and Laura Arriaga, interview by author, 18 September 2015.

33. Abel Arriaga to author, "Paul Arriaga," e-mail, 25 October 2015; author's files. Abel does not have a copy of his father's birth and death certificates. Also, "Obituaries," *Rivera Family Funerals and Cremations* (memorialsolutions.com/sitemaker/sites/rivera0/memsol.cgi?user_id=1991), for Paul Arriaga, 27 December 2006, naming Abel "Arriago" as son.

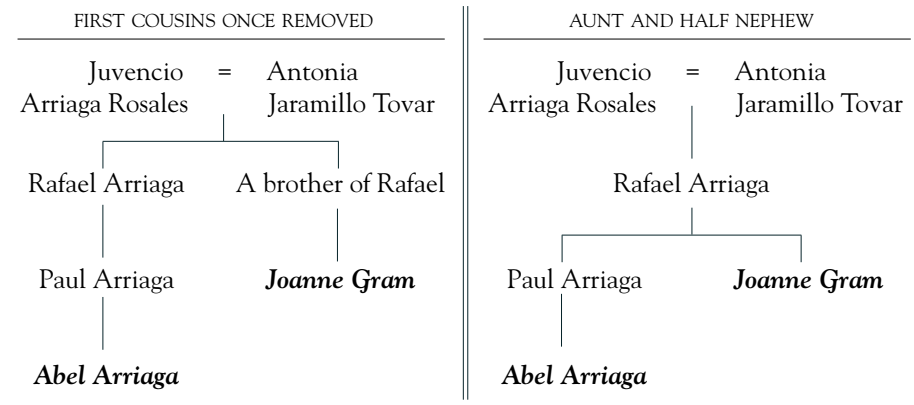
34. For Abel's father, see Arizona, birth certificate no. SB-102-84-023729, issued 10 November 2015, Abel Joseph Arriaga (1983); files of Abel Arriaga, Tempe, Ariz.

35. "Autosomal DNA Statistics," *International Society of Genetic Genealogy Wiki*.

36. "One-to-one DNA Comparison," *GEDmatch*, kit nos. A767282 (Joanne Gram) and A317650 (Abel Arriaga).

Figure 6

Hypothesized Relationships of Joanne Gram and Abel Arriaga



For Abel's father, see Arizona, birth certificate no. SB-102-84-023729, issued 10 November 2015, Abel Joseph Arriaga (1983); files of Abel Arriaga, Tempe, Arizona. For Paul's parentage, see Angelica Aboytes de Arriaga, Silvia Arriaga, and Laura Arriaga, interview by author, 18 September 2015; notes in author's files. For Rafael's parentage, see *FamilySearch* (https://familysearch.org/search/collection/1860831) > Mexico, Guanajuato, Catholic Church Records, 1519–1984 > Cortazar > San José > Bautismos, 1920–1926 > image 349, for Cortazar, Bautismos [baptisms] vol. 22, fol. 123, no. 1233, J.[e] Luis Rafael Arriaga, 20 April 1925.

Conflicting with that conclusion are the amounts of atDNA Joanne shares with the Gasca clan and Alejandro Macías. Those amounts show closer relationships than those traced for Rafael's biological daughter. See table 4. The conflict, however, is resolvable.

The preferred method for calculating the percentage of atDNA shared by two people assumes each person's parents have no common ancestors.[37] *GEDmatch* provides a tool—"Are Your Parents Related?"—for testing parental relatedness. It suggests Roberto and Anita Gasca's parents share at least one common ancestor.[38]

Joanne's other Gasca clan matches—María Teresa Ruiz and Jorge Zúñiga—are children and grandchildren of Roberto and Anita's siblings. By extension, they also descend from related parents or grandparents. Those endogamous descents explain why Joanne shares more atDNA with them than expected.

37. "Fully identical region," *International Society of Genetic Genealogy Wiki* (www.isogg.org/wiki/Fully_identical_region).

38. "Are Your Parents Related?" *GEDmatch*, kit nos. A187233 (Anita Gasca) and T363242 (Roberto Gasca).

Table 4

Selected Traced and Genetic Relationships to Joanne Gram

TESTEE'S NAME	TRACED RELATIONSHIP	PREDICTED CMS SHARED (AVERAGE)	ACTUAL CMS SHARED
Roberto Gasca	2C2R	53.13	174.2
Ana "Anita" Gasca	2C2R	53.13	114.8
María Teresa Ruiz	3C1R	26.56	71.8
Alejandro Macías	4C1R	6.64	56.9
Jorge Zúñiga	4C	13.28	48.0

For traced relationships (second column), see figure 5, plus Joanne Gram hypothesized as Rafael Arriaga's daughter. C represents *cousin* and *R* represents *removed*. Thus, 2C2R means second cousin twice-removed. For predicted average cMs for those relationships (third column), see "Autosomal DNA Statistics," *International Society of Genetic Genealogy Wiki* (http://isogg.org/wiki/Autosomal_DNA_statistics). For total shared cMs on segments greater than 7cMs (fourth column), see " 'One-to-one' compare," *GEDmatch* (gedmatch.com), kit A767282 (Joanne Gram) compared individually to kits T363242 (Roberto Gasca), A187233 (Ana "Anita" Gasca), M694610 (María Teresa Ruiz), A382232 (Alejandro Macías), and A600364 (Jorge Zúñiga). The acronym cMs refers to centiMorgans, a measure of genetic linkage based on recombinant frequency.

GEDmatch's "Are Your Parents Related?" tool does not predict a relationship between Alejandro Macías's parents. More sensitive tools, however, suggest they had at least one common ancestor.[39]

CONCLUSION

The absence of a record naming Joanne's biological father does not prevent identifying him. Systematic research, using DNA test results, documentary sources, and oral accounts, provide evidence. Comparisons and targeted testing identified him.

DNA comparisons began with a group of distant cousins from one location. Pedigrees researched and rebuilt generation-by-generation incorporated other matches. Oral evidence identified distant cousins near the time and place Joanne was born. Targeted testing showed they were related to her. X-chromosome analysis narrowed the search to seven brothers. Additional targeted testing ruled out all but one brother. Comparison tools resolved a conflict regarding expected amounts of shared atDNA. The resulting evidence fits together only one way—Rafael Arriaga of Cortazar, Mexico, and Grand Rapids, Michigan, was Joanne (Goecke) Gram's biological father.

39. Felix Immanuel, "Pedigree Collapse Calculator," *Genetic Genealogy Tools* (y-str.org/2014/12/pedigree-collapse-calculator.html). The tool predicts that Alejandro's parents are fifth cousins. Also, "Search for Runs of Homozygosity (ROH)," *David Pike's Utilities* (www.math.mun.ca/~dapike/FF23utils/). The results suggest a relationship between Alejandro's parents.