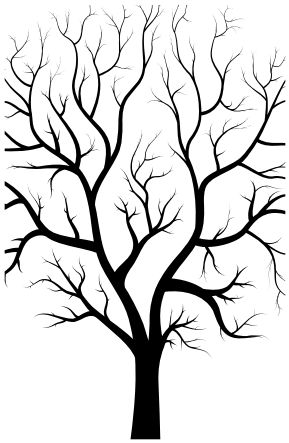

Joseph Smith Jr., the Question of Polygamous Offspring, and DNA Analysis

by Ugo A. Perego

Introduction

During the last decade, DNA testing has contributed to the improvement of a broad range of disciplines. It transformed paternity testing from rudimentary eye color and blood type assessments to precise and accurate affirmations of biological relationship, to the resolution of 99.99%. It created a new niche within the fields of archaeology and anthropology (termed archaeogenetics)[1] where the histories, identities, migrations, and relationships of ancient people and civilizations can now be studied from a molecular point of view.[2] Other areas which have greatly benefited from the introduction of genetic analysis are forensic

1. Antonio Amorim, "Archaeogenetics," *Journal of Iberian Archaeology* 1 (1999): 15–25.

2. See for example Alessandro Achilli and others, "Mitochondrial DNA variation of modern Tuscans supports the near eastern origin of Etruscans," *American Journal of Human Genetics* 80 (2007): 759–768.

investigation and the study of historical events, where other methods may have proven insufficient for providing conclusive answers in the past.[3] With even greater pertinence to the current topic, DNA testing has provided invaluable assistance to family historians, who are able to corroborate traditional genealogical documentation by adding genetic evidence to resolve previously ambiguous family connections.[4] Included in such instances are several cases of disputed biological paternities involving Joseph Smith Jr., founder of the Mormon movement. Although somewhat disputed in the past, there is now a great abundance of evidence to support that, as a religious leader, Joseph Smith introduced the practice of polygamy, even if it is still not completely clear to what extent he practiced it.[5]

That being said, how confidently can DNA testing be applied to genealogical questions? While DNA is not a panacea that completely replaces traditional genealogical research, it can provide an added level of understanding and an increased degree of confidence to traditional research findings. It is estimated that more than one million people have used some form of DNA testing to learn something about their ancestry.[6] DNA testing applied to resolving dubious paternities has application to the study of polygamy. Many such relationships in the early years of the Mormon Church were surreptitious in nature thus leaving room for speculation regarding the extent to which polygamy was practiced. Obviously, the existence and identification of offspring would provide unquestionable evidence about the former-day parties involved. Joseph Smith spoke often of a numerous and eternal posterity as one of the explanations for introducing polygamy.[7] Joseph himself had several documented biological children from his first recorded wife, Emma Hale

3. Ugo A. Perego, Jayne E. Ekins, and Scott R. Woodward, "Mountain Meadows Survivor? A Mitochondrial DNA Examination," *Journal of Mormon History* 32 (2006): 45–53.

4. See for example Ugo A. Perego, Kaisa Bailey, Pekka Hellemaa, "'Anchoring' Family History through DNA," *Family Chronicle* (2009): 42–44; J. Michael Hunter and Ugo A. Perego, "DNA and Genealogy: A Case Study," *Family Chronicle* (2009): 29–31.

5. Richard P. Howard, "The Changing RLDS Response to Mormon Polygamy: A Preliminary Analysis," *The John Whitmer Historical Association Journal* 3 (1983): 14–28.

6. Howard Wolinsky, "Genetic Genealogy Goes Global," *EMBO Reports* 7, no. 11 (2006): 1072–1074. Also see Blaine Bettinger, "The Genetic Genealogist: How Big Is the Genetic Genealogy Market?", http://www.thegeneticgenealogist.com/2007/11/06/how-big-is-the-genetic-genealogy-market (accessed June 17, 2010).

7. Doctrine and Covenants (LDS) 132:30–34.

Smith, but no other children have been confirmed as being born from any of his alleged polygamous relationships. However, different sources suggest that a few individuals are possible candidates for biological children of Joseph Smith considering facts such as time of birth (from the date of sealing and within eight or nine months of his death in June 1844), known opportunities for cohabitation, family accounts, or even physiognomy.[8] A partial list and corresponding references of alleged children attributed to Joseph Smith through relationships other than with his first wife Emma is provided in figure 7.1.

The History of DNA and the Joseph Smith Family

In the early phases of the developing niche of molecular genealogy, the Joseph Smith Sr. family was identified as a test case for reconstructing ancestral DNA profiles and using this information to investigate questions of progeny, as well as further ancestry. The number of living descendants of Hyrum Smith alone exceeds 15,000, and additionally a number of genealogical situations exist within the family that are ideal applications of the new science of molecular genealogy.[9]

The basics of molecular genealogy

Within the nucleus of the cells, each person carries genetic material called DNA, which is organized in structures called chromosomes: 23 inherited from their mother and 23 from their father. DNA is the blueprint of life, providing the cell with the instructions to perform all the necessary biological functions. Moreover, information stored in our DNA can provide valuable information about one's past, although the ancestral signal can be quite difficult to isolate and trace due to the reshuffling and loss of one parent or the other's genetic material that occur at each subsequent generation. Two exceptions are found in the paternally inherited Y chromosome (Ycs) and the maternally inherited mitochondrial DNA (mtDNA). These uniparental markers don't recombine with nuclear DNA, but remain mostly intact generation after genera-

8. Fawn M. Brodie, *No Man Knows My History: The Life of Joseph Smith, the Mormon Prophet*, 2d ed. rev. (New York: Alfred A. Knopf, 1971), 297–298, 460–462.

9. Ugo A. Perego, Ann Turner, Jayne E. Ekins, and Scott R. Woodward, "The Science of Molecular Genealogy," *National Genealogical Society Quarterly* 93 (2005): 245–259.

Child	*Mother*	*Source*
Oliver Norman Buell	Presendia Huntington	A
John Reed Hancock	Clarissa Reed	A
Moroni Llewellyn Pratt	Mary Ann Frost	A
Orson Washington Hyde	Nancy Marinda Johnson	A
Frank Henry Hyde	Nancy Marinda Johnson	A
Josephine Rosetta Lyon (Fisher)	Sylvia Sessions	A, B, C
Josephine Henry (King)	Margaret Creighton	D
Mosiah Lyman Hancock	Clarissa Reed	E
Zebulon Williams Jacobs	Zina Diantha Huntington	C
Carolyn Delight	Lulu Vermillion	E
Alleged son or daughter	Hannah Dubois	C
Alleged son or daughter	Fanny Alger	B
George Algernon Lightner	Mary Rollins Lightner	A, C
Sarah Elizabeth Holmes	Marietta Carter	E

Figure 7.1: Provisional list of alleged children recorded as being born through the union of Joseph Smith Jr. and women other than Emma Hale, his first documented wife.

Sources: A – Fawn M. Brodie, *No Man Knows My History;* B – Todd Compton, *In Sacred Loneliness;* C – Richard S. Van Wagoner, *Mormon Polygamy;* D – Larry R. King, *The Kings of the Kingdom;* E – Personal communication in possession of the author.

tion. Population geneticists and molecular genealogists have employed Ycs and mtDNA extensively in reconstructing strict and unbroken paternal and maternal lineages, respectively. The majority of our DNA is found in the remaining chromosomes, termed autosomes. Autsomal DNA may also contain a surviving genetic legacy of any of our ancestors, while Ycs and mtDNA are limited to progenitors found on the two outermost branches of our family tree (figure 7.2).

The analysis of Ycs proved to be particularly useful in resolving a number of questions surrounding the ancestry and posterity of Joseph Smith Jr. (hereafter referred to only as Joseph Smith). In addition large sections of autosomal DNA have also been reconstructed for the Smith

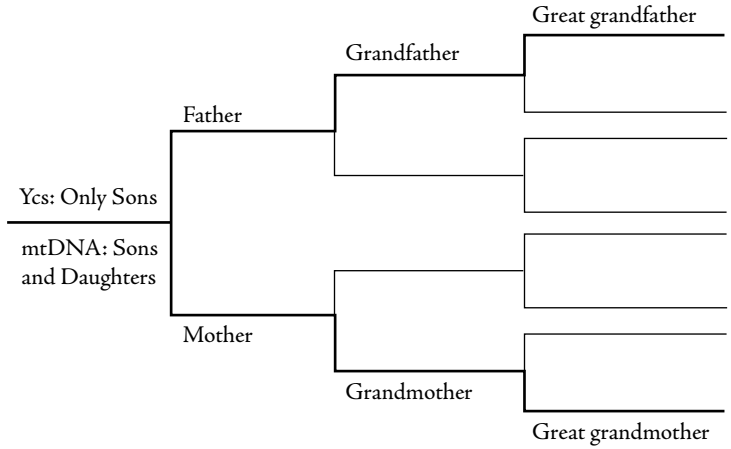

Figure 7.2 – Pedigree representing Y chromosome (Ycs) and mitochondrial DNA (mtDNA) paternal and maternal inheritance patterns respectively.

family for future case studies. With regard to Joseph Smith's ancestry, genetic analysis had already been considered in the 1990s as a means to assist in locating the exact birth place of Joseph Smith's paternal third-great-grand father, a Robert Smith of Boxford, Massachusetts, who emigrated from Lincolnshire, England, in the earlier part of the seventeenth century.[10] To test this hypothesis, we initially reconstructed the Ycs profile (haplotype) of the Smith family with the optimistic anticipation of someday finding Smith individuals in the UK carrying a similar genetic signature. Since the Ycs is found only in males and since it follows the surname line of the pedigree chart, we were able to successfully and accurately establish a Ycs profile for the Smith family by identifying a number of living descendants sharing Asael Smith (Joseph Smith's grandfather) as the most recent common ancestor (MRCA) and carrying the Smith surname (figure 7.3).[11]

10. Elaine C. Nichols, "Corrections to Joseph Smith's English Ancestry: The Parentage of Robert Smith of Boxford, Massachusetts," *Utah Genealogical Journal* 19 (1991): 138–143.

11. Mark A. Jobling, "In the Name of the Father: Surnames and Genetics," *Trends in Genetics* 17 (2001): 353–357. Materials and methods regarding the reconstruction of the Smith Ycs profile have been described in Ugo A. Perego, Natalie M. Myres, and Scott R. Woodward, "Reconstructing the Y-Chromosome of Joseph Smith: Genealogical Applications" *Journal of Mormon History* 31 (Fall 2005): 42–60.

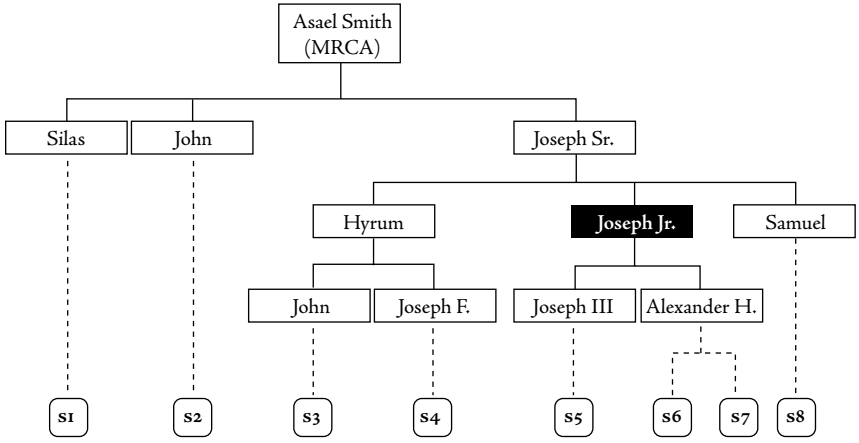

Figure 7.3 – Schematic pedigree representing male lines of the Smith family sharing Asael Smith as their most recent common ancestor (MRCA). Individuals S1 – S8 contributed DNA samples that were utilized to reconstruct an accurate Y chromosome profile for Joseph Smith Jr. (see figure 7.4).

Although any male descendant of the Joseph Smith family line would carry their paternal ancestor's Ycs haplotype, in order to test cases involving alleged biological offspring in subsequent generations, two aspects must be taken into consideration. First, to exclude possible non-paternity events (NPEs), it is mandatory to obtain genetic data from multiple documented male descendants whose MRCA is the man suspected to be the biological father of the alleged posterity. In this case, direct male descendants of Joseph Smith needed to be tested in order to confidently reconstruct Joseph Smith's exact Ycs profile. This presents a challenge in that Joseph Smith had eleven children with Emma (two adopted),[12] but only four biological sons that grew to adulthood, and only two of them — Joseph Smith III and Alexander Hale Smith — are survived by a living biological posterity. The next consideration is the gender of the alleged child. Because Ycs is paternally inherited, only cases involving suspected sons could be tested using this uniparental marker. Any potential biological daughter of Joseph Smith born through one of his several polygamous relationships would not carry the father's Ycs, thus

12. Michael Kennedy, "Joseph and Emma's Family," *Ensign* (February 2008): 39–41.

leaving the more complex deciphering of autosomal DNA as the only alternative.[13]

Fortunately, a few direct male descendants of both Joseph Smith III and Alexander Hale Smith were identified and willingly donated a DNA sample to this project. Additionally, other descendants from Joseph Smith's brothers (Samuel and Hyrum), as well as others descending from Joseph Smith's uncles also contributed a biological specimen from which DNA was extracted and Ycs data obtained. Over time, with the intent of examining autosomal DNA questions, more than one hundred individuals — males and females — sharing Asael Smith as their MRCA donated DNA and genealogical data to Sorenson Molecular Genealogy Foundation (SMGF).

Testing Smith paternal lines with Asael Smith as the MRCA in addition to direct male descendants of Joseph Smith excluded any chances of NPEs, and also confirmed the value of two ambiguous markers (alleles). Ycs data for the Smith family is summarized in figure 7.4, which include the individuals reported on the schematic pedigree in figure 7.3. At first twenty-four and then eventually a total of forty-three short tandem repeat (STR) markers were confidently reconstructed for the Joseph Smith Ycs profile. Although only two descendants may be sufficient to reconstruct a MRCA Ycs profile, additional paternal lines needed to be tested to increase confidence of each allele value. In particular markers DYS439 and DYS449 (12 and 30 respectively) required further testing from related Smith males to confidently infer their allelic values.[14] These findings were confirmed in a 2009 study published in the prestigious *American Journal of Human Genetics*, where the Joseph Smith Ycs was inferred by mining data from public genetic databases containing DNA information of Hyrum Smith's descendants.[15]

13. Mitochondrial DNA testing is not helpful in confirming father-daughter biological relationships as it is inherited exclusively from the girl's mother. See also Perego and Woodward, "Mountain Meadows Survivor? A Mitochondrial DNA Examination," 53–61.

14. DYS is an acronym for *DNA Y-Chromosome Segment*. Few differences at the same DYS markers (loci) can be occasionally observed even in individuals sharing a documented biological relationship. These changes are the result of random mutations occurring along the radiating paternal lineages.

15. Jane Gitschier, "Inferential Genotyping of Y Chromosomes in Latter-Day Saints Founders and comparison to Utah Samples in the HapMap Project," *American Journal of Human Genetics* 84 (2009): 251–258.

Locus	S1 *descendent of Silas Smith*	S2 *descendent of John Smith*	S3 *descendent of Hyrum through John*	S4 *descendent of Hyrum through Joseph F.*	S5 *descendent of Joseph Jr. through Joseph III*	S6 *descendent of Joseph Jr. through Alexander*	S7 *descendent of Joseph Jr. through Alexander*	S8 *descendent of Samuel Smith*	Joseph Smith Jr. *Inferred Ycs Haplotype*
DYS19	14	14	14	14	14	14	14	14	14
DYS385a	11	11	11	11	11	11	11	11	11
DYS385b	13	13	13	13	13	13	13	13	13
DYS388	12	12	12	12	12	12	12	12	12
DYS389I	14	14	14	14	14	14	14	14	14
DYS389II	30	30	30	30	30	30	30	30	30
DYS390	(25)	24	24	24	24	24	24	24	24
DYS391	11	11	11	11	11	11	11	11	11
DYS392	14	14	14	14	14	14	14	14	14
DYS393	13	13	13	13	13	13	13	13	13
DYS426	12	12	12	12	12	12	12	12	12
DYS437	15	(14)	15	15	15	15	15	15	15
DYS438	12	12	12	12	12	12	12	12	12
DYS439	12	12	12	12	12	(11)	12	12	12
DYS441	14	14	14	14	14	14	14	14	14
DYS442	17	17	17	17	17	17	17	17	17
DYS444	12	12	12	12	12	12	12	12	12
DYS445	12	12	12	12	12	12	12	12	12
DYS446	13	13	13	13	13	13	13	13	13
DYS447	25	25	25	25	25	25	25	25	25
DYS448	18	18	18	18	18	18	18	18	18
DYS449	30	30	30	30	(31)	30	30	30	30
DYS452	30	30	30	30	30	30	30	30	30
DYS454	11	11	11	11	11	11	11	11	11
DYS455	11	11	11	11	11	11	11	11	11
DYS456	17	17	17	17	17	17	17	17	17
DYS458	17	17	17	17	17	17	17	17	17

Figure 7.4: Y chromosome profiles (haplotypes) from male descendants of different Smith lines sharing Asael Smith (Joseph Smith Jr.'s grandfather) as their most recent common ancestor (see figure 7.3). This information was used to reconstruct Joseph Smith Jr.'s Y chromosome signature. Mutated values from Joseph Smith Jr.'s inferred haplotype are circled.
(Figure continued on next page.)

Locus	S1 *descendent of Silas Smith*	S2 *descendent of John Smith*	S3 *descendent of Hyrum through John*	S4 *descendent of Hyrum through Joseph F.*	S5 *descendent of Joseph Jr. through Joseph III*	S6 *descendent of Joseph Jr. through Alexander*	S7 *descendent of Joseph Jr. through Alexander*	S8 *descendent of Samuel Smith*	Joseph Smith Jr. *Inferred Ycs Haplotype*
DYS459a	9	9	9	9	9	9	9	9	9
DYS459b	10	10	10	10	10	10	10	10	10
DYS460	11	11	11	11	11	11	11	11	11
DYS461	12	12	12	12	12	12	12	12	12
DYS462	11	11	11	11	11	11	11	11	11
DYS463	24	24	24	24	24	24	24	24	24
DYS464a	15	15	15	15	15	15	15	15	15
DYS464b	16	16	16	16	16	16	16	16	16
DYS464c	16	16	16	16	16	16	16	16	16
DYS464d	17	17	17	17	17	17	17	17	17
GGAAT1B07	10	10	10	10	10	10	10	10	10
YCAIIa	19	19	19	19	19	19	19	19	19
YCAIIb	23	23	23	23	23	23	23	23	23
YGATAA10	15	15	15	15	15	15	15	15	15
YGATAC4	23	23	23	23	23	23	23	23	23
YGATAH4.1	12	12	12	12	12	12	12	12	12

Figure 7.4 (continued)

By testing additional male lines and with findings confirmed by a second independent study, we approach total confidence that the Ycs data obtained can be correctly assigned to Joseph Smith and his paternal relatives. If a cheek swab could be acquired from Joseph Smith himself, the DNA would not be any different from the profile we reconstructed from his living descendants. However there is no need to exhume bodies and test bones. The inferences obtained using this technology are highly accurate.

The Posterity of Joseph Smith

With the Ycs profile of Joseph Smith in hand, questions about the progeny of Joseph Smith can also be addressed. It is essential to note that any direct paternal descendent of Joseph Smith, no matter who

the mother is, will have the same Ycs profile as has been established for Joseph Smith via his documented sons Joseph Smith III and Alexander Hale Smith, and reinforced by descendants of Hyrum and Samuel Smith. Reviewed here are five cases of proposed paternity. Each is unique in its history and background but represents a possible direct paternal connection to Joseph Smith, and therefore can be directly assessed using the Ycs approach. While each case uses this same technology, it is evaluated in a slightly different way, demonstrating that while there are some limitations, a wide range of possible scenarios can be addressed with DNA testing.

Following these five cases is the case of Josephine Lyon, a question of paternity which is currently being addressed through the emerging science of autosomal DNA testing.

Case #1: Moroni Llewellyn Pratt — The Ideal Situation

In her book *No Man Knows My History*, author Fawn Brodie speculates that Moroni Llewellyn Pratt was Joseph Smith's son, based on a number of assumptions.[16] Moroni Pratt was born on December 7, 1844, and his recorded father is Parley P. Pratt. However, Moroni's mother, Mary Ann Frost, has been recorded as being both the wife of Parley and later of Joseph Smith. Children born from Parley's and Mary Ann's union in the years following the death of Joseph Smith in 1844 were still sealed to the prophet, as was the custom in those days.[17] Having the predetermined Ycs profile of Joseph Smith available, the remaining requirement for investigating Moroni's biological paternity is his own Ycs profile for purposes of comparison. This was obtained by collecting DNA samples from two male individuals who shared Moroni as their paternal MRCA.

16. Brodie, *No Man Knows My History*, 345, 484. See also, Todd Compton, *In Sacred Loneliness: The Plural Wives of Joseph Smith* (Salt Lake City: Signature Books, 1997), 763 note V.

17. Thomas Milton Tinney, *The Royal Family of the Prophet Joseph Smith, Junior; First President of the Church of Jesus Christ of Latter-day Saints* (N.p.: Tinney-Green[e] Family Organization Publishing Company, 1973), 12, L. Tom Perry Special Collections, Lee Library, Brigham Young University, Provo, Utah, records this proxy sealing information: "GS# 183, 374—Res. Page 513–514 Proxy Sealings, # 3660—Joseph Smith, Junior. Sealing Date: Feb. 6, 1846 at 1:30 P.M. solemnized by H.C. Kimball; Witnesses &: [meaning more than one witness] Wm. Redfield F.D. Richards—No. 19, page 3. M.S. #1 Mary Ann Frost, #3164, born Jan. 14, 1809 at Groton, Caledonia, Vermont; #2 Parley P. Pratt, #3163, Proxy for time."

As stated earlier, it is important to have at least two representatives in order to exclude any possible cases of undocumented NPEs.

The two individuals who contributed DNA samples to be used to reconstruct Moroni's Ycs haplotypes were descendants of two of Moroni's sons: Irving and Lester. Their Ycs profiles were an exact match, so consequently Moroni's Ycs haplotype is inferred with great confidence. By directly comparing each genetic marker for Joseph Smith's Ycs alongside those of Moroni, it was possible to conclusively answer a genealogical question that has been the subject of speculation for more than one hundred and fifty years.[18] As observed in figure 7.5, the two haplotypes have several differences between them. Based on the established Ycs mutation rate, the time to the MRCA between these two paternal lineages predates the birth year of Moroni by more than two-thousand years.[19] Therefore, the DNA test performed conclusively determines that Moroni Pratt is not the biological offspring of Joseph Smith.

However the question remains, if Joseph Smith was not the father of Moroni, can we say with certainty that it was Parley? To test this hypothesis, two descendents of Parley P. Pratt through two other sons were tested. The profile of these individuals matched each other, thus allowing inference of Parley's own Ycs profile. The exact matches between Parley and all of his sons' lineages tested, including Moroni, confirmed that the latter was indeed Parley's, and not Joseph's, biological son. This case demonstrates an ideal situation in which Ycs data for all the interested lines can be reconstructed from living descendants in order to assess paternity questions from the past. Unfortunately, the availability of such conclusive data is not always the case.

18. Additional figures and tables are found in Perego, "Reconstructing the Y-Chromosome of Joseph Smith."

19. Bruce Walsh, "Estimating the Time to Most Recent Common Ancestor for the Y Chromosome or Mitochondrial DNA for a Pair of Individuals," *Genetics* 158 (2001): 897–912; Manfred Kayser and others, "Characteristics and Frequency of Germline Mutations at Microsatellite Loci from the Human Y Chromosome, as Revealed by Direct Observation in Father/Son Pairs," *American Journal of Human Genetics* 66 (2000): 1580–1588.

Case #2: Zebulon Jacobs — Testing Brothers

Zebulon Jacobs was considered a possible son of Joseph Smith, as stated by Richard Van Wagoner in *Mormon Polygamy*.[20] His brother, Henry C. Jacobs, was born in 1846, two years after the martyrdom of Joseph Smith, and therefore excluded as a possible Joseph Smith descendant. DNA samples were collected and analyzed for descendants of both Zebulon and Henry, and the two Ycs haplotypes were a perfect match (figure 7.5).[21] This indicates that they share the same biological father – recorded as Henry Bailey Jacobs — although additional paternal lines could not be tested to ensure it. However, the Jacobs' profile differs from that of Joseph Smith at nine locations, removing Joseph Smith from the pool of candidate biological fathers.

Case #3: Orrison Smith — Direct Testing

Fanny Alger has been recorded as the possible first plural companion of Joseph Smith, although evidence about this union is quite inconsistent. Purportedly, in 1836 Fanny was pregnant, but no additional information is available about the birth of the child and the name of the father.[22] Several years ago, a man surfaced who claimed to be a descendant of an Orrison Smith, son of Joseph Smith and Fanny Alger. The only supporting information available about this Orrison Smith was the approximate year of birth (1834) and the location of his birth (somewhere in Ohio). As of today, the public genealogical database FamilySearch.org still lists him as a son of Joseph Smith and Fanny Alger.[23] While the previous two case studies presented strong genetic evidence in excluding Joseph Smith as the biological father of the two alleged sons, this case presented the specific challenges of dealing with a single descendant with a poorly documented genealogy. All that could be done at that time was to run the DNA of the individual that contacted us (he himself being a Smith and claiming a direct paternal ancestry to Orrison) and compare his DNA with Joseph Smith's inferred Ycs haplotype. The com-

20. Richard S. Van Wagoner, *Mormon Polygamy: A History* (Salt Lake City: Signature Books, 1989), 48–49.

21. Perego, "Reconstructing the Y-Chromosome of Joseph Smith."

22. Compton, *In Sacred Loneliness*, 35–36. See also Brodie, *No Man Knows My History*, 345.

23. http://www.familysearch.org (accessed June 19, 2010).

Locus	*Moroni L. Pratt*	*Zebulon Jacobs*	*Orrison Smith*	*Oliver N. Buell*	*Mosiah L. Hancock*	*Joseph Smith Jr.*
DYS19/394	14	14	14	14	(13)	14
DYS385a	11	11	11	–	(17)	11
DYS385b	(12)	(14)	(14)	(16)	(19)	13
DYS388	12	12	12	(13)	12	12
DYS389I	(13)	(13)	(13)	(13)	14	14
DYS389II	(29)	(28)	(29)	30	(31)	30
DYS390	(23)	(22)	(25)	(23)	24	24
DYS391	11	11	(12)	(10)	11	11
DYS392	(13)	(13)	(13)	(12)	(11)	14
DYS393	13	13	(13)	(14)	(14)	13
DYS426	12	12	12	(11)	(11)	12
DYS437	15	15	(14)	(14)	–	15
DYS438	12	12	12	(10)	–	12
DYS439	12	(11)	12	(11)	(11)	12
DYS441	–	–	–	14	–	14
DYS442	–	–	–	17	–	17
DYS444	–	–	–	–	–	12
DYS445	–	–	–	(10)	–	12
DYS446	–	–	–	(10)	–	13
DYS447	25	25	(24)	25	–	25
DYS448	–	–	–	(20)	–	18
DYS449	–	–	–	30	–	30
DYS452	–	–	–	(29)	–	30
DYS454	11	11	11	11	–	11
DYS455	11	11	11	11	–	11
DYS456	–	–	–	(14)	–	17
DYS458	–	–	–	(16)	–	17
DYS459a	–	–	–	(8)	–	9

Figure 7.5: Inferred Y chromosome haplotypes for the five case study candidates compared to the inferred haplotype for Joseph Smith Jr. Circled numerals indicate the differences between haplotypes clearly demonstrating that they each belong to a separate paternal line. "–" indicates data that is not available for that particular marker. Allele values are reported following the currently approved standards proposed by the National Institute of Standard Technology (NIST).

Locus	*Moroni L. Pratt*	*Zebulon Jacobs*	*Orrison Smith*	*Oliver N. Buell*	*Mosiah L. Hancock*	*Joseph Smith Jr.*
DYS459b	–	–	–	–	–	10
DYS460	11	11	11	11	–	11
DYS461	12	12	12	12	–	12
DYS462	11	11	11	(12)	–	11
DYS463	–	–	–	(23)	–	24
DYS464a	–	–	–	(11)	–	15
DYS464b	–	–	–	(14)	–	16
DYS464c	–	–	–	(14)	–	16
DYS464d	–	–	–	(15)	–	17
GGAAT1B07	10	(9)	10	10	–	10
YCAIIa	19	19	19	(20)	–	19
YCAIIb	23	(24)	23	(21)	–	23
YGATAA10	15	15	15	(14)	–	15
YGATAC4	23	23	(24)	23	–	23
YGATAH4.1	(11)	(13)	12	(11)	–	12

Figure 7.5 (continued)

parison resulted in nine differences between haplotypes, which are too many to indicate a possible biological relationship within Joseph Smith's lifetime (figure 7.5). Notwithstanding its poor documentation, until an additional paternal descendant of Orrison can be identified and tested, we cannot completely rule out the alleged connection since we cannot rule out NPEs in the generations separating Orrison Smith from the individual tested.

Case #4: Oliver Norman Buell — The Added Value of Online Databases

Another paternity case mentioned in Fawn Brodie's book is that of Oliver Norman Buell, the son of Presendia Huntington and her recorded husband Norman Buell. Oliver was born in Clay County, Missouri, in 1840 during a time when Norman was no longer affiliated with the Mormon Church. Among other things, the cited evidence for paternity

comes from an uncanny resemblance between Oliver Norman Buell and his proposed half brother, Joseph Smith III.[24]

Unfortunately, two individuals sharing Oliver Buell as their MRCA could not be located. In absence of this preferable scenario, two descendants of Oliver's grandson, Owen F. Buell born in 1894, were tested. Their Ycs profiles matched exactly, allowing the inference of Owen's Ycs profile.[25] Although this haplotype could likely represent Oliver Buell's true profile, it is not possible to exclude the possibility of an NPE — such as an undocumented adoption or illegitimacy — that may have occurred in the two intervening generations between Oliver and his grandson. If that was the case, conclusions drawn from the Owen Buell haplotype could not be correctly extended to Oliver Buell. To circumvent this difficulty, a novel approach was considered to more conclusively determine the paternity of Oliver N. Buell, with the goal to increase the likelihood that the genetic profile we had for Owen is also representative of his grandfather Oliver, Joseph Smith's alleged son.

The SMGF houses a correlated genetic and genealogical database that includes a large Ycs component. Using the Ycs profile for Owen Buell, we queried the database for possible matches. A single match was obtained with the surname Buell, sharing 40 of the 43 Ycs haplotype obtained from Owen's two grandsons. Through traditional genealogical investigation it was discovered that the anonymous Buell donor in the SMGF database shared a common paternal ancestor with the Oliver Buell's line in the person of Samuel W. Buell, born in 1641. Based on the Ycs molecular clock, an interval of 400 years is enough time for the three differences observed between the two paternal haplotypes to have occurred. With the confirmation of relationship between the two Buell lines, it is also possible to conclude with a high degree of certainty that at least 40 STRs could be accurately inferred to Oliver's Ycs haplotype.

Using the 40 marker inferred haplotype of Oliver Buell, a direct comparison was made to Joseph Smith's Ycs profile. This analysis showed that out of 40 markers there were too many differences between haplotypes to entertain the possibility of Joseph Smith being the biological father of

24. Brodie, *No Man Knows My History*, portrait facing 299, 301–02, 345–46, 460–62.

25. Ugo A. Perego, Jayne E. Ekins, and Scott R. Woodward, "Resolving the Paternities of Oliver N. Buell and Mosiah L. Hancock through DNA," *The John Whitmer Historical Association Journal* 27 (2008): 128–136.

Oliver Buell (figure 7.5). Moreover, due to the fact that a strong link was already determined between the two descendants of Owen Buell and the individual in the SMGF database, we already knew that Oliver is indeed a Buell and not a Smith.

Case #5: Mosiah Lyman Hancock — Little Sometimes Is Enough

There is a journal entry stating that at the onset of her son's illness, Clarissa Reed said to Joseph Smith, "Our Mosiah is dying." [26] There are several individuals, including LDS historians and family members, who have taken this phrase to infer Joseph Smith's biological paternity of this child, though Clarissa could have been indicating her husband, Levi Hancock. Mosiah Lyman Hancock was born in Kirtland, Ohio, on April 9, 1834.

At the onset of this investigation, a descendant of Mosiah surfaced already having in hand a 12 marker Ycs profile. Although more markers are needed to confidently confirm or refute relationship between individuals, some preliminary assessments can be made. A haplotype of only 12 markers is not usually enough to determine with great confidence if two individuals truly share a common paternal ancestor (identical-by-descent, or IBD) or if they coincidentally share a similar genetic profile (referred to as identical-by-state, or IBS). Basically, if too few markers are compared a false positive outcome could result. Further, with only one descendant of Mosiah it is not possible to rule out possible NPEs in the intervening generations.

However, using the 12-marker haplotype to query the SMGF Ycs database produced six exact matches sharing the Hancock surname. Genealogical examination of the pedigrees associated with each one of the SMGF matches revealed a common paternal ancestor with the Hancock lineage of interest, coalescing to Mosiah's grandfather.[27] All of these considerations combine to give fair confidence that the 12-marker profile represents a true biological Hancock line to which Mosiah also belonged. Additionally, when compared to the same 12 markers from Jo-

26. Emily Hancock (Mosiah's daughter) recorded such affirmation in her voice journal. Personal correspondence dated May 9, 2007, from Emily's grandson in possession of the author.

27. Perego, "Resolving the Paternities."

seph Smith Ycs profile (figure 7.5), too many differences are observed to allow the possibility of Joseph Smith as the father, thus suggesting Levi Hancock as the true biological father of Mosiah Hancock.

These five cases provide a glimpse of the range of possible situations that can be addressed by combining genealogical data with Ycs haplotypes. However, as explained earlier, only cases involving alleged sons on strictly unbroken paternal lines can be considered with this approach. If the biological relationship to test involved a possible daughter of Joseph Smith, neither Ycs nor mtDNA testing could be of assistance. X chromosome (the female counterpart of the Ycs) or autosomal DNA analysis would be the only two genetic systems that could be utilized in such cases, although interpreting the results of these tests is not as straightforward as with Ycs and mtDNA. Additionally, any hypothesis of alleged children of Joseph Smith that do not have living descendants in the present day also pose serious difficulty to this type of genetic analysis. Therefore, it is highly unlikely that all the proposed cases of paternities involving Joseph Smith will ever be addressed and resolved by this methodology. However, new technological advancement in the field of autosomal DNA testing may allow for further investigations that previously would not have been touched by Ycs or mtDNA testing.

This technology is currently being employed in resolving the paternity of Josephine Rosetta Lyon Fisher.

Case #6: Josephine Rosetta Lyon Fisher — An Autosomal DNA Approach

Josephine was born on February 8, 1844, in Nauvoo, Illinois. Her recorded parents are Sylvia Porter Session and Windsor Palmer Lyon, who were married in Far West, Missouri, in 1838. The case of Josephine is interesting in that it is possibly the strongest case of an alleged biological child born of Joseph Smith through a polygamous union, but the well-developed sciences of Ycs and mtDNA testing cannot address their relationship at all. Josephine's disputed paternity is based on an affidavit containing her mother's confession on her dead bed:

> Just prior to my mothers death in 1882 she called me to her bedside and told me that her days on earth were about numbered and before she passed away from mortality she desired to tell me something which she had kept as an en-

> tire secret from me and from all others but which she now desired to communicate to me. She then told me that I was the daughter of the Prophet Joseph Smith, she having been sealed to the Prophet at the time that her husband Mr. Lyon was out of fellowship with the Church.[28]

Significant weight has been given to this affidavit as it relates to Josephine's paternity. Considering that there is documented evidence about Sylvia's union to Joseph Smith and that Windsor had physically relocated outside of their home at the time of Josephine's conception and birth,[29] it is plausible that such declaration has reference to an actual biological association between Josephine and Joseph Smith. The very name of Josephine seems to imply a connection to the Mormon Prophet. However, as demonstrated in the previous cases, situational accounts that historically have been accepted as evidence, proved to be speculative.

Despite the interpretation of Sylvia Sessions' statement, the greatest challenge from a genetic testing perspective is the incompatibility of Josephine's gender with well established genetic testing techniques. Being a woman, she did not inherit the male-characteristic Ycs from her father and her mtDNA is not applicable in this situation as the mother's identity is not in question. A different avenue of testing was in order for this particular question.

Starting in 2000, a considerable number of DNA samples from individuals — both males and females — descending from six of Josephine's ten children were collected through the assistance of the Sessions family group. To date, more than 120 people sharing Josephine Rosetta Lyon as their MRCA and removed from her by as few as three generations have contributed a DNA sample together with their pedigree chart to assist in this case study. It was obvious that the issue of Josephine's paternity was more than just an historical question, as hundreds of her descendants wanted to discover if the biological connection to Joseph Smith was real. All were hopeful that autosomal DNA could provide some answers.

After just a short decade, technological advances in the field of genetics make it possible to generate data from hundreds of thousands of single nucleotide polymorphisms (SNPs) from the autosomal genome.

28. Compton, *In Sacred Loneliness*, 183.

29. Brian C. Hales, "The Joseph Smith — Sylvia Sessions Plural Sealing: Polyandry or Polygyny?" *Mormon Historical Studies* 9 (Spring 2008): 41–57.

The large amount of data produced through this method is phenomenal and was unthinkable just few years ago. Providing a meaningful analysis of it requires powerful computers and algorithms capable of interpreting the data in light of the hypotheses that are being tested. Rather than an unambiguous and clear genetic signal obtained from the analysis of uniparental markers, the large quantity of SNPs produced cannot be linked in a straightforward way to specific branches of the family tree. However, ancestral legacy can be measured using genetic scores, percentages, and probabilities that must be carefully taken in consideration within the familial context being tested.

Using the recently developed Affymetrix 6.0 GeneChip®,[30] nearly one million SNPs were generated from a small number of carefully selected individuals belonging to both the Lyon and Smith families. DNA samples were run on a GeneChip® Scanner 3000 7G and analysis of the data was conducted in collaboration with scientists at the University of Utah.

Based on the inheritance properties of DNA and considering factors such as the random loss of part of the genetic signal at each subsequent generation (a feature known as genetic drift), a measurable genetic contribution of Smith DNA among Lyon's descendants would be somewhat expected if Joseph Smith was the actual father of Josephine. However, considerable discrepancy was observed in the results obtained. Such incongruity could be linked to genetic drift or to other contributing factors: more "Smith DNA" could have survived in some individuals but not in others, or Joseph Smith may or may not have been Josephine's father and alternative reasons could explain the genetic discrepancy observed. In order to address this issue, we evaluated the possibility of genetic contribution from other common ancestors in addition to the alleged ancestry linked to the union between Joseph Smith and Sylvia Sessions. This assessment was performed using empirical genealogical data.

Family trees were provided by participants at the time of the contribution of the biological specimen to the Josephine Lyon case study. These records were extended and verified using primary sources and online databases by the genealogical team at SMGF. Common ancestors

30. http://affymetrix.com (accessed June 19, 2010).

and corresponding degrees of relationships were carefully analyzed to determine the amount of DNA that would be expected to be shared between closely related individuals. This line of investigation was poised on the fact that descendants from the Smith and Lyon/Fisher families are part of the same pioneer stock that participated in the first colonization of the Great Salt Lake Valley nearly 150 years ago, and could have potentially had many overlapping ancestors. A considerable number of additional ancestral relationships between the descendants tested for the Smith and Lyon families were catalogued in this genealogical exercise.

Although the presented assessment of the data is preliminary, the finding of additional common ancestors existing among the individuals tested proved to be significant and cannot be ignored in light of the genetic scores (GS) obtained. In fact, it appears that Josephine's descendants with the highest genetic affinity to the Smith family gene pool were also closely related to Smith's descendants through common ancestors besides the purported Joseph Smith ancestry. Likewise, individuals with the lowest scores were more distantly related. Figures 7.6A–F show such examples from the dataset analyzed. Each figure contains one set of individuals — one from the Smith and the other from the Lyon's families — that were tested for autosomal SNPs and whose DNA was compared in order to obtain a GS. The additional information in each figure includes genealogical data describing all the ancestors they have in common and the degrees of relationship derived by such genealogical connections. Most likely, as in the comparison reported in figure 7.6A, the higher genetic score observed could be linked to the fact that the two individuals are also second cousins once removed through a common ancestor that was born in 1862. Likewise, the lowest genetic score, as reported in figure 7.6F, could be explained by the more distant familiar relationship shared by Josephine's descendant with the member of the Smith family tested (an occurrence of fourth degree cousinship and one as a third cousin once removed).

In summary, as this work progresses and analysis is performed in light of the multiple familial relationships shared by both Josephine Lyon's and Joseph Smith's descendants, it is clear that a lot of "genealogical noise" is also present. This complicates any attempt to identify a clear and straightforward genetic signal from Joseph Smith in Josephine's descen-

Figure 7.6A — Genetic Score 185.98
Smith (S–623328) and Lyon (S–693396)*

Common Ancestors and Birthdates	*Generations*	*Relationship*
Mon (Mans) Monson (22 July 1862)	7	2C1R
Thomas Scott (1594)	24	10C2R

Figure 7.6B — Genetic Score 179.74
Smith (S–623328) and Lyon (S–681833)*

Common Ancestors and Birthdates	*Generations*	*Relationship*
Mon (Mans) Monson (22 July 1862)	7	2C1R
Thomas Scott (1594)	24	10C2R

Figure 7.6C — Genetic Score 127.47
Smith (S–633895) and Lyon (S–693359)

Common Ancestors and Birthdates	*Generations*	*Relationship*
Joel Hills Johnson (23 Mar. 1802)	8	3C
Anthony Johnson Stratton (11 Jan. 1824)	9	3C1R
William Sabin (11 Oct. 1609)	21	9C1R
Edward Griswold (1607)	23	10C1R
John Emery Sr. (29 Sept. 1598)	23	10C1R
Thomas Scott (1594)	24	10C2R

Figures 7.6A–F (continued on following page): Six examples of autosomal DNA comparison between members of the Smith and Lyon's families. The genetic score for each pair of individuals is reported in the corresponding table together with information about their common ancestors, number of generations separating them, and their biological relationships (i.e. 4C = 4th cousin, 9C2R= 9th cousin twice removed, 11C1R = 11th cousin once removed, etc.). Genetic scores indicate the amount of DNA shared between each pair of individuals. The higher the value reported, the larger the amount of the DNA shared.

* S-681833 and S-693396 are siblings and they were both included in the study for calibration purposes. The similar genetic scores in figures 7.6A and 7.6B is in agreement with the ancestry both individuals share.

Figure 7.6D — Genetic Score 77.83
Smith (S–633895) and Lyon (S–693351)

Common Ancestors and Birthdates	*Generations*	*Relationship*
Joel Hills Johnson (23 Mar. 1802)	9	3C1R
Anthony Johnson Stratton (11 Jan. 1824)	10	4C
William Sabin (11 Oct. 1609)	22	9C2R
Edward Griswold (1607)	24	11C
John Emery Sr. (29 Sept. 1598)	24	11C
Thomas Scott (1594)	25	11C1R

Figure 7.6E — Genetic Score 58.88
Smith (S–633895) and Lyon (S–693375)

Common Ancestors and Birthdates	*Generations*	*Relationship*
Sanford Porter (7 Mar. 1790)	7	4C
Thomas Scott (1594)	24	10C2R

Figure 7.6F — Genetic Score 56.21
Smith (S–682958) and Lyon (S–693347)

Common Ancestors and Birthdates	*Generations*	*Relationship*
Samuel Carter (1 Sept. 1836)	9	3C1R
Thomas Scott (1594)	10	4C

Figures 7.6A–F (continued from previous page).

dants. In other words, the challenge that researchers face is to be able to distinguish the genetic contribution by Joseph Smith in the purported paternity of Josephine, from all the other related Smiths who married ancestors of Josephine's descendants before and after Joseph Smith's time. It is possible that this paternity case may never be fully resolved by means of genetic testing, although it appears that the analysis obtained to date shows a strong genetic association of Josephine's descendants to the multiple documented genealogical relationships observed, independent of the claim that Joseph Smith was Josephine's biological father.

Conclusions

The analysis of alleged paternities involving Joseph Smith, the Mormon Prophet, through the use of DNA could further the understanding of the extent and nature of his involvement with the practice of polygamy. If one of the explanations of introducing polygamy as part of one of the fundamental doctrines in this dispensation was to have a numerous posterity, it is at least puzzling considering that as of today no biological children of Joseph Smith have been identified besides those born with his wife, Emma Hale. The Ycs cases reviewed and summarized in this essay provide strong evidence against Joseph Smith being the father of the five boys recorded as his from the different historical sources examined, and such results should be taken into consideration in future publications dealing with Joseph Smith's polygamous unions and the corresponding alleged paternities. However, it is likely that not all the cases of children linked to the founder of Mormonism will ever be resolved through DNA testing due to limitations such as the gender of the child or the lack of living progeny. Ancient DNA analysis using remains from Joseph Smith and some of his other purported children could be an option for additional case studies and any data retrieved with this approach could be more easily interpreted, but the bureaucracy involved with exhumation permits, accurately identifying burial sites, and obtaining high-quality DNA samples adds to the complexity of this alternative methodology.

DNA has inarguably added a new and powerful level of comprehension with regard to ancient and recent historical events. Genetic evidence may offer a valuable complement when other sources of information to investigate the past are not sufficient to provide conclusive answers. Genetic analysis has the capacity to impact the study of time periods spanning from our species' origins hundreds of thousands of years ago to the identification of previously unknown details in the life of historical figures that lived just few decades ago.[31] DNA may contribute significantly to deciphering the ancient and recent history of people as long as suitable biological specimens are attainable, testable hypotheses formulated, and

31. Alessandro Achilli and Ugo Perego, "Mitochondrial DNA: A Female Perspective in Recent Human Origins and Evolution," in Paola Spinozzi and Alessandro Zironi, eds., *Origins as a Paradigm in the Sciences and in the Humanities* (Goettingen: V&R Unipress, 2010), 41–58.

appropriate methodologies applied. However, it must be remembered that genetic analysis alone does not replace other methods traditionally employed in historical and genealogical research. It enhances conventional means and becomes more relevant when analyzed within a specific context and in combination with other sources of information.