NEAL A. MAXWELL INSTITUTE
FOR RELIGIOUS SCHOLARSHIP

BRIGHAM YOUNG UNIVERSITY • PROVO, UTAH

Title Elusive Israel and the Numerical Dynamics of Population Mixing

Author(s) Brian D. Stubbs

Reference *FARMS Review* 15/2 (2003): 165–82.

ISSN 1550-3194 (print), 2156-8049 (online)

Abstract This article discusses how a population's number of pure-blooded individuals can diminish drastically to only a few percent in a few hundred years. This information suggests that it is difficult and perhaps impossible to draw any definite conclusions concerning the genetics of Native Americans in relation to the people spoken of in the Book of Mormon.

Elusive Israel and the Numerical Dynamics of Population Mixing

Brian D. Stubbs

Ethnic mixing viewed through the glimpse of a single lifetime can seem negligible. However, a detailed examination of the mathematics of population mixing over a few lifetimes reveals how quickly and thoroughly populations mix over time. Even scholars seldom realize how dynamic the cumulative effect of this mixing is upon a pedigree. The passage of only five hundred years can result in 98 percent of a tribe's or community's posterity not being pure- or full-blooded. This article examines the numerical dynamics of population mixing and their significance for Book of Mormon peoples in the New World and for Israel generally throughout the world.

As a potential candidate for being in an ethnically mixed marriage, I have given the matter of mixing considerable thought: my wife is from Argentina, while my known/recorded ancestry comes out of the British Isles. I call myself a *potential* candidate because the common views used to determine this sort of distinction are oversimplified, if not erroneous, so I have doubts that my wife and I qualify any more than most others would. The lineage of most persons and groups consists of genetic contributions from several ethnic varieties. The three numerically prominent population groups in the history of Western Europe are the Celts, the Germanic peoples, and the Romans. Everyone with roots out of Western Europe would have all three well represented in his or her ancestry, whether verifiable or not. As I look at my pedigree from 1700 to 1850, half the marriages

are unions between a Germanic spouse (English) and a Celtic spouse (Welsh, Scottish, or Irish), though each of those individuals would already have been a thorough Germanic-Celtic mix.

The Romans ruled Britain from the middle of the first century A.D. to the year 410[1] and during that time undoubtedly bestowed a considerable genetic contribution upon the island population. Whatever islanders missed out on Roman genes through that episode probably picked up some from their pre-English Germanic ancestors on the continent, who also mixed with and were ruled by the Romans through the same centuries before crossing the channel in the middle of the fifth century A.D. And if those two episodes didn't make enough of a genetic impact, a third opportunity came in the centuries after 1066 during the rule of the Norman French, who were themselves at least a four-way mix of Norsemen (hence the name *Norman*), Germanic Franks, Celtic Gauls, and (of course) Romans, whose Latin was largely the progenitor of the French language. So I—and everyone from the British Isles—would have quite a thorough mix of Germanic, Celtic, and Roman ancestors.

My wife's ancestors are primarily from Spain and Italy, with a probable, though unverifiable, Native American line or two. (Of course, I may have one, too.) In areas now labeled Spain and Italy, the Celtiberians (a Celtic-Iberian mix) in Spain and other Celtic groups lived in or bordered and mixed with the populations of both areas more centuries than they did not. Similarly, the Visigoths and other Germanic peoples were also prominent in the histories and pedigrees of those areas; and, of course, the Romans came out of Italy and ruled Spain for some time. So if I am 40 percent Germanic, 30 percent Celtic, 20 percent Roman, and 10 percent other, and if my wife is 20 percent Germanic, 30 percent Celtic, 40 percent Roman, and 10 percent other, are we more different than most

1. Albert C. Baugh and Thomas Cable, *A History of the English Language,* 3rd ed. (Englewood Cliffs, N.J.: Prentice-Hall, 1978), 44–46; Winston L. S. Churchill, *Churchill's History of the English-Speaking Peoples,* originally published as four volumes in 1955, arranged for one volume by Henry S. Commager (New York: Barnes and Noble, 1995), 3–12. Although Julius Caesar mounted invasions of Britain in 55 and 54 B.C., Roman influence was neither widespread nor lasting until the conquest begun by Claudius in A.D. 43.

random couples of Western European extraction? She and I are distant cousins three ways! Even the geneticists find national identities in Europe rather indistinguishable.[2]

Israel Disseminated

According to mathematical probabilities that will be detailed below, Israel's permeation of world populations affects the genetic heritage of at least a hundred times more people than is obvious or known—in the Old World and the New. The linguistic variety in the Americas[3] and John Sorenson's population analysis[4] both suggest that many other peoples dwelt in ancient America in addition to Book of Mormon groups.[5] After the Book of Mormon groups arrived in the New World, the diffusion of Israel in the New World would in many

2. Nancy Shute, "Where We Come From," *U.S. News and World Report,* 29 January 2001, 36, states that "most people of European origin are so genetically mixed that it's impossible to tell German from Frenchman, Bosnian from Serb."

Of course, this line of thinking concerns biology more than culture, the other dimension of ethnicity, but culture preservation has been an elusive ideal among civilized peoples ever since they decided what culture is. I know nothing about the culture(s) of my Celtic ancestors except that they played bagpipes instead of CDs. Even the more recent pioneer culture from which so many Latter-day Saints in the western United States spring is becoming a poorly comprehended past for most youth. The only culture those youth and I know very well is the present U.S. culture, with its valued visitation rights to Wal-Mart and McDonalds—our favorite Celtic restaurant.

3. Lyle Campbell, *Historical Linguistics: An Introduction* (Cambridge, Mass.: MIT Press, 1999), 163; Johanna Nichols, *Linguistic Diversity in Space and Time* (Chicago: University of Chicago Press, 1992), 233. Campbell and Nichols are among the foremost specialists in Amerindian languages. Campbell sets the number of Amerindian language families at over 150; Nichols offers a number of 157; I have seen other counts around 100 and as low as 80. A language family is a group of languages that linguists can demonstrate to be related to one another and descended from a common parent language spoken anciently. In size, language families can range from a small number of languages, or an isolate not verifiably related to anything else, to large numbers, like the Algonkian and the Uto-Aztecan language families, which consist of about 30 languages each.

4. John L. Sorenson, "When Lehi's Party Arrived in the Land, Did They Find Others There?" *Journal of Book of Mormon Studies* 1/1 (1992): 1–34.

5. See Matthew Roper, "Nephi's Neighbors: Book of Mormon Peoples and Pre-Columbian Populations," in this number, pages 91–128; John L. Sorenson and Matthew Roper, "Before DNA," *Journal of Book of Mormon Studies* 12/1 (2003): 13–23.

ways have paralleled that in the Old World. In both hemispheres, many persons, families, and groups regularly left the several main bodies to seek perceived "greener pastures" of land, opportunity, or marriage. For example, even before Christ's time, enough Jews had left Palestine that the Jewish population outside of Palestine was likely greater than the Jewish population in Palestine.[6]

Similar diffusions of Lehites and Mulekites into surrounding populations of the New World (or assimilations of outside populations into Lehite and Mulekite groups) were undoubtedly occurring throughout Book of Mormon history and since.[7] For example, the Mulekite group that the Nephites found in Zarahemla may have been only one of many groups splintered off since their original disembarkment, just as the Nephites who found them were but a fraction of Lehi's posterity in the Americas at that time. Then the several splinter groups would subsequently have mixed with other pre-Columbian populations.

Besides revealing a magnified extent of population mixing, an understanding of the numerical dynamics behind it also discourages the common oversimplification that a person is either "of Israel" or is "not of Israel." The likelihood of a person having a high percentage of Israelite blood these days is improbable to impossible, yet in many areas the likelihood of high percentages of people having some Israelite ancestry is probable. No one has a lot, but a lot have a little.

No one is a "pure Israelite," nor ever has been, except Israel (Jacob) himself. Jacob's twelve sons—who were only half Israelite—presumably did not marry sisters, so Jacob's grandchildren, who made the trek into Egypt to meet their uncle Joseph, were already only one-quarter Israelite, Israel (Jacob) being only one of the four grandparents of each of his son's children. How many of those grandchildren married cousins and how

6. Ralph Marcus, "The Challenge of Greco-Roman Culture," in *Great Ages and Ideas of the Jewish People,* ed. Leo W. Schwarz (New York: Random, 1956), 114–15, states that by the time of Christ, the Jewish population comprised 10 percent of the Roman Empire and was found in two hundred communities throughout southern Europe, western Asia, and northern Africa.

7. See Matthew Roper, "Swimming in the Gene Pool: Israelite Kinship Relations, Genes, and Genealogy," in this number, 129–64.

many married outside the group is not known. Some of Jacob's posterity probably married into the ethnic group to which Joseph's wife and children belonged. Regardless, by the time Jacob died in Egypt, most of his posterity were probably from a quarter to one thirty-second Israelite, genetically speaking. Those proportions diminished through succeeding centuries as Israelites married Midianites, Moabites, Hittites, and so on. Following the various dispersions, the percentages of Israelite ancestry within each person would diminish at more accelerated rates.[8]

As a result, few, if any, could be as much as 25 percent Israelite (even in Jewish communities), yet the numerical dynamics of population mixing suggest that smaller percentages of the literal "blood of Israel" are likely to be in many more persons than ever suspected. However, the thoroughness, extent, and rapidity of the spread and diffusion of Israel in both hemispheres cannot be fully appreciated without a careful consideration of the actual mathematics involved.

Tracking the Numbers

Neighboring populations mix whether they are comparable or different in size, but small populations mix even faster because the smaller the group, the greater the percentage that marries outside the group. For example, in an Amerindian tribe or Jewish community of 1,000 to 2,000, there may be 50 to 100 unmarried persons of marriageable age at any given time. Therefore, about 25 to 50 potential partners of the opposite gender exist within one's own group, which is not a wide selection. Even though a certain number will marry one of those 25 to 50 within the group, it is likely that others will marry outside the group. So the percentage of a small population that will marry outside its group, due simply to a lack of prospective partners within the group, is much higher than the percentage of a large population that will marry into an outside or neighboring group.[9]

8. See ibid.

9. For example, about half of the small population of Utes on the White Mesa Ute Reservation in southeastern Utah (about 250 persons) marry another Ute; the other half marry non-Utes. That pattern over the last five or ten generations would result in few if any of them being "pure Ute."

Consider a hypothetical and simplified but realistic scenario for a tribe, a Jewish community, or some other minority population living among a larger population of "outsiders." Jewish families or communities are as cohesive as any, yet they, too, naturally diffuse into neighboring populations—and they allow incursions by genetic outsiders through conversions. This is apparent by the facts that many Jews in Africa are black, that the Jews in China look oriental,[10] that the Jews in Europe look more European than Mediterranean, and so on. Suppose that a small percentage of the children born into a Jewish community marries outside the group. Even if the "outsider" spouse was not a convert to Judaism, the children of this marriage would likely know of their Jewish heritage and might be acquainted with their Jewish grandparents, aunts, uncles, and cousins. But the children of these children—that is, the great-grandchildren of the last regular reader of the Torah—may or may not know that they are of Jewish descent, that their great-grandfather was the last orthodox observer in their line, and that their second cousins and their parents' cousins are Jewish. I know my thirty aunts and uncles and my eighty first cousins well, but I knew none of my parents' cousins or my second cousins until I moved to a small town three hundred miles away, made new friends, and after several years of acquaintance discovered that three of them were my second cousins. In other words, the passage of a few generations often obscures ancestral identities.

Returning to the example, it is instructive to chart the numerical impact over several generations of even a fraction of the community's young people marrying outside the community, as I have done in table 1 (see p. 172). To facilitate the math, I have calculated the ratio of those who marry outside the community at 10 percent; the

10. *The Jewish Encyclopedia* (New York: Funk and Wagnalls, 1907), 4:33–38, s.v. "China," discusses customs of Jewish groups in China that point to the possibility that they left Palestine before rabbinic Judaism developed, eventually arriving in China about 2,000 years ago. A photo in the article shows Chinese Jews to be indistinguishable from Chinese non-Jews. See also the photographic essay depicting Jews with a wide range of physical features in "The Problematic Role of DNA Testing in Unraveling Human History," *Journal of Book of Mormon Studies* 9/2 (2000): 66–74.

number of discrete generations per century as three—or 33 years per generation, which is actually longer than the average; and a constant population growth rate of 2.5 children per couple. This latter figure might be slightly high considering the infant mortality rate of past centuries, but the percentages shown on the table would be valid regardless. I have also assumed equal gender ratios and a constant rate of diffusion in each generation. These are simplifications, certainly, but they do not diminish the value of the illustration.

On the table, the generation number is on the left. The next four numbers then follow for those whose ancestry comes exclusively from within the ethnic group: the number of adults with ancestry from exclusively within the group, the percentage they represent of the total number of adults in that generation that are related to the group, the number of couples that those adults would form if everyone married, and the number of offspring of those couples if couples averaged 2.5 children who reached adulthood. In the next four columns to the right are parallel figures for those marrying partners with ancestry from outside the group; the fourth of these columns, labeled "offspring," represents those born to these marriages, having ancestry partly from outside the original group and partly from within it. The last column shows the total number of adults of that generation, of whatever ancestry, who are descended from it.

Let's walk through the first few generations. From a community including, say, 1,000 adults of one generation, 900, or 90 percent, marry within the group to form 450 couples (c_i)—half the number of individuals, since both spouses come from within the group. The other 10 percent, or 100, marry outside the group to form 100 couples (c_o), since the partner of each member of the group comes from outside the group. This factor alone accounts for a phenomenal geometric growth of posterity with ancestry from outside the group that increases much faster than the number of posterity with ancestry from exclusively within the group. However, each succeeding generation with ancestry from outside the group will have ever smaller fractions of their ancestry from within the group.

Table 1. The Numerical Dynamics of Population Mixing

generation	those with ancestry exclusively from within the ethnic group				those with ancestry from outside the group				total adults descended from group (a_i + a_o = a_x)
	adults (a_i)	% of a_x	couples (c_i)	offspring* (c_i x 2.5)	adults (a_o)	% of a_x	couples (c_o)	offspring (c_o x 2.5)	
1	900	90%	450	1,125 = 1,013 + 112	100	10%	100	250	1,000
	112 + 250 = 362 adults with mixed ancestry in the 2nd generation								
2	1,013	74%	506	1,265 = 1,139 + 126	362	26%	362	905	1,375
	126 + 905 = 1,031 adults with mixed ancestry in the 3rd generation								
3	1,139	52%	570	1,425 = 1,283 + 142	1,031	48%	1,031	2,577	2,170
	142 + 2,577 = 2,719 adults with mixed ancestry in the 4th generation								
4	1,283	32%	640	1,600 = 1,440 + 160	2,719	68%	2,719	6,797	4,002
5	1,440	17%	720	1,800 = 1,620 + 180	6,957	83%	6,957	17,392	8,397
6	1,620	8%	810	2,025 = 1,823 + 202	17,572	92%	17,572	43,930	19,192
7	1,823	4%	911	2,277 = 2,050 + 227	44,132	96%	44,132	110,330	45,955
8	2,050	2%	1025	2,562 = 2,306 + 256	110,557	98%	110,557	276,392	112,607

*In this column, the total number of offspring with ancestry exclusively from within the group is broken into figures representing 90 percent and 10 percent of that total. The 90-percent figure becomes the a_i figure for the next generation, while the 10-percent figure is added to the c_o x 2.5 figure of the same generation to yield the a_o figure of the next generation.

At a population growth rate of 2.5 children per couple, the 450 couples that marry within the ethnic group would have 1,125 children (c_i x 2.5), 90 percent of whom (1,013) marry within the group and 10 percent of whom (112) marry outside the group—meaning that they marry someone whose ancestors were not exclusively from within the group, even if some of them were. The 112 marrying outside the group in this second generation combine with the 250 born to those with one parent from outside the group for a total of 362 persons descended from the group but with ancestry from outside of it in the second generation. Those 362 comprise 26 percent of the total 1,375 (that is, 1,013 + 362, or a_x) descended from the group in the second generation. Those 362 persons marry an equal number with ancestry from outside the group to form 362 couples who in turn have 905 children, while the 1,013 who marry within the group form 506 couples (assuming that one did not marry) and have 1,265 children. Of those 1,265 children, 10 percent, or 126, marry partners with ancestry from outside the group in the third generation, combining with their 905 relatives with ancestry from outside the group for a total of 1,031 adults with ancestry from outside the group in the third generation. Keep in mind that the number of related adults with ancestry from outside the group for any given generation (a_o) is the 10 percent of the previous generation that married outsiders or partners of mixed ancestry added to the offspring with mixed ancestry born in that generation. The related adults with ancestry from outside the group in the fifth generation, for example, is 6,957, adding the numbers 160 + 6,797 from the fourth generation. The percentage figure to the right of each figure in the "adults" columns is the percentage that number of adults comprises of the total adult population related to the group, of whatever ancestry (a_x). For example, in the fifth generation, 1,440 adults with ancestry from exclusively within the group comprise 17 percent of the total 8,397 adults related to the group, while the remaining 83 percent are the 6,957 adults of mixed ancestry.

After only eight generations (approximately 267 years), only 2 percent of the group's posterity still has ancestry exclusively from

within the group and 98 percent of those related to the group have mixed ancestry. In actuality, the numbers of individuals with ancestry from outside the group will not multiply quite as rapidly as table 1 portrays because, as indicated, many in surrounding areas will be distant relatives with some ancestry from within the group; that is, not every person who marries outside the group will marry a person totally unrelated to the group. Some would marry outside partners who themselves are 1/8 or 1/64 Jewish, Hopi, Zuñi, or whatever; thus, after the first generation, the number of marriageable adults with some ancestry from outside the group (a_o) will not quite equal that same number of new couples (c_o), as portrayed in the table. The argument that Jews or other groups are more strictly cohesive than to allow 10 percent to leave may occasionally apply, but even 3 percent would yield the same result, though this would come about in 800 years instead of 267: 2 to 10 percent with ancestry from exclusively within the group versus 90 to 98 percent with ancestry from outside the group.

The dynamics of this phenomenon also explain why thousands of the present descendants of the Cherokee look Caucasian. The Cherokee may have mixed with Europeans more than any tribe; thus, claims of Cherokee ancestry made by people who do not look remotely Amerindian are not necessarily fictitious but may simply reflect these figures—that 2 to 10 percent of Cherokee descendants are still in the group and look Amerindian, while 90 to 98 percent of Cherokee descendants are Caucasian-looking Americans.[11] Continuing the math over a millennium or two would leave less than 1 percent of today's literal descendants of the Cherokee, Hopi, Kiowa, Jews, or whatever minority population knowing about that heritage, while more than 99 percent would not know about it and would label themselves according to their most recent ancestry, since a knowledge of one's ancestors beyond great-grandparents is often lost.

11. It has been reported to me by part-Cherokee persons that these ratios are apparent at tribal reunions, where the majority of Cherokee descendants look Caucasian.

For example, I once told a Navaho friend that he looked Hopi to me. As a fluent speaker of Navaho, born and raised by two Navaho parents, he replied confidently, "I'm full-blooded Navaho." I asked where his family was from originally, and it was an area not far from Hopi land. Two years later he reminded me of my previous observation and told me that he had recently learned from a grandparent that some of his ancestral lines were Hopi. As I told him, it is probable that many Navahos and Hopis near the joint-use area are about half-Hopi and half-Navaho and are thus blood brothers who feud only according to most recent ancestry. The same would be true of ethnic groups in many parts of the world. Some studies find Jews and Palestinians nearly indistinguishable genetically.[12]

Some may claim that in former, less-mobile times, peoples and places were more homogenous than they are today. However, many historical accounts (such as Acts 2:5–12) show that international travel was as common and ethnic variety in many places as diverse as they are today. Historical records of pre-Columbian American life are rare, but what sixteenth- to nineteenth-century accounts we do have suggest a "melting-pot" effect in Native Americans at least as dynamic as today.[13]

Let us use a different method to figure how many persons and families of Europe, for example, could have traces of Jewish or Israelite ancestry. It will use simplifications similar to those in the previous hypothetical scenario, but again, they do not lessen its value as an illustration. Ralph Marcus writes that at the time of Christ, 10 percent of the Roman Empire was Jewish, comprising about 6 million of a total population of 60 million. They were identified in two hundred communities around the Mediterranean besides Palestine,

12. Shute, "Where We Come From," 39, cites a study by Michael Hammer and states that "although Palestinian and Jewish men may be political foes, they are also brethren, so closely related as to be genetically indistinguishable."

13. My monograph "Athapaskans, Puebloans, and the Prehistory of the Navaho People," a manuscript in process, cites several examples of eighteenth- and nineteenth-century historical accounts addressing the frequency of intertribal mixing, especially as it applies to the Puebloan ancestry of the Navaho people.

and their numbers appear to have been significant in Spain, Italy, and Greek-speaking areas.[14] Because such estimates could be high—although it should be borne in mind that they reflect only those *known* to be Jewish—we will cut them in half to be conservative and estimate the total Jewish population at 3 million instead of 6 million. Most Jewish emigrations occurred between the destructions of the First and Second Temples—586 B.C. to A.D. 70. The destinations of choice were Africa, Arabia, Europe, or deeper into Asia. But of the four possible areas, let us not assume that a full fourth of the Jewish population immigrated to Europe—let's assume a total of perhaps 120,000, representing only 4 percent of the 3 million.

Estimates of Europe's population in those times usually range from 30 to 40 million.[15] For mathematical convenience, let's select an intermediate estimate of 36 million. Calculating about 4.5 people per family, 36 million would yield 8 million families in Europe. The 120,000 Jews living in Europe at a given time would represent about three generations, so if one in 20 of the 40,000 in the generation of marriageable age married a non-Jew at a constant rate of diffusion, then 2,000 "gentile," or non-Jewish, families would receive a new member having Jewish ancestry in the first generation. If each of those mixed couples had two children that reached adulthood and married (which represents zero population growth, again for the sake of mathematical simplicity), then in the second generation, 4,000 families would receive some Jewish heritage through them, plus another 2,000 families who would receive from among the next generation of Jews a new member—the one in

14. Marcus, "Challenge of Greco-Roman Culture," 114–15; Haim Beinart, *Atlas of Medieval Jewish History* (New York: Simon and Schuster, 1992), 80–82; Cecil Roth, ed., *The Standard Jewish Encyclopedia,* new rev. ed. (Garden City, N.Y.: Doubleday, 1966), 791, 1608, 1744–46, and 1753–56.

15. J. M. Roberts, *History of the World* (New York: Oxford University Press, 1993), 334, 409, suggests a population of about 40 million in A.D. 1000; "Medieval Sourcebook: Tables on Population in Medieval Europe," online at www.fordham.edu/halsall/source/pop-in-eur.html (accessed 3 October 2003), offers population figures of 27.5 million in A.D. 500, 18 million in A.D. 650, and 38.5 million in A.D. 1000; several other sources in similar ranges are not cited.

20 that would marry outside their Jewish community—for a total of 6,000 families with some Jewish heritage. The two offspring from each of those 6,000 families would unite with offspring from 12,000 gentile families, and an additional 2,000 of the next Jewish generation would marry outside their community, for a total of 14,000 families containing a member with some Jewish heritage. This pattern would continue as follows:

Table 2. Jewish Diffusions into the Families of Europe

generation	Jews marrying into outside families	part-Jewish persons creating families	total families affected
1	2,000	none	2,000
2	2,000	4,000	6,000
3	2,000	12,000	14,000
4	2,000	28,000	30,000
5	2,000	60,000	62,000
6	2,000	124,000	126,000
7	2,000	252,000	254,000
8	2,000	508,000	510,000
9	2,000	1,020,000	1,022,000
10	2,000	2,044,000	2,046,000
11	2,000	4,092,000	4,094,000
12	2,000	8,188,000	8,190,000

In 12 generations—only 400 years—the total number of affected families has already surpassed the approximate total number of families in Europe, according to our population estimate. Even if the number of families were actually double our estimate, it would take only one more generation for all to be affected; if quadruple that, only two more generations. In other words, whether our initial estimates are entirely accurate or not hardly matters, since the passage of time would fill out the established pattern very rapidly in any case.

However, the numbers in table 2 do not mean that all the families of Europe would be affected in 400 years, because families nearer the Jewish communities would be impacted several times

during these centuries, while other families further away would not be affected at all in the early generations. That is, certain areas would receive higher proportions of the total "offshoots" or available "diffusions" from each Jewish generation, while other areas would receive few to none, early in the process at least. From the twelfth generation on, the 2,000 "pure" Jews leaving the main groups each generation is so minuscule compared to the number who are part Jewish and producing posterity that one could leave out that part of the calculation, to simplify the math even further, and merely double the number of those who are part Jewish each generation for an approximation of the number of diffusional branches sent out each generation. Rounding our twelfth-generation number off to 8 million and doubling that for 33 more generations, for a total time period of 1,500 years or 45 generations—say, from the time of Christ to A.D. 1500—we would reach a billion familial contributions at the nineteenth generation, a trillion at the twenty-ninth, and about 64 quadrillion after 45 generations,[16] which exceeds by many times the population of the earth, let alone the number of families in Europe. However, once again, the numbers would not grow as rapidly as the tables portray because many of these part-Jewish people would be marrying each other, creating only one new family instead of two. Said differently, many persons, families, or areas would be receiving dozens to hundreds of these infusions into their ancestry over the generations and may have surprisingly high percentages of Jewish ancestry; others, of course, would have less. However, with even a

16. For doubters, I shall complete the chart: 12th generation = 8 million; 13th = 16 million; 14th = 32 million; 15th = 64 million; 16th = 128 million; 17th = 256 million; 18th = 512 million; 19th = 1 billion (rounded off); 20th = 2 billion; 21st = 4 billion; 22nd = 8 billion; 23rd = 16 billion; 24th = 32 billion; 25th = 64 billion; 26th = 128 billion; 27th = 256 billion; 28th = 512 billion; 29th = 1 trillion (rounded off); 30th = 2 trillion; 31st = 4 trillion; 32nd = 8 trillion; 33rd = 16 trillion; 34th = 32 trillion; 35th = 64 trillion; 36th = 128 trillion; 37th = 256 trillion; 38th = 512 trillion; 39th = 1 quadrillion (rounded off); 40th = 2 quadrillion; 41st = 4 quadrillion; 42nd = 8 quadrillion; 43rd = 16 quadrillion; 44th = 32 quadrillion; 45th = 64 quadrillion. In numerals, a quadrillion is written as a 1 followed by 15 zeros.

fraction of that number of diffusional branches being sent out over 1,500 years, how many persons in Europe would *not* have Jewish ancestry? Probably very few.

So, as mentioned, it may be misleading to think of persons as either "of Israel" or "not of Israel." Even Jacob's grandchildren were only one-quarter (25 percent) "of Israel," and the percentages among Israelites can only have decreased since. On the other hand, a surprisingly high percentage of the world's present population may have traces of Israelite ancestry, and Abraham's descendants may indeed be numbered as the stars in the sky and the sands of the seashore (Genesis 22:17).

The Meaning of It All

So what is the significance of all this to the Amerindians in the New World and to peoples in the Old World and to you and me? It means that no one is "pure" Israelite but that very many are part Israelite. In the Old World, it probably means that if Joseph Smith, whose known and more recent ancestry is out of the British Isles, was as much Ephraimite as any on earth, as has been said of him,[17] and if the roots of most early church leaders came out of the same areas, then it stands to reason that a migration of Ephraimites entered northwestern Europe and the British Isles in the distant past. As for other places in the Old World, we have mentioned the large numbers of Jews living in Rome and Spain even before Christ was born, and the substantial Jewish and Yiddish-speaking presence in central and eastern Europe speaks for the probability that significant numbers throughout Europe and Asia have Israelite ancestry. The same is possible for much of the world.

In the New World, the numerical dynamics of population mixing make easily feasible the views of Mark E. Petersen and Ted E.

17. In addition to 2 Nephi 3:11, several other sources assert the literal descent of Joseph Smith Jr. from Joseph in Egypt and his son Ephraim, though the term *pure* is used loosely in some of them: Brigham Young, in *Journal of Discourses,* 2:269 (8 April 1855); Joseph Fielding McConkie, "Joseph, Son of Jacob," in *Encyclopedia of Mormonism* (New York: Macmillan, 1992), 2:760–61; W. Cleon Skousen, *The Fourth Thousand Years* (Salt Lake City: Bookcraft, 1966), 584–85.

Brewerton that most Amerindians are descended from Book of Mormon peoples,[18] even if Book of Mormon peoples were originally a minority of ancient American populations and are thus only a part of the ancestry of most individuals. Exact numbers and percentages must await more sophisticated and accurate measures, but the pattern makes such views easily possible, if not probable.

The latest sensation for Book of Mormon critics is DNA. A video produced by Living Hope Ministries entitled *DNA vs. the Book of Mormon* discusses both Native American DNA and linguistic data in an attempt to discount the Book of Mormon. I am not a microbiologist, but I am a linguist, and for scholarship's sake, I hope that the treatment of the genetic data was more credible than the comments on the linguistic data. In that poorly documented "documentary," Thomas Murphy, listed as an anthropologist and scholar, claimed that the linguistic data of Amerindian languages generally show a link with Asia.[19] That is 2 percent true and 98 percent false. Of some hundred-plus Amerindian language families,[20] one (Eskimo-Aleut) still straddles the Bering Strait and one other (Na-Dene, or at least Athapaskan) shows promise for demonstrable language origins from Asia.[21] However, the other ninety-eight or so language families show no demonstrable linguistic tie with Asia. Most linguists, like most scholars, assume that those languages came from Asia, but too long ago to have retained a verifiable link due to too much change

18. Mark E. Petersen, *Children of Promise: The Lamanites, Yesterday and Today* (Salt Lake City: Bookcraft, 1981), 31; Ted E. Brewerton, "The Book of Mormon: A Sacred Ancient Record," *Ensign,* November 1995, 30.

19. *DNA vs. The Book of Mormon,* videocassette (Brigham City, Utah: Living Hope Ministries, 2003).

20. See note 3 above.

21. Robert Shafer, "Athapaskan and Sino-Tibetan," *International Journal of American Linguistics* 18/1 (1952): 12–19. Before becoming aware of Shafer's article, I served a Navaho-speaking mission and found enough semantic similarity between Athapaskan and Asian languages to convince me of a probable connection between the two; but even if their language is largely from across the Bering Strait, the Navaho are genetically an Athapaskan-Puebloan mix. I will address this issue in "Athapaskans, Puebloans, and the Prehistory of the Navaho People."

over too many centuries. But that is an assumption. Any credible linguist would agree that no one has identified a linguistic connection between East Asian languages and any of the other language families except the two mentioned.

Even the film's claim that 99 percent of Amerindian DNA is of Asian origin, with no sign of Jewish DNA, raised many questions in my mind: (1) First, in the European gene pool, have microbiologists been able to identify Celtic DNA as opposed to Germanic or Roman? Even if Celtic DNA could be isolated, to say that 99 percent of Europeans have Celtic DNA would be misleading, since similarly high percentages would also have Germanic, Roman, Greek, Basque, Jewish, and several other kinds of DNA—that is, most individuals in Europe would have those several kinds of DNA—if the science were advanced enough to identify the DNA supplied by all the varied people who filled an individual's billion ancestral slots eight hundred years ago.[22] (2) Bering Strait DNA will, of course, exist throughout the Americas, just like Celtic DNA exists throughout Europe. So if Celtic DNA cannot be isolated, given the well-documented history of Europe, what can definitively be said of the varieties of DNA (besides East Asian) that may exist in the Americas? Though 99 percent of samples from Amerindians may show Asian DNA, 75 percent could also show Lehite DNA, as soon as, or if, it is ever identified—because it will not be the same as Jewish DNA.[23] Lehi and Ishmael were Josephites, not Jewish; though the two tribes are distantly related, the genetic compositions of both have been highly diluted in the millennia since Judah and Joseph were born to the same father through different mothers. (3) Is it even possible to identify Josephite DNA? Are there any Israelite human remains from northern Palestine dating

22. One's ancestral slots double each generation back: 2 parents; 4 grandparents; 8; 16; 32; 64; 128; 256; 512; 1,024 (only 10 generations back, or 267 years ago). One can continue doubling or else calculate that each of those 1,024 have 1,024 progenitors of their own 10 generations back, totaling over a million slots 20 generations back, or 533 years ago. Each 10 generations, or 267 years, adds three more digits to the number of ancestral slots—though it does not add that number of ancestors, since the number of one's ancestral slots would soon exceed the population of the earth; instead, the same persons begin appearing several times in one's pedigree.

23. See Roper, "Swimming in the Gene Pool," in this number.

between 1000 and 600 B.C. that might be used for a test? (4) Even if a comparison with Jewish DNA is allowed, what Jewish DNA have the studies dealt with—the Jews in Europe, or the black Jews in Africa, or the Jews in China, or whatever DNA all these groups have in common? (5) Has molecular science been sufficiently refined to measure dates or amounts of change over a given time period or for a given number of generations? (6) Of the trillion-plus ancestral slots on anyone's pedigree chart forty generations back (ca. 1,200 years), how many individual ancestors could the science presently identify?

I understand that the science of DNA identification is still in its infancy, that only small percentages of the DNA strands have been dealt with successfully, and that even though tremendous potential exists, most of that potential remains to be realized.[24] I am excited about the potential, but I am less than overwhelmed by the premature shots in the dark and unfounded assumptions based upon perhaps the first 5 percent of that potential. It may be only a matter of time until evidence for multitudes of Lehite posterity in the Americas becomes clear. The numerical dynamics of population mixing would undoubtedly be involved; for in both the Old World and the New, the parable of the olive tree in Jacob 5, with its grafts being transplanted into populations the world over, is profoundly significant.

24. See Martin Jones, *The Molecule Hunt: Archaeology and the Search for Ancient DNA* (New York: Arcade, 2001).