A MOSAIC OF PEOPLE: THE JEWISH STORY AND A REASSESSMENT OF THE DNA EVIDENCE

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The Jewish community has been the focus of extensive genetic study over the past decade in an attempt to better understand the origins of this group. In particular, those descended from Northwestern and Eastern European Jewish groups, known as "Ashkenazim," have been the subject of numerous DNA studies examining both the Y chromosome and mitochondrial genetic evidence.

The focus of the present study is to analyze and reassess Ashkenazi results obtained by DNA researchers and synthesize them into a coherent picture of Jewish genetics, interweaving historical evidence in order to obtain a more accurate depiction of the complex genetic history of this group. Many of the DNA studies

Recent genetic research has greatly expanded our understanding of the probable origins and distinct geographic patterns of certain groups of people, including Jews. This recent research has superceded some of the earlier studies on Jewish DNA, allowing a reassessment of the theories of Jewish origins in light of this new research.

The new analysis shows that Jewish ancestry reflects a mosaic of genetic sources. While earlier studies focused on the Middle Eastern component of Jewish DNA, new research has revealed that both Europeans and Central Asians also made significant

these distinctive groupings – in particular, the Falasha Jews of Ethiopia and the Chinese Jews.

Contemporary Jewry is comprised of approximately 13 million people, of whom 5.7 million live in the United States, 4.7 million live in Israel, and the remainder resides throughout the world (Ostrer 2001). Approximately 90% of the Jews of the U.S. are of Ashkenazi origin, while among the Jews of Israel, 47% are Ashkenazi, 30% are Sephardic, and 23% are of Mizrachi/Oriental origin (Ostrer 2001). Within Jewish groups, membership in three male castes (Cohen, Levi, and Israelite) is determined by paternal descent (Behar et al. 2003).

The history and genetic ancestry of Sephardic Jews is dealt with in only a cursory fashion here. There have been only very limited genetic studies on Jews of Sephardic descent, while in contrast, many DNA studies have explored the genetic ancestry of Ashkenazi Jews. Thus, the primary focus of this work is on Ashkenazim DNA results, but also included is a comparison of Sephardic and Ashkenazi results pertaining to Y chromosome haplogroups J and E.

The word "Ashkenazi" is derived from the Hebrew word for Germany, while "Sephardic" is derived form the Hebrew word for Spain. The word "Ashkenazi" was first used in medieval rabbinical literature to define western European Jews. An interesting story was related by author Arthur Koestler, who noted that the term "Ashkenaz" is also mentioned in the Hebrew bible, referring to a people living somewhere in the vicinity of Armenia. Probably for this reason, the Khazars, a people who lived in and around this area in ancient times and converted to Judaism in the 7th-8th centuries, came to believe they were the descendants of these biblical people. Some scholars argue that they began to call themselves "Ashkenazim" when they migrated to Poland in the 13th century. Eventually, perhaps, the term came to describe the community as a whole, not just the Khazarian immigrants (Koestler 1976, pp. 181-182).

While the Jews of today are connected historically and religiously to the Jews of ancient Israel, the DNA evidence also indicates that a significant amount of Jewish ancestry can be traced directly back to their Israelite/Middle Eastern ancestors. However, these ancestors represented a heterogeneous mix of Semitic and Mediterranean groups, even at their very beginnings.

The Israelite Kingdom arose in the 11th century BCE in an area between modern-day Lebanon, Jordan and Saudi Arabia. Current archaeological evidence indicates that the Israelite kingdom arose out of the earlier, Bronze Age Canaanite culture of that region, and displayed significant continuity with the Canaanites in culture, technology, language and ethnicity (Dever 2003, pp. 153-154).

While the Canaanites were a Western Semitic people indigenous to the area, they appear to have consisted of a diverse ethno-cultural mix from the earliest times. It is from this diverse group that the evolution of the Israelites occurred. Although little is known about these groups, they probably included some of the following populations:

- Amorites: Western Semites like the Canaanites. They were probably the pastoral nomadic component of the Canaanite people.
- 2. Hittites: A non-Semitic people from Anatolia and Northern Syria.
- Hurrians (Horites): A non-Semitic people who inhabited parts of Syria and Mesopotamia. Many kings of the early Canaanite city-states had Hurrian names.
- 4. Amalekites: Nomads from southern Transjordan. Even inimical references to this group in the Hebrew Bible "tacitly" acknowledge that the Israelites and Amalekites shared a common ancestry.
- Philistines: Referred to in ancient texts as "Sea Peoples." They invaded and settled along the coasts of ancient Canaan. Their culture appears to stem from that of Mycenae.

(Dever 2003, pp. 219-220).

While the Israelite kingdom clashed with a number of world powers over the centuries, including Egypt, Babylon, and Persia, it was the Roed. anes 5(p[(M)-3.6(e)-2.7(s)-3.6(e)-2.7(s)-3.6(e)-3.

slaves, others settled there voluntarily. There were as many as 50,000 Jews in and around Rome by the first century CE, most who were "poor, Greekspeaking foreigners" scorned for their poverty and slave status (Konner 2003, p. 86). Eventually, however, many of these slaves gained their freedom, continuing to live in and around Rome.

By the first century, however, the Jewish Diaspora had already spread to a number of regions of the world, many of which may have contributed to the make-up of the early Ashkenazi Jewish community. These include the Aegean Island of Delos, Ostia (a main port of Rome), Alexandria, and other places in Macedonia and Asia Minor (Konner 2003, p. 83). Jews also began to migrate north of the Alps, probably from Italy (Ostrer 2001).

By 600 CE, Jews were present in many parts of Europe, with small settlements in GeroraTc0.1y par Europe, .2667 T-di-uin

than J1. Overall, J1 constitutes 14.6% of the Ashkenazim results and 11.9% of the Sephardic results (Semino et al. 2004). Nor is Cohanim status dependent on a finding of haplogroup J1.

Additionally, many other haplogroups among the Ashkenazim, and among the Cohanim in particular, appear to be of Israelite/Middle Eastern origin. According to Behar (2003), the Cohanim possess an unusually high frequency of haplogroup Jin general, reported to comprise nearly 87% of the total Among the Sephardim, the Cohanim results. frequency of 75% is also notably high (Behar 2003). Both groups have dramatically lower percentages of other haplogroups, including haplogroup E. Given the high frequency of haplogroup J among Ashkenazi Cohanim, it appears that J2 may be only slightly less common than J1, perhaps indicating multiple J lineages among the priestly Cohanim dating back to the ancient Israelite kingdom.

However, J1 is the only haplogroup that researchers consider "Semitic" in origin because it is restricted almost completely to Middle Eastern populations, with a very low frequency in Italy and Greece as well (Semino et al. 2004). The group's origins are thought to be in the southern Levant. Its presence among contemporary Sephardic and Ashkenazi populations indicates the preservation of Israelite Semitic ancestry, despite their long settlement in Europe and North Africa. Further, the CMH is considered the putative ancestral haplotype of haplogroup J1 (Di Giacomo et al. 2004).

Table 1 compares the Jewish J1 CMH to the J1 modal haplotypes of other Middle Eastern

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participants from Ashkenazi Jewish groups, all were Eastern Ashkenazim of Polish ancestry. Ashkenazi results were compared to other Jewish groups from Iraq, Libya, Morocco, Ethiopia and Yemen, as well as to non-Jewish Samaritan, Druze and Palestinian populations. Shen found that haplogroup R was found in 10-30% of all the groups, with the exception of Palestinians and Ethiopian Jews, though the majority belonged to R1b and R*. In contrast, the Ashkenazim had the highest percentage of haplogroup R (30%), with two-thirds of those results found in haplogroup R1a (Shen et al. 2004).

As for when R1a1 first entered the Jewish community, Behar (2003) estimated a mean TMRCA (time to the most recent common ancestor) of 663 years before the present using the Simple Stepwise Mutation Model and a mean time of 1,000

entering the Jewish community at this time – except the Khazars.

Additionally, given the relatively late date of

Approximately 19 out of the 23 Q results exhibited the above haplotype, with 3 additional results being a single step mutation away on DYS marker #393 (Behar et al. 2004b, Supplementary Material). In fact, so many identical haplotypes makes it difficult to accurately date Ashkenazi Q, since using a TMRCA calculation indicates these Ashkenazim, both eastern and western groups, could be related within the last hundred years. This, however, seems highly unlikely, given the separation between these

Ashkenazim and very low frequency among eastern Ashkenazim suggests that the high frequency of Sephardic K* may be due to pronounced genetic drift or significantly more K* founders as part of the original Sephardic population. However, it is also possible that Sephardic K* is the result of admixture with African or Mediterranean groups. Haplogroup

Mediterranean and Northern European populations. And haplogroup G is rarely discussed in depth; its origin and distribution remain poorly understood.

Haplogroup G Among Jews

Lack of reported data regarding haplogroup G is surprising given that it is found in approximately 9% of Ashkenazi Jews, with G-M 201* consisting of the great majority of those results (Behar et al. 2004b, Supplementary Material). Behar (2004b) considers G-M 201* a "minor founder haplogroup" likely to have been present in the founding Ashkenazi population due to its very low frequency among non-Jewish Europeans. It is unclear whether Behar's G-M 201* indicates G* results rather than sub-group G1, though this seems unlikely given the lack of G* reported in the Middle East and southern Europe (Cinnioglu et al. 2004). Haplogroup G-M 201* is distributed among both western and eastern Ashkenazi groups (Behar et al. 2004b, Supplementary Material). Unfortunately, so little has been reported about the distribution of this haplogroup among European and Middle Eastern populations that its origins among the Ashkenazim

Among Middle Eastern groups, it is found in Turkish, Druze Arab and Palestinian populations (Cruciani et al. 2004). This cluster is distinguishable from the Balkan form by distinctive STR haplotype differences.

In a study that presented frequencies of haplogroups J and E among various groups, including both Ashkenazi and Sephardic populations, researchers found 14 out of 77 Ashkenazim (18.2%) were E3b, while 12 out of 40 Sephardim were E3b (30%). (Semino et al. 2004). Ashkenazim were also reported to have a frequency of 5.2% of E-M78, while Sephardim had 12.5%. Yet the providence of this sub-clade among Jews continues to remain unresolved. It is possible that Ashkenazi E-M78 is the result of multiple sources. Only further testing of E-M78 among Sephardic and Ashkenazi groups will determine which of Cruciani's clusters Jewish groups belong to and whether Ashkenazi and Sephardic groups share similar E-M78 ancestry. However, the fact that Behar Supplementary Material) found E-M78 to be much more prevalent among eastern versus western Ashkenazim (10 out of 12 results) argues in favor of admixture with Greek, Italian, Balkan or Eastern European populations. It is also possible that the origin of this sub-clade among Ashkenazim is attributable to Khazarian ancestors.

The higher frequency of E-M 78 among Sephardic groups may be the result of pronounced genetic drift, or more likely, gene flow from North African and Spanish populations. The likelihood of European and North African gene flow is further supported by the fact that another sub-clade, E-M 81, occurs only among Sephardim (Semino et al. 2004). It is also found in very high percentages among North Africans. Its frequency among the Sephardim at 5% is comparable to that seen in Spanish populations, again suggesting possible gene flow from Spanish and Berber populations into Sephardic groups.

Behar (2004b) deemed sub-clade E-M 35* a "major founding lineage" among Ashkenazim. But according to Semino (2004), E-M 35* only occurs among 1.3% of Ashkenazim and among 2.5% of Sephardim. Behar, on the other hand, reports finding E-35 at a frequency of 7.1% among Eastern European Ashkenazim, versus 19.1% among Ashkenazim in the west. Not only do Behar's figures contrast sharply with that found by Semino, but Behar also apparently discovered a significant difference in the frequency of this sub-group between eastern and western Jews. The discrepancy between Behar and Semino's results may be

attributable to Behar including sub-clade E-M 123 results within his larger E-M 35 category. The fact that E-M 123 does not appear separately as part of Behar's data suggests that he did, in fact, combine these sub-clades into a single category.

In fact, the best betwu6.9(rp5 Tw4.3(ps()[ri)(y .001/[7(M3to8))5it

significantly greater in Europe and Turkey than in the Middle East (Semino et al. 2004). Thus, whether Jews obtained their J-M 67* ancestry from Israelite, European, or a mixture of ancestors remains unknown at this point in time.

Semino (2004) reports the following regarding the origins of $J-M 67^*$ and $J-M 92^*$:

...JM67* and JM92 could have arrived in Europe from Anatolia via the Bosporus isthmus, as well as by seafaring Neolithic populations who reached southern Italy. JM67* and JM92 could represent, at least in part, the Y-chromosome component that King and Underhill (2002) found to correlate with the distribution, from Anatolia toward Europe, of archaeological painted pottery and anthropomorphic figurines.

Thus, Semino has expertly merged the findings of both Di Giacomo and King/Underhill regarding the origin and expansions of J2 (Neolithic versus Post-Neolithic Aegean/Greek) into a cohesive interpretation regarding the multiple migrations of J2 throughout the Mediterranean world.

The final sub-clade of J2 found among Jews is J-M172*. While 12.2% of Ashkenazim are in this sub-clade, Sephardim have a frequency nearly twice as high (Semino et al. 2004). This sub-clade appears in high percentages among Lebanese and Iraqi populations (20% and 10.2%, respectively) and its presence in this region can probably be attributed to J-M 172* migrations out of Anatolia into the northern areas of the Levant (Semino et al. 2004). J-M 172* is also found in a number of European populations, particularly among French Basque and Thus, its origin among Jewish Italian groups. populations remains unclear, though its absence among Spanish populations, but presence in Sephardic groups, supports the theory that at least some of Jewish J-M 172* may be of Israelite origin. Behar (2004b) also acknowledges that J-M 172* among the Ashkenazim may have originated with multiple ancestral sources.

European Admixture Among the Ashkenazi

Although there has been strenuous opposition to intermarriage with non-Jews since biblical times, including biblical prohibitions, bans, warnings, rules and laws-law is one thing, practice often another.

It should be stressed that it was not only the Jewish communities that opposed such intermarriage.

According to author Raphael Patai, the Christian authorities in Europe outlawed not only "Christian-Jewish sexual relations but also all kinds of social contact between members of the two religions, and backed up their injunctions with generally severe penalties, including the death penalty, imposed on both the Jewish and Christian partners to the crime. However, the very frequency and repetitiousness of the promulgation of such laws are ... indications of their ineffectiveness" (Patai 1989, p. 105). Unfortunately, we do not have an accurate picture of the frequency of such sexual contact between Jews and Christians, since only those relatively few cases which led to criminal prosecution are known. However, Patai believes the number was significantly higher than that reported by the authorities.

Such prohibitions did not prevent such sexual contact among Christians and Jews; nor did it prevent Christians from converting to Judaism, individually and in groups, though it was probably much more common for Jews to convert or simply leave the Jewish community, given the significant oppression they faced in Europe. The word "proselyte" originally designated a Greek person who had converted to Judaism, indicating that conversion among Greek populations must have been common enough at one time to have led to the creation of this descriptive word.

Frankly, the fact that Jews have substantial European ancestry is obvious to most onlookers — many Jews *look* like Europeans. The question for DNA researchers was: How much of that European appearance actually translates into European genetic ancestry?

Patai (1989, pp. 16-17) argues that the Jews had never lived in sufficient reproductive isolation to have developed distinctive genetic features. Rather, he states that "all the available evidence indicates that throughout their history the Jews continually received an inflow of genes from neighboring populations as a result of proselytism, intermarriage, rape, the birth of illegitimate children fathered by Gentiles, and so on." In addition, the ancient

However, Behar's own reported R1b (R-P25), R1a (R-M17) and I (I-P19) haplogroup frequencies indicate that these groups comprise approximately one-quarter to one-third of the Ashkenazi Y chromosomes. Furthermore, Behar acknowledges that these haplogroups are probably indicative of European admixture with Ashkenazi populations.

According to the findings of Behar (2004b, Supplementary Material), R1b comprises 44 out of 442 results, or nearly 10% of Ashkenazi results. Additionally, Behar (2004b) reports that the highly-admixed Dutch Jews have 26.1% R1b results. Haplogroup I (I-P19) comprises 18 out of 442 results, or approximately 4% of the Ashkenazi results. Thus, haplogroups R1b and I among Ashkenazi Jews comprise almost 15% of the DNA results.

Patai (1989, p. 41) provides an example of the cumulative effects of admixture within the Ashkenazi population:

Let us assume that there was a Jewish community somewhere in the Rhineland which in the year [CE] 800 numbered 100 souls, and that it maintained the same number until [CE] 1600. If, in this community, one case of interbreeding occurred once every ten years, then, after 100

years, there were in it 95 per cent Jewish 571t0.45n29ears, thgnrTJT*-0.0, there wmTw()Tj/10lCprogenes; ten . 2r.

Palestinians. In fact, Pereira (2005) deemed H3 "exclusively European."

Sub-clades H4 and H13 are found in Europe, the Caucasus and the Middle East; therefore, the origins of these groups among Ashkenazim remain unresolved. The same can be stated for H*, which began in the Middle East, but is found at its highest frequency in east-central Europe and the Balkans, as well as along the Atlantic fringes of Europe, such as Spain and Ireland (Pereira et al. 2005).

Sub-clade H6 is identified as Eastern European and Trancaucasian in origin and distribution (Pereira et al. 2005). The description is in agreement with findings from another mtDNA study which located H6 and its sub-groups almost exclusively within in Savic and Turkish groups (Loogvali et al. 2004).

populations remain to be fully investigated by DNA researchers.

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