

Jewish Genetics: Abstracts and Summaries

Part 1: Jewish Populations

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This page collects Y-DNA and mtDNA data and analysis related to traditionally Rabbinical Jewish populations of the world, including: Ashkenazim (Jews of Northern and Eastern Europe) • Sephardim (Spanish and Portuguese Jews) • Mizrahim (Middle Eastern Jews) • Italkim (Italian Jews) • Caucasian Mountain Jews (Dagestani and Azerbaijani Jews) • Georgian Jews • Indian Jews • North African Jews • Yemenite Jews • Ethiopian Jews

Steven Bray's study, 2010

Steven M. Bray, Jennifer G. Mulle, Anne F. Dodd, Ann E. Pulver, Stephen Wooding, and Stephen T. Warren. "Signatures of founder effects, admixture, and selection in the Ashkenazi Jewish population." *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* 107:37 (September 14, 2010): pages 16222-16227. 471 unrelated Ashkenazim were genotyped. Among the comparative populations were 1705 continental Europeans and 1251 European-Americans. Also used for comparison were 3 Middle Eastern populations: Palestinian Arabs, Druze, and Bedouins. [Abstract](#):

"The Ashkenazi Jewish (AJ) population has long been viewed as a genetic isolate, yet it is still unclear how population bottlenecks, admixture, or positive selection contribute to its genetic structure. Here we analyzed a large AJ cohort and found higher linkage disequilibrium (LD) and identity-by-descent relative to Europeans, as expected for an isolate. However, paradoxically we also found higher genetic diversity, a sign of an older or more admixed population but not of a long-term isolate. Recent reports have reaffirmed that the AJ population has a common Middle Eastern origin with other Jewish Diaspora populations, but also suggest that the AJ population, compared with other Jews, has had the most European admixture. **Our analysis indeed revealed higher European admixture than predicted from previous Y-chromosome analyses.** Moreover, we also show that admixture directly correlates with high LD, suggesting that admixture has increased both genetic diversity and LD in the AJ population. Additionally, we applied extended haplotype tests to determine whether positive selection can account for the

level of AJ-prevalent diseases. We identified genomic regions under selection that account for lactose and alcohol tolerance, and although we found evidence for positive selection at some AJ-prevalent disease loci, the higher incidence of the majority of these diseases is likely the result of genetic drift following a bottleneck. Thus, the AJ population shows evidence of past founding events; however, admixture and selection have also strongly influenced its current genetic makeup."

Excerpts from page 16222:

"The Ashkenazi Jewish (AJ) population has long been viewed as a genetic isolate, kept separate from its European neighbors by religious and cultural practices of endogamy (1). [...] Y-chromosome studies also indicate only a low amount of admixture with neighboring Europeans (8-10). [...] Consistent with recent reports (13, 20, 23-25), principal component analysis (PCA) using these combined datasets confirmed that the **AJ individuals cluster distinctly from Europeans, aligning closest to Southern European populations along the first principal component**, suggesting a more southern origin, and **aligning with Central Europeans along the second**, consistent with migration to this region (Fig. S1)."

Excerpts from page 16223:

"The higher diversity in the AJ population was paralleled by a lower inbreeding coefficient, F , indicating the AJ population is more outbred than Europeans, not inbred, as has long been assumed ($P < 1e-7$) (Table 1). The greater genetic variation among the AJ population was further confirmed using a pairwise identity-by-state (IBS) permutation test, which showed that average pairs of AJ individuals have significantly less genomewide IBS sharing than pairs of EA or Euro individuals (empirical P value < 0.05). Thus, our results show that the AJ population is more genetically diverse than Europeans. [...] We also compared the genome-wide haplotype structure between the AJ and European populations using a haplotype modeling algorithm (26), which models phased haplotypes as edges that pass through nodes at each SNP across the genome. The number of nodes in the model is correlated to the genetic variation, and the number of edges per node is inversely correlated to the haplotype length. Using this model, we found that the AJ population has a greater number of nodes (0.88-1.11% more) but fewer edges per node (3.82-4.76% fewer) compared with the Europeans ($P < 1e-50$) (Table S2), indicating both higher genetic variation and longer haplotypes in the AJ population, consistent with our previous results. [...] We removed SNPs in high LD and measured the mean heterozygosity per locus across the combined Middle Eastern populations (Bedouin, Palestinian, and Druze) and found that the AJ population had higher heterozygosity (0.3121 vs. 0.3053, $P < 1e-23$). Other reports showing no increased heterozygosity in the AJ relative to Middle Eastern populations (13, 22) were probably limited by lower AJ sample sizes, which our dataset overcomes. Thus, the increased genetic diversity and LD appear consistent with **admixture** rather than founding effects. [...] To evaluate admixture in the AJ population, we investigated the similarity between AJ and HGDP populations using PCA as well as a population clustering algorithm (32). Both analyses show that **AJ individuals cluster between Middle Eastern and European populations** (Fig. 2 A and B and Fig. S2A), corroborating other recent reports (13, 20, 22, 23, 25). Interestingly, our population clustering reveals that the AJ population shows an admixture pattern **subtly more similar to Europeans than Middle Easterners** (Fig. 2 A and C, *Lower*), while also verifying that the Ashkenazi Jews possess a unique genetic signature clearly distinguishing them from the other two regions (Fig. 2C, *Upper*). The fixation index, F_{ST} ,

calculated concurrently to the PCA, confirms that there is a **closer relationship between the AJ and several European populations (Tuscans, Italians, and French) than between the AJ and Middle Eastern populations** (Fig. S2B)."

Excerpts from pages 16223-16224:

"Although the **proximity of the AJ and Italian populations could be explained by their admixture** prior to the Ashkenazi settlement in Central Europe (13), it should be noted that different demographic models may potentially yield similar principal component projections (33); thus, it is **also consistent that the projection of the AJ populations is primarily the outcome of admixture with Central and Eastern European hosts** that coincidentally shift them closer to Italians along principle component axes relative to Middle Easterners."

Excerpts from page 16224:

"We used the combined Palestinian and Druze populations to represent the Middle Eastern ancestor and tested three different European groups as the European ancestral population (SI Materials and Methods). Using these proxy ancestral populations, **we calculated the amount of European admixture in the AJ population to be 35 to 55%**. Previous estimates of admixture levels have varied widely depending on the chromosome or specific locus being considered (18), with studies of Y-chromosome haplogroups estimating from 5 to 23% European admixture (8, 9). Our higher estimate is in part a result of the use of different proxies for the Jewish ancestral population."

Excerpts from page 16226:

"Multiple studies have found that the 'lactase-persistence' allele at the *LCT* locus was selected for in Northern Europeans, with the selective sweep presumably occurring at the time of the domestication of cattle 2,000 to 20,000 y ago (42, 43). The absence of this allele in our data would suggest that the selective sweep was complete before the Ashkenazi establishment in Europe. Moreover, the prevalence of lactase deficiency in Ashkenazi Jews has been estimated at 60 to 80% (44), further corroborating the lack of selection for the *LCT* locus in the AJ population. [...] Intriguingly, the AJ population has long been known to have lower levels of alcoholism than other groups (16, 46), with one study showing that Jewish males have a 2.5-fold lower lifetime rate of alcohol abuse/dependence compared with non-Jews (47). [...] Our results, together with a recent study showing that variation in the *ALDH2* promoter affects alcohol absorption in Jews (48), now suggest that genetic factors and selective pressure at the *ALDH2* locus may have contributed to the low levels of alcoholism."

Quinn Eastman of Emory University with ScienceDaily staff. ["Analysis of Ashkenazi Jewish Genomes Reveals Diversity, History."](#) *ScienceDaily* (August 27, 2010). Excerpts:

"Through genomic analysis, researchers at Emory University School of Medicine have shown that the Ashkenazi Jewish population is genetically more diverse than people of European descent, despite previous assumptions that Ashkenazi Jews have been an isolated population. In addition, analyses of disease-related genes of higher prevalence in the Ashkenazi Jewish population indicate that only a minority of traits show signs of positive selection, suggesting that most have arisen through random genetic drift. [...] 'We were surprised to find evidence that

Ashkenazi Jews have higher heterozygosity than Europeans, contradicting the widely-held presumption that they have been a largely isolated group,' says first author Steven Bray, PhD, a postdoctoral fellow in Warren's laboratory. [...] High linkage disequilibrium can come either from an isolated population (for example, an island whose residents are all descendents of shipwreck survivors) or the relatively recent mixture of separate populations. Bray and his colleagues did find evidence of elevated linkage disequilibrium in the Ashkenazi Jewish population, but were able to show that this matches signs of interbreeding or 'admixture' between Middle Eastern and European populations. The researchers were able to estimate that between 35 and 55 percent of the modern Ashkenazi genome comes from European descent. [...] He adds that his group's analysis agrees with a recently published study from New York University and Albert Einstein College of Medicine, and supports estimates of a high level of European admixture, accounting for up to half of the genetic make-up of contemporary Ashkenazi. The genomic analysis also provided information about selection pressures on mutations prevalent in the Ashkenazi Jewish population, such as those leading to conditions like Tay-Sachs disease or mutations in cancer susceptibility genes like BRCA1. [...]"

Harry Ostrer's study, 2010

Gil Atzmon, Li Hao, Itsik Pe'er, Christopher Velez, Alexander Pearlman, Pier Francesco Palamara, Bernice Morrow, Eitan Friedman, Carole Oddoux, Edward Burns, Harry Ostrer. ["Abraham's Children in the Genome Era: Major Jewish Diaspora Populations Comprise Distinct Genetic Clusters with Shared Middle Eastern Ancestry."](#) *The American Journal of Human Genetics* 86:6 (June 3, 2010): pages 850-859. Abstract:

"For more than a century, Jews and non-Jews alike have tried to define the relatedness of contemporary Jewish people. Previous genetic studies of blood group and serum markers suggested that Jewish groups had Middle Eastern origin with greater genetic similarity between paired Jewish populations. However, these and successor studies of monoallelic Y chromosomal and mitochondrial genetic markers did not resolve the issues of within and between-group Jewish genetic identity. Here, genome-wide analysis of seven Jewish groups (Iranian, Iraqi, Syrian, Italian, Turkish, Greek, and Ashkenazi) and comparison with non-Jewish groups demonstrated distinctive Jewish population clusters, each with shared Middle Eastern ancestry, proximity to contemporary Middle Eastern populations, and variable degrees of European and North African admixture. Two major groups were identified by principal component, phylogenetic, and identity by descent (IBD) analysis: Middle Eastern Jews and European/Syrian Jews. The IBD segment sharing and the proximity of European Jews to each other and to southern European populations suggested similar origins for European Jewry and refuted large-scale genetic contributions of Central and Eastern European and Slavic populations to the formation of Ashkenazi Jewry. Rapid decay of IBD in Ashkenazi Jewish genomes was consistent with a severe bottleneck followed by large expansion, such as occurred with the so-called demographic miracle of population expansion from 50,000 people at the beginning of the 15th century to 5,000,000 people at the beginning of the 19th century. Thus, this study demonstrates that European/Syrian and Middle Eastern Jews represent a series of geographical isolates or clusters woven together by shared IBD genetic threads."

["Common Genetic Threads Link Thousands of Years of Jewish Ancestry."](#) *ScienceDaily* (June 4, 2010).

Excerpts:

"The genetic, cultural and religious traditions of contemporary Jewish people originated in the Middle East over three thousand years ago. Since that time, Jewish communities have migrated from the Middle East into Europe, North Africa and across the world. ... This study shows that although Jewish people experienced genetic mixing with surrounding populations, they retained a genetic coherence along with a religious one. 'Previous genetic studies of blood group and serum markers suggested that Jewish groups had Middle Eastern origin with greater genetic similarity between paired Jewish populations,' says senior study author, Dr. Harry Ostrer... 'More recent studies of Y chromosomal and mitochondrial DNA have pointed to founder effects of both Middle Eastern and local origin, yet, the issue of how to characterize Jewish people as mere coreligionists or as genetic isolates that may be closely or loosely related remained unresolved. ... Yet the genomes of the Jewish Diaspora groups have distinctive features that are representative of each group's genetic history.' says Dr. Ostrer. 'Our study demonstrated that the studied Jewish populations represent a series of geographical isolates or clusters with genetic threads that weave them together,' added Dr. Gil Atzmon... The researchers identified distinct Jewish population clusters that each exhibited a shared Middle Eastern ancestry, proximity to contemporary Middle Eastern populations and variable degrees of European and North African genetic intermingling. ... The two major groups, Middle Eastern Jews and European Jews, were timed to have diverged from each other approximately 2500 years ago. Southern European populations show the greatest proximity to Ashkenazi, Sephardic and Italian Jews, reflecting the **large-scale southern European conversion and admixture** known to have occurred over 2,000 years ago during the formation of the European Jewry. An apparent North African ancestry component was also observed as was present in the Sephardic groups potentially reflecting gene flow from Moorish to Jewish populations in Spain from 711 to 1492. ... Dr. Ostrer noted, 'The study supports the idea of a Jewish people linked by a shared genetic history. Yet the admixture with European people explains why so many European and Syrian Jews have blue eyes and blonde hair.'"

Razib Khan. ["Genetics and the Jews."](#) *Discover Magazine - Gene Expression* (June 6, 2010).

"Dienekes Pontikos". ["Two Major Groups of Living Jews."](#) *dienekes.blogspot.com* (June 3, 2010).

Alla Katsnelson. ["Jews worldwide share genetic ties: But analysis also reveals close links to Palestinians and Italians."](#) *Nature.com* (June 3, 2010). Excerpts:

"Different communities of Jews around the world share more than just religious or cultural practices -- they also have strong genetic commonalities, according to the largest genetic analysis of Jewish people to date. But the study also found strong genetic ties to non-Jewish groups, with the closest genetic neighbours on the European side being Italians, and on the Middle Eastern side the Druze, Bedouin and Palestinians. Researchers in New York and Tel Aviv conducted a genome-wide analysis on 237 individuals from seven well-established Jewish communities around the world, hailing from Iran, Iraq, Italy, Greece, Turkey, Syria and eastern Europe. The team then compared these genetic profiles to those of non-Jews in the same geographic regions based on data from the Human Genome Diversity Project.... The genetic ties identified in the present study... are consistent with the results of previous work, says Sarah Tishkoff, a human geneticist at the University of Pennsylvania in Philadelphia, 'but this is, I would say, the first study to put everything together into a big picture by looking at a large number of sites in the nuclear genome'. The researchers analysed single-letter differences in the genome called single nucleotide polymorphisms, longer segments of DNA shared between different Jewish groups, as well as deleted or duplicated stretches of DNA called copy-number variants. Although the groups

had strong genetic commonalities, the results also showed a varying degree of genetic mixing with nearby non-Jewish populations. The most genetically distinct Jewish communities, compared both to other Jewish groups and to nearby non-Jews, were those from Iran and Iraq. ...one theory proposes that Ashkenazi Jews (of eastern European origin) are largely descended from Khazars in eastern Europe who converted to Judaism, but the genetic closeness between Ashkenazi Jews and other non-European Jews does not support this idea. ...Ostrer says... 'We really see the events of the Jewish diaspora in the genomes of Jewish people.' ... Ostrer says that the researchers are extending their analysis to more Jewish populations. They also hope to apply the findings to medical research..."

Sharon Begley. ["The DNA of Abraham's Children."](#) *Newsweek* Web Exclusive (June 3, 2010). Excerpts:

"The latest DNA volume weighs in on the controversial, centuries-old (and now revived in a 2008 book) claim that European Jews are all the descendants of Khazars, a Turkic group of the north Caucasus who converted to Judaism in the late eighth and early ninth century. The DNA has spoken: no. ... To sort it out, researchers collected DNA from Iranian, Iraqi, Syrian, and Ashkenazi Jews around New York City; Turkish Sephardic Jews in Seattle; Greek Sephardic Jews in Thessaloniki and Athens; and Italian Jews in Rome as part of the Jewish HapMap Project. (All four grandparents of each participant had to have come from the same community.) ... Jewish populations, that is, have retained their genetic coherence just as they have retained their cultural and religious traditions, despite migrations from the Middle East into Europe, North Africa, and beyond over the centuries, says geneticist Harry Ostrer of NYU Langone Medical Center, who led the study. Each Diaspora group has distinctive genetic features 'representative of each group's genetic history,' he says, but each also 'shares a set of common genetic threads' dating back to their common origin in the Middle East. 'Each of the Jewish populations formed its own distinctive cluster, indicating the shared ancestry and relative genetic isolation of the members of each of those groups.' The various Jewish groups were more related to each other than to non-Jews, as well. Within every Jewish group, individuals shared as much of their genome as two fourth or fifth cousins, with Italian, Syrian, Iranian, and Iraqi Jews the most inbred, in the sense that they married within the small, close-knit community. In general, the genetic similarity of any two groups was larger the closer they lived to one another, but there was an exception: Turkish and Italian Jews were most closely related genetically, but are quite separated geographically. Historical records suggest that Iranian and Iraqi Jews date from communities that formed in Persia and Babylon, respectively, in the fourth to sixth centuries B.C.E., and the DNA confirms that. The genetic signatures of these groups show that they remained relatively isolated--inbred--for some 3,000 years. The DNA also reveals that these Middle Eastern Jews diverged from the ancestors of today's European Jews about 100 to 150 generations ago, or sometime during the first millennium B.C.E."

Andrea Anderson. ["Study Points to Shared Genetic Patterns amongst Jewish Populations."](#) *GenomeWeb News* (June 3, 2010). Excerpts:

"The research, scheduled to appear online today in the *American Journal of Human Genetics*, suggests all Jewish populations tested fall into a large genetic cluster that contains population-specific sub-groups with different levels of Middle Eastern ancestry and European and North African admixture. 'It's really cool that Jews have maintained this degree of genetic coherence over time,' senior author Harry Ostrer, a human genetics researcher with the New York University School of Medicine, told *GenomeWeb Daily News*. Within this larger Jewish group,

the team found two main sub-groups: one representing Jewish populations in Europe and Syria and another containing Jewish populations from Iran and Iraq. ...studies of most Jewish populations have relied on relatively limited Y-chromosome or mitochondrial DNA sequence data. For the current study, researchers used the Affymetrix 6.0 microarray platform to genotype 305 Jewish participants... These individuals came from one of seven major Jewish groups, representing Ashkenazi Jews, Sephardic Jews from Italy, Greece, and Turkey, and Mizrahi Jews from Iran, Iraq, and Syria. After quality control steps, the team was left with data for 237 Jewish individuals, which they compared with hundreds of non-Jewish samples from the Human Genome Diversity Project... In particular, Ostrer said, the researchers were surprised to see such a high level of genetic relatedness in European Jewry, with Ashkenazi, Sephardic, Italian, and Syrian Jews clustering more closely to one another than to Jewish populations in Iran and Iraq. The results argue against the notion that Ashkenazi Jews are descendants of Eastern European groups such as the Slavs or Khazars, Ostrer noted. 'There's just no evidence for that.' Instead, Ashkenazi Jews seem to be more genetically similar to non-Jewish populations in Northern Italy, France, and Sardinia. Meanwhile, Jewish populations in Iran and Iraq tended to cluster closer to non-Jewish Palestinian, Druze, and Bedouin populations than to Europeans. ... Down the road, the team intends to genotype additional populations..."

Naama Kopelman's study, 2009

Naama M. Kopelman, Lewi Stone, Chaolong Wang, Dov Gefel, Marcus W. Feldman, Jossi Hillel, and Noah A. Rosenberg. ["Genomic microsatellites identify shared Jewish ancestry intermediate between Middle Eastern and European populations."](#) *BMC Genetics* 10:80 (published online only, December 8, 2009). ([Mirror](#)) Excerpts:

"We perform a genome-wide population-genetic study of Jewish populations, analyzing 678 autosomal microsatellite loci in 78 individuals from four Jewish groups together with similar data on 321 individuals from 12 non-Jewish Middle Eastern and European populations. ... We find that the Jewish populations show a high level of genetic similarity to each other, clustering together in several types of analysis of population structure. Further, Bayesian clustering, neighbor-joining trees, and multidimensional scaling place the Jewish populations as intermediate between the non-Jewish Middle Eastern and European populations. ... These results support the view that the Jewish populations largely share a common Middle Eastern ancestry and that over their history they have undergone varying degrees of admixture with non-Jewish populations of European descent. ... The Middle Eastern populations included in the study were Bedouin (46), Druze (42), Mozabite (29), and Palestinian (46). The European populations were Adygei (17), Basque (24), French (28), Italian (13), Orcadian (15), Russian (25), Sardinian (28), and Tuscan (8). Middle Eastern and European non-Jewish individuals were taken from the H952 subset of the HGDP-CEPH panel [24]. The Jewish samples included Ashkenazi Jews (20), Moroccan Jews (20), Tunisian Jews (20), and Turkish Jews (20). ... Figure 2 illustrates the major clustering solutions for each value of K from 2 to 6. ... For K = 4, the Druze, Bedouins and Palestinians are each largely distinct in cluster membership coefficients; the Jewish populations show somewhat greater similarity to these three Middle Eastern groups than do the European populations other than the Adygei, but they also have greater similarity to the European populations than do the Middle Eastern groups. Among the European populations, the Adygei population, from the Caucasus region, shows some similarity in cluster membership coefficients

to the Jewish populations, especially to the Ashkenazi population (this similarity is also observable for $K = 2$ and $K = 3$). For $K = 5$, the new cluster produced contains most Palestinian individuals, as well as sizable components of the four Jewish populations, the Adygei and the Bedouins. For $K = 6$, this cluster is further subdivided, producing one cluster that corresponds mainly to Palestinians and one cluster that corresponds mainly to the Jewish populations and to a lesser extent, the Adygei and Bedouins. ... French and Palestinians also provide the most similar pair for Moroccan Jews, with coefficients very nearly equal to the values in the case of Turkish Jews ($r = 0.45$ for French). The most similar pair for Ashkenazi Jews consists of French and Turkish Jews ($r = 0.50$), whereas for Tunisian Jews the most similar pair consists of Sardinians and Palestinians ($r = 0.42$ for Sardinians). For all four Jewish populations, many of the ten closest pairs of populations consist of one Middle Eastern population and either one European population or one of the other Jewish populations. ... The Tunisian Jews are located further from the pooled European populations than are any of the other Jewish populations... The plot places the Palestinians closer to the Moroccan and Turkish Jews than to the other Jewish populations... It further suggests that the Tunisian Jews are the most distinctive Jewish population, whereas the Ashkenazi, Turkish, and Moroccan Jewish populations are genetically more similar to each other. ... The Turkish Jews are not easily distinguished from the Ashkenazi and Moroccan Jews in the MDS analysis, and are placed in positions overlapping with the Ashkenazi and Moroccan Jewish individuals. ... While the ultimate fate of the Khazar population remains unknown, the theory has been advanced that a large fraction of the ancestry of eastern European Jews derives from the **Khazars** [60,62-64]. This theory would predict ancestry for the eastern European Ashkenazi Jewish population to be distinct from that of the other Jewish populations in the study. Although we did not observe such a distinct ancestry, it is noteworthy that in some analyses ... we did detect similarity of the Adygei, a north Caucasian group from the area once occupied by the Khazars, to the Jewish populations. ... Among the Jewish populations, the Tunisians were found to be the least variable and most distinctive, and their genotypes could be most easily distinguished from those of the three other Jewish populations. This result suggests a smaller population size and greater degree of genetic isolation for this population compared to the other Jewish groups, or a significant level of admixture with local populations. These explanations are not incompatible, as it is possible that early admixture was followed by a long period of isolation. Some **Berber** admixture of Tunisian Jews may very well have taken place [61,63], and documentation of rare Mendelian disorders in Tunisian Jews [67-69] supports a view of isolation with relatively few founding individuals. A smaller-scale autosomal study that did not include Tunisian Jews found the neighboring Libyan Jewish population to be distinctive with respect to other Jewish populations [66], and our results concerning the Tunisian Jewish population might reflect a similar phenomenon."

University College London study, 2002

Judy Siegel-Itzkovich. "Dad was out and about, while Mom stayed home." *Jerusalem Post* (June 16, 2002): 9. Excerpts:

"Data on the Y chromosome indicates that the males originated in the Middle East, while the mothers' mitochondrial DNA seems to indicate a local Diaspora origin in the female community founders.... [Karl Skorecki described the study as] 'very exciting' [and] 'very important'...."

Nicholas Wade. ["In DNA, New Clues to Jewish Roots."](#) *The New York Times* (May 14, 2002): F1 (col. 1).

Excerpts:

"The emerging genetic picture is based largely on two studies, one published two years ago and the other this month, that together show that the men and women who founded the Jewish communities had surprisingly different genetic histories.... A new study now shows that the women in nine Jewish communities from Georgia, the former Soviet republic, to Morocco have vastly different genetic histories from the men.... The **women's** identities, however, are a mystery, because, unlike the case with the men, their genetic signatures are **not related** to one another or **to those of present-day Middle Eastern populations**.... The new study, by Dr. David Goldstein, Dr. Mark Thomas and Dr. Neil Bradman of University College in London and other colleagues, appears in *The American Journal of Human Genetics* this month.... His [Goldstein's] own speculation, he said, is that most Jewish communities were formed by unions between Jewish men and local women, though he notes that the women's origins cannot be genetically determined.... Like the other Jewish communities in the study, the Ashkenazic community of Northern and Central Europe, from which most American Jews are descended, shows less diversity than expected in its mitochondrial DNA, perhaps reflecting the maternal definition of Jewishness. But unlike the other Jewish populations, it does not show signs of having had very few female founders. It is possible, Dr. Goldstein said, that the Ashkenazic community is a mosaic of separate populations formed the same way as the others.... 'The authors are correct in saying the historical origins of most Jewish communities are unknown,' Dr. [Shaye] Cohen [of Harvard University] said. 'Not only the little ones like in India, but even the mainstream Ashkenazic culture from which most American Jews descend.'.... If the founding mothers of most Jewish communities were local, that could explain why Jews in each country tend to resemble their host community physically while the origins of their Jewish founding fathers may explain the aspects the communities have in common, Dr. Cohen said.... The Y chromosome and mitochondrial DNA's in today's Jewish communities reflect the ancestry of their male and female founders but say little about the rest of the genome... Noting that the Y chromosome points to a Middle Eastern origin of Jewish communities and the mitochondrial DNA to a possibly local origin, Dr. Goldstein said that the composition of ordinary chromosomes, which carry most of the genes, was impossible to assess. 'My guess,' Dr. Goldstein said, 'is that the rest of the genome will be a mixture of both.'"

Mark G. Thomas, Michael E. Weale, Abigail L. Jones, Martin Richards, Alice Smith, Nicola Redhead, Antonio Torroni, Rosaria Scozzari, Fiona Gratrix, Ayele Tarekegn, James F. Wilson, Cristian Capelli, Neil Bradman, and David B. Goldstein. ["Founding Mothers of Jewish Communities: Geographically Separated Jewish Groups Were Independently Founded by Very Few Female Ancestors."](#) *The American Journal of Human Genetics* 70:6 (June 2002): 1411-1420. The study collected mtDNA from about 600 Jews and non-Jews from around the world, including 78 Ashkenazic Jews and Georgians, Uzbeks, Germans, Berbers, Ethiopians, Arabs, etc. 17.9% of sampled Iraqi Jews have an mtDNA pattern known as U3, compared to 2.6% of Ashkenazic Jews, 0.9% of Moroccan Jews, 1.7% of ethnic Berbers, 1.1% of ethnic Germans, 0.0% of Iranian Jews, 0.0% of Georgian Jews, 0.0% of Bukharian Jews, 0.0% of Yemenite Jews, 0.0% of Ethiopian Jews, 0.0% of Indian Jews, 0.0% of Syrian Arabs, 0.0% of Georgians, 0.0% of Uzbeks, 0.0% of Yemeni Arabs, 0.0% of Ethiopians, 0.0% of Asian Indians, 0.0% of Israeli Arabs. (According to Vincent Macaulay, U3 is found also among some Turks, Iraqis, Caucasus tribes, Alpine Europeans, North Central Europeans, Kurds, Azerbaijanis, Eastern Mediterranean Europeans, Central Mediterranean Europeans, Western Mediterranean Europeans, and southeastern Europeans.) Another pattern, called Haplotype I, was found among 12.1% of Bukharan Jews, 2.6% of Ashkenazic Jews, 1.8% of Iraqi Jews, 1.3% of Iranian Jews, 1.1%

of ethnic Germans, and 2.4% of ethnic Asian Indians, and none of the other groups among individuals tested. (According to Vincent Macaulay, Haplotype I is found also among some Northeastern Europeans, North Central Europeans, Caucasus tribes, Northwestern Europeans, and Scandinavians.) Yet another pattern, called Haplotype J1, was found among 12.5% of Iraqi Jews, 2.7% of Iranian Jews, 9.2% of Yemenite Jews, and 1.7% of Israeli Arabs, and none of the other groups among individuals tested. (According to Vincent Macaulay, Haplotype J1 is found also among some Iraqi Arabs, Bedouins, Palestinian Arabs, and Azerbaijanis.) To compare with Vincent Macaulay's research on mtDNA, visit [Supplementary data from Richards et al. \(2000\)](#). Abstract:

"We have analyzed the maternally inherited mitochondrial DNA from each of nine geographically separated Jewish groups, eight non-Jewish host populations, and an Israeli Arab/Palestinian population, and we have compared the differences found in Jews and non-Jews with those found using Y-chromosome data that were obtained, in most cases, from the same population samples. The results suggest that most Jewish communities were founded by relatively few women, that the founding process was independent in different geographic areas, and that subsequent genetic input from surrounding populations was limited on the female side. In sharp contrast to this, the paternally inherited Y chromosome shows diversity similar to that of neighboring populations and shows no evidence of founder effects. These sex-specific differences demonstrate an important role for culture in shaping patterns of genetic variation and are likely to have significant epidemiological implications for studies involving these populations. We illustrate this by presenting data from a panel of X-chromosome microsatellites, which indicates that, in the case of the Georgian Jews, the female-specific founder event appears to have resulted in elevated levels of linkage disequilibrium."

Excerpt:

"Unfortunately, in many cases, it is not possible to infer the geographic origin of the founding mtDNAs within the different Jewish groups with any confidence.... In two cases, however, comparison [of Jewish mtDNA] with the published data does provide some indication of the possible geographic origins of the modal types. The modal type in the Bene Israel is a one-step mutational neighbor of a haplotype present in the Indian sample, as well as being a one-step neighbor of a type previously identified in India (Kivisild et al. 1999a, 1999b). Similarly, the commonest type in the Ethiopian Jewish sample is also present in the non-Jewish Ethiopian sample and occurs in the worldwide mtDNA database only in Somalia (Watson et al. 1997). Other high-frequency haplotypes in the Ethiopian Jewish sample are also found almost entirely in Africa (data not shown). The lack of an indication of a Middle Eastern origin for these haplotypes, on the basis of the Richards database, makes local recruitment a more reasonable explanation in these two cases." (pp. 1415, 1417)

Martin Richards. ["Beware the gene genies."](#) *The Guardian* (February 21, 2003). Excerpts:

"Studies of human genetic diversity have barely begun. Yet the fashion for genetic ancestry testing is booming.... Buoyed by the hype, the private sector has been moving in. Other groups, such as Jews, are now being targeted. This despite the fact that Jewish communities have little in common on their mitochondrial side - the maternal line down which Judaism is traditionally inherited. It's the male side that shows common ancestry between different Jewish communities - so, of course, that's what the geneticists focus on."

Ariella Oppenheim's study, 2001

Almut Nebel, Dvora Filon, Bernd Brinkmann, Partha P. Majumder, Marina Faerman, and Ariella Oppenheim. "[The Y Chromosome Pool of Jews as Part of the Genetic Landscape of the Middle East.](#)" *The American Journal of Human Genetics* 69:5 (November 2001): 1095-1112. Abstract:

"A sample of 526 Y chromosomes representing six Middle Eastern populations (Ashkenazi, Sephardic, and Kurdish Jews from Israel; Muslim Kurds; Muslim Arabs from Israel and the Palestinian Authority Area; and Bedouin from the Negev) was analyzed for 13 binary polymorphisms and six microsatellite loci. The investigation of the genetic relationship among three Jewish communities revealed that Kurdish and Sephardic Jews were indistinguishable from one another, **whereas both differed slightly, yet significantly, from Ashkenazi Jews.** The differences among Ashkenazim may be a result of low-level gene flow from European populations and/or genetic drift during isolation. Admixture between Kurdish Jews and their former Muslim host population in Kurdistan appeared to be negligible. In comparison with data available from other relevant populations in the region, Jews were found to be more **closely related to groups in the north of the Fertile Crescent (Kurds, Turks, and Armenians)** than to their Arab neighbors. The two haplogroups Eu 9 and Eu 10 constitute a major part of the Y chromosome pool in the analyzed sample. Our data suggest that Eu 9 originated in the northern part, and Eu 10 in the southern part of the Fertile Crescent... Palestinian Arabs and Bedouin differed from the other Middle Eastern populations studied here, mainly in specific high-frequency Eu 10 haplotypes not found in the non-Arab groups. These chromosomes might have been introduced through migrations from the Arabian Peninsula during the last two millennia..." ([Mirror](#))

Excerpts:

"The most-frequent haplotype in all three Jewish groups (the CMH [haplotype 159 in the Appendix]) segregated on a Eu 10 background, together with the three modal haplotypes in Palestinians and Bedouin (haplotypes 144, 151, and 166). The dominant haplotype of the Muslim Kurds (haplotype 114) was only one microsatellite-mutation step apart from the CMH and the modal haplotype of the Bedouin, but it belonged to haplogroup Eu 9. Previous studies of Y chromosome polymorphisms reported a small European contribution to the Ashkenazi paternal gene pool (Santachiara-Benerecetti et al. 1993; Hammer et al. 2000). In our sample, this low-level gene flow may be reflected in the Eu 19 chromosomes, which are found at elevated frequency (12.7%) in Ashkenazi Jews and which are very frequent in Eastern Europeans (54%-60%) (Semino et al. 2000). Alternatively, it is attractive to hypothesize that Ashkenazim with Eu 19 chromosomes represent descendants of the **Khazars**, originally a Turkic tribe from Central Asia, who settled in southern Russia and eastern Ukraine and converted en masse to Judaism in the ninth century of the present era, as described by Yehuda Ha-Levi in 1140 A.D. (Dunlop 1954)."

Page 1104: "It is worth mentioning that, on the basis of protein polymorphisms [which are not to be confused with Y chromosome polymorphisms], most Jewish populations cluster very closely with Iraqis (Livshits et al. 1991) that the latter, in turn, cluster very closely with Kurds (Cavalli-Sforza et al. 1994)."

Observations:

In the article ["The DNA revolution in population genetics"](#) by Luigi Luca Cavalli-Sforza, *Trends Genet.* 14, No. 2: 60-65, we learn that protein polymorphisms were studied in the previous generation of population genetic analysis, hence the term "classical polymorphisms" is often applied to them, but today the new technologies test Y DNA and mtDNA instead.

At [Table 1: Y Chromosome Haplogroup Distribution](#), it is indicated that 11.6 percent of Muslim Kurds and 9.4 percent of Bedouins also have Eu 19 chromosomes; hence, genetic drift rather than admixture with East Europeans may theoretically explain Eu 19's presence among Ashkenazi Jews. On the other hand, the origin of Eu 19 (now known as R1a1) is from eastern Europe thousands of years ago, perhaps the kurgan culture, and is found in much higher quantities among Slavs (like Sorbs, Belarusians, Ukrainians, and Poles) than any Middle Eastern tribe. For further data consult figure 1 in Ornella Semino, et al., ["The genetic legacy of Paleolithic Homo sapiens sapiens in extant Europeans: a Y chromosome perspective,"](#) *Science* 290(5494) (Nov. 10, 2000): 1155-1159, as well as the [2003 Levite study referenced here](#). [Update added December 21, 2013: The Ashkenazic Levite variety of R1a1, sometimes called R1a-M582, was later found to be from an Iranian source rather than an East European source.]

In Figure 3 of Nebel et al.'s 2001 paper, it can be seen that while some Muslim Kurds possess the Cohen Modal Haplotype (at a frequency of 0.011), and even some Palestinian Arabs do (at a frequency of 0.021), more Muslim Kurds (0.095) have a haplotype that is a different Y DNA lineage, with a different allele number in one of the six microsatellite loci. Figure 3 is also interesting since it shows that 0.021 of Palestinian Arabs have the Cohen Modal Haplotype.

Judy Siegel. ["Genetic evidence links Jews to their ancient tribe."](#) *Jerusalem Post* (November 20, 2001). Excerpts:

"Despite being separated for over 1,000 years, Sephardi Jews of North African origin are genetically indistinguishable from their brethren from Iraq, according to The Hebrew University of Jerusalem. They also proved that Sephardi Jews are very close genetically to the Jews of Kurdistan, and only slight differences exist between these two groups and Ashkenazi Jews from Europe. These conclusions are reached in an article published recently in the American Journal of Human Genetics and written by Prof. Ariella Oppenheim of the Hebrew University (HU) and Hadassah-University Hospital in Ein Kerem. Others involved are German doctoral student Almut Nebel, Dr. Marina Faerman of HU, Dr. Dvora Filon of Hadassah-University Hospital, and other colleagues from Germany and India. The researchers conducted blood tests of Ashkenazi, Sephardi and Kurdish Jews and examined their Y chromosomes, which are carried only by males. They then compared them with those of various Arab groups - Palestinians, Bedouins, Jordanians, Syrians and Lebanese - as well as to non-Arab populations from Transcaucasia - Turks, Armenians and Moslem Kurds. The study is based on 526 Y chromosomes typed by the Israeli team and additional data on 1,321 individuals from 12 populations... Surprisingly, the study shows a closer genetic affinity by Jews to the non-Jewish, non-Arab populations in the northern part of the Middle East than to Arabs."

["Study: North African, Iraqi Jewry nearly genetic twins."](#) *Jerusalem Post* (November 19, 2001). Excerpts:

"Sephardic North African Jews are genetic twins of their Iraq brethren, says a study by

researchers [Nebel, Faerman, et al.] at the Hebrew University of Jerusalem.... Although the genetic affinity of Jews to the ancient, Middle Eastern non-Arab populations is greater than to Arabs (as shown in the present study), a substantial portion of Y chromosomes of Jews (70%) and Palestinian Muslim Arabs (50%) belong to the same chromosome pool. An additional 30% of the Muslim Arab chromosomes belong to a very closely related lineage... [because] part - or perhaps the majority - of Muslim Arabs in the Land of Israel descended from local inhabitants, mainly Christians and Jews, who had converted after the Islamic conquest of the 7th century A.D."

Tamara Traubman. "[Study finds close genetic connection between Jews, Kurds.](#)" *Ha'aretz* (November 21, 2001). Excerpts:

"The people closest to the Jews from a genetic point of view may be the Kurds, according to results of a new study at the Hebrew University. Scientists who participated in the research said the findings seem to indicate both peoples had common ancestors who lived in the northern half of the fertile crescent, where northern Iraq and Turkey are today. Some of them, it is assumed, wandered south in pre-historic times and settled on the eastern shores of the Mediterranean. Professor Ariella Oppenheim and Dr. Marina Feirman [sic: Faerman], who carried out the research at the Hebrew University, said they were surprised to find a closer genetic connection between the Jews and the populations of the fertile crescent than between the Jews and their Arab neighbors... The present study, however, involved more detailed and thorough examinations than previous research. In addition, this was the first comparison of the DNA of Jews and Kurds... The study's findings are published in the current issue of *The American Journal of Human Genetics*. The researchers used the DNA of 1,847 Jewish men of Ashkenazi, Sephardi and Kurdish descent; Muslims and Christians of Kurdish, Turkish and Armenian descent; various Arab populations; and Russians, Poles and residents of Belarus."

"The Jewish World: This Week in Israel." *Global Jewish Agenda* (Jewish Agency for Israel, November 22, 2001). Excerpts:

"A new study by the Hebrew University in Jerusalem reveals: the Kurds are the people closest to the Jews genetically. Scientists who carried out the study, including Prof. Ariella Friedman [sic: Oppenheim] and Dr. Marina Fireman [sic: Faerman], say that according to the findings, the Jews and the Kurds share common ancient forefathers, who lived in the northern part of the Fertile Crescent (a part of contemporary Iraq and Syria). Some moved southward in pre-historic times and settled along the eastern seaboard of the Mediterranean. The researchers say that they were surprised to find that the Jews were closer genetically to the Kurds (and to the Turks) than to their Arab neighbors. The findings of the study, which for the first time included a comparison between DNA samples from Jews and DNA samples from Muslim Kurds, also surprised historians such as Prof. Bezalel Bar-Kochba of Tel-Aviv University and Dr. Gunner Lehman of Ben-Gurion University in the Negev, who said: "It is difficult to explain the findings within the context of the knowledge we have about material and historic culture."

"Evrei i kurdi - brat'ya po genam." *MIGnews.com* (*Media International Group*)

Max Gross. "'A Certain People': Study Confirms Deep Similarities Among Jews." *Forward* (August 16, 2002): B11. Excerpts:

"Professor Ariella Oppenheim of Hebrew University, a geneticist of mixed Ashkenazic and Sephardic descent and one of six scientists who authored the study, called the results surprising. 'I expected a few more admixtures,' Oppenheim told the Forward. Almost all the researchers expected to see a greater link between Ashkenazic Jews and non-Jewish Eastern Europeans. They thought they would see in the bloodlines the results of Eastern European pogroms, when many Jewish women were raped, producing offspring whose biological fathers were not Jewish.... 'It had an effect,' Oppenheim said, but it didn't significantly alter the gene pool. Ashkenazic Jews are still closer, genetically, to Sephardic and Kurdish Jews than to any other population.... 'Part of [the study] was financed by [the government of] India,' Oppenheim said.... The scientists looked at Y-chromosomes, which come from the male, 'Mostly because [they] give us a bit of a simpler picture,' Oppenheim said. Oppenheim said that a more thorough study, involving mitochondrial DNA, which comes from the female, will soon get under way."

Ariella Oppenheim's study, 2000

Almut Nebel, Ariella Oppenheim, Dvora Filon, Mark G. Thomas, D. A. Weiss, M. Weale, Marina Faerman. ["High-resolution Y chromosome haplotypes of Israeli and Palestinian Arabs reveal geographic substructure and substantial overlap with haplotypes of Jews."](#) *Human Genetics* 107(6) (December 2000): 630-641.

Abstract excerpts:

High-resolution Y chromosome haplotype analysis was performed in 143 paternally unrelated Israeli and Palestinian Moslem Arabs (I&P Arabs) by screening for 11 binary polymorphisms and six microsatellite loci. At the haplogroup level, defined by the binary polymorphisms only, the Y chromosome distribution in Arabs and Jews was similar but not identical. At the haplotype level, determined by both binary and microsatellite markers, a more detailed pattern was observed. Single-step micro-satellite networks of Arabs and Jewish haplotypes revealed a common pool for a large portion of Y chromosomes, suggesting a relatively recent common ancestry. The two modal haplotypes in the I&P Arabs were closely related to the most frequent haplotype of Jews (the Cohen modal haplotype). However, the I&P Arab clade that includes the two Arab modal haplotypes (and makes up 32% of Arab chromosomes) is found at only very low frequency among Jews, reflecting divergence and/or admixture from other populations. ([Mirror](#))

["Jews and Arabs Share Recent Ancestry."](#) *Science Now* (American Academy for the Advancement of Science, October 30, 2000). In the last sentence, it is admitted that European Jews mixed with groups residing in Europe. Excerpts:

"More than 70% of Jewish men and half of the Arab men whose DNA was studied inherited their Y chromosomes from the same paternal ancestors who lived in the region within the last few thousand years. The results match historical accounts that some Moslem Arabs are descended from Christians and Jews who lived in the southern Levant, a region that includes Israel and the Sinai... Intrigued by the genetic similarities between the two populations, geneticist Ariella Oppenheim of Hebrew University in Jerusalem, who collaborated on the earlier study, focused on Arab and Jewish men. Her team examined the Y chromosomes of 119 Ashkenazi and Sephardic Jews and 143 Israeli and Palestinian Arabs. The Y chromosomes of many of the men had key segments of DNA that were so similar that they clustered into just three of many groups known as haplogroups. Other short segments of DNA called microsatellites were similar enough to reveal that the men must have had common ancestors within the past several thousand years.

The study, reported here at a Human Origins and Disease conference, will appear in an upcoming issue of Human Genetics. Hammer praises the new study for 'focusing in detail on the Jewish and Palestinian populations.' Oppenheim's team found, for example, that **Jews have mixed more with European populations**, which makes sense because some of them lived in Europe during the last millennium."

Judy Siegel. "[Experts find genetic Jewish-Arab link.](#)" *Jerusalem Post* (November 6, 2000). Despite its merits, this study uses a small sample size and an improbable set of test subjects. It is puzzling that the Northern Welsh were tested, because it's obvious that they are farther away from European Jews than Arabs. Why were they tested instead of the Serbs, Romanians, Italians, or Austrians - groups which, unlike the Welsh, had significant contact with Jews over the centuries? The selection of groups influences the results of any genetics study. Notice, however, that even according to this test, somewhere between 20 and 30 percent of the Jews do NOT have paternal-line ancestry from Israel. Excerpts:

"DNA research carried out at the Hebrew University-Hadassah Medical School and University College in London has shown that many Jews and Arabs are closely related. Over seven out of 10 Jewish men and half of Arab men whose DNA was studied inherited their Y chromosomes from the same paternal ancestors - who lived in the Middle East in the Neolithic period in prehistoric times. The research, to be published soon in the journal Human Genetics... was carried out by Prof. Ariella Oppenheim, a senior geneticist in the Hebrew University's hematology department. Dr. Marina Faerman, Dr. Dvora Filon of the Hadassah-University Hospital in Jerusalem, HU doctoral student Almut Nebel, and Mark Thomas and others at the British university assisted. The work was also reported last week in the journal Science. Oppenheim and her colleagues tested blood from 143 Israeli and Palestinian Moslem Arabs whose great-grandfathers were not related. Chromosome set data were compared with that of 119 Ashkenazi and Sephardi Jews, and to that of non-Jewish residents of northern Wales. The researchers found that the Arabs are more closely related to Jews than they are to the Welsh, indicating a more recent common ancestry. Arabs and Jews had about 18 percent of all their chromosomes in common... 'Our findings are in good agreement with historical evidence and suggest genetic continuity in both populations despite their long separation and the wide geographic dispersal of Jews,' Oppenheim wrote."

Nicholas Wade. "Scientists Rough Out Humanity's 50,000-Year-Old Story." *The New York Times* (November 14, 2000). Excerpts:

"Analysis of the Y chromosome has already yielded interesting results. Dr. Ariella Oppenheim of the Hebrew University in Jerusalem said she had found considerable similarity between Jews and Israeli and Palestinian Arabs, as if the Y chromosomes of both groups had been drawn from a common population that began to expand 7,800 years ago."

Tamara Traubman. "A new study shows that the genetic makeup of Jews and Arabs is almost identical, and that both groups share common prehistoric ancestors." *Ha'aretz* (2000). Excerpts:

"About two-thirds of Israeli Arabs and Arabs in the territories and a similar proportion of Israeli Jews are the descendents of at least three common prehistoric ancestors who lived in the Middle East in the Neolithic period, about 8,000 years ago. This is the finding of a new study conducted by an international team of scholars headed by Prof. Ariella Oppenheim, a senior geneticist in the Hebrew University's hematology department and at Hadassah Hospital in Jerusalem. In the

study, soon to be published in the scientific journal 'Human Genetics,' the researchers probed the history of Jewish and Arab men by analyzing the genetic changes in the Y chromosome... The study was conducted by doctoral student Almut Nebel, with the participation of Dr. Dvora Filon and Dr. Marina Faerman of the Hebrew University and Dr. Mark Thomas of the University College of London. The results of the study, says Prof. Oppenheim, 'support the historical documentation according to which the Arabs are descendents of an ancient population of the country and that a large proportion of them were Jews who converted to Islam after Islam reached Eretz Israel in the seventh century CE.'... They examined 134 Palestinians from Israel and the Palestinian Authority and 119 Ashkenazi and Sephardi Jews. Unlike the previous study, they also traced changes in DNA that occur more frequently, at a rate of about once in 1,000 generations. In this way, they discovered that Jews and Arabs have common prehistoric ancestors who lived here until just the last few thousand years.... In view of the small geographical area of Israel and the Palestinian Authority, the researchers were surprised to discover that some Palestinians on the West Bank have a unique genetic trait that is reflected in a relatively high frequency of certain genetic signs. This fact indicates that they are the descendents of people who have lived here for a few hundred years at least. The unique genetic feature of the Palestinians from the West Bank became even more explicit when the researchers studied a genetic defect that may cause a blood disease known as thalassemia. There are many genetic defects that can cause thalassemia, but 50 percent of the mountain dwellers examined carried the identical defect, compared to only 10 percent of Galilee dwellers and 15 percent of Gaza residents. Dr. Filon says that the unique genetic trait is characteristic of a population that has lived in the same place for many generations."

Michael Hammer's study, 2000

Rachel Fléaux. "Chercher ses racines par l'ADN: En quête d'identité." *Sciences et Avenir* No. 650 (April 2001). Excerpts:

"La diaspora juive est l'autre communauté directement intéressée par les technologies ADN. Family Tree DNA en a fait son point fort. Il est vrai que cette compagnie texane, qui se flatte d'offrir les tests du chromosome Y les plus précis de toute l'industrie ", est associée au généticien Mike Hammer de l'université d'Arizona, dont c'est précisément la spécialité. Le chercheur a ainsi publié il y a quatre ans, dans la revue *Nature*, une étude portant sur les Cohanim ou Cohen, ces grands prêtres juifs qui se transmettent leur titre de père en fils depuis 3300 ans, selon la tradition biblique. Analysant le chromosome Y des derniers Cohanim, Mike Hammer a montré que l'on pouvait bel et bien remonter leur lignée paternelle jusqu'à un ancêtre mâle, peut-être cet Aaron décrit dans la Bible comme le premier des grands prêtres. Finalement, tant chez les Séfarades que chez les Ashkénazes, les Cohen portent la même signature chromosomique, très distincte des autres. Le généticien d'Arizona a également élucidé le mystère des Khazars (lire p. 123), démontant la théorie selon laquelle cette tribu d'Europe centrale pourrait être à l'origine des Ashkénazes. Sourd aux critiques d'une fraction de la communauté juive, qui redoute un fichage génétique, Mike Hammer a lancé en collaboration avec le Dr Harry Ostrer, de l'Ecole de médecine de l'université de New York, le projet " Jewish Genetic Origins ". Son ambition est de suivre la diaspora à la trace, de permettre à chacun de ses membres de retisser, depuis le XVIIIe siècle au moins, l'histoire et l'origine d'une famille éclatée. Huit cents hommes et femmes ont déjà fait don de leur ADN accompagné de l'arbre détaillé de leur famille (2)."

Nadine Epstein. ["Family Matters: Funny, We Don't Look Jewish."](#) *Hadassah Magazine* 82:5 (January 2001).

Excerpts:

"...As the fair-haired, blue-eyed daughter of a woman who looks more Nordic than Jewish, I always wondered if I was really Semitic. My siblings and I didn't look much like most other Jews - Ashkenazic or Sefardic... As a child, I blamed our looks on Cossack rapes. When I read Arthur Koestler's *The Thirteenth Tribe*, I bought his theory that Ashkenazim were descended from the Khazars, a Caucasian people who had converted to Judaism in the Middle Ages. The search for genetic knowledge strikes a deep chord among Jews. Last year, through my local genealogy society, I met Dr. Harry Ostrer, head of the Human Genetics Program at the New York University School of Medicine... The study of evolutionary and genetic history through DNA analysis is transforming what we know about ourselves... In 1997, Karl Skorecki in Haifa, Michael Hammer in Tucson and several London researchers surprised everyone by finding evidence of the Jewish priestly line of males, the Kohanim. Half of Ashkenazic men and slightly more than half of Sefardic men who claimed to be Kohanim were found to have a distinctive set of genetic markers on their Y chromosome, making it highly possible that they are descendants of a single male or group of related males who lived between 1180 and 650 B.C.E., about the time of Moses and Aaron. The Kohen marker is but a fragment of the information gleaned from DNA analysis... A study published last year in the *Proceedings of the National Academy of Science* looked at the Y chromosomes of 1,371 males from seven Jewish population groups and came up with a profile of Jewish genes. They found 13 major Y-chromosome patterns or signatures, called haplotypes. 'The haplotypes of all but Ethiopian Jews shared a similar pattern,' says Ostrer, a member of the study team led by Hammer and Batsheva Bonne-Tamir of Tel-Aviv University. 'This means we are not descended from one person or 12 tribes but 13 founder males.' The same 13 haplotypes, by the way, are common among Middle Eastern Arabs including Palestinians and Syrians. They also show up in Greeks and other ancient Mediterranean lines, who may date from the time before Jews emerged as a people... 'We are definitely Jews,' says Ostrer. 'We share Jewish haplotype patterns.' Ostrer estimates the European admixture over 80 generations is an extremely low 0.5 percent. The study also found that male Jews of Russian and Polish ancestry do not have a chromosome profile similar to Russian and Polish non-Jews. Haplotypes have also helped the identity seekers to retrace the path of the wandering Ashkenazic Jew. We who hail from East Europe most likely migrated there from Alsace and Rhineland, says Ostrer, as confirmed by Yiddish, a form of low German. Based on his study of Roman Jews, Ostrer concludes that Ashkenazim lived in Italy for a thousand years before they migrated into Alsace and Rhineland. 'There's no genetic difference between Ashkenazic and Roman Jews, who say they have lived in Italy for 2,000 years,' he observes. Ostrer and Hammer are now conducting the largest study of Jewish genetics so far, trying to determine how we are all related, and tracing the migrations that formed communities during the 2,000 years of diaspora... 'Being Jewish is a spiritual, metaphysical state and DNA is a physical characteristic, like nose size,' said Skorecki in an interview in *The Jerusalem Report*. 'But we wouldn't dare go around saying we're going to determine who is Jewish by the length of their nose. Similarly we're not going to determine who is Jewish by the sequence of their DNA!'... And so for me, the positives of Y-chromosome analysis far outweigh the possible negatives. We are an ancient group of clans descended from 13 polygamous men, and our genetic history is part of the redefinition of humanity... 'Blonde genes occur in Middle Eastern groups as well,' he [Ostrer] explains. 'There is no evidence that white skin and blue eyes originated in northern Europe. That is a Nordic myth. Semitic people had the whole range!'... Researchers have only begun to study

the mitochondria of Jewish women... Mitochondria will likely reveal different data: Women were more likely than men to relocate and convert due to marriage... My father and brother are descendants of the clan known as Haplotype Four, the second largest group of Ashkenazim, and common among Middle Eastern and southern European populations. My son is descended from a clan that is part of Haplotype One, which has a Y-chromosome pattern common in central and western Asian populations... 'These clans were formed a long time ago,' says Ostrer. 'They all ended up in the Middle East and landed in Ur where Abraham lived. He convinced some of them to adopt [the God of Israel] and when they did, they brought their Y chromosomes with them. Their next-door neighbors waited for Allah. They brought their chromosomes with them, too.'

The assertion of Ostrer that Yiddish comes from Alsace and Rhineland has been debunked by solid research showing that Yiddish derives from Bavaria. Yiddish is clearly a form of High German, too, and not Low German. Epstein's article demonstrates a lack of linguistic knowledge.

Christopher Hitchens. ["The Part-Jewish Question: Double the Pleasure or Twice the Pain? Of 'Semi-Semites' and Those Who Fear Them."](#) *Forward* (January 26, 2001). Excerpts:

"Recent advances in DNA testing have either simplified or complicated the claims of holy books and founding texts. A riveting recent essay in *Commentary* described the results of a match-up between the genetic database of the Kohanim - those whose Jewish ancestry is supposedly the strongest and best-attested - and that of a "lost tribe" in Namibia that has long claimed Jewish descent. The fit was amazingly close. So it is with other groups in the Asian diaspora, many of whose folk stories had been thought to be merely legendary. It also turns out that there is a close DNA affinity between Israeli Jews and Palestinian Arabs... How long before we can codify Khazar DNA and find out if Koestler was right or if the Ashkenazim have any genetic claim to Gaza? (The learned author of the *Commentary* article, eventually concluded that enough was enough already, and that better uses could be found for the research money than the infinite theoretical expansion of the prolific seed of Abraham.)"

Hillel Halkin. ["Wandering Jews -- and Their Genes."](#) *Commentary* 110:2 (September 2000): 54-61. Excerpts:

"Finally, published in last June's *Proceedings of the National Academy of Science* were the results of a study conducted by an international team of scientists led by Michael Hammer of the University of Arizona and Batsheva Bonn -Tamir of Tel Aviv University... Based on genetic samples from 1,371 males... its main conclusions are: 1. With the exception of Ethiopian Jews, all Jewish samples show a high genetic correlation... 3. In descending order after these Middle Easterners, Ashkenazi Jews correlate best with Greeks and Turks; then with Italians; then with Spaniards; then with Germans; then with Austrians; and least of all with Russians... And on the other hand again: whereas the traditional explanation of East European Jewish origins was that most Ashkenazi Jews reached Poland and Russia from... the Rhineland; Rhineland from northern France... this version has come under increasing challenge in recent years on both demographic and linguistic grounds. Most Jews, the challengers maintain, must have arrived in Eastern Europe not from the west and southwest but from the south and east - that is, via northern Italy and the Balkans; Asia Minor and the Greek Byzantine empire; the Volga kingdom of the Khazars...; or a combination of all three. Now comes the *Proceedings of the National Academy of Science* report, which appears to bear out the newer version of events. Ashkenazi Jews, it informs us, have a more significant admixture of Italian, Greek, and Turkish genes than of Spanish, German, or even Austrian ones. Of course, things are not so simple. Even without questioning the study's

highly technical procedures, different interpretations could be put on them. It could be argued, for example, that the resemblance of Jewish to Greek and Italian Y chromosomes is traceable to proselytization in the Mediterranean world during the period of the Roman Empire... What must also be remembered is that Y chromosomes tell us only about males. But we know that in most societies, women are more likely to convert to their husband's religion than vice-versa... If true, this might also explain a number of differences between the Hammer/Bonné-Tamir study and earlier research on the geographical distribution of specific Jewish diseases, blood types, enzymes, and mitochondrial DNA... a predominance of female converts might provide the answer. It might also explain opposed findings on Jews from Yemen, who in earlier tests matched poorly with other Jews. This particular result was understood to support the theory that Yemenite Jewry originated in the widespread conversion of non-Jews under the Himyarite kings of southern Arabia in the first centuries of the Common Era. But now the Hammer/Bonné-Tamir report shows that the Y chromosomes of Yemenite Jews have typically Jewish haplotypes. The contradiction could be resolved by positing that Jewish men... reached Yemen... married local women..."

Multiple letters in response to Hillel Halkin's article were published in Commentary's December 2000 issue.

Michael F. Hammer, Alan J. Redd, Elizabeth T. Wood, M. R. Bonner, Hamdi Jarjanazi, Tanya Karafet, A. Silvana Santachiara-Benerecetti, Ariella Oppenheim, Mark A. Jobling, Trefor Jenkins, Harry Ostrer, and Batsheva Bonné-Tamir. ["Jewish and Middle Eastern non-Jewish Populations Share a Common Pool of Y-chromosome Biallelic Haplotypes."](#), *PNAS* 97:12 (June 6, 2000): 6769-6774. Summary:

This study alleges that Jews around the world, both Sephardic and Ashkenazic, are more closely related to one another than to non-Jews tested in the study, and that converts and intermarriages played little role in Jewish population history. But the study does not test peoples who are at all related to the Khazars, so the genetic distance between European Jews and Khazars was left untested, and the focus is on paternal rather than on maternal lines.

According to Mark Jobling, "Jews are the genetic brothers of Palestinians, Lebanese, and Syrians".

Some revealing comments from the study's geneticists: Dina Kraft's May 9, 2000 article in the Associated Press quotes Hebrew University geneticist Howard Cedar who "said even though Y chromosomes are considered the best tool for tracing genetic heritage, **researchers still don't know what the history is behind the variations. As a result, it is difficult to draw conclusions about genetic affinity.**" The article also quotes Batsheva Bonne-Tamir, a Tel Aviv University geneticist, who "cautioned that the techniques were new and that until the human genome is mapped, **it will be difficult to be certain about the conclusions.**"

"To say that Jews are somehow homogeneous across the entire diaspora is completely fallacious," says Ken Jacobs of the University of Montreal. "There is so much incredible genetic heterogeneity within the Jewish community -- any Jewish community." Jewish people simply don't exhibit the genetic homogeneity that [Kevin] MacDonald ascribes to them, Jacobs says. According to an Jacobs' views as summarized in an article in the *New Times Los Angeles Online* (April 20-26, 2000), "Witness For The Persecution" by Tony Ortega: "The only Jewish subgroup that does show some homogeneity -- descendants of the Cohanim, or priestly class -- makes up only about 2 percent of the Jewish population. **Even within the Cohanim, and certainly within**

the rest of the Jewish people, there's a vast amount of genetic variation that simply contradicts MacDonald's most basic assertion that Jewish genetic sameness is a sign that Judaism is an evolutionary group strategy." In H-ANTISEMITISM, Ken Jacobs added: "Hammer's Jewish samples are heavily skewed towards the Kohanim... This is bound to reduce within-population variance in the Jewish sample... I pointed out solely that the data reported for the Jewish samples in the recent PNAS were remarkably similar to those published previously in studies of which Hammer was a co-author, the focus of which was the Kohanim... There is an ahistorical aspect to this work, as well as a serious conflation of genes, ethnicity, and religious belief. For example, as used in Hammer's study, the distinction between 'Syrian' and 'Palestinian' is based on fairly recent geo-political constructs that have little or no bearing on the patterns of gene flow in the region prior to 1000 CE.... In the original Lemba study, the complex of Y-chromosome genes was found in 45% of Kohanim among Ashkenazim, the percentage was 56% of Kohanim among the Sepharad, and 53% among the Buba clan of the Lemba. Among non-Kohanim the average Jewish % for this gene complex is less than 5%. One does not have to understand the lingo to see that there was inbreeding in one part of the dispersed Jewish communities and a certain level of outbreeding in the rest."

John Tooby, Professor of Anthropology at the University of California at Santa Barbara, is quoted in an article for *Slate's* "Culturebox" by Judith Shulevitz as saying: "The notion that Jews are a genetically distinct group doesn't make it on the basis of modern population genetics."

Chris Garifo. ["U of A researcher heads breakthrough genetic study."](#) *Jewish News of Greater Phoenix* 52:37 (May 19, 2000). Excerpts:

"Our work definitely refutes a lot of that discussion of alternate origins for Jewish populations,' Hammer says. 'It shows that we really are a single ethnic group coming from the Middle East. Even if you look like another European with blue eyes and light skin, your genes are telling that you're from the Middle East.'.... Hammer says one reason he began the research was his curiosity about his own Jewish roots."

Ivan Oransky. "Tracing Mideast Roots Back to Isaac and Ishmael: Study of Y Chromosome Suggests a Common Ancestry for Jews and Arabs." *The Forward* (May 19, 2000). Excerpts:

"The study also found the degree of intermarriage by the Askenazi Jewish population over the past 2000 years to be remarkably small. The study, published in the Proceedings of the National Academy of Sciences by University of Arizona geneticist Michael Hammer and colleagues from Italy, Israel, England and America, refutes some earlier studies which suggested that modern Jews were mainly descendants of converts -- particularly the Turkish Khazars -- with high rates of intermarriage.... The director of the human genetics program at the New York University School of Medicine and a co-author of the paper, Harry Ostrer, told *The Forward* that... the story provides a useful allegory for the roots of Jews and Arabs. 'We're the children of a discrete number of founders who lived in the Middle East, where these Y chromosomes originated and became concentrated.', Dr. Ostrer said.... Dr. [Arno] Motulsky, who was not involved with the study, said that the results suggest that genes from non-Jewish males have not entered the Jewish population to any great extent.... The study could raise important questions about who is a Jew. For example, the results suggest that Ethiopian Jews, thought to be long separated from other Jewish groups, may be more closely related to North African non-Jews than to other Jews. Follow-up studies are already being planned. Dr. Ostrer is hoping to collect genetic information

from 1000 Ashkenazi Jews to study migrational patterns across Europe. Dr. Hammer said he will study the DNA for mitochondria... This will shed light onto the rate than which women intermarried into Jewish communities, since these genes are strictly passed by the mother."

Hillary Mayell. "Genetic Link Established Between Jews and Arabs." *National Geographic News* (May 10, 2000).

["Jews and Arabs are 'genetic brothers'."](#) *BBC News* (May 10, 2000). Excerpts:

"...The study, published in the Proceedings of the National Academy of Sciences, found that Jewish men shared a common set of genetic signatures with non-Jews from the Middle East, including Palestinians, Syrians, and Lebanese. These signatures were significantly different from non-Jewish men outside of the Middle East. This means Jews and Arabs have more in common with each other, genetically speaking, than they do with any of the wider communities in which they might live. Dr Mark Jobling of Leicester University, UK, one of the authors of the new study, told the BBC: 'The kind of DNA we have used to analyse this question is the human Y chromosome. This represents only 2% of our genetic material and it is passed down from father to son... The fact that we don't see it [signals of genetic mixture between Jews and non-Jews] suggests that after the Diaspora these populations really have managed to maintain their Jewish heritage.'"

Nicholas Wade. ["Y Chromosome Bears Witness to Story of the Jewish Diaspora."](#) *The New York Times* (May 9, 2000): F4 (col. 1). Excerpts:

"The analysis provides genetic witness that these communities have, to a remarkable extent, retained their biological identity separate from their host populations, evidence of relatively little intermarriage or conversion into Judaism over the centuries.... The results accord with Jewish history and tradition and refute theories like those holding that Jewish communities consist mostly of converts from other faiths, or that they are descended from the Khazars, a medieval Turkish tribe that adopted Judaism.... But present-day Ethiopian Jews lack some of the other lineages found in Jewish communities, and overall are more like non-Jewish Ethiopians than other Jewish populations, at least in terms of their Y chromosome lineage pattern.... Roman Jews have a pattern quite similar to that of Ashkenazis, the Jewish community of Eastern Europe. Dr. Hammer said the finding accorded with the hypothesis that Roman Jews were the ancestors of the Ashkenazis. Despite the Ashkenazi Jews' long residence in Europe, their Y signature has remained distinct from that of non-Jewish Europeans."

Norton Godoy. ["Judeus e árabes: irmãos."](#) *IstoÉ* (2000).

R. Highfield. "Jews, Arabs share ancestral link, study says." *Calgary Herald* (May 9, 2000): A19.

Marilynn Larkin. ["Jewish-Arab affinities are gene-deep."](#) *The Lancet* 355 (2000): 1699.

Maggie Fox. ["Middle Eastern Roots: Shared Y Chromosome Illustrates Genetic Map of the Past."](#) *Reuters* (May 9, 2000).

Joel J. Elias. ["The Genetics of Modern Assyrians and their Relationship to Other People of the Middle East."](#) *Assyrian Health Network* (July 20, 2000). Excerpts:

"Based on earlier studies using classical genetic methods⁷, Cavalli-Sforza et al. came to the conclusion 'that Jews have maintained considerable genetic similarity among themselves and with people from the Middle East, with whom they have common origins.' Evidence for the latter concept was very convincingly made and extended by an international team of scientists [Hammer et al.] in a very recent research article⁸, widely reported in the press, in which the genetics of different Middle Eastern populations were studied using a completely different method than the classical methods that form the great majority of papers in the Cavalli-Sforza et al book. The research involved direct DNA analysis of the Y chromosome, which is found only in males and is passed down from father to son. Seven different Jewish groups from communities in Europe, North Africa and the Middle East were compared to various non-Jewish populations from those areas. The results showed, first of all, that 'Despite their long-term residence in different countries and isolation from one another, most Jewish populations were not significantly different from one another at the genetic level.' Furthermore, the genetic characteristics of Jews were shown to be distinctly different from (non-Jewish) Europeans, suggesting that very little admixture occurred between Jews and Europeans, even after about 80 generations of Jews in Europe.... In fact, the Palestinians and Syrians were so close to the Jews in genetic characteristics that they 'mapped within the central cluster of Jewish populations.'"

7. Carmelli, D. and Cavalli-Sforza, L.L. The genetic origin of the Jews: A multi-variate approach. *Hum. Biol.*, 51:41-61. 1979.

8. Hammer, M.F. et al. [12 authors]. Jewish and Middle Eastern non-Jewish populations share a common pool of Y-chromosome biallelic haplotypes. *Proceedings National Academy Sciences USA*...

Doron Behar's study, 2013

Doron M. Behar, Mait Metspalu, Yael Baran, Naama M. Kopelman, Bayazit Yunusbayev, Ariella Gladstein, Shay Tzur, Havhannes Sahakyan, Ardeshir Bahmanimehr, Levon Yepiskoposyan, Kristiina Tambets, Elza K. Khusnutdinova, Aljona Kusniarevich, Oleg Balanovsky, Elena Balanovsky, Lejla Kovacevic, Damir Marjanovic, Evelin Mihailov, Anastasia Kouvatsi, Costas Trawantaphyllidis, Roy J. King, Ornella Semino, Anotonio Torroni, Michael F. Hammer, Ene Metspalu, Karl Skorecki, Saharon Rosset, Eran Halperin, Richard Villems, and Noah A. Rosenberg. "[No Evidence from Genome-Wide Data of a Khazar Origin for the Ashkenazi Jews.](#)" *Human Biology* 85:6 (December 2013): pages 859-900. Ashkenazi Jews are especially closely related to Sephardic Jews and North African Jews (page 876) but substantially different from Middle Eastern Jews and especially different from Yemenite Jews. Jews from India and Ethiopia are genetically distinctive. Mountain Jews from Azerbaijan are somewhat genetically close to non-Jewish peoples of the Caucasus including Armenians (closer than Ashkenazim are to Armenians). Ashkenazim from more easterly regions of Europe differ from western Ashkenazim by having a little more [East Asian and Northeast Asian ancestry](#) (and a little more [Eastern European](#) too). Eastern European peoples used for comparison in this study were Belarusians, Estonians, Lithuanians, Poles, Romanians, and Ukrainians. Ashkenazim are hardly connected to non-Jews of the North Caucasus and Volga-Ural regions (the study includes the comparative populations Adygei, Balkar, Chechens, Kabardins, Kumyks, Lezgins, Nogai, North Ossetians, Tabarasans, Chuvashes, and Volga Tatars from those regions). Eastern Turkic-speaking peoples (Altaians, Turkmens, Tuvinians, Uygurs, Uzbeks) are very genetically distant from Ashkenazim as they have extremely low identical-by-descent sharing (a measure of shared ancestors). Taking all their evidence together, the authors conclude on page 885 that there is "no indication of a detectable Khazar contribution" to Ashkenazim, although on page 880 they admit "no direct link to extant populations has been established" between Khazars

and any modern populations they sampled. They did do a good job of "including as many samples as possible from a region encompassing the geographic range believed to correspond to the Khazar Khaganate."

Excerpts from page 881:

"North African Jews show slightly elevated membership in the *k2* component prevalent in African populations. Similarly, in the Ashkenazi Jews, the proportion of the largely European *k5* component is somewhat larger than that in the Sephardi Jews (23% vs. 16%). Within the Ashkenazi Jews from Eastern and Central Europe, we do see a signal (2.2%) of components common in East Asia that are less visible in Ashkenazi Jews from Western Europe or European Sephardi Jews (0.6%)."

Excerpts from page 882:

"Admixture demonstrates the connection of Ashkenazi, North African, and Sephardi Jews, with the most similar non-Jewish populations to Ashkenazi Jews being Mediterranean Europeans from Italy (Sicily, Abruzzo, Tuscany), Greece, and Cyprus. When subtracting the *k5* component, which perhaps originates in Ashkenazi and Sephardi Jews from admixture with European hosts, the best matches for membership patterns of the Ashkenazi Jews shift to the Levant: Cypriots, Druze, Lebanese, and Samaritans. [...] Considering the IBD threshold of 3 Mb for shared segments, Ashkenazi Jews are expected to show no significant IBD sharing with any population from which they have been isolated for \geq [approximately more than] 20 generations. [...] Ashkenazi Jews show significant IBD sharing only with Eastern Europeans, North African Jews, and Sephardi Jews."

Doron Behar's study, 2010

Doron M. Behar, Bayazit Yunusbayev, Mait Metspalu, Ene Metspalu, Saharon Rosset, Jüri Parik, Siiri Rootsi, Gyaneshwer Chaubey, Ildus A. Kutuev, Guennady Yudkovsky, Elza K. Khusnutdinova, Oleg Balanovsky, Ornella Semino, Luisa Pereira, David Comas Martínez, David Gurwitz, Batsheva Bonne-Tamir, Tudor V. Parfitt, Michael F. Hammer, Karl Skorecki, and Richard Villems. "[The genome-wide structure of the Jewish people.](#)" *Nature* 466 (July 8, 2010): 238-242. First published online 9 June 2010. Among the tested populations were Ashkenazic Jews from eastern Europe, Sephardic Jews from Bulgaria and Turkey, Bukharan Jews of Central Asia, Jews of India, Ethiopian Jews, and Yemenite Jews. They were compared to peoples such as Italians from Tuscany and Sardinia, Russians, Chuvashes, Lithuanians, Adygeis, Lezgins, Georgians, Armenians, Basques, French, Romanians, Syrians, Palestinians, Jordanians, Turks, Cypriots, and several others. Abstract:

Contemporary Jews comprise an aggregate of ethno-religious communities whose worldwide members identify with each other through various shared religious, historical and cultural traditions. Historical evidence suggests common origins in the Middle East, followed by migrations leading to the establishment of communities of Jews in Europe, Africa and Asia, in what is termed the Jewish Diaspora. This complex demographic history imposes special challenges in attempting to address the genetic structure of the Jewish people. Although many genetic studies have shed light on Jewish origins and on diseases prevalent among Jewish communities, including studies focusing on uniparentally and biparentally inherited markers, genome-wide patterns of variation across the vast geographic span of Jewish Diaspora

communities and their respective neighbours have yet to be addressed. Here we use high-density bead arrays to genotype individuals from 14 Jewish Diaspora communities and compare these patterns of genome-wide diversity with those from 69 Old World non-Jewish populations, of which 25 have not previously been reported. These samples were carefully chosen to provide comprehensive comparisons between Jewish and non-Jewish populations in the Diaspora, as well as with non-Jewish populations from the Middle East and north Africa. Principal component and structure-like analyses identify previously unrecognized genetic substructure within the Middle East. Most Jewish samples form a remarkably tight subcluster that overlies Druze and Cypriot samples but not samples from other Levantine populations or paired Diaspora host populations. In contrast, **Ethiopian Jews (Beta Israel) and Indian Jews (Bene Israel and Cochini) cluster with neighbouring autochthonous populations in Ethiopia and western India, respectively**, despite a clear paternal link between the Bene Israel and the Levant. These results cast light on the variegated genetic architecture of the Middle East, and trace the **origins of most Jewish Diaspora communities to the Levant**.

Agence France-Presse. "[Study confirms Jewish Middle East origins.](#)" *Sydney Morning Herald*, June 11, 2010. Excerpt:

"'We found evidence that Jewish communities originated in the Near East,' said molecular scientist Doron Behar of the Rambam Health Care Campus in Haifa, Israel, who led an investigation gathering experts in eight countries. 'Our genetic findings are concordant with historical records.'"

Alla Katsnelson. "[Genes link Jewish communities, take 2.](#)" *Nature: The Great Beyond* (June 9, 2010). Excerpt:

"...the study showed that all of the Jewish communities share some common genetic features, and for the most part, the Jewish groups are more similar to each other than to the non-Jews in the same regions. 'These two studies are the first pair of genome-wide studies of SNP variations in collections of multiple Jewish populations,' says Noah Rosenberg, a population geneticist at the University of Michigan who was not involved in either study. ... Because of their large panel of populations, the researchers were able to dive more deeply than ever before into fine scale relationships between different populations. The closest genetic clustering, both among Jewish and non-Jewish groups, is seen in the eastern Mediterranean area known as the Levant, including Israel, Lebanon, Syria, and surrounding regions, the study finds."

Razib Khan. "[Genetics and the Jews \(it's still complicated.\)](#)" *Discover Magazine - Gene Expression* (June 10, 2010). Excerpts:

"Ashkenazi Jews are roughly between European and Middle Eastern populations, as one would expect if they were in some sense an admixture between the groups. ... This paper seems to confirm the east-west division evident in the earlier paper [by Ostrer et al.], whereby Ashkenazi & Sephardic groups form a natural cluster, as do the Mizrahi Jews of Iraq and Iran. ... The Yemeni Jews... seem to shake out as just another Middle Eastern population. They're a subset of the Saudis in both plots. ... From this figure it looks as if the Moroccan Jews are fundamentally distinctive in some way from the non-Jewish population of Morocco. ... What likely occurred in India was that generations of admixture between Jews and non-Jews resulted in the elision of differences between the two groups, despite the persistence of a cultural distinction. ... Non-Jews

could, and did, move into the Indian Jewish community, while this was taboo in the Islamic or Christian world."

Doron Behar's study, 2008

Doron M. Behar, Ene Metspalu, Toomas Kivisild, Saharon Rosset, Shay Tzur, Yarin Hadid, Guennady Yudkovsky, Dror Rosengarten, Luisa Pereira, Antonio Amorim, Ildus A. Kutuev, David Gurwitz, Batsheva Bonne-Tamir, Richard Villems, and Karl Skorecki. "[Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora.](#)" *PLoS ONE* 3:4 (April 30, 2008): e2062. ([mirror](#)) 1142 mtDNA samples were gathered from Jews of non-Ashkenazi origin (including Georgian Jews, Indian Jews, Iraqi Jews, Tunisian Jews, Bulgarian Jews, and others) plus 253 samples from Near Eastern non-Jews. These data were compared with data from 583 Ashkenazi Jews. Abstract:

The history of the Jewish Diaspora dates back to the Assyrian and Babylonian conquests in the Levant, followed by complex demographic and migratory trajectories over the ensuing millennia which pose a serious challenge to unraveling population genetic patterns. Here we ask whether phylogenetic analysis, based on highly resolved mitochondrial DNA (mtDNA) phylogenies can discern among maternal ancestries of the Diaspora. Accordingly, 1,142 samples from 14 different non-Ashkenazi Jewish communities were analyzed. A list of complete mtDNA sequences was established for all variants present at high frequency in the communities studied, along with high-resolution genotyping of all samples. Unlike the previously reported pattern observed among Ashkenazi Jews, the numerically major portion of the non-Ashkenazi Jews, currently estimated at 5 million people and comprised of the Moroccan, Iraqi, Iranian and Iberian Exile Jewish communities showed no evidence for a narrow founder effect, which did however characterize the smaller and more remote Belmonte, Indian and the two Caucasus communities. The **Indian and Ethiopian Jewish sample sets suggested local female introgression**, while mtDNAs in all other communities studied belong to a well-characterized West Eurasian pool of maternal lineages. Absence of sub-Saharan African mtDNA lineages among the North African Jewish communities suggests negligible or low level of admixture with females of the host populations among whom the African haplogroup (Hg) L0-L3 sub-clades variants are common. In contrast, the **North African and Iberian Exile Jewish communities show influence of putative Iberian admixture as documented by mtDNA Hg HV0 variants**. These findings highlight striking differences in the demographic history of the widespread Jewish Diaspora.

Excerpts:

"It is now possible to address the question of the matrilineal origin of these [non-Ashkenazi] communities using phylogenetic resolution at maximum depth, and also to extend phylogeographic comparisons with a much wider range of reference populations. ... The Jewish community of the Caucasus also known as Mountain Jews is believed to have been established during the 8th century C.E. in the region corresponding to Dagestan and the current state of Azerbaijan as a result of a movement of Jews from Iran. Indeed, this community shows a striking maternal founding event, with 58.6% of their total mtDNA genetic variation tracing back to only one woman carrying an mtDNA lineage within Hg J2b. ... The Georgian Jewish community, considered to have been established in the 6th century C.E., similarly shows a founding event with 58.1% of its total mtDNA variation tracing back to one woman. ... Multiple theories exist regarding the establishment of the Ethiopian Beta Israel community... The four most frequent

lineages belonged to Hgs R0a1b, L3h1a2a1, L5a1a and M1a1c (Table 2) all frequent in the region [10] suggesting East Africa and not the Levant as their likely geographic origin. The Indian Jewish community of Mumbai (known as B'nei Israel) oral history claim to have descended from Jews who reached the shores of India in the 2nd century C.E. MtDNA analysis for this community shows a strong maternal founding event, with 41.2% of its total mtDNA genetic variation tracing back to one woman and 67.6% tracking back to four women (Table 2). The Indian Jewish community of Cochin myth claims the community to have emanated in the times of King Solomon and has had no documented contact with the B'nei Israel of Mumbai. This community also shows a strong maternal founding event, with 44.4% of its total mtDNA genetic variation tracing back to two women (Table 2). **In both Indian Jewish communities, their mtDNA gene pool is dominated by Hg M sub-branches specific for the subcontinent [11], and therefore appears to be of clearly local origin.** It is important to note that in agreement with an oral tradition of the two independent founding events for the respective communities, the prevailing sub-branches among B'nei Israel Hg M samples belong to Hgs M39a1 and M30c1a1, while the Cochin Hg M sub-branches belong to Hgs M5a1 and M50 (Table 2). ... The Libyan and Tunisian Jewish communities share, as their two most frequent mtDNA variants, lineages in Hgs X2e1a1a and H30 (Table S4). It is important to note that the Hg H30 is split by the coding region information into 2 sub-lineages, one restricted to Libyan Jews and one primarily to Tunisian Jews. ... The Yemenite Jewish community is thought to have been established in the second century CE. Here we found that 42.0% of the mtDNA variation in this community can be attributed to 5 women carrying mtDNAs that belong to sub-branches of Hgs R0a1c, R2a, HV1b, L3x1a and U1a2. While these Hgs, except L3x1a, can be considered as a part of the general West Asian mtDNA genetic pool, they have higher frequencies in East Africa and Yemen [10]. ... The Libyan and Tunisian Jewish communities shared among them an X2e1a1a lineage as the most frequent. We examined the two Libyan-Tunisian Jewish lineage-specific coding region mutations 9380 and 13789... Position 13789 appears uninformative, while 9380 was shared among Hg X samples from the Near East and Africa, but not from Europe, suggesting Near Eastern/ North African origin of the particular founder lineage. ... The Iranian Jewish mtDNA is particularly rich in Hg H (30.5%, see Tables S1 and Table S3)-the variant of maternal lineages that constitutes on average more than 40% of the mtDNA variation in Europe. Hg H is also well represented in the Iraqi Jewish community with an overall frequency of 11.8% (Tables S1 and Table S3). Meanwhile, Hg H frequency in Ashkenazi Jews of recent European ancestry is 20.4% [4]. This raises an interesting question regarding the possible source of Hg H lineages among the various Jewish communities. Recent progress in the understanding of mtDNA variation in East and West Europe [16]-[18], as well as in the Near East [12] fits with the inference that at least three quarters of Iranian and Iraqi Jewish Hg H genomes belong to sub-Hgs H6, H13 and H14, characteristic of the Near Eastern-Central Asian variants of Hg H. In view of the historical records claiming the establishment of the North African Jewish communities from the Near Eastern Jewish communities, it is noteworthy that the communities do not share their respective major founding lineages. ... African-specific Hgs-variants of largely sub-Saharan Hg L(xM,N)-as well as more northern and eastern Hgs M1 and U6, do occur within the gene pools of some, though not all non-Ashkenazi Jewish communities (Table S3). ...they were found in Ethiopian and Yemenite Jews (Tables S1 and Table S3), perhaps reflecting the mtDNA population structure of the host countries. In contrast, it is intriguing to find that the North African Jews (Moroccan, Tunisian, Libyan) possess only a very small fraction of Hg L(xM,N) lineages (2.2%) and, even more unexpectedly, seem to lack typically North African Hg M1 and U6 mtDNAs (Tables S1 and Table S3). In striking contrast, sub-Saharan L lineages are

prevalent in North African Arab and Berber populations at frequencies around 20-25% (25.5% in Moroccans, 24.9% in Tunisians, 30.2% in Libyans; our unpublished data), yielding a difference exceeding an order of magnitude. Curiously, the Ashkenazi mtDNA pool of recent European descent includes Hg L(xM,N) at a frequency comparable to that among North African Jewry [4], [5]. Hence, **the lack of U6 and M1 chromosomes among the North African Jews and the low frequency of Hg L(xM,N) lineages, renders the possibility of significant admixture between the local Arab and Berber populations with Jews unlikely**, consistent with social restrictions imposed by religious restrictions. ... The second [case study] example highlighted the Georgian Jewish HV1a1a1 haplotype (Table 4, Figure 2b) and showed that it existed only in Georgian Jews. While it is clear that the ancestry of this lineage can be traced to the broad geographic swathe encompassing the Near and Middle East as well as the Caucasus region, even the level of resolution generated from the complete mtDNA analysis could not provide greater phylogeographic specificity, since equidistant ancestral lineages could be found in each of the three geographic locations. The third case study addresses the shared Libyan-Tunisian X2e1a1a haplotype. Again, it became clear that the ancestry of this lineage can be similarly attributed to the broad geographic region encompassing the Near and Middle East and the Caucasus region (Table 5, Figure 2c), but unlike the Georgian case study, the particular haplotype was shared with non-Jewish Tunisians, encompassing 0.8% to the overall Tunisian mtDNA pool. In addition, no HVS-I variation was observed in non-Jewish Tunisians, while such variation was clearly observed in Jews, suggesting the possibility of gene flow into the host population from Jews."

Martin Richards's study, 2013

Marta D. Costa, Joana B. Pereira, Maria Pala, Verónica Fernandes, Anna Olivieri, Alessandro Achilli, Ugo A. Perego, Sergei Rychkov, Oksana Naumova, Jiří Hatina, Scott R. Woodward, Ken Khong Eng, Vincent Macaulay, Martin Carr, Pedro Soares, Luísa Pereira, and Martin B. Richards. ["A substantial prehistoric European ancestry amongst Ashkenazi maternal lineages."](#) *Nature Communications* 4 (October 8, 2013): article number 2543. The researchers sequenced 74 mitochondrial genomes and looked at the mitochondrial genomes of over 3,500 individuals of various ethnic groups from Europe, the Caucasus, and Western Asia. The specific Ashkenazi mtDNA origin frequencies are stated to be 81% European, 8.3% Near Eastern, 1.1% Asian (not including Western Asia), and 9.9% Unassigned. The Supplementary Figures document's written analysis says there's "very little case to be made for any assimilation into Ashkenazi communities" from peoples of the North Caucasus and Chuvashia. Figure 10 details the frequencies they found for European-specific mtDNA lineages in Ashkenazim: 20.5% H, 4.1% HV0, 1.3% I, 6.3% J, 31.8% K, 0.7% M1, 9.2% N1b, 3% T, 0.2% U, 2% U5, and 1.6% W. They didn't find haplogroups K, N1b, H, or J among Samaritans but did find they have "several [haplogroups] that are in fact closely related to minor Ashkenazi lineages of putative Near Eastern origin (U6a, R0a)." Excerpts from the Abstract:

"[...] Like Judaism, mitochondrial DNA is passed along the maternal line. Its variation in the Ashkenazim is highly distinctive, with four major and numerous minor founders. However, due to their rarity in the general population, these founders have been difficult to trace to a source. Here we show that all four major founders, ~40% of Ashkenazi mtDNA variation, have ancestry in prehistoric Europe, rather than the Near East or Caucasus. Furthermore, most of the remaining minor founders share a similar deep European ancestry. Thus the great majority of Ashkenazi maternal lineages were not brought from the Levant, as commonly supposed, nor recruited in the Caucasus, as sometimes suggested, but assimilated within Europe. [...]"

Excerpts from the body of the article:

"If we allow for the possibility that K1a9 and N1b2 might have a Near Eastern source, then we can estimate the overall fraction of European maternal ancestry at ~65%. Given the strength of the case for even these founders having a European source, however, **our best estimate is to assign ~81% of Ashkenazi lineages to a European source, ~8% to the Near East and ~1% further to the east in Asia**, with ~10% remaining ambiguous [...]. Thus at least two-thirds and most likely more than four-fifths of Ashkenazi maternal lineages have a European ancestry."

Martin Richards. ["New information is discovered about the ancestry of Ashkenazi Jews."](#) Press release released October 8, 2013. Excerpts:

"[...] Y-chromosome studies have shown that the male line of [Ashkenazi] descent does indeed seem to trace back to the Middle East. But the female line, which can be illuminated by studies of mitochondrial DNA has until now proved more difficult to interpret. [...] We have settled this issue by looking at large numbers of whole mitochondrial genomes - sequencing the full 16,568 bases of the molecule - in many people from across Europe, the Caucasus and the Middle East. We have found that, in the vast majority of cases, Ashkenazi lineages are most closely related to southern and western European lineages - and that these lineages have been present in Europe for many thousands of years. This means that, even though Jewish men may indeed have migrated into Europe from Palestine around 2000 years ago, they brought few or no wives with them. They seem to have married with European women, firstly along the Mediterranean, especially in Italy, and later (but probably to a lesser extent) in western and central Europe. This suggests that, in the early years of the Diaspora, Judaism took in many converts from amongst the European population, but they were mainly recruited from amongst women. [...]"

Nicholas Wade. ["Genes Suggest European Women at Root of Ashkenazi Family Tree."](#) *The New York Times* (October 9, 2013). Excerpts:

"A new genetic analysis [...] establishes that the women who founded the Ashkenazi Jewish community of Europe were not from the Near East, as previously supposed, and reinforces the idea that many Jewish communities outside Israel were founded by single men who married and converted local women. The study, published Tuesday in the journal *Nature Communications*, is based on a genetic analysis of maternal lineages. A team led by Martin B. Richards of the University of Huddersfield in England took a fresh look at Ashkenazi lineages by decoding the entire mitochondrial genomes of people from Europe and the Near East. [...] With the entire mitochondrial genome in hand, Dr. Richards could draw up family trees with a much finer resolution than before. His trees show that the four major Ashkenazi [maternal-line] lineages in fact form clusters within descent lines that were established in Europe some 10,000 to 20,000 years ago. The same is true of most of the minor lineages. [...] Overall, at least 80 percent of Ashkenazi maternal ancestry comes from women indigenous to Europe, and 8 percent from the Near East, with the rest uncertain, the researchers estimate. Dr. Richards estimates that the four major lineages became incorporated into the Ashkenazi community at least 2,000 years ago. A large Jewish community flourished in Rome at this time and included many converts. This community could have been the source of both the Ashkenazim of Europe and the Sephardim of Spain and Portugal, given that the two groups have considerable genetic commonality, Dr. Richards said."

Jon Entine. ["Ashkenazi Jewish Women Descended Mostly from Italian Converts, New Study Asserts."](#) *Genetic Literacy Project* (October 8, 2013). Excerpts:

"[...] Professor Martin Richards, who heads the University of Huddersfield's Archaeogenetics Research Group (and who participated in the 2002 study), and colleagues sequenced 74 mitochondrial genomes and analyzed more than 3,500 mitochondrial genomes - far more data than the 2006 survey, which reviewed only a short length of the mitochondrial DNA, containing just 1,000 or so of its 16,600 DNA units, in all their subjects. [...] According to Nicholas Wade of the New York Times, Doron Behar, one of the key authors of the 2006 analysis, said he disagreed with the conclusions, but has provided no detailed critique as yet. Wade also talked to David Goldstein, who said he believed the estimate that 80 percent of Ashkenazi Jewry originated in Europe was too high considering the unpredictability of mitochondrial DNA data. [...]"

Kate Yandell. ["Genetic Roots of the Ashkenazi Jews."](#) *The Scientist Magazine* (October 8, 2013). Excerpts:

"[...] 'While it is clear that Ashkenazi maternal ancestry includes both Levantine [Near Eastern] and European origins--the assignment of several of the major Ashkenazi lineages to pre-historic European origin in the current study is incorrect in our view,' physician-geneticists Doron Behar and Karl Skorecki [...] wrote in an e-mail to The Scientist. They argue that the mitochondrial DNA data used in the new study did not represent the full spectrum of mitochondrial diversity. [...] David Goldstein, [...] said that the questions of whether there was a Khazar contribution to the Ashkenazi Jews' lineage, or exactly what percentage of mitochondrial variants emanate from Europe, cannot be answered with certainty using present genetic and geographical data. Even if a set of variants are present in a specific region today, that doesn't mean that the region always had that set of variants. Some variants could have been lost due to drift, or perhaps migration altered the balance of variants present in the population. [...]"

Eva Fernández, Alejandro Pérez-Pérez, Cristina Gamba, Eva Prats, Pedro Cuesta, Josep Anfruns, Miquel Molist, Eduardo Arroyo-Pardo, and Daniel Turbón. ["Ancient DNA Analysis of 8000 B.C. Near Eastern Farmers Supports an Early Neolithic Pioneer Maritime Colonization of Mainland Europe through Cyprus and the Aegean Islands."](#) *PLoS Genetics* 10:6 (June 5, 2014): e1004401. Some ancient skeletons from the "Pre-Pottery Neolithic B" ("PPNB") sites at Tell Halula and Tell Ramad in what's now Syria had the "K" mtDNA haplogroup. This PPNB population genetically clusters with the modern-day Ashkenazi Jews, Csángó people, and the population of Cyprus, who all have high frequencies of "K". (Modern Syrians are in a different cluster.) The evidence weighs against Costa et al.'s interpretation that the "K" haplogroups that Ashkenazim possess reflect European ancestors rather than Middle Eastern ones. Fernández et al. wrote:

"Another interesting case are the Ashkenazi Jews, who display a frequency of haplogroup K similar to the PPNB sample together with low non-significant pairwise F_{st} values, which taken together suggests an ancient Near Eastern origin. This observation clearly contradicts the results of a recent study, where a detailed phylogeographical analysis of mtDNA lineages has suggested a predominantly European origin for the Ashkenazi communities [Costa et al.] [...] Moreover, in the light of the evidence presented here of a loss of lineages in the Near East since Neolithic times, the absence of Ashkenazi mtDNA founder clades in the Near East should not be taken as a definitive argument for its absence in the past."

Miscellaneous studies

Yambazi Banda, Mark N. Kvale, Thomas J. Hoffmann, Stephanie E. Hesselson, H. Tang, Dilrini Ranatunga, Lawrence Walter, Catherine Schaefer, Pui-Yan Kwok, and Neil J. Risch. "[Admixture Estimation in a Founder Population.](#)" A paper presented at the annual meeting of The American Society of Human Genetics (ASHG) in October 22-26, 2013 in Boston, Massachusetts. Among other samples, they used 3,366 Ashkenazi Jewish samples provided by the Kaiser Permanente Genetic Epidemiology Research on Adult Health and Aging (GERA). Excerpts from the Abstract:

"[...] For the analysis of the AJ, we included surrogate Middle Eastern, Italian, French, Russian, and Caucasus subgroups to represent the ancestral populations. [...] For the AJ, we estimated mean ancestral proportions of 0.380, 0.305, 0.113, 0.041 and 0.148 for Middle Eastern, Italian, French, Russian and Caucasus ancestry, respectively. [...] We also noted considerably less variation in the individual admixture proportions for the AJ (s.d. = .02 to .05) compared to the AA [African American] (s.d. = .15), consistent with an older age of admixture for the former. [...]"

Shai Carmi, Ethan Kochav, Ken Y. Hui, Xinmin Liu, James Xue, Fillan Grady, Saurav Guha, Kinnari Upadhyay, Semanti Mukherjee, B. Monica Bowen, Joseph Vijai, Ariel Darvasi, Kenneth Offit, Laurie J. Ozelius, Inga Peter, Judy H. Cho, Harry Ostrer, Gil Atzmon, Lorraine N. Clark, Todd Lencz, and Itsik Pe'er. "The Ashkenazi Jewish Genome." A paper presented at the annual meeting of The American Society of Human Genetics (ASHG) in October 22-26, 2013 in Boston, Massachusetts. The researchers sequenced 128 complete genomes from Ashkenazi Jews. From their results they estimate that about 55 percent plus or minus 2 percentage points of Ashkenazi ancestry derives from European peoples.

Shai Carmi, Ken Y. Hui, Ethan Kochav, Xinmin Liu, James Xue, Fillan Grady, Saurav Guha, Kinnari Upadhyay, Dan Ben-Avraham, Semanti Mukherjee, B. Monica Bowen, Tinu Thomas, Joseph Vijai, Marc Cruets, Guy Froyen, Diether Lambrechts, Stéphane Plaisance, Christine Van Broeckhoven, Philip Van Damme, Herwig Van Marck, Nir Barzilai, Ariel Darvasi, Kenneth Offit, Susan Bressman, Laurie J. Ozelius, Inga Peter, Judy H. Cho, Harry Ostrer, Gil Atzmon, Lorraine N. Clark, Todd Lencz, and Itsik Pe'er. "[Sequencing an Ashkenazi reference panel supports population-targeted personal genomics and illuminates Jewish and European origins.](#)" *Nature Communications* 5 (September 9, 2014): article number 4835. The complete genomes of 128 Ashkenazi Jewish individuals were examined. Based on their analysis, the authors estimate that Ashkenazi Jews are about 46-50% of European origin, sharing ancestry with Western Europeans like the Flemish, who were also sampled in this study. The authors state that the other contributing population to Ashkenazic genetics are Middle Easterners. Their model suggests the present Ashkenazic population was founded after a bottleneck that occurred 25 to 32 generations ago, that is about "600-800 years" ago. The Ashkenazim have higher heterozygosity than non-Jewish Europeans yet descend from "a recent bottleneck of merely ~350 individuals." Page 63 of their "[Supplementary Information](#)" under "Reasons for increased heterozygosity" asserts "Additionally, AJ genomes were shown to have ~3% West-African ancestry." This is highly questionable as the authors cite not their own data to support this claim, but rather the methodologically-flawed study "The history of African gene flow into Southern Europeans, Levantines, and Jews" by Moorjani et al. that appeared in *PLoS Genetics* 7 in 2011. Most other admixture tests have shown zero or at most 0.1% Sub-Saharan West African/Negroid) ancestry in Ashkenazi individuals, and only tiny amounts of East African as well. Neither the Supplementary Information provided by Carmi et al. nor their main article discuss the evidence for small amounts of [East Asian](#) and [Slavic](#) ancestry in Eastern Ashkenazi Jews. Excerpt from the Abstract:

"[...] Modelling of ancient histories for AJ and European populations using their joint allele frequency spectrum determines AJ to be an even admixture of European and likely Middle

Eastern origins. [...]

Karen Kaplan. ["DNA ties Ashkenazi Jews to group of just 330 people from Middle Ages."](#) *Los Angeles Times* (September 9, 2014). Excerpts:

"[...] An international team of scientists sequenced the complete genomes of 128 healthy Ashkenazi Jews and compared each of those sequences with the others, as well as with the DNA of 26 Flemish people from Belgium. [...] Despite their close ties with Europe, no more than half of their DNA comes from ancient Europeans, the researchers found. Only 46% to 50% of the DNA in the 128 samples originated with the group of people who were also the ancestors of the Flemish people in the study. Those ancient people split off from the ancestors of today's Middle Easterners more than 20,000 years ago, with a founding group of about 3,500 to 3,900 people, according to the study. The rest of the Ashkenazi genome comes from the Middle East, the researchers reported. [...]"

Jesse Emspak. ["Oy Vey! European Jews Are All 30th Cousins, Study Finds."](#) *LiveScience* (September 9, 2014). Excerpts:

"[...] The findings bolster the mainstream view that the ancestors of European Jews were people from the Levant and local Europeans. An earlier, 19th-century theory posited that the core of the Ashkenazi Jewish population is descended from Khazars, from the Russian steppes, but the genetic evidence makes that even less likely, said study researcher Itsik Pe'er, [...] '[Among Ashkenazi Jews] everyone is a 30th cousin,' Pe'er said. 'They have a stretch of the genome that is identical.' [...]"

Alkes L. Price, Johannah Butler, Nick Patterson, Cristian Capelli, Vincenzo L. Pascali, Francesca Scarnicci, Andres Ruiz-Linares, Leif Groop, Angelica A. Saetta, Penelope Korkolopoulou, Uri Seligsohn, Alicja Waliszewska, Christine Schirmer, Kristin Ardlie, Alexis Ramos, James Nemesh, Lori Arbeitman, David B. Goldstein, David E. Reich, and Joel N. Hirschhorn. ["Discerning the Ancestry of European Americans in Genetic Association Studies."](#) *Public Library of Science Genetics (PLoS Genetics)* (January 2008). Sampled Southern Italians (Sicilians as well as those on the mainland), and other Europeans - 4,198 individuals in all. Excerpts:

"Important work has already shown that northwest and southeast Europeans can be distinguished using as few as 800-1,200 ancestry-informative markers mined from datasets of 6,000-10,000 markers. Here we mine much larger datasets (more markers and more samples) to identify a panel of 300 highly ancestry-informative markers which accurately distinguish not just northwest and southeast European, but also Ashkenazi Jewish ancestry. [...] Our results are consistent with a previous study in which Ashkenazi Jewish and southeast European samples occupied similar positions on the northwest-southeast axis, although there was insufficient data in that study to separate these two populations[7]. A historical interpretation of this finding is that both Ashkenazi Jewish and southeast European ancestries are derived from migrations/expansions from the Middle East and subsequent admixture with existing European populations [12,13]."

Chao Tian, Roman Kosoy, Rami Nassir, Annette Lee, Pablo Villoslada, Lars Klareskog, Lennart Hammarström, Henri-Jean Garchon, Ann E. Pulver, Michael Ransom, Peter K. Gregersen, and Michael F. Seldin. ["European Population Genetic Substructure: Further Definition of Ancestry Informative Markers for Distinguishing among Diverse European Ethnic Groups."](#) *Molecular Medicine* vol. 15(11-12) (November

2009), pages 371-383. Sampled people from Italy (Lombards, Tuscans, Sardinians, Southern Italian-Americans living in New York) and Ashkenazi Jews to genotype them for 300,000 autosomal SNPs. Excerpts:

"The current study extends the analysis of European population genetic structure to include additional southern European groups and Arab populations. Even within Italy, the relative position of northern Italians compared with subjects from Tuscany is consistent with the general geographic correspondence of PCA results. Interestingly, the majority of Italian Americans (NYCP four grandparents defined) appear to derive from southern Italy and overlap with subjects of Greek heritage. Both of these observations are consistent with previous historical information. Possible exceptions to this observation of geographic correspondence include the Ashkenazi Jewish population. While the Ashkenazi are clearly of southern origin based on both PCA and STRUCTURE studies, in our analyses of diverse European populations, this group appears to have a unique genotypic pattern that may not reflect geographic origins."

Chao Tian, Robert M. Plenge, Michael Ransom, Annette Lee, Pablo Villoslada, Carlo Selmi, Lars Klareskog, Ann E. Pulver, Lihong Qi, Peter K. Gregersen, and Michael F. Seldin. ["Analysis and Application of European Genetic Substructure Using 300 K SNP Information."](#) *Public Library of Science Genetics (PLoS Genetics)* (January 2008). Abstract excerpt:

"European population genetic substructure was examined in a diverse set of >1,000 individuals of European descent, each genotyped with >300 K SNPs. Both STRUCTURE and principal component analyses (PCA) showed the largest division/principal component (PC) differentiated northern from southern European ancestry. A second PC further separated Italian, Spanish, and Greek individuals from those of Ashkenazi Jewish ancestry as well as distinguishing among northern European populations. In separate analyses of northern European participants other substructure relationships were discerned showing a west to east gradient."

Michael F. Seldin, Russell Shigeta, Pablo Villoslada, Carlo Selmi, Jaakko Tuomilehto, Gabriel Silva, John W. Belmont, Lars Klareskog, and Peter K. Gregersen. ["European Population Substructure: Clustering of Northern and Southern Populations."](#) *Public Library of Science Genetics (PLoS Genetics)* 2(9) (September 2006). Abstract:

Using a genome-wide single nucleotide polymorphism (SNP) panel, we observed population structure in a diverse group of Europeans and European Americans. Under a variety of conditions and tests, there is a consistent and reproducible distinction between "northern" and "southern" European population groups: most individual participants with southern European ancestry (Italian, Spanish, Portuguese, and Greek) have >85% membership in the "southern" population; and most northern, western, eastern, and central Europeans have >90% in the "northern" population group. **Ashkenazi Jewish as well as Sephardic Jewish** origin also showed >85% membership in the "southern" population, consistent with a later **Mediterranean** origin of these ethnic groups.

Talia Bloch. ["One Big, Happy Family: Litvaks and Galitzianers, Lay Down Your Arms; Science Finds Unity in the Jewish Gene Pool."](#) *Forward* (August 22, 2007). Excerpts:

"... A year ago, Michael Seldin, a geneticist at the University of California Davis School of Medicine, and his research team made a remarkable discovery: Studying how Europeans

grouped genetically, they found that Ashkenazic Jews formed their own distinct subgroup. Northern and Southern Europeans fell into two clearly separable genetic cohorts, and although the Ashkenazic Jews had more in common with the Southern Europeans, they formed a recognizable, relatively homogenous group of their own. ... Through a series of collaborations with labs around the world, Seldin and his lab began exploring something called 'ancestry informative markers,' specific areas of a person's genetic code that reveal which part of the globe most of his ancestors came from. The study on those of European ancestry, which looked at both Europeans and European Americans, was also an international collaboration. In September 2006, it was published in the Public Library of Science Genetics journal. Since then, Seldin said, he has pursued a second study of an even larger sample of the genetic code, and his original findings for Ashkenazic Jews have only been confirmed. Seldin's work is emblematic of a rapidly expanding phenomenon within genetics: research of the genetic roots of diseases that end up revealing something about the history of a particular population."

Anna C. Need, Dalia Kasperavičiute, Elizabeth T. Cirulli, and David B. Goldstein. "[A genome-wide genetic signature of Jewish ancestry perfectly separates individuals with and without full Jewish ancestry in a large random sample of European Americans.](#)" *Genome Biology* 10(1) (2009): R7 (electronically published on January 22, 2009). Excerpts:

"We also included Palestinian (n = 46), Druze (n = 42) and Bedouin (n = 45) samples as groups that might be similar to ancestral Jewish 'source' populations [10]. We found that the Middle Eastern populations clustered separately from the European and European-American populations, as expected, and the subjects with four Jewish grandparents clustered close to (but separate from) the Adygei and lay between the Middle Eastern and the European and European-American populations (Figure 3). This is an important finding for a number of reasons. Firstly, the Jewish subjects remain in a separate cluster when mixed with both European and Middle Eastern populations... **Secondly, the Jewish cluster lies approximately midway between the European and the Middle Eastern clusters, implying that the Ashkenazi Jews may contain mixed ancestry from these two regions.** This is consistent with the Y chromosome and mitochondrial DNA genetic evidence that has been interpreted by some to suggest a stronger paternal genetic heritage of Jewish populations from the Middle East and stronger maternal genetic heritage from the host populations of the Diaspora [10]. Finally, the **proximity of the Jewish cluster to the Adygei** is of interest, but the small sample size of the Adygei and sparse availability of Central Asian populations makes interpretation of this proximity difficult."

Marc Haber, Dominique Gauguier, Sonia Youhanna, Nick Patterson, Priya Moorjani, Laura R. Botigué, Daniel E. Platt, Elizabeth Matisoo-Smith, David F. Soria-Hernanz, R. Spencer Wells, Jaume Bertranpetit, Chris Tyler-Smith, David Comas, and Pierre A. Zalloua. "[Genome-Wide Diversity in the Levant Reveals Recent Structuring by Culture.](#)" *PLoS Genetics* 9(2) (February 28, 2013): e1003316. Participants in this study about the Levant region of West Asia included Sephardi Jews, Ashkenazi Jews, Palestinians, Lebanese Christians, Lebanese Druze, Lebanese Muslims, Syrians, Jordanians, Bedouins, Cypriots, Armenians, Saudis, Yemenis, Iranians, and multiple European, East/South/Central Asian, and African populations. Ashkenazi Jews and Sephardi Jews were found to be closely related to each other and more closely related to Lebanese than Palestinians are. Excerpts:

"[...] The population tree (Figure 3A) splits Levantine populations in two branches: one leading to Europeans and Central Asians that includes Lebanese, Armenians, Cypriots, Druze and Jews, as well as Turks, Iranians and Caucasian populations; and a second branch composed of

Palestinians, Jordanians, Syrians, as well as North Africans, Ethiopians, Saudis, and Bedouins. [...] The tree shows a correlation between religion and the population structures in the Levant: all Jews (Sephardi and Ashkenazi) cluster in one branch; Druze from Mount Lebanon and Druze from Mount Carmel are depicted on a private branch; and Lebanese Christians form a private branch with the Christian populations of Armenia and Cyprus placing the Lebanese Muslims as an outer group. The predominantly Muslim populations of Syrians, Palestinians and Jordanians cluster on branches with other Muslim populations as distant as Morocco and Yemen. [...] [Also,] an MDS (Figure 2) and a normalized principle component analysis (PCA) (Figure S2) plots [...] were built. [...] The plots reveal a Levantine structure not reported previously: Lebanese Christians and all Druze cluster together, and Lebanese Muslims are extended towards Syrians, Palestinians, and Jordanians, which are close to Saudis and Bedouins. **Ashkenazi Jews are drawn towards the Caucasus and Eastern Europe, reflecting historical admixture events with Europeans**, while Sephardi Jews cluster tightly with the Levantine groups. These results are consistent with previous studies reporting higher European genome-wide admixture in Ashkenazi Jews compared with other Jews [...]"

Doron M. Behar, Ene Metspalu, Toomas Kivisild, Alessandro Achilli, Yarin Hadid, Shay Tzur, Luisa Pereira, Antonio Amorim, Lluís Quintana-Murci, Kari Majamaa, Corinna Herrstadt, Neil Howell, Oleg Balanovsky, Ildus A. Kutuev, Andrey Pshenichnov, David Gurwitz, Batsheva Bonne-Tamir, Antonio Torroni, Richard Villems, and Karl Skorecki. "The Matrilineal Ancestry of Ashkenazi Jewry: Portrait of a Recent Founder Event." *American Journal of Human Genetics* 78 (2006): 487-497. Abstract:

"Both the extent and location of the maternal ancestral deme from which the Ashkenazi Jewry arose remain obscure. Here, using complete sequences of the maternally inherited mitochondrial DNA (mtDNA), we show that close to one-half of Ashkenazi Jews, estimated at 8,000,000 people, can be traced back to only 4 women carrying distinct mtDNAs that are virtually absent in other populations, with the important exception of low frequencies among non-Ashkenazi Jews. We conclude that four founding mtDNAs, likely of Near Eastern ancestry, underwent major expansion(s) in Europe within the past millennium."

Judy Siegel. ["40% Ashkenazim come from matriarchs."](#) *Jerusalem Post* (January 13, 2006). Excerpts:

"...four Jewish "founding mothers" who lived in Europe 1,000 years ago have been credited with being the ancestors of nearly half of all Ashkenazi Jews... ..40 percent of Ashkenazi Jews currently alive - are descended from these matriarchs, who were among a small group, probably after migrating from the Middle East, according to the Israeli researchers, who also provide evidence of shared maternal ancestry between Ashkenazi and non-Ashkenazi (Sephardi and Oriental) Jews. The studies that led to these findings were performed by Dr. Doron Behar as part of his doctoral thesis, and were done under the supervision of Prof. Karl Skorecki of the Rappaport Faculty of Medicine and Research Institute at the Technion-Israel Institute of Technology and at the Rambam Medical Center in Haifa. ... Researchers from universities in Italy, Estonia, Portugal, France, the US and Russia contributed to the important study, which was published on-line by the prestigious American Journal of Human Genetics on Thursday and will appear in print in the March. ... The researchers' conclusions are based on detailed comparative analysis of DNA sequence variation in the mitochondrial DNA (mtDNA) region of the human genome. ... Non-Ashkenazi Jews also carry low frequencies of these distinct mtDNA types, thus providing evidence of shared maternal ancestry of Ashkenazi and non-Ashkenazi Jews. This is consistent with previous findings based on studies of the Y-chromosome, pointing to a similar

pattern of shared paternal ancestry of global Jewish populations, originating in the Middle East. The researchers concluded that the four founding mtDNA - likely of Middle Eastern origin - underwent a major overall expansion in Europe during the last millennium."

Nicholas Wade. ["New Light on Origins of Ashkenazi in Europe."](#) *The New York Times* (January 14, 2006): A12. Excerpts:

"Until now, it had been widely assumed by geneticists that the Ashkenazi communities of Northern and Central Europe were founded by men who came from the Middle East, perhaps as traders, and by the women from each local population whom they took as wives and converted to Judaism. But the new study, published online this week in *The American Journal of Human Genetics*, suggests that the men and their wives migrated to Europe together. The researchers, Doron Behar and Karl Skorecki of the Technion and Ramban Medical Center in Haifa, and colleagues elsewhere, report that just four women, who may have lived 2,000 to 3,000 years ago, are the ancestors of 40 percent of Ashkenazis alive today. The Technion team's analysis was based on mitochondrial DNA... inherited only through the female line. ... Looking at other populations, the Technion team found that some people in Egypt, Arabia and the Levant also carried the set of mutations that defines one of the four women. They argue that all four probably lived originally in the Middle East. ... David Goldstein, now of Duke University, reported in 2002 that the mitochondrial DNA of women in Jewish communities around the world did not seem to be Middle Eastern, and indeed each community had its own genetic pattern. But in some cases the mitochondrial DNA was closely related to that of the host community. Dr. Goldstein and his colleagues suggested that the genesis of each Jewish community, including the Ashkenazis, was that Jewish men had arrived from the Middle East, taken wives from the host population and converted them to Judaism, after which there was no further intermarriage with non-Jews. The Technion team suggests a different origin for the Ashkenazi community: if the women too are Middle Eastern in origin, they would presumably have accompanied their husbands. ... Dr. Hammer said the new study "moves us forward in trying to understand Jewish population history." His own recent research, he said, suggests that the Ashkenazi population expanded through a series of bottlenecks - events that squeeze a population down to small numbers... But Dr. Goldstein said the new report did not alter his previous conclusion. The mitochondrial DNA's of a small, isolated population tend to change rapidly as some lineages fall extinct and others become more common, a process known as genetic drift. In his view, the Technion team has confirmed that genetic drift has played a major role in shaping Ashkenazi mitochondrial DNA. But the linkage with Middle Eastern populations is not statistically significant, he said. Because of genetic drift, Ashkenazi mitochondrial DNA's have developed their own pattern, which makes it very hard to tell their source. This differs from the patrilineal case, Dr. Goldstein said, where there is no question of a Middle Eastern origin."

Malcolm Ritter. ["Study: Most Ashkenazi Jews from four women."](#) *Associated Press* (January 12, 2006). Excerpts:

"...about 40% of the total Ashkenazi population ? are descended from just four women, a genetic study indicates. Those women apparently lived somewhere in Europe within the last 2,000 years, but not necessarily in the same place or even the same century, said lead author Dr. Doron Behar of the Rambam Medical Center in Haifa, Israel. ... Each woman left a genetic signature that shows up in their descendants today, he and colleagues say in a report published online by the *American Journal of Human Genetics*. Together, their four signatures appear in about 40% of

Ashkenazi Jews, while being virtually absent in non-Jews and found only rarely in Jews of non-Ashkenazi origin, the researchers said. Ashkenazi Jews are a group with mainly central and eastern European ancestry. Ultimately, though, they can be traced back to Jews who migrated from Israel to Italy in the first and second centuries, Behar said. Eventually this group moved to Eastern Europe in the 12th and 13th centuries and expanded greatly, reaching about 10 million just before World War II, he said. The study involved mitochondrial DNA, called mtDNA, which is passed only through the mother. ... Mike Hammer, who does similar research at the University of Arizona, said he found the work tracing back to just four ancestors "quite plausible... I think they've done a really good job of tackling this question." But he said it's not clear the women lived in Europe. "They may have existed in the Near East," Hammer said. "We don't know exactly where the four women were, but their descendants left a legacy in the population today, whereas ... other women's descendants did not." Behar said the four women he referred to did inherit their genetic signatures from female ancestors who lived in the Near East. But he said he preferred to focus on these later European descendants because they were at the root of the Ashkenazi population explosion."

Maggie Fox. ["Study finds why Jewish mothers are so important."](#) *Reuters* (January 13, 2006). Excerpts:

"Four Jewish mothers who lived 1,000 years ago in Europe are the ancestors of 40 percent of all Ashkenazi Jews alive Friday, an international team of researchers reported Friday. The genetic study of DNA paints a vivid picture of human evolution and survival, and correlates with the well-established written and oral histories of Jewish migrations, said Dr. Doron Behar of the Technion-Israel Institute of Technology, who worked on the study. ... For their study, Behar and geneticist Karl Skorecki, with collaborators in Finland, France, Estonia, Finland, Portugal, Russia and the United States sampled DNA from 11,452 people from 67 populations. ... "I think there was some kind of genetic pool that was in the Near East," Behar said in a telephone interview. "Among this genetic pool there were four maternal lineages, four real women, that carried the exact specific mitochondrial DNA markers that we can find in mitochondrial DNA today." They, or their direct descendants, moved into Europe. "Then at a certain period, most probably in the 13th century, simply by demographic matters, they started to expand dramatically," Behar said. "Maybe it was because of Jewish tradition, the structure of the family that might have been characterized by a high number of children." But these four families gave rise to much of the population of European Jews - which exploded from 30,000 people in the 13th century to "something like 9 million just prior to World War II," Behar said. ... Behar said as they sampled people from Ashkenazi communities around the world, the same mitochondrial genetic markers kept popping up. They did not find the markers in most of the non-Jewish people they sampled, and only a very few were shared with Jews of other origin."

Donald Macintyre. ["3.5 million Ashkenazi Jews 'traced to four female ancestors'."](#) *The Independent* (January 14, 2006).

["Four mothers' for Europe's Jews."](#) *BBC News* (January 13, 2006). Excerpts:

"The Ashkenazis moved from the Mid-East to Italy and then to Eastern Europe, where their population exploded in the 13th Century, the scientists say. ... The four women are thought to have lived in the Middle East about 1,000 years ago but they may not have lived anywhere near [an]other, according to the study published in the American Journal of Human Genetics. However, they bequeathed genetic signatures to their descendants, which do not appear in non-

Jews and are rare in Jews not of Ashkenazi origin."

Hillel Halkin. "[Jews and Their DNA.](#)" *Commentary Magazine* 126:2 (September 2008): beginning on page 37. Excerpts:

"Early studies of mitochondrial DNA reported that Jewish women, unlike Jewish men, did not correlate well with one another globally. ...Jewish males with antecedents in such widely separated places as Yemen, Georgia, and Bukhara in Central Asia are far more likely to share similar Y-chromosome DNA with one another than with Yemenite, Georgian, or Bukharan non-Jews. Jewish females from the same backgrounds, on the other hand, yield opposite results: their mitochondrial DNA has markedly less resemblance to that of Jewish women from elsewhere than it does to that of non-Jewish women in the countries their families hailed from. ... In the absence of rabbis to perform conversions, they [Jewish immigrants to new lands] married local women who, while consenting to live as Jews, were not halakhically Jewish. ... In a class by itself is the mitochondrial DNA of Ashkenazi women. It does not correlate closely with the DNA of non-Jewish women in Western, Central, or Eastern Europe and it has a large Middle Eastern component. ...the Y chromosomes of Ashkenazi Jews have more in common with those of Italians and Greeks than with those of West Europeans. ... An 11.5-percent incidence of R-M117 among Ashkenazi Jews in general is easily explainable: the mutation could have entered the Jewish gene pool slowly, in small increments in every generation, during the thousand years of Ashkenazi Jewry's existence. ... But the 52-percent rate among Levites is something else. Here we are dealing not with a gradual, long-term process (for no imaginable process could have produced such results), but with a one-time event of some sort. ... Both of our studies, therefore, raise the possibility that the original R-M117 Levites were Khazarian Jews who migrated westward upon the fall of the Khazar kingdom. ... Analyzing the data, the American-Israeli-British study concludes that the number of R-M117 Levites absorbed by Ashkenazi Jewry ranged from one to fifty individuals. ... Nor do we know the percentage of Khazars possessing M117, which is found in 12 or 13 percent of Russian and Ukrainian males today. If these were also its proportions among the Khazars, there would have been seven non-M117 Khazars joining or founding Ashkenazi Jewry for every Khazar who had the mutation. In sum, even if the R-M117 Levites are traceable to Khazaria, the total flow of Khazarians into the East European Jewish population could have been anywhere from a single person to many thousands. If it was the latter, the Khazar input was significant, as David Goldstein suspects it was; if the former, it was trivial, as Jon Entine believes. ... I myself have long suspected, starting far before I knew anything of historical genetics or Arthur Koestler's *The Thirteenth Tribe*, that I have Khazar blood in me. One of my father's sisters had distinctly slanty eyes. In one of her daughters, these are even more pronounced. The daughter's daughter has features that could come straight from the steppes of Asia."

David B. Goldstein. "[In Jewish Genetic History, the Known Unknowns.](#)" *Forward* (August 28, 2009). Excerpts:

"... We have learned that Jewish populations from around the world -- with a few exceptions -- have a remarkable degree of genetic connectedness with each other and with the Near East. ... But many unknowns about Jewish history remain, leaving geneticists with an interest in Jewish origins with plenty of sleuthing work to do. ... A recent study looking at hundreds of thousands of variable sites in the genome revealed a clear genetic signature for Jewish ancestry among randomly selected university students in America. When this Jewish signature was compared

with the genetic makeup of other populations, it became clear that Ashkenazic Jews have a genetic makeup more similar to Near Eastern populations than do other Northern European populations. Yet despite sharing an origin point in the Near East, individual Jews today tend to look markedly different from one another in terms of their physical appearance, depending upon which part of the world their ancestors resided in during recent centuries. Clearly, this diversity of physical appearance is the result of a degree of intermingling with the populations among which Jews have lived. But we don't know precisely when or how this intermingling took place. Did large numbers of gentiles join the Jewish population through mass conversion in the ancient world? Was there a steady trickle of intermarriage? Was there some combination of these? ... One hint we do have is that research shows -- in multiple Jewish groups from Ashkenazic Jews to Georgian Jews -- more genetic continuity with Near Eastern populations on the paternal side (indicated by the Y chromosome) than on the maternal side (indicated by mitochondrial DNA). ... And findings by genetic researchers of significant Near Eastern ancestry among Ashkenazic Jews put to rest the notion that this population originated with or is predominantly descended from the Khazars. Be that as it may, there is one odd and tantalizing feature of Ashkenazic Jewish Y chromosomes that may lead us back to **Khazaria**. ... There is no Y chromosome link that unites Ashkenazic and Sephardic Levites. Among the Ashkenazic Levites, however, there is a particularly common Y chromosome type that is not often found in other Jewish groups. But it is found among people who now live where the Khazars once did. ... One way to answer this question might be to try to develop a fuller picture of the genetics of the Turkic-speaking peoples, particularly modern-day speakers of Chuvash, a Turkic language related to that spoken by the Khazars. Then we could compare their genes to the Ashkenazic genes we suspect may be of Khazar origin."

Almut Nebel, Dvora Filon, Marina Faerman, Himla Soodyall, and Ariella Oppenheim. ["Y chromosome evidence for a founder effect in Ashkenazi Jews."](#) *European Journal of Human Genetics* 13:3 (March 2005): 388-391. Preceded by advance electronic publication on November 3, 2004. This study focuses on one of the two main non-Mideastern Y-DNA lineages among Ashkenazic Jewish men: haplogroup R1a1 (the other is haplogroup Q). [Abstract](#):

"Recent genetic studies, based on Y chromosome polymorphic markers, showed that Ashkenazi Jews are more closely related to other Jewish and Middle Eastern groups than to their host populations in Europe. However, Ashkenazim have an elevated frequency of R-M17, the dominant Y chromosome haplogroup in Eastern Europeans, suggesting possible gene flow. In the present study of 495 Y chromosomes of Ashkenazim, 57 (11.5%) were found to belong to R-M17. Detailed analyses of haplotype structure, diversity and geographic distribution suggest a founder effect for this haplogroup, introduced at an early stage into the evolving Ashkenazi community in Europe. R-M17 chromosomes in Ashkenazim may represent vestiges of the mysterious Khazars."

Mait Metspalu, Doron M. Behar, Y. Baran, Saharon Rosset, N. Kopelman, Bayazit Yunusbayev, A. Gladstein, Michael F. Hammer, Shay Tzur, E. Halperin, Karl Skorecki, Richard Villems, and Noah A. Rosenberg. "No indication of Khazar genetic ancestry among Ashkenazi Jews." A paper presented at the annual meeting of The American Society of Human Genetics (ASHG) in October 22-26, 2013 in Boston, Massachusetts. Some of the comparisons here are of questionable utility since the Khazars did not descend originally from the ancient peoples of the Caucasus and there is no proof that modern Caucasus peoples are descended from Khazars. So, the study doesn't directly test for Khazarian descent. Excerpts from the Abstract:

"[...] It has been difficult to explicitly test for Khazar contributions into Ashkenazi Jews, because it is not clear which extant populations can be used to represent modern descendants of the Khazars, and because the proximity of the southern Caucasus region to the Middle East makes it difficult to attribute any potential signal of Caucasus ancestry to Khazars rather than Middle Eastern populations. Here, we assemble the largest sample set available to date for assessment of Ashkenazi Jewish genetic origins, containing genome-wide single-nucleotide polymorphism data in 1,774 samples from 107 Jewish and non-Jewish populations that span the possible regions of potential Ashkenazi Jewish ancestry: Europe, the Middle East, and 15 populations from the region historically associated with the Khazar kingdom at its peak. Employing a variety of standard techniques for the analysis of population structure, we find that Ashkenazi Jewish samples share the greatest genetic ancestry with other Jewish populations, and among non-Jewish populations, with groups from Mediterranean Europe and the Middle East, and that they have no particular signal of genetic sharing with populations from the Caucasus. Thus, analysis of the most comprehensive set of Jewish and other Middle Eastern and European populations together with a large sample from the region of the Khazar kingdom **does not support the hypothesis of a significant contribution of the elusive Khazars into the gene pool of the Ashkenazi Jews.**"

Doron M. Behar, Daniel Garrigan, Matthew E. Kaplan, Zahra Mobasher, Dror Rosengarten, Tatiana M. Karafet, Lluís Quintana-Murci, Harry Ostrer, Karl Skorecki, and Michael F. Hammer. "Contrasting patterns of Y chromosome variation in Ashkenazi Jewish and host non-Jewish European populations." *Human Genetics* 114:4 (March 2004): 354-365. 442 Ashkenazi Jews were sampled for this study and differentiated according to geographic, religious, and ethno-historical subcategories like "Byelorussian Jews" and "Dutch Jews". In Table 2 on page 357 we see that the mutation lineage designation R-M17, corresponding to haplogroup R1a1 (most often found among Ashkenazi Levites), is found at a frequency of 0.075 among the Ashkenazi Jews as a whole in this study, and at a frequency of 0.264 among the Non-Jewish Europeans (French, Germans, Austrians, Hungarians, Poles, Romanians, and Russians) in the study. Excerpts:

"Haplogroups J and E were by far the most prevalent haplogroups in AJ populations. Haplogroup J was present at similar frequencies in western AJ (41.1%) and eastern AJ (37.0%) populations, whereas haplogroup E-M35 was present at lower frequencies in western AJ than in eastern AJ populations (7.1% versus 19.1%, respectively). This survey of variation at 32 binary (SNP) and 10 STR markers in a sample of 442 Ashkenazi males from 10 different western and eastern Europe communities represents the largest study of Ashkenazi paternal genetic variation to date. The best candidates for haplogroups that entered the AJ population recently via admixture include I-P19, R-P25, and R-M17. These haplogroups were thought to represent the major Paleolithic component of the European paternal gene pool... Because haplogroups R-M17 and R-P25 are present in non-Ashkenazi Jewish populations (e.g., at 4% and 10%, respectively) and in non-Jewish Near Eastern populations (e.g., at 7% and 11%, respectively; Hammer et al. 2000; Nebel et al. 2001), it is likely that they were also present at low frequency in the AJ founding population. The admixture analysis shown in Table 6 suggests that 5%-8% of the Ashkenazi gene pool is, indeed, comprised of Y chromosomes that may have introgressed from non-Jewish European populations. In particular, the Dutch AJ population appears to have experienced relatively high levels of European non-Jewish admixture. ... However, Dutch Jews do not appear to have increased levels of European mtDNA introgression (Behar et al. 2004), suggesting that admixture in this population is mainly the result of higher rates of intermarriage between Jewish woman [sic] and non-Jewish men."

Doron M. Behar, Michael F. Hammer, Daniel Garrigan, Richard Villems, Batsheva Bonne-Tamir, Martin Richards, David Gurwitz, Dror Rosengarten, Matthew Kaplan, Sergio Della Pergola, Lluís Quintana-Murci, and Karl Skorecki. "[MtDNA evidence for a genetic bottleneck in the early history of the Ashkenazi Jewish population.](#)" *European Journal of Human Genetics* 12:5 (May 2004): 355-364. (Advance online publication on January 14, 2004.) An observer who read the study indicates that the study shows that approximately 60 percent of European Jewish maternal roots come from European sources, with the other 40 percent from Middle Eastern or Asian roots. [Abstract](#) excerpt:

To test for the effects of a maternal bottleneck on the Ashkenazi Jewish population, we performed an extensive analysis of mitochondrial DNA (mtDNA) hypervariable segment 1 (HVS-1) sequence and restriction site polymorphisms in 565 Ashkenazi Jews from different parts of Europe. These patterns of variation were compared with those of five Near Eastern (n=327) and 10 host European (n=849) non-Jewish populations. Only four mtDNA haplogroups (Hgs) (defined on the basis of diagnostic coding region RFLPs and HVS-1 sequence variants) account for approximately 70% of Ashkenazi mtDNA variation. While several Ashkenazi Jewish mtDNA Hgs appear to derive from the Near East, there is also **evidence for a low level of introgression from host European non-Jewish populations.**

Bayazit Yunusbayev, Mait Metspalu, Mari Järve, Ildus A. Kutuev, Siiri Rootsi, Ene Metspalu, Doron M. Behar, Kärt Varendi, Hovhannes Sahakyan, Rita Khusainova, Levon Yepiskoposyan, Elza K. Khusnutdinova, Peter A. Underhill, Toomas Kivisild, and Richard Villems. "[The Caucasus as an asymmetric semipermeable barrier to ancient human migrations.](#)" *Molecular Biology and Evolution* For future print publication. First published online on September 13, 2011. Among many other peoples of the Caucasus, 10 Mountain Jews were sampled to evaluate their haplogroups. These Mountain Jews' Y-DNA haplogroups were as follows: 3 belonged to haplogroup J1e*, 4 to J2a*, 1 to J2a2*, and 2 to L2. These haplogroups suggest overwhelmingly Near Eastern ancestry for the Mountain Jews' paternal lineages (represented by the J haplogroups) and a smaller South Asian element (represented by the L haplogroup).

Dror Rosengarten. "Y Chromosome Haplotypes Among Members of the Caucasus Jewish Communities." *Proceedings of the 6th International Conference on Ancient DNA and Associated Biomolecules, July 21-25, 2002*. Abstract excerpt:

"...buccal swab genomic DNA samples were collected from 51 unrelated males from the Mountain Jewish community and from 55 unrelated males from the Georgian Jewish community... Corresponding haplotype frequencies in other Jewish communities and among neighboring non-Jewish populations were derived from the literature. Based on a variety of genetic distance and admixture measures we found that majority of Kavkazi Jewish haplotypes were shared with other Jewish communities and were consistent with a Mediterranean origin. This result strengthens previous reports, which indicated a shared ancestral pool of genetic haplotypes for most contemporary Jewish communities. In the case of the Georgian Jewish samples, both Mediterranean and European haplotypes were found. This could indicate either a Mediterranean origin with a European genetic contribution or a European source with a Mediterranean contribution. Generally, Georgian Jews were found to be closer to European populations than to Mediterranean populations. Despite their geographic proximity, there was a significant genetic distance between the Mountain and Georgian Jewish communities, at least based on Y-haplotype analysis..."

Stefania Bertocini, Kazima Bulayeva, Gianmarco Ferri, Luca Pagani, Laura Caciagli, Luca Taglioli, Igor

Semyonov, Oleg Bulayev, Giorgio Paoli, and Sergio Tofanelli. ["The Dual Origin of Tati-Speakers from Dagestan as Written in the Genealogy of Uniparental Variants."](#) *American Journal of Human Biology* 24:4 (July/August 2012): pages 391-399. First published online on January 24, 2012. They genetically tested the Y-DNA and mtDNA of two Tat-speaking peoples who live in Daghestan in southern Russia: the Mountain Jews (also called Juhurim) and Muslim Tats. The two communities speak different dialects of the Tat language. The genetics of the Jewish and Muslim Tat speakers were found to be quite different, with the authors saying that they "do not reflect a common ancestry." The Mountain Jews were shown to be "a group with tight matrilineal genetic legacy who separated early from other Jewish communities." In the section "Analysis of paternal lineages", the authors indicate that the dominant Y-DNA haplogroup in Mountain Jews is G-M201 (3M285, P15, and M287), representing 36.8% of their total paternal lineages. The Mountain Jews' branch of G doesn't match the G sublineages of "two major Caucasian linguistic domains" nor does their branch cluster with the G STR Y-DNA haplotypes of Ashkenazim that were reported in Behar et al. 2004 and Hammer et al. 2009. The researchers were surprised that the Mountain Jews' kinds of G "can be separated into at least two divergent clades falling many mutational steps away from any G haplotype ever published before [...]. One of these clades is defined by a very peculiar incomplete allele, DYS448*17.4, most likely the results of a deletion external to the repeat units." They also make this observation: "In the MJ [Mountain Jews], the highest level of haplotype sharing (lowest DHS values at the nine-locus level of analysis) was observed with autochthonous groups from Dagestan (Tabasarans, Kubachians, and Laks) and the Jews from Afghanistan". The Y-DNA haplogroup that Mountain Jews share with Tabasarans, called J1*-M267, isn't the same haplogroup that's shared between Muslim Tats and Tabasarans; the two lineages are not even close.

Felice L. Bedford. ["Sephardic signature in haplogroup T mitochondrial DNA."](#) *European Journal of Human Genetics* 20 (2012): 441-448. First released electronically on November 23, 2011. Excerpts from the Abstract:

"A rare combination of mutations within mitochondrial DNA subhaplogroup T2e is identified as affiliated with Sephardic Jews[...] Four investigations were pursued: Search of the motif in 250 000 control region records across 8 databases, comparison of frequencies of T subhaplogroups (T1, T2b, T2c, T2e, T4, T*) across 11 diverse populations, creation of a phylogenetic median-joining network from public T2e control region entries, and analysis of one Sephardic mitochondrial full genomic sequence with the motif. It was found that the rare motif belonged only to Sephardic descendants (Turkey, Bulgaria), to inhabitants of North American regions known for secret Spanish-Jewish colonization, or were consistent with Sephardic ancestry. The incidence of subhaplogroup T2e decreased from the Western Arabian Peninsula to Italy to Spain and into Western Europe. The ratio of sister subhaplogroups T2e to T2b was found to vary 40-fold across populations from a low in the British Isles to a high in Saudi Arabia with the ratio in Sephardim more similar to Saudi Arabia, Egypt, and Italy than to hosts Spain and Portugal. [...]"

Christopher L. Campbell, Pier F. Palamara, Maya Dubrovsky, Laura R. Botigué, Marc Fellous, Gil Atzmon, Carole Oddoux, Alexander Pearlman, Li Hao, Brenna M. Henn, Edward Burns, Carlos D. Bustamante, David Comas Martínez, Eitan Friedman, Itsik Pe'er, and Harry Ostrer. ["North African Jewish and non-Jewish populations form distinctive, orthogonal clusters."](#) *Proceedings of the National Academy of Sciences USA (PNAS)*. Scheduled for print publication. First published online on August 6, 2012. This investigates the roots of five Jewish populations from North Africa (Moroccan, Algerian, Tunisian, Djerban, and Libyan Jews) and compares them to various Jewish and non-Jewish groups. The researchers found evidence that North African Jews descend from ancient Israelites as well as North African converts to Judaism and confirmed that they intermarried with Sephardic Jews who settled there during the Inquisition era. The degree to which the North

African Jewish groups descend from Europeans varied. The study was able to separate Moroccan and Algerian Jews from Djerban and Libyan Jews. The PCA analysis and structure analysis showed that non-Jews of North Africa have more sub-Saharan African ancestry than Jews from North Africa do, confirming earlier studies like Behar et al. 2008.

Dan Even. "[International genetic study traces Jewish roots to ancient Middle East.](#)" *Ha'aretz* (August 8, 2012). Excerpts:

"A new study of genetic affinity among Jewish communities has uncovered evidence of genetic roots among Jews from North Africa that stretch back 2,000 years. [...] Syrian Jews have more genetic commonality with Ashkenazi (European) Jews than with other oriental Jews (Jews from Asian and African lands). Also, Yemenite Jews, who have long been thought to have lived in isolation, apparently have genetic connections with people from neighboring states. Jews of North African origins have greater genetic affinity with Ashkenazi Jews than with non-Jewish residents from North African countries. [...]"

A. L. Non, A. Al-Meer, R. L. Raaum, L. F. Sanchez, and C. J. Mulligan. "[Mitochondrial DNA reveals distinct evolutionary histories for Jewish populations in Yemen and Ethiopia.](#)" *American Journal of Physical Anthropology* 144:1 (January 2011): pages 1-10. First published online on July 7, 2010. This study of mtDNA included 45 Yemenite Jewish participants, 41 Ethiopian Jewish participants, 50 Yemenite non-Jewish participants, and some Ethiopian non-Jewish participants who speak Semitic language(s). The results showed Yemenite Jews and Ethiopian Jews both have high frequencies of "sub-Saharan African L haplogroups [...]" indicating a significant African maternal contribution unlike other Jewish Diaspora populations. However, no identical haplotypes were shared between the Yemenite and Ethiopian Jewish populations, suggesting very little gene flow between the populations and potentially distinct maternal population histories." The authors explain that Ethiopian Jews are maternally Ethiopian rather than Israelite in origin, but they think Yemenite Jews partially have "potential descent from ancient Israeli exiles" and don't believe they have much ethnic Yemenite ancestry.

Noah A. Rosenberg, Eilon Woolf, Jonathan K. Pritchard, Tamar Schaap, Dov Gefel, Isaac Shpirer, Uri Lavi, Batsheva Bonné-Tamir, Jossi Hillel, and Marcus W. Feldman. "[Distinctive genetic signatures in the Libyan Jews.](#)" *Proceedings of the National Academy of Sciences USA (PNAS)* 98:3 (January 30, 2001): 858-863. ([Mirror](#)) Excerpts:

"It is consistent with historical sources that the Libyan Jews should separate from and show strong differentiation from the other populations of our study. This population has a unique history among North African Jewish communities, including an early founding, a harsh bottleneck, possible admixture with local Berbers, limited contact with other Jewish communities, and small size in the recent past.... Ethiopian Jewish Y-chromosomal haplotypes are often present in Yemenite and other Jewish populations..., but analysis of Y-chromosomal haplotype frequencies does not indicate a close relationship between Ethiopian and other Jewish groups.... However, the evidence of an African contribution to the ancestry of Ethiopian Jews and the evidence of communication across the Red Sea suggest that gene flow between these populations would be a more plausible explanation for our clustering of some Yemenite Jews with some Ethiopian Jews. Recent studies suggest that the Lemba of southern Africa derive partly from Yemenite Jews or other Semitic peoples of this region (17), and that Ethiopians share a combination of African and Middle Eastern genotypes and languages.... Although gene flow between the Ethiopian and Yemenite Jewish populations is one explanation of our results, it is

also possible that gene flow did not occur directly between these two populations, but rather took place between non-Jewish populations of Ethiopia and Arabia, between Ethiopian Jews and Ethiopian non-Jews, and also between Yemenite Jews and Yemenite non-Jews."

Yedael Y. Waldman , Arjun Biddanda , Natalie R. Davidson, Paul Billing-Ross, Maya Dubrovsky, Christopher L. Campbell, Carole Oddoux, Eitan Friedman, Gil Atzmon, Eran Halperin, Harry Ostrer, and Alon Keinan. ["The Genetics of Bene Israel from India Reveals Both Substantial Jewish and Indian Ancestry."](#) *PLoS ONE* 11:3 (March 24, 2016): e0152056. Autosomal DNA analysis shows that the Bene Israel community of western India was formed by intermarriage between Middle Eastern Jewish men and local Indian women. 18 Bene Israel individuals were compared with hundreds of representatives of Jewish and non-Jewish populations. They have increased lengths of identical-by-descent matches with Jewish populations from outside of India, including Mizrahi Jews, compared to any other population within India or Pakistan. A weakness of this study is that it doesn't compare the Bene Israel against any non-Jewish population from the eastern Middle East (Iran/Iraq area).

Aleza Goldsmith. [Jews and Arabs share genes, Stanford research scientist says.](#) *Jewish Bulletin of Northern California* (March 9, 2001). Excerpts:

"Peter Underhill, a senior research scientist in the department of genetics at Stanford University, has a reality check for the Middle East: 'No matter how you define yourself today -- whether Palestinian, Israeli, Syrian, Turkish -- Middle Easterners share much of the same gene pool.' Based on research on the Y chromosome, published by Underhill and Stanford colleagues in a recent issue of *Nature Genetics*.... Underhill, along with Stanford colleagues and geneticists in the United States, Europe, Israel and Africa, have been working with the paternally transmitted Y chromosomes of more than 1,000 men from 22 geographical areas...."

Peter A. Underhill, P. Shen, A. A. Lin, L. Jin, G. Passarino, W. H. Yang, E. Kauffman, Batsheva Bonn -Tamir, J. Bertranpetit, P. Francalacci, M. Ibrahim, T. Jenkins, J. R. Kidd, S. Q. Mehdi, M. T. Seielstad, R. S. Wells, A. Piazza, R. W. Davis, M. W. Feldman, Luigi Luca Cavalli-Sforza, and P. J. Oefner. ["Y chromosome sequence variation and the history of human populations."](#) *Nature Genetics* 26 (2000): 358-361. [Sequence information for the 167 Y chromosome markers.](#)

Nicholas Wade. ["Studies Show Jews' Genetic Similarity."](#) *The New York Times* (June 10, 2010): A14. Excerpts:

"Jewish communities in Europe and the Middle East share many genes inherited from the ancestral Jewish population that lived in the Middle East some 3,000 years ago, even though each community also carries genes from other sources... Ashkenazic and Sephardic Jews have roughly 30 percent European ancestry, with most of the rest from the Middle East, the two surveys find. The two communities seem very similar to each other genetically... One explanation is that they come from the same Jewish source population in Europe. The Atzmon-Ostrer team found that the genomic signature of Ashkenazim and Sephardim was very similar to that of Italian Jews, suggesting that an ancient population in northern Italy of Jews intermarried with Italians could have been the common origin. The Ashkenazim first appear in Northern Europe around A.D. 800, but historians suspect that they arrived there from Italy. ... The genetics confirms a trend noticed by historians: that there was more contact between Ashkenazim and Sephardim than suspected, with Italy as the linchpin of interchange, said Aron Rodrigue, a Stanford University historian. A common surname among Italian Jews is Morpurgo, meaning

someone from Marburg in Germany. Also, Dr. Rodrigue said, one of the most common names among the Sephardim who settled in the Ottoman Empire is Eskenazi, indicating that many Ashkenazim had joined the Sephardic community there. The two genetic surveys indicate 'that there may be common origins shared by the two groups, but also that there were extensive contacts and settlements,' Dr. Rodrigue said."

Mayrav Saar. ["Genetic testing raises an age-old question - are the Jews a people, or a religion?"](#) *New York Post* (June 13, 2010). Excerpts:

"'The debate is over,' said Dr. Edward R. Burns, one of the lead authors of the study. 'The Jewish people are one people with a common genetic thread that evolved in the second or third century BC.' The study, 'Abraham's Children in the Genome Era,' compared the genetic analyses of 237 Jews, including Sephardic (Middle Eastern) and Ashkenazi (Eastern European) Jews - as well as an analysis of 418 non-Jews worldwide, and found that the Jews were more closely related to each other than to their fellow countrymen. Past studies have reached similar conclusions, but they looked at smaller populations and considered only blood groups, mitochondrial DNA (a type of DNA passed down by mothers) or Y chromosomes (passed down by fathers). ... The study - and a second genetic study published Friday in the journal *Nature* - scientifically undermines arguments made by those who challenge Jews' historical relationship to Israel... 'It seems that most Jewish populations, and therefore most Jewish individuals, are closer to each other [at the genetic level], and closer to the Middle Eastern populations, than to their traditional host population in the Diaspora,' Israeli geneticist Doron Behar, author of the *Nature* study, told the BBC. ... That the new data also seemed to follow the Jews' historical and Biblical narrative was particularly exciting to Burns, who is Jewish. 'I, along with my co-authors, went to these different populations, Iraqis, Iranians, etc. We talked to these people, and they had a certain hopefulness that the genetic analysis would establish for them a type of universal Jewish pride,' he said. 'My own personal feeling is that (among Jews) differences in culture and geography become meaningless because we're all sisters and brothers.' ... 'My sister-in-law is Filipino. She practices Judaism - which is more than I do - but I can't call her a fellow Jew in that same sense,' said Sandy Malek, president of the Jewish Genealogical Society of Los Angeles... 'There is a peoplehood for Jewish people that is separate from the religion.' ... While the new research says much about Jews, it doesn't have any bearing on Judaism, said David Wolpe, the rabbi, who explained that he is 'not moved' by the effort to scientifically link and define Jews. ... 'Spiritually this is a pleasant and welcome reinforcement of what I already knew, but the bottom line is Torah trumps genome,' said David Wolpe, the rabbi. ... The analysis by Burns and his colleagues provides the first detailed genetic map of the major Jewish groups, information that can be used as a kind of dictionary to study the genetic origins of commonly acquired diseases such as cancer and heart disease. This information can benefit not only Jews, but the population as a whole, as researchers use the data better understand possible genetic components of diseases, researchers said. The study could also yield valuable information for a host of conditions already thought to have a genetic component, from near-sightedness to breast cancer - just don't call any of those diseases 'Jewish.' Even the host of ailments that are considered 'Jewish genetic diseases,' including Tay-Sachs Disease and Bloom's Disease, occur in the general population, said Paul Wolpe, the bioethicist, who is also on the board of the Victor Centers for Jewish Genetic Diseases."

Lea Winerman. "Is Being Jewish All in the Genes?" *New Voices: National Jewish Student Magazine* 9:3

(January 2001): 8-13. Excerpts:

"The studies of the past several years have provided fascinating insights into Jewish history, but they've hardly closed the book on the question of modern Jews' ancestry. Right now, two separate research groups are taking a more in-depth look at the origins and migration patterns of Eastern European Jews. Michael Hammer and Harry Ostrer are leading one study; Dr. Vivian Moses and Dr. Neil Il Bradman are conducting the other at the Center for Genetic Anthropology at University College-London. Vivian Moses suggests that the results of his study might diverge somewhat from what Hammer and his colleagues presented last June. 'I think perhaps we are using more DNA markers than they did,' he says, 'and therefore the results might not be exactly the same. We already have some **preliminary indications of a link between [Eastern European Jews and] Slavs.**'"

Nathaniel Pearson. "[My Blood Brother in Samarkand.](#)" *Stanford Magazine* (May/June 1999). Nathaniel Pearson, a scientist who has studied at Stanford University and the University of Chicago, conducted research on genetics as part of the Human Genome Project. He traveled to Eastern Europe, Asia, and the Middle East collecting genetic data using blood samples and cheek swabs. Some of his test subjects were North Caucasians, Turks, and Sino-Tibetans. (However, it needs to be noted that the haplotype Pearson describes has also been found among Moroccan Jews, and thus not only among Jews, Tajiks, Uzbeks, and Indians. So the origin of the haplotype remains mysterious.) Excerpts:

"As population geneticists, Spencer Wells and I were working with Stanford emeritus professor Luca Cavalli-Sforza and others to study DNA variation among different groups... Our expedition eventually took us through the forests, steppes and deserts between the Black Sea and Central Asia's Altai Mountains. We collected hundreds of samples from people whose ancestors included nomads, farmers, sultans and serfs and whose genetic makeup had been shaped for millennia by waves of conquest and trade in this region of the Silk Road... [O]ur expedition rolled into the old oasis city of Samarkand... Back at Stanford, my labmates and I had compared hundreds of DNA samples from men around the world, focusing on about a dozen sites along the Y chromosome... Out of curiosity, I submitted my own sample to the database -- and discovered that I matched with four other donors. One was a Turkic-speaking man in western Uzbekistan, two lived in New Delhi, and one was a Tajik living in Samarkand... Sharif's Tajiks are Persian-speakers who moved east to Samarkand well before the arrival of Islam there about 1,300 years ago and the heyday of overland trade. They mixed with people already there and, later, with Turkic immigrants and others. My recent ancestors were Ashkenazi Jews in Ukraine; that population likely moved by several routes from the Middle East to Eastern Europe over the past couple of thousand years, mixing with Indo-European and Turkic people along the way. The common influence of Indo-European, Semitic and Turkic ancestry is one clue to how we might share a recent ancestor. That both Jews and Tajiks plied the Silk Road about a thousand years ago is another."

See also Pearson's "[St. Louis to Samarkand -- A Tale of Two Chromosomes](#)". Also see his [message here](#) where he revealed he belongs to Y-DNA haplogroup Q1b ("Here's a little piece I wrote a few years ago about my own little branch of the Q1b tree:"). Q1b is the same as Q-P36 and is found among about 5% of Ashkenazic men.

Stephen Magagnini. "[DNA helps unscramble the puzzles of ancestry.](#)" *The Sacramento Bee* (August 3, 2003). This article mentions several cases of individualized genetic testing by companies like Trace Genetics and

Family Tree DNA. Of interest to us is the case of an Ashkenazi woman whose mtDNA bears the marker of the transversion at np16257, which may have originated among the Han Chinese people and travelled westward along the Silk Road into Uzbekistan. This marker is not likely to have been common among the Khazars. Excerpts:

"The brave new world of DNA roots-quests -- barely three years old -- sometimes produces surprising results. ... And a Jewish schoolteacher from Oakland learned at least one of her forebears came out of China. ... Alanya Snyder, a [Ashkenazi] Jewish middle school teacher in Oakland [with maternal-line ancestry from Moldova], had her [mt] DNA tested [by Trace Genetics of Davis, California] as a wedding present and discovered she matches people from central Asia [including some Uzbekistani Jews near Bukhara, plus some Han Chinese inhabitants of eastern China and some Mongolians]. The news thrilled Snyder's mother, Carel Bertram, a San Francisco State professor with a lifelong love of Turkic art and culture. Bertram suspects she and Snyder are descendants of the **Khazars**, a Turkic-speaking group that converted to Judaism about A.D. 750 and later was conquered by the Kiev Rus, or early Russians. 'Maybe there was this wonderful, Turkic-speaking Jewish woman,' she mused. 'It's so enriching, something added to my life that I had not expected.'"

Harlette Lacau, Tenzin Gayden, Maria Regueiro, Shilpa Chennakrishnaiah, Areej Bukhari, Peter A. Underhill, Ralph L. Garcia-Bertrand, and Rene J. Herrera. ["Afghanistan from a Y-chromosome perspective."](#) *European Journal of Human Genetics*. Forthcoming in print. First published online on April 18, 2012. An analysis of the Y-chromosomes of 168 Pathan males from Afghanistan. Excerpts from the Abstract:

"Central Asia has served as a corridor for human migrations providing trading routes since ancient times. [...] Our study demonstrates genetic similarities between Pathans from Afghanistan and Pakistan, both of which are characterized by the predominance of haplogroup R1a1a*-M198 (>50%) and the sharing of the same modal haplotype. Furthermore, the high frequencies of R1a1a-M198 and the presence of G2c-M377 chromosomes in Pathans might represent phylogenetic signals from **Khazars**, a common link between Pathans and **Ashkenazi** groups, [...]"

Siiri Rootsi, Natalie M. Myres, Alice A. Lin, Mari Järve, Roy J. King, Ildus A. Kutuev, Vicente M. Cabrera, Elza K. Khusnutdinova, Kärt Varendi, Hovhannes Sahakyan, Doron M. Behar, Rita Khusainova, Oleg Balanovsky, Elena Balanovska, Pavao Rudan, Levon Yepiskoposyan, Ardeshir Bahmanimehr, Shirin Farjadian, Alena Kushniarevich, Rene J. Herrera, Viola Grugni, Vincenza Battaglia, Carmela Nici, Francesca Crobu, Sena Karachanak, Baharak Hooshir Kashani, Massoud Houshmand, Mohammad H. Sanati, Draga Toncheva, Antonella Lisa, Ornella Semino, Jacques Chiaroni, Julie Di Cristofaro, Richard Villems, Toomas Kivisild, and Peter A. Underhill. ["Distinguishing the co-ancestries of haplogroup G Y-chromosomes in the populations of Europe and the Caucasus."](#) *European Journal of Human Genetics* 20 (2012): pages 1275-1282. First published online on May 16, 2012. The freely-accessible [Supplementary Information](#) contains important data. Per [Supplementary Table 1](#), 10 of the 157 Ashkenazi Jewish males in the study (6.4%) had G haplogroups, compared to 24 of the 171 non-Ashkenazi Jewish males (14%); these data were updated from Behar et al. 2010. The G subclade frequencies didn't match between Ashkenazi and non-Ashkenazi Jews. The G-M377 mutation was found in 5.1% of the Ashkenazim but none of the non-Ashkenazim. The G-P303 mutation was found in 6.4% of the non-Ashkenazim but none of the Ashkenazim had it. Also found exclusively among non-Ashkenazim was G-P15 with 1.8% of them possessing it, G-M406 found in 2.3% of them, G-M485 found in 1.2% of them, and G-L91 found in 0.6% of them. Two subclades were held in common: G-M285 was found in 0.6% of Ashkenazim and the same percentage of non-Ashkenazim, while G-

P16 was found in 0.6% of Ashkenazim and 1.2% of non-Ashkenazim. Not one of the 10 Mountain Jews in the study had a G haplogroup.

[Eran Elhaik](#). "[The Missing Link of Jewish European Ancestry: Contrasting the Rhineland and the Khazarian Hypotheses](#)." *Genome Biology and Evolution* 5:1 (2013): 61-74. Finalized article first published online by gbe.oxfordjournals.org on December 14, 2012. Excerpts from the Abstract:

"[...] We applied a wide range of population genetic analyses to compare these two hypotheses. Our findings support the Khazarian Hypothesis and portray the European Jewish genome as a mosaic of Caucasus, European, and Semitic ancestries, thereby consolidating previous contradictory reports of Jewish ancestry. We further describe major difference among Caucasus populations explained by early presence of Judeans in the Southern and Central Caucasus. [...]"

An excerpt from the body of the article:

"Central and Eastern European Jews differ mostly in their Middle Eastern (30% and 25%, respectively) and Eastern European ancestries (3% and 12%, respectively), probably due to late admixture. [...] The close genetic distance between Central European Jews and Southern European populations can be attributed to a late admixture."

Elhaik's article was accompanied by a commentary (with interviews) by Danielle Venton published in *Genome Biology and Evolution* 5:1 on pages 75-76: "[Highlight: Out of Khazaria--Evidence for 'Jewish Genome' Lacking](#)".

Agence France-Presse. "[Gene study settles debate over origin of European Jews](#)." January 16, 2013. Article about Elhaik's study.

Rita Rubin. "['Jews a Race' Genetic Theory Comes Under Fierce Attack by DNA Expert](#)." *Jewish Forward*, published online May 7, 2013 and in print on May 10, 2013. Article about both sides in the debate over Elhaik's study.

Also see [this commentary against Elhaik's study's consideration of Armenians as a fundamentally Caucasus-based people](#)

and [this commentary about its mistake in using Armenians as "a proxy for the gene pool of the Khazar Empire"](#)

as well as [Seth Frantzman's Jerusalem Post commentary "Terra Incognita: The return of the Khazar myth"](#) mentioning a possible problem relating to the Druse (Druze) among other concerns.

Anatole A. Klyosov criticizes Elhaik's study in an article in Russian in *Proceedings of the Academy of DNA Genealogy* 6:3 (2013).

Marc Perelman. "[Palestinian Gene Study Breeds Scandal](#)." *Forward* (November 30, 2001).

Robin McKie. "[Journal axes gene research on Jews and Palestinians](#)." *The Observer* (November 25, 2001).

Lila Guterman. "Science Journal Retracts Paper That Veered Into Geopolitical Speculation." *The Chronicle of Higher Education* (November 16, 2001).

Antonio Arnaiz-Villena, Nagah Elaiwa, Carlos Silvera, Ahmed Rostom, Juan Moscoso, Eduardo Gómez-

Casado, Luis Allende, Pilar Varela, and Jorge Martínez-Laso. "The Origin of Palestinians and Their Genetic Relatedness With Other Mediterranean Populations." *Human Immunology* 62(9) (September 2001): 889-900. Published by Elsevier Science Inc. Recalled by editors after publication. Retraction in *Human Immunology* 62(10) (October 2001): 1063. Abstract excerpts:

"The genetic profile of Palestinians has, for the first time, been studied by using human leukocyte antigen (HLA) gene variability and haplotypes. The comparison with other Mediterranean populations by using neighbor-joining dendrograms and correspondence analyses reveal that Palestinians are genetically very close to Jews and other Middle East populations, including Turks (Anatolians), Lebanese, Egyptians, Armenians and Iranians. Archaeologic and genetic data support that both Jews and Palestinians came from the ancient Canaanites, who extensively mixed with Egyptians, Mesopotamian and Anatolian peoples in ancient times..."

Excerpts:

"Both Jews and Palestinians share a very similar HLA genetic pool (Table 3, Figures 4, 5 and 6) that support a common ancient Canaanite origin.... Jews, Cretans, Egyptians, Iranians, Turks and Armenians are probably the closest relatives to Palestinians..." (p. 897)

Harry Ostrer. ["A genetic profile of contemporary Jewish populations."](#) *Nature Reviews Genetics* 2(11) (November 2001): 891-898. Excerpt:

"Studies of Y-chromosomal markers have provided an opportunity to assess gene flow into Jewish populations from non-Jewish males. Contemporary Jews and Middle Eastern Arabs have 13 common Y-chromosomal haplotypes that are shared both within and across groups, indicating that the original Jews might have arisen from local peoples [Canaanites, Sumerians, etc.] and are not the offspring of a single patriarch [Abraham]. The most common Y-chromosomal haplotypes are thought to be of Middle Eastern and North African origin, and the less common haplotypes of Asian origin, indicating that gene flow had a role in the formation of the Jewish people."

Carole Oddoux, Encarnacion Guillen-Navarro, C. M. Clayton, H. Nelson, H. Peretz, U. Seligsohn, L. Luzzatto, M. Nardi, M. Karpatkin, C. DiTivoli, E. DiCave, Felicia Axelrod, and Harry Ostrer. "Genetic Evidence for a Common Origin among Roman Jews and Ashkenazi Jews." *American Journal of Human Genetics* 61:4 (1997): A207. Abstract excerpts:

"The present Ashkenazi Jewish population is believed to be derived from an initial group of 10,000 founders who moved to Eastern Europe 1000 years ago, possibly from Rome. In order to test the hypothesis that these two populations originated from a common founder population we collected samples from a group of 107 Roman Jews representing 176 unique chromosomes and analyzed them for specific mutations known to be prevalent among Ashkenazi Jews.... The FXI type III mutation has previously been observed exclusively among Ashkenazi Jewish populations suggesting a common origin for the Roman and the Ashkenazi Jews and dating the mutation to between 1,000 and 2,000 years ago."

"Genetic Road May Lead to Rome: Scientists Discover Ties Between Ashkenazim and Roman Jews." *Forward* (August 29, 1997): v. C1, p. 22.

Steve Sailer. ["Q&A: Tracing Jewish history through genes."](#) (UPI, May 15, 2003). Published in that day's

edition of *The Washington Times*. Excerpts:

"From a historical perspective, however, this current era of Jews marrying gentiles is not unique, according to author Jon Entine. While other peoples have come and gone over the millennia, the world Jewish community has survived both through eras of horrific persecution and eras of high rates of intermarriage. ... Entine said: 'Biblical literalists have long contended that Jews are a 'race apart,' citing Deuteronomic Law: 'You shall not intermarry with them (non-Jews).' As a result, some Jewish populations, such as the Ashkenazi from Eastern Europe, are among the more genetically distinct in the world... Under the Roman Empire, the Jewish community in Italy was quite sizable for a time, with lots of flow in and out. During the early Christian period in the Roman Empire, Jewish males who had left the Mideast often took on Gentile wives. Their offspring probably became the core of Ashkenazi Jewry. However, some time around the fall of Rome is when the taboos on intermarriage (imposed by both Jews and Gentiles) became stringent. The real end to Ashkenazi Jewish out-marrying did not come until the Middle Ages as the economic and social position of Jews worsened considerably. This historical trend is reflected in the genetic data, which suggests that the genetic core of modern Ashkenazi Jewry was not formed until this period. The core consisted mostly of Jewish men with Middle Eastern roots marrying a high percentage of local Gentile women, then forming Jewish communities.'"

Jon Entine. ["Jews Are a 'Race,' Genes Reveal."](#) *Forward* (May 11, 2012). Excerpts:

"In his new book, ['Legacy: A Genetic History of the Jewish People,'](#) Harry Ostrer, a medical geneticist and professor at Albert Einstein College of Medicine in New York, claims that Jews are different, and the differences are not just skin deep. Jews exhibit, he writes, a distinctive genetic signature. [...] Ostrer bolsters his analysis with volumes of genetic data, [...] threads of Jewish ancestry link the sizable Jewish communities of North America and Europe to Yemenite and other Middle Eastern Jews who have relocated to Israel, as well as to the black Lemba of southern Africa and to India's Cochin Jews. But, in a twist, the links include neither the Bene Israel of India nor Ethiopian Jews. Genetic tests show that both groups are converts, contradicting their founding myths. [...] About 80% of [the lineages of] Jewish males and 50% of Jewish females trace their ancestry back to the Middle East. The rest entered the 'Jewish gene pool' through conversion or intermarriage. [...]"

G rard Lucotte and G raldine Mercier. ["Y-chromosome DNA haplotypes in Jews: comparisons with Lebanese and Palestinians."](#) *Genetic Testing* 7:1 (Spring 2003): 67-71. Abstract:

One Y-specific DNA polymorphism (p49/Taq I) was studied in 54 Lebanese and 69 Palestinian males, and compared with the results found in 693 Jews from three communities (Oriental, Sephardic, and Ashkenazic). Lebanese, Palestinian, and Sephardic Jews seem to be similar in their Y-haplotype patterns, both with regard to the haplotype distributions and the ancestral haplotype VIII frequencies. The haplotype distribution in Oriental Jews is characterized by a significantly higher frequency of haplotype VIII. These results confirm similarities in the Y-haplotype frequencies in Lebanese, Palestinian, and Sephardic Jewish men, three Near-Eastern populations sharing a common geographic origin.

G rard Lucotte and Pierre Smets. ["Origins of Falasha Jews studied by haplotypes of the Y chromosome."](#) *Human Biology* 71:6 (December 1999): 989-993. ([mirror](#)) Abstract:

"DNA samples from Falasha Jews and Ethiopians were studied with the Y-chromosome-specific DNA probe p49a to screen for TaqI restriction polymorphisms and haplotypes. Two haplotypes (V and XI) are the most widespread in Falashas and Ethiopians, representing about 70% of the total number of haplotypes in Ethiopia. Because the Jewish haplotypes VII and VIII are not represented in the Falasha population, we conclude that the Falasha people descended from ancient inhabitants of Ethiopia who converted to Judaism."

A. Amar, O. J. Kwon, U. Motro, C. S. Witt, Batsheva Bonn -Tamir, R. Gabison, and Chaim Brautbar. "Molecular analysis of HLA class II polymorphisms among different ethnic groups in Israel." *Human Immunology* 60(8) (August 1999): 723-730. This study failed to study Slavic populations, yet the study apparently showed that Israeli Arabs are closer to Sephardic Jews than either group is to Ashkenazi Jews. Excerpts:

"Genetic studies classify the Israeli Jewish population into two major groups: Ashkenazi from Central and Eastern Europe and Sephardic or non Ashkenazi, from the Mediterranean and North Africa... Ethiopian Jews were found to be closer to the Blacks than to any of the Israeli Jewish groups. We have shown that Jews share common features, a fact that points to a common ancestry. A certain degree of admixture with their pre-immigration neighbors exists despite the cultural and religious constraints against intermarriage."

Jorge Martinez-Laso, Ephraim Gazit, Eduardo Gomez-Casado, Pablo Morales, Narcisa Martinez-Quiles, Miguel Alvarez, J. M. Martin-Villa, V. Fernandez, and Antonio Arnaiz-Villena. "HLA DR and DQ polymorphism in Ashkenazi and non-Ashkenazi Jews: comparison with other Mediterraneans." *Tissue Antigens* 47(1) (January 1996): 63-71. Excerpts:

"HLA-DR and DQ alleles have been detected by DNA typing in Ashkenazi and non-Ashkenazi Jews from Israel. Allele frequencies, characteristic DR/DQ linkage disequilibria, population distances and their corresponding dendrogram by using the Neighbor-Joining method were used to study relatedness between Jewish and other Mediterranean and non Mediterranean populations. Closest relatedness is observed between Ashkenazi and non-Ashkenazi Jews, and, in decreasing order, also with Algerians, Spaniards (including Spanish-Basques), French and Italians. Also, particular characteristic Central European alleles are observed in Ashkenazi Jews and Mediterranean/African alleles in non-Ashkenazi Jews. This is consistent with historical data, Jews being an ancient Mediterranean population, who have had a certain degree of admixture with their 2000-3000 years old neighbors in spite of cultural and religious traditions which have preserved identity outside Israel."

William Klitz, Loren Gragert, Martin Maiers, Marcelo Fernandez-Vi a, Y. Ben-Naeh, Gil Benedek, Chaim Brautbar, and Shoshana Israel. "[Genetic differentiation of Jewish populations.](#)" *Tissue Antigens* 76:6 (December 2010): pages 442-458. First published online on September 22, 2010. Most Jewish populations carry human leucocyte antigen (HLA) varieties of Middle Eastern origin, but the Ethiopian Jews are a notable exception. Ethiopian Jews instead show some affinity to Ethiopian non-Jews. Excerpts from the Abstract:

"[...] We analyzed the HLA allele and haplotype frequencies for each national sample using population genetic and clustering methods. [...] We suggest that a major contributing factor to the genetic divergence between Jewish groups may have been admixture with local host populations, while, at the same time, threads of Eastern Mediterranean ancestry remain evident."

Robert Pollack. "[The Fallacy of Biological Judaism.](#)" *Forward* (March 7, 2003): Op-Ed section. Excerpt:

"Though there are many deleterious versions of genes shared within the Ashkenazic community, there are no DNA sequences common to all Jews and absent from all non-Jews. There is nothing in the human genome that makes or diagnoses a person as a Jew."

Leonard B. Glick. [Abraham's Heirs: Jews and Christians in Medieval Europe.](#) Syracuse, NY: Syracuse University Press, 1999. Glick is a cultural anthropologist and historian. Excerpt from page xi:

"In the earliest period of Jewish settlement in Gaul... Jews were relatively well accepted, and Jewish men appear to have intermarried frequently enough with local non-Jewish women (probably all of whom converted) to create a Jewish population of decidedly mixed genetic origins. Modern physical anthropological studies of European Jews have demonstrated conclusively that the term 'Semitic' masks the large European component in the Jewish genetic pool."

Shmuel A. Cygielman. (Article about Jewish settlement in Poland in medieval times) in [Medieval Jewish History: An Encyclopedia](#), ed. Norman Roth. Routledge, 2003. Excerpt:

"...the Jews... in Poland... employed local Slavic slaves who aided them in developing their enterprises. The Jews were mostly single men, from Jewish centers in western and southern Europe... As by Jewish law, after seven years they were required to free their slaves, often, the owner, when his female slave continued working with him after her release, proposed that she remain with him as his wife, and undertake the management of the household as an equal partner, all on condition that she convert to Judaism. This could also explain the Slavic cast which often manifests itself on the faces of Jews from this region."

Steve Jones. [In the Blood: God, Genes, and Destiny.](#) Flamingo, 1997. Excerpts:

"Ashkenazim are quite distinct from their Mediterranean and Middle-Eastern co-religionists in the incidence of the disease and in the mutations responsible... The genetic family tree of Jews from different parts of Europe shows that they are not a unique group, biologically distinct from other peoples around them. There is, though, evidence of common ancestry that gives Jews at least a partial identity of their own. In most places, there is overlap between the genes of the Jewish population and those of local non-Jews. There has been interchange; sometimes through recent marriage, but more often as a result of mating long ago.... **The Y chromosomes of Jews are - unsurprisingly - not all the same;** the idea of the sons of Abraham is a symbolic one. They do show that many males, some only distantly related to each other, have contributed to the genes of European Jewry. On the average, most Jewish populations contain more diversity for male lineages than for female (whose history is recorded in mitochondrial DNA). This means that there has been more invasion of the Jewish gene pool by the genes of non-Jewish men than of women. **The Y chromosomes of Jewish men from the Balkans are rather unlike those of other European Jews,** perhaps because there was more admixture in this unstable part of the world."

Judit Beres and C. R. Guglielmino. "Genetic Structure in relation to the history of the Hungarian ethnic group." *Human Biology* 68:3 (June 1996): 335-about 356. Summary:

Studies multiple nationalities: Magyars, Jews, Gypsies, Germans, Slovaks, Kuns, Romanians, etc. In this very large study, Hungarian Jews were found to be highly distinct from all other groups residing in Hungary.

U. Ritte, E. Neufeld, M. Broit, D. Shavit, and U. Motro. ["The Differences Among Jewish Communities: Material and Paternal Contributions."](#) *Journal of Molecular Evolution* 37:4 (October 1993): 435-440.

E. S. Poloni, Ornella Semino, G. Passarino, A. Silvana Santachiara-Benerecetti, I. Dupanloup, A. Langaney, and L. Excoffier. ["Human Genetic Affinities for Y-Chromosome P49a,f/TaqI Haplotypes Show Strong Correspondence with Linguistics."](#) *American Journal of Human Genetics* 61 (1997): 1015-1035. Excerpts:

"Afro-Asiatic and Indo-European samples differentiate along the second axis of the multivariate analysis. The Sephardim Jews, the Ashkenazim Jews, the Turks, and the Lebanese samples are genetically located at the intersection of these two linguistic groups, the Ashkenazim samples being somewhat closer to Indo-Europeans.... Although the overall pattern of population differentiation globally appears to be very similar for male- and female-transmitted markers (fig. 3), some populations clearly show different affinities for their maternal and paternal genetic components, as already noticed for Ethiopian Jews (Zoonsman-Diskin et al. 1991), Arab tribal groups in the Sinai Peninsula (Salem et al. 1996), Finns (Zerjal et al. 1997), and Basques (as discussed above)."

[Graph of Y-chromosome clusters derived from this study](#) (Leb = Lebanese, Ash = Ashkenazic Jews, NAS = North African Jews, NES = Near Eastern Jews, Sep = Sephardic Jews, SoS = South Sardinian, Tur = Anatolian Turkish, Ita = Italian)

A. Silvana Santachiara-Benerecetti, Ornella Semino, G. Passarino, A. Torroni, R. Brdicka, M. Fellous, G. Modiano. "The common, Near-Eastern origin of Ashkenazi and Sephardi Jews supported by Y-chromosome similarity." *Annals of Human Genetics* 57 (January 1993): 55-64 (part 1). Excerpts:

"About 80 Sephardim, 80 Ashkenazim and 100 Czechoslovaks were examined for the Y-specific RFLPs revealed by the probes p12f2 and p49a,f on TaqI DNA digests. The aim of the study was to investigate the origin of the Ashkenazi gene pool through the analysis of markers which, having an exclusively holoandric transmission, are useful to estimate paternal gene flow. The comparison of the two groups of Jews with each other and with Czechoslovaks (which have been taken as a representative source of foreign Y-chromosomes for Ashkenazim) shows a great similarity between Sephardim and Ashkenazim who are very different from Czechoslovaks. On the other hand both groups of Jews appear to be closely related to Lebanese. A preliminary evaluation suggests that the contribution of foreign males to the Ashkenazi gene pool has been very low (1% or less per generation)."

Jared Diamond. "Who Are the Jews?" *Natural History* 102:11 (November 1993): 12-19. Summary:

Diamond argues that Ashkenazic Jews are connected to "their ancient Arab and Egyptian neighbors." (p. 18). Yet he admits: "Although the Jews have been scattered for only a few thousand years, their faces often reflect their scattered homelands." (p. 12). Diamond's explanations are somewhat bizarre. While he is willing to consider Indian Jews, Yemenite Jews, and Ethiopian Jews descendants of converts and mixed marriages (p. 18), he seems to think Ashkenazic Jews are more purely Israelite than other Jewish groups. He suggests that natural

selection, rather than intermarriage and conversion, explains how Jews resemble their non-Jewish neighbors (p. 16). In other words, Jews move to Europe, speed up the process of evolution that usually is slower among other human groups, and somehow magically start to look like Russians, Poles, Italians, and Germans, without any genetic contact with them. Skin color and ABO blood group studies contradict the notion that Jews are all homogeneous Middle Easterners (Diamond p. 14, 16) and "G6PD deficiency" genetics is common to Ashkenazim, Russians, and Germans (p. 16-17). But Diamond keeps insisting that this was not due to mixing. "In their fingerprints, Rhesus blood group frequencies, haptoglobins, and several enzyme markers, Ashkenazic Jews resemble Sephardic and Yemenite Jews and differ from Eastern European Gentiles. Furthermore, in these respects Jews resemble many Gentile peoples of the eastern Mediterranean, such as Samaritans, Armenians, Egyptian Cops, and Syrian, Lebanese, and Palestinian Arabs." (p. 16) "Thus, judging by neutral markers, the non-Jewish contribution to the Ashkenazic and Sephardic Jewish gene pool has been low. These groups of Jews may really be transplanted Semites, not converted Khazars or products of massive intermarriage." (p. 18). But this does nothing to explain the magical way in which Jews come to resemble their neighbors. It is as if a Dutchman moving to South Africa would have descendants who would at least be beginning to look more like native Africans, or descendants of the Mayflower starting to adopt American Indian facial characteristics, or Englishmen in Australia turning Aboriginal. Are such things happening absent intermarriage? Obviously not. And how and why would a minority group drastically change its physical appearance (e.g. lightening skin) in order to blend in with the majority? Diamond the intermarriage-denier thinks "Jews thus provide a striking example of rapid, recent evolution." Is this idle speculation? His article contains the typical Koestler-bashing, which shows that one of his intentions was to use genetics research to "disprove" any sort of connection between Khazars and Russian Jews. While he provided a valuable service in summarizing some scientific studies for the general public, his overall explanation is not credible. (In his book *Guns, Germs, and Steel* he indicated that he believes that geography determined historical patterns much more than human action.) UPDATE: In December 2005 it was revealed in a study by Keith C. Cheng that the light skin color of Europeans (particularly in northern Europe), a genetic suppression of the production of melanin, probably originated at one time, after the geographical separation of Africans and others. Most Africans and most Asians do not share this suppressing gene. Thus, the claim is debunked that European Jews underwent a separate (!) process of lightening their skin within a short amount of time (!!), absent intermarriage (!!!), a process which its proponents do not pretend to claim happened to other Jewish groups. In reality, European physical traits came from a certain degree of intermarriage with Europeans. Deal with reality, folks. They don't just "happen". There is no separate gene that brought about the same lightening process in Ashkenazic Jews. I do not believe Ashkenazic Jews are primarily Europeans, but by the same token we cannot deny that there was some substantial intermarriage with Europeans among Ashkenazim.

Comment added 2012: Actually, data from a couple of new genetic papers suggest that Ashkenazic Jews may in fact be majority-European by ancestry.

Batsheva Bonné-Tamir (editor). [*Genetic Diversity Among the Jews: Diseases and Markers at the DNA Level*](#). New York, NY: Oxford University Press, 1992.

Batsheva Bonné-Tamir. *Indian Anthropologist* (1985). Claims that Yemenite Jews are descended from Arabic tribes that converted to Judaism.

Batsheva Bonn -Tamir, S. Ashbel, and S. Bar-Shani. "Ethnic communities in Israel: the genetic blood markers of the Moroccan Jews." *American Journal of Physical Anthropology* 49 (1978): 465-472. The authors state that different North African Jewish communities exhibit genetic differences and should not be lumped together into one group.

Avshalom Zoosmann-Diskin, A. Ticher, I. Hakim, Z. Goldwicht, A. Rubinstein, and Batsheva Bonn -Tamir. "[Genetic affinities of Ethiopian Jews.](#)" *Israel Journal of Medical Sciences* 27:245 (1991). Ethiopian Jews are Ethiopian Africans who converted to Judaism.

L. L. Field, J. A. Lowden, and A. K. Ray. "[Immunoglobulin \(Gm\) allotypes in a sample of Canadian Ashkenazic Jews.](#)" *American Journal of Physical Anthropology* 48(2) (February 1978): 159-164. This is an old study which may not be using current techniques. Abstract:

"Gm typing on the serum specimens of 507 Ashkenazic Jews (pre-dominantly of Polish-Russian ancestry) from Toronto, Canada has established the presence of haplotypes Gm3;5, Gm1;21, Gm1,2;21, and Gm1,17;5, and the absence of haplotypes Gm1;13,15,16, Gm1;5,6, and Gm1;5,6,24 which have been found in other Jewish peoples. It is suggested that Ashkenazic populations have lower frequencies of haplotype Gm1,17;5 than non-European Jewish populations, and that some eastern European Jewish populations have acquired the Gm1;13,15,16 haplotype through gene flow from Central Asia. Thus Jewish populations show differences in the Gm system; many of the differences may be in the direction of similarities to neighbouring non-Jewish populations."

For more information about the DNA of Jewish Cohens and Levites, see:
[Studies of Cohens and Levites](#)

For more information about Jewish genetic diseases, see:
[Studies on Jewish genetic diseases](#)

For more information about Slavic-Ashkenazic links, see:
[East European Admixture in Ashkenazic Jews](#)

For more information about Chinese-Ashkenazic links, see:
[East/Northeast Asian Admixture in Ashkenazic Jews](#)

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