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Survey of Recent Halakhic Literature

Validity of DNA Evidence For Halakhic Purposes (Part 4): The "Jewish" Gene

I. BACKGROUND

In past decades the Israeli government vigorously encouraged *aliyah* on the part of Jews residing in what was then known as the U.S.S.R. Discrimination against Jews, economic deprivation and lack of civil liberties were significant motivating factors spurring emigration. Similar factors also aroused desire for emigration in large numbers of non-Jews as well. But, for reasons of international politics, there was an extended period of time in which Jews enjoyed a unique and probably unprecedented privilege, *viz.,* the Russian government allowed them to leave the country but denied that right to others among its nationals. Probably for the first time since the days of Ahasuerus when "all the populace were becoming Jews" (Esther 8:17) were Jewish identity and proof thereof, authentic or otherwise, assiduously sought by many non-Jews. Concomitantly, the Israeli Law of Return (1950) granted a right of entry, a cornucopia of economic and social benefits as well as citizenship to all immigrants of Jewish extraction and to their spouses and children as well regardless of the halakhic status of the immigrant.

Israeli citizenship is within the province of the State. Identity as a Jew is determined by religious authorities. There is no civil marriage in Israel and virtually all cemeteries are subject to the oversight of religious authorities. Close to one million Russians came to Israel under the Law of Return. The number of immigrants who are presumed to be non-Jews because they have not claimed to be Jews or have not been able to provide

I wish to express my thanks to Rabbi Joseph Cohen of RIETS and the Technion Medical School for his invaluable expert assistance. I owe a particular debt of gratitude to Rabbi Cohen for the inordinate amount of time he expended in providing sources and references which would otherwise have been unavailable to me during these difficult weeks. My appreciation also to Rabbi Moshe Schapiro of the Mendel Gottesman Library of Yeshiva University for his indefatigable efforts throughout the period during which libraries have been inaccessible. —J.D.B.

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satisfactory proof of Jewish identity was conservatively estimated by the Israel Democracy Institute as more than 25%, or 250,000, and by others as approximately 400,000.[1] The vast majority have become fluent in Hebrew, have integrated into Israeli society, served in the Israeli Defense Forces and rightfully consider themselves to be Israeli. The resultant social and political problems were readily predictable. Conversion to Judaism is an obvious expedient to avoid such problems, but an expedient that is fraught with halakhic difficulties when undertaken for material benefit or mere convenience.[2] There are also some who for reasons of conscience or intellectual honesty refuse to profess a faith-commitment they do not harbor but—not unlike many of their secular fellow citizens—are proud of their claimed ethnic heritage as Jews.[3]

Judaism is a religion based upon faith commitment. But as a nomistic religion its rules and regulations recognize identity as a Jew as fundamentally a matter of ethnic origin. Primarily, Halakhah recognizes as a Jew any individual who was born to a Jewish mother and, additionally, any person who has become a convert to Judaism. The first is an accident of birth; the second involves a faith commitment and acceptance of the "yoke of the commandments."

A considerable number of Russian émigrés are indeed Jews by birth but are unable to produce halakhically recognized proof. Many of them had sought to conceal their ethnic origin while yet in their native country in order to avoid rampant persecution. Some lived in remote areas in which there were few, if any, Jews who, even if they were available, could vouch for the immigrant's identity as a Jew. Others either did not preserve or lost documentary evidence of their Jewish identity and, for lack of interest, did not identify with Jewish communities in their native land.

A crucial question, then, is whether there exists an empirical criterion that might establish a person's ethnic identity as a Jew comparable to the manner by which, in the days of Shakespeare, a person could establish his identity as a cleric by demonstrating an ability to read and thereby become subject to the jurisdiction of the ecclesiastic courts rather than the

[1] See Alan Rosenbaum, "Conversion in Israel: The Russian Aliya," *The Jerusalem Post*, Nov. 1, 2017.

[2] For comprehensive surveys of the halakhic criteria required to confirm a claim to Jewish identity and their application to Russian immigrants, see R. Moshe Mordecai Farbstein, *Teḥumin*, XII (5751), 17-80; R. Yigal Uriel, *ibid*., pp. 81-96; and R. Yitzchak Zevi Ushinsky, *Teḥumin*, XXXV (5775), 203-219.

[3] Judy Maltz, "Russian Immigrants Leaving Israel, Discouraged by Conversion Woes," *Haaretz*, November 2, 2014.

courts of the realm.[4] Better still—at least for purposes of establishing ethnic identity—were the presumption of physiognomy projected to the masses by Michelangelo correct, a person might establish his identity as a Jew by pointing to keratotic projections emerging from his skull.

In an age of tremendous advances in the science of genetics such a concept is not at all far-fetched. Mitochondrial DNA is presumed to be passed on exclusively from mother to child and thereby from generation to generation. Were it to be shown that Jews, and only Jews, share a particular gene or even a singular unique allele, it might be argued that the presence of that unique fragment of genetic material constitutes a *siman*, or identificatory mark, establishing identity as a Jew.

Absence of such a gene would prove absolutely nothing. It might well be the case that at some time during ancestral history a woman may have undergone conversion to Judaism and hence had no "Jewish" gene to pass on to her progeny. Whether there is a halakhic basis for accepting DNA evidence as proof of Jewishness will be explored presently. But quite baffling is the libertarian hue and cry raised in secular and even quasi-halakhic circles against advocacy of acceptance of the results of mitochondrial DNA testing in support of a determination of Jewishness.[5] In establishing Jewish identity the burden of proof is upon the claimant. No rabbinic authority seeks to compel any individual to advance such a claim or to compel production of supporting genetic evidence of such a claim. Absence of DNA proof of Jewishness would not negate identity as a Jew and hence is in no way prejudicial; the individual might well be a Jew or a descendant of a Jewish woman by virtue of conversion. If DNA analysis proves to be acceptable proof of Jewish identity it would represent an unmitigated boon to any person claiming to be a Jew with no concomitant negative effect whatsoever.

Examination for the presence of the hypothetical "Jewish" gene herein described is analogous to genetic testing employed to establish personal identification or a blood relationship between two individuals. In each of those situations the proof lies in the presence of a unique genetic sequence that, it is presumed, cannot be random. Such a "Jewish" gene, common to all Jews by virtue of birth, would be no different from genes shared, for example, by cousins. In the latter case, the presence of a common gene establishes the existence of a single grandparent. The "Jewish"

[4] For a history and description of "clergy privilege" as well as allusions thereto in Shakespeare's plays see B.J. Sokol and Mary Sokol, *Shakespeare's Legal Language: A Dictionary* (London, 2000), p. 42.

[5] Merissa Newman, "Rabbinate DNA Tests Seek Jewishness in the Blood, Become a Bone of Contention," *Times of Israel*, October 7, 2019.

gene would establish the existence of a Jewish grandmother many, many generations in the distant past who transmitted the gene to her daughter and subsequently the gene was passed on directly from mother to daughter over the span of centuries. Since Judaism recognizes only matrilineal succession, that genetic material must appear in mitochondrial DNA which is passed on from mother to child.[6] The problem is that no one has demonstrated the existence of such a single gene or even claimed that it exists.

The halakhic issues involved in accepting the Jewish gene as probative evidence of Jewish identity are analyzed in *Berurei Yahadut le-Or Meḥkarim Genetiyim* (Sivan, 5777), a monograph authored by R. Israel Barenbaum, a member of the Moscow *bet din*, and an Israeli scholar, R. Ze'ev Litke, and in two more cursory responsa, one by an unidentified author or authors that appears in *Be-Mar'eh ha-Bazak*, vol. IX, no. 30 (5777), published by Eretz Hemdah Institute and the second by R. Asher Weiss, *Oraḥ Mishpat*, I (Jerusalem, Shevat 5778). *Berurei Yahadut* also includes a contribution by R. David Lau, Chief Rabbi of Israel, discussing the level of evidence required to establish identity as a Jew as well as a survey of relevant halakhic issues by Dr. Abraham Steinberg, editor of the *Encyclopedia Hilkhatit Refu'it*. *Berurei Yahadut* also features two presentations of scientific information, one by Dr. Steinberg and the second by Dr. Shai Tzur and Professor Kalman Skorecki, geneticists renowned for their study of the Jewish gene.

One might be forgiven for assuming that the buzz within the Jewish community in recent years arose because of scientific discovery of a gene or a segment of a gene whose distinctive characteristics are shared by Jews worldwide. After all, if we are all descended from Abraham, his genes should be highly represented in all Abrahamic progeny. It would be reasonable to assume that the descendants of Isaac and Jacob should share aspects of a genotype dissimilar from those of non-Jewish Abrahamic descent. Even more to the point, mitochondrial DNA is passed on only from mother to child and, in theory at least, contains no genetic material of paternal origin.[7] If so, every natural-born Jew should have uniquely

[6] See Doron M. Behar *et al.,* "MtDNA Evidence for a Genetic Bottleneck in the Early History of the Ashkenazi Jewish Population," *European Journal of Human Genetics*, vol. 12, no. 5 (January, 2004), p. 357.

[7] In an extremely small number of instances, mixed haplotypes were found indicating paternal sources. The cause of that phenomenon is not fully understood. Presumably, for halakhic purposes, the rarity of those occurrences render them an inconsequential *mi'uta de-mi'uta*. See M. Schwartz and J. Vissing, "New Patterns of Inheritance in Mitochondrial Disease," *Biochemical Biophysical Research Communications*, vol. 310, no. 2 (October 17, 2003), pp. 247-251; M. Schwartz and J. Vissing, "No Evidence for Paternal Inheritance of mtDNA Mutations," *Journal of*

identifiable mitochondrial DNA traceable to one or another of the original Four Mothers, i.e., the four wives of Jacob.

But that is not the case. No scientist has claimed to have discovered a single genetic component that is emblematic of all Jews. Geneticists have not even expressed surprise at not being able to do so. It would seem that no such phenomenon exists because of the vast number of genetic mutations that occur regularly. The public is well aware of mutations that are responsible for hereditary diseases. Such mutations are serious but, fortunately, they are few and far between. However, mutations also occur with regularity among the myriad alleles present in the human genome, including the relatively large portions of genes that are forever unexpressed. Every occurrence of mitosis, or cell division, is an opportunity for mutation and since mutations occur regularly, the total number of mutations that take place over the course of millennia is virtually astronomical. The rate of mutation is estimated to be $1.2x10^3$ per genetic sequence per generation.[8] Little wonder, then, that no allele has survived and been shared in its original form by all collateral relatives from the inception of the Jewish people until the present.

Nevertheless, the so-called Jewish gene or, more accurately, the Jewish genes, are scientifically quite remarkable. The Jewish community has been the subject of much genetic research for a number of reasons, primarily because it is probably the largest identifiable existing ethnic group and because, at least until recent times, endogamy was the normative practice. Scientific interest is concentrated upon the study of genetic diseases and more than twenty recessive disorders have been identified as occurring with elevated frequencies in the Ashkenazic community.[9]

No one has claimed that all, or even a majority of, Ashkenazic Jews share a single genetic marker. The evidence does show that some forty percent of Ashkenazic Jews[10] are endowed with mitochondrial DNA that

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Neurological Science, vol. 218, no. 1-2 (March 15, 2004), pp. 99-101; S. Luo *et al.*, "Biparental Inheritance of Mitochondrial DNA in Humans," *Proceedings National Academy of Science*, vol. 115, no. 51 (December 18, 2018), pp. 13,039-13,044; S. Lutz-Bonengel and W. Parson, "No Further Evidence for Paternal Leakage of Mitochondrial DNA in Humans Yet," *Proceedings National Academy of Science*, vol. 116, no. 61 (February 5, 2019), pp. 1821-1822; and M. Schwartz and J. Vissing, "Paternal Inheritance of Mitochondrial DNA," *New England Journal of Medicine*, vol. 347, no. 8 (May 22, 2002), pp. 576-580.

[8] See Behar, "MtDNA Evidence for a Genetic Bottleneck," p. 357.

[9] *Loc. cit.*

[10] See Doron M. Behar *et. al.*, "Counting the Founders: The Matrilineal Genetic Ancestry of the Jewish Diaspora," *PLoSone*, vol. 3, no. 4 (April 30, 2008), e2062, and Doron M. Behar *et al.*, "The Matrimonial Ancestry of Ashkenazi Jewry: Portrait of a

can be traced back to four women.[11] Those genetic components are extremely rare in non-Jewish populations. But, interestingly enough, they do occur in low frequencies in non-Ashkenazic Jews. Similarly, most individual non-Ashkenazic Jewish communities similarly have a high representation of their own unique genetic markers attributable to a small group of female founders ranging in number from one to six.

Present-day Ashkenazic Jews are believed to be descended from a pool of less than 25,000 individuals who began to immigrate from northern Italy to the Rhine Basin in the early part of the 14th century. That population, in turn, was established by a small number of families who arrived from northern Italy during the 7th and 8th centuries.[12] Present-day Ashkenazic Jews are the progeny of those bottleneck immigrations.[13] It would not be at all surprising if, in each of such events, the emigrants were members of extended family groups, a phenomenon that would account for a small number of founding mothers.[14]

It is significant that studies of Ashkenazic Jewish genes have established that the genes are by no means found exclusively among members of the Jewish community. Those studies show only that a majority of individuals who possess one of the four "Jewish" genes are independently known to be Jews. That is far different from other forms of genetic analysis designed to show a familial relationship between two individuals. In the latter cases the possibility of a false positive is, statistically speaking, infinitesimal. As has been shown,[15] the halakhic basis for recognizing

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Recent Founder Event," *The American Journal of Human Genetics*," vol. 78, no. 3 (March, 2006) 487-497.

[11] *Ibid*., p. 492.

[12] Behar, "The Matrilineal Ancestors of Ashkenazi Jewry," p. 492.

[13] Such bottleneck immigration has been documented in Italian and Greek populations. There was also a profound bottleneck effect within the Roma (Gypsy) population. See Behar, "Counting the Founders," p. 363.

[14] 58.6 percent of the mountain Jews of the Caucasus can be traced to one woman; 51.1% of the Georgian to one woman; 39.8% of Libyan Jews to one woman; 41.2% of the B'nai Israel of Mumbai to one woman and 67.6% to four women; 44.4% of the Indians of Cochin to two women; 41.5% of Persian Jews to six women; 43% of Iraqi Jews to five women; 43.2% of Tunisian Jews to one women; and 42% of Yemenite Jews to five women. See Behar *et al.*, "Counting the Founders," e2062.

Quite interestingly, 93.3% of the isolated Belmonte Marrano population of 300-400 people possess mitochondrial DNA attributed to a single mother. Not surprisingly, members of the Ethiopian Beta Israel (Falasha) community manifest no similar genetic marker. On the contrary, the most frequent lineages of that ethnic group are of Eastern African origin. See *loc. cit.* Cf., J. David Bleich, *Contemporary Halakhic Problems*, I (New York, 1997), 297-310.

[15] See J. David Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," *Tradition*, vol. 51, no. 4 (Fall, 2019), p. 155.

genetic identity of alleles and familial relationships based upon common genetic sequences is predicated upon principles of *rov*. The known existence of a relatively high incidence of the Jewish gene among some non-Jews means that the argument for accepting the presence of a "Jewish" gene as evidence of Jewish ancestry is quite complex.

Moreover, utilization of the "Jewish" gene to establish identity as a Jew is quite different from other questions of personal identity that might be resolved on the basis of DNA analysis. DNA testing is generally employed to show that two DNA fragments come from the same person or from closely related individuals. Mitochondrial DNA used to establish Jewish identity must show derivation from a female ancestress who flourished many, many generations ago. If all, or the majority of, Jews are endowed with a specific gene, the blood relationship, it is argued, is confirmed. Mitochondrial DNA is transmitted only from mother to child.[16] The fact that a particular group within a populace shares a particular DNA fragment establishes that they are descendants of a single "grandmother." The argument is that, if persons sharing the DNA fragments are independently known to be Jews, the "grandmother" must have been a Jewess as well. If it is established that the "grandmother" was Jewish, despite any other presumption to the contrary, it follows that any person who inherits her DNA must *ipso facto* be a Jew as well. Assuming that the science upon which identification of the Jewish gene is correct, the presence of the Jewish gene among non-Jews is readily explained. The reason lies in the fact that, to our sorrow, over the course of millennia countless numbers of Jews were lost to Judaism because of apostasy or intermarriage.

But, although blood relationship speaks for itself and despite the fact that Jewish identity is established by matrilineal descent, it does not follow that all maternal blood relatives are necessarily Jewish—albeit perhaps lapsed Jews. It is quite possible that the "grandmother" whose mitochondrial DNA is manifest in her progeny lived prior to Revelation at Sinai. Jews became Jews as a result of conversion at Sinai.[17] Women who lived prior to the wives of the twelve sons of Jacob may have had other daughters whose progeny never became Jews. If so, those women would have devised the so-called "Jewish" gene to both Jewish and non-Jewish progeny. Present-day non-Jews would have inherited such genes from non-Jewish grandmothers rather than from the latter's female cousins who were present at Sinai. Alternatively, those bearing the gene who profess Judaism and who are known as Jews may be descendants of a later

[16] Cf., *supra*, note 7.
[17] See *Keritut* 9a.

post-Sinaitic female convert to Judaism while those who seek to establish Jewish identity by means of the selfsame gene may be blood relatives of a common ancestress who never converted to Judaism. For the Jewish gene to have any halakhic import it would be necessary for geneticists to present, not only evidence of the existence of a Jewish gene, but also to provide halakhically acceptable evidence that the gene came into existence, presumably by mutation, sometime after the founding of the Jewish people at Sinai.

Ostensibly, the presence of the Jewish gene among non-Jews reflects one of two things: 1) either the carrier of the gene is the descendant of a pre-Sinaitic common grandmother some of whose progeny did not become Jews at Sinai; or 2) the carrier is a descendant of a Jewish grandmother whose descendants' identity as Jews was forgotten because of apostasy or intermarriage. Since with regard to any particular bearer of the gene, which of the two occurred cannot readily be ascertained, the presence of the Jewish gene can hardly be accepted as *prima facie* proof of the Jewish identity of any person not otherwise known to be a Jew. Any halakhic grounds that would validate such a finding must be carefully elucidated.

II. THE STANDARD OF EVIDENCE

The issue with regard to acceptance of mitochondrial DNA analysis as evidence of Jewish maternal descent is compound in nature: 1) Is establishment of identity as a Jew subject to a two-witness rule and 2) is manifestation of a Jewish gene sufficiently compelling to qualify as acceptable proof on the basis of some other evidentiary standard? R. Moshe Mordecai Farbstein, *Ein ha-Da'at*, pp. 371-378, Rabbi Ze'ev Litke, *Berurei Yahadut*, chap. 17, and Rabbi David Lau, *Berurei Yahadut*, pp. 117-122, present surveys of halakhic opinions regarding the ambit of the two-witness rule.

It is universally accepted that the testimony of a single witness is sufficient to establish facts pertinent to ordinary matters of Jewish law, e.g., whether a piece of meat is kosher or non-kosher. It is, of course, well-recognized that the two-witness rule is the standard of evidence applicable in judicial proceedings as well as in any matter categorized as a *davar she-be-ervah*, i.e., any matter having an impact upon forbidden conjugal relationships such as adultery and incest. Issues pertaining to marriage and divorce are clearly of that nature.

1. Conversion as a *Davar she-be-Ervah*

There are conflicting views with regard to whether the two-witness rule applies to establishing identity as a Jew by conversion. R. Ezekiel Landau, *Teshuvot Noda bi-Yehudah*, *Even ha-Ezer*, *Mahadura Kamma*, no. 55, cites the statement of Rav Sheshet, *Yevamot* 47a, indicating that hearsay evidence is sufficient to establish proof of conversion. Acceptance of hearsay evidence is not compatible with a two-witness rule. *Noda bi-Yehudah*, however, points out that Rav Sheshet's opinion is not accepted as authoritative by Rif or Rambam and is ignored by *Shulhan Arukh*, *Yoreh De'ah* 267.[18] Presumably, those rabbinic decisors had reason to categorize conversion as a *davar she-be-ervah*, i.e., a matter pertaining to prohibited sexual relationships, because conversion affects permissibility of marriage between a proselyte and a natural-born Jew. Accordingly, concludes *Noda bi-Yehudah*, two witnesses would be required. R. Moshe Feinstein, *Iggerot Mosheh*, *Yoreh De'ah*, II, no. 127, takes issue with *Noda bi-Yehudah* and maintains that, although matters of sexual relationship are consequent upon conversion, the status of a proselyte in and of itself is not of that category.[19] Earlier, R. Shlomoh Kluger, *Teshuvot Tuv Ta'am va-Da'at*, *Mahadura Telita'a*, nos. 109-110, described conversion as a matter of *issur*, or ordinary religious law, subject to the single-witness rule. The standard of evidence necessary to resolve a question regarding identity as a natural-born Jew would appear to be similarly contingent upon that controversy.

Nevertheless, as shown earlier,[20] the two-witness rule does not always require eye-witness testimony exclusively. In limited situations testimony of witnesses can be dispensed with because "*anan sahadei*—we are witnesses," i.e., the facts are either known or readily surmised. At times, the facts are so well-known or the presumption is so great that the *bet din* can take "judicial notice" of the facts without benefit of actual testimony. Thus, if a divorced couple seclude themselves there is a presumption that they have reconciled and cohabited for purposes of marriage. Such cohabitation effects a second marriage that requires a new *get* for dissolution. But, to have that effect, the act of cohabitation requires two witnesses. Nevertheless, seclusion alone in the presence of witnesses is sufficient

[18] Cf., Rosh, *Yevamot* 4:34.

[19] Rabbi Moshe Mordecai Farbstein, *Ein ha-Da'at* p. 372, cites *Taz*, *Yoreh De'ah* 157:6 and *Shakh*, *Yoreh De'ah* 167:12 in explaining *Noda bi-Yehudah* as maintaining that a non-Jewess is considered to be an *ervah*. Consequently, testimony regarding abrogation of her status as a non-Jew is a *davar she-be-ervah*.

[20] See J. David Bleich, "Validity of DNA Evidence (Part 1)," pp. 160-164.

because "we are witnesses" that, under such circumstances, cohabitation for the purpose of marriage took place. As was earlier shown,[21] the consensus of halakhic opinion is that establishment of personal identity on the basis of DNA analysis does not rise to the level of *anan sahadei*.

For many authorities, deductive evidence comparable to that which was present in the narrative concerning R. Shimon ben Shetaḥ recorded by the Gemara, *Shevu'ot* 34a, is acceptable even in capital cases because the result is mandated by reason and is no less compelling than the testimony of two eyewitnesses. Those authorities regard logically compelled deductions based upon empirical evidence to be tantamount to an *anan sahadei*.[22] However, the presence of a Jewish gene cannot establish Jewish identity with deductive certainty, as evidenced by the fact that some non-Jews carry that gene as well.[23] Accordingly, treating identification of a person as a Jew as a *davar she-be-ervah* and applying the two-witness rule would serve to exclude reliance upon a Jewish gene to establish identity as a Jew.

2. Status as a Jew as a *Davar she-be-Ervah*

There may, however, be an additional factor that would relegate testimony regarding status as a natural-born Jew to the category of testimony pertaining to a *davar she-be-ervah*.

[21] *Ibid*, p. 169.

[22] See *ibid*, p. 129.

[23] Even were we to assume it to be an invariable rule of genetics that all bearers of the gene in question must be descended from a common ancestress, the presence of the gene would not prove that all bearers of the gene, including those heretofore presumed to be non-Jews, are of Jewish extraction. Were Halakhah to accept such a principle as a matter of certainty, we would be confronted with a factual doubt: Either a) all bearers of the gene are of maternal Jewish lineage with the implication that those considered to be non-Jews are descendants of apostates or progeny of intermarriage; or b) all bearers of the gene are actually of non-Jewish ancestry but at some time in Jewish history one or more carriers of the gene converted to Judaism with the result that carriers of the gene can be divided into two classes, *viz.*, Jewish carriers and non-Jewish carriers.

Furthermore, establishing that the Jewish gene arose by mutation before the establishment of Jewish identity at Mount Sinai would be of no avail. At present, geneticists do not claim to be able to assign a date with any degree of precision to the first appearance of the Jewish gene. But, assuming that such a date could be reliably established and that the date established is prior to Sinai, such a finding would not necessarily entail that all carriers of the gene are Jews: Perhaps one or more of the "grandmothers" of women who became Jewesses at Sinai also gave birth to daughters who married men other than those of the seed of Jacob. Such a historical course of events would readily account for the presence of identical mitochondrial DNA both among groups of Jews and among groups of non-Jews.

Establishing the ambit of a *davar she-be-ervah* involves two issues: 1) Who is an *ervah* and 2) what constitutes a "*davar she-be-ervah*," i.e., what is the meaning of a matter "pertaining to" an *ervah*? The term *ervah* as used in Leviticus 18:6-19 with regard to forbidden sexual relationships is applied only to sexual relationships punishable by death at the hands of a human court or excision at the hands of heaven.[24] However, Ritva and *Tosafot Rid*, *Kiddushin* 66b, declare that a single witness lacks capacity to testify that a woman is a divorcée, even though the punishment for cohabitation between a divorcée and a *kohen* is less severe than punishment for incest or adultery. Yet, Rambam, *Hilkhot Sanhedrin* 16:13, rules that if a single witness testifies that a woman is a divorcée and the woman subsequently consorts with a *kohen* she is subject to the statutory punishment, provided that the ensuing sexual act is witnessed by two individuals. That ruling seems to contradict the previously stated implication of the Gemara, *Kiddushin* 66b, requiring two witnesses to establish the status of a woman as a divorcée.

Maḥaneh Efrayim, no. 13, presents a number of possible solutions to that contradiction. *Maḥaneh Efrayim* suggests that a divorcée is actually no different from any other unmarried woman and is not an *ervah*. Hence, testimony to her status as a divorcée is not a *davar she-be-ervah*. Nevertheless, the divorcée becomes an *ervah* when she enters into a forbidden relationship with a *kohen*. Therefore, if such an event has already occurred, a single witness cannot be heard to force the couple to separate because at that point the testimony pertains to an *ervah*, i.e., a woman in a forbidden marital relationship. Similarly, testimony that a child was born of a union between a divorcée and a *kohen* is tantamount to testimony to the mother's forbidden liaison with a *kohen* and hence is categorized by the Gemara as a *davar she-be-ervah*. *Avnei Milu'im* 45:6 offers an identical explanation. *Maḥaneh Efrayim*, however, rejects the distinction between a divorcée prior to marriage and a divorcée already married to a *kohen* because the Mishnah, *Yevamot* 53b, in speaking of "*arayot* or [women

[24] Thus, R. Jacob of Lissa, author of *Netivot ha-Mishpat*, maintains that testimony regarding status as a *mamzer* is not a *davar she-be-ervah*. R. Jacob of Lissa is of the opinion that application of the two-witness rule with regard to *mamzerut* is a rabbinic stringency. See also *Ḥazon Ish*, *Even ha-Ezer* 11:13. R. Akiva Eger disagrees with R. Jacob of Lissa but acknowledges that such is the position of *Mordekhai*. See *Teshuvot R. Akiva Eger*, no. 124, s.v. *lekhe'ora* and no. 125, s.v. *mah she-katav* as well as *Teshuvot R. Akiva Eger me-Ktav Yad*, ed. R. Nathan Gestetner (Jerusalem, 5728), no. 90, s.v. *ein*. The latter volume, nos. 89-90, includes an exchange of letters between R. Akiva Eger and R. Jacob of Lissa.

prohibited] to the priestly class," apparently refers to women who have not yet actually entered into a prohibited relationship with a *kohen*.

Instead, *Maḥaneh Efrayim* proceeds to draw a distinction between testimony designed to establish a prohibition against performing an act, e.g., testimony that meat is non-kosher designed to forbid the act of consuming the meat in question or testimony that a woman is a divorcée designed to prohibit her from cohabiting with a *kohen*, and testimony concerning a person designed to disqualify him from a certain status, e.g., from serving as a *kohen*, or to establish his qualification for such status. The latter type of testimony is directed to a matter of personal status, not to an act. Testimony regarding personal qualification or disqualification, asserts *Maḥaneh Efrayim*, requires two witnesses.[25] Testimony designed to prohibit a woman from cohabiting with a *kohen* is treated as ordinary matters of religious prohibition regarding which a single witness has credibility.

Rambam, *Hilkhot Sanhedrin* 16:13, rules that a single witness may be heard to testify that a woman is a divorcée but he fails to rule that a single witness is qualified to testify that a person is the son of a divorcée. Rambam, unlike Ritva and *Tosafot Rid*, understands the Gemara, *Kiddushin* 66b, as disqualifying a single witness from testimony regarding the son of a divorcée, i.e., testimony regarding the non-priestly status of the son, designed to deny him the privileges of priestly status rather than from testimony designed to forbid an act, i.e., testimony that a woman is a divorcée, the effect of which is only to prevent cohabitation with a *kohen*.

Maḥaneh Efrayim draws a further distinction in asserting that the Gemara declares that the testimony of a single witness to the effect that a person is the son of a divorcée is acceptable only because the subject of the testimony had heretofore identified himself, and was publicly recognized, as a qualified *kohen*. In such cases, testimony that he is the son of a divorcée is designed to negate a previously presumed status. A single witness, asserts *Maḥaneh Efrayim*, cannot be heard to negate a *ḥazakah* of priesthood. Rambam's ruling that a single witness is sufficient, asserts *Maḥaneh Efrayim*, is limited to situations in which nothing was previously known regarding the person's status and hence the testimony of a single witness suffices to establish his status.[26]

[25] See also *Maḥaneh Efrayim*, *Hilkhot Edut*, no. 19. Rabbi Farbstein cites Re'ah, *Bedek ha-Bayit*, *bayit* 4, *sha'ar* 2; Ritva, *Avodah Zarah* 39b; *Pri Ḥadash*, *Yoreh De'ah* 119:17; *Rit Algazi*, *Bekhorot*, chap. 4, no. 32; and *Tosafot R. Akiva Eger*, *Dem'ai* 4:43, as also espousing this view.

[26] See also *Teshuvot Maharik*, no. 72 and *Teshuvot R. Akiva Eger*, no. 107.

Although *Maḥaneh Efrayim* speaks only of priesthood, *Shev Shem'ateta*, *shem'ata* 6, chap. 15,[27] maintains that some additional categories of personal status require two witnesses and for that reason they are classified as a *davar she-be-ervah*. In a manner similar to that of *Maḥaneh Efrayim*, *Shev Shem'ateta* recognizes that the Gemara, *Kiddushin* 66b, speaks only of the son of a divorcée in positing a two-witness rule but expresses a somewhat different distinction between testimony regarding a woman as a divorcée and testimony regarding her son as the son of a divorcée. Rambam rules only that a single witness can establish a woman's status as a divorcée; he makes no mention of testimony disqualifying a *kohen* because he is the son of a divorcée. *Shev Shem'ateta* draws a different distinction between testimony with regard to status as a *mamzer* or disqualification from the priesthood as the son of a divorcée and a woman's own status as a divorcée disqualified from marrying a *kohen*. According to *Shev Shem'ateta*, testimony that a woman is a divorcée is testimony with regard to an "accidental" event, i.e., that a bill of divorce was delivered to her. Participation of that act is not "necessary" in the sense that it might or might not have occurred. In contradistinction, testimony that a person is a *mamzer* or the son of a divorcée is not testimony with regard to an "accidental" event; it is testimony to a status acquired at birth arising from a necessary fact of nature.[28] Rabbi Farbstein explains that status that devolves upon an individual upon birth is part of the essential nature of a person whereas a change arising from a later act is an "accident" superimposed upon the essential nature of the individual.[29]

According to *Shev Shem'ateta*, testimony regarding any intrinsic matter of personal status requires two witnesses. Thus, *Shev Shem'ateta* presumes that two witnesses are necessary to declare a person to be a *mamzer*. That rule, asserts *Shev Shem'ateta*, is deduced from the credibility explicitly accorded a father by the Torah to declare his son to be a *mamzer*[30] despite the fact that he is but a single witness. The inference, argues *Shev Shem'ateta*, is that other single witnesses have no comparable credibility

[27] *Shev Shem'ateta* also formulates the same distinction in *shem'ata* 6, chap. 2. Cf., however, R. Shimon ha-Kohen Shkop, *Sha'arei Yosher*, *sha'ar* 6, chap. 3 and *Ḥazon Ish*, *Even ha-Ezer*, no. 20, sec. 37, who disagree.

[28] See also *Avnei Nezer*, *Even ha-Ezer*, no. 21, secs. 22-24. That distinction is peremptorily dismissed by R. Shimon Shkop, *Sha'arei Yosher*, *sha'ar* 6, chap. 3 and *Ḥiddushei R. Shimon Yehuda ha-Kohen*, *Ketubot*, no. 14, as well as by *Ḥazon Ish*, *Even ha-Ezer* 20:16.

[29] The distinction is comparable to the Aristotelian distinction between necessary and accidental attributes. Man is a rational being and is also a featherless biped; the first is a necessary attribute of the human species while the second is simply an accident.

[30] See Bleich, "Validity of DNA Evidence (Part 1)," pp. 137-139.

with regard to matters of personal status that restrict entering into marriage with a person of legitimate birth. Accordingly, such matters are treated as a *davar she-be-ervah*. Thus, disqualifying a person from marriage to a person of legitimate birth by testifying that he is a *mamzer* is a *davar she-be-ervah*. The converse, i.e., qualifying a person for such marriage by testifying that he is not a *mamzer*, asserts *Shev Shem'ateta*, similarly requires two witnesses.[31] By extension, asserts *Shev Shem'ateta*, two witnesses are required to testify that a person is the son of a divorcée and thus disqualified from membership in the "community of priests." That disqualification is an intrinsic disqualification. Hence, status regarding eligibility to marry a *kohen* by reason of birth is treated in the same manner as testimony with regard to status as a *mamzer*. However, asserts *Shev Shem'ateta*, disqualification of a woman from marriage to a person of priestly birth by virtue of the fact that she is a divorcée is an "accidental" disqualification to which the two-witness rule does not apply.[32]

Applying the theses developed by *Maḥaneh Efrayim* and *Shev Shem'ateta*, testimony designed either to establish or to negate presumed Jewish or non-Jewish lineage would require testimony of two witnesses regardless of whether or not conversion qualifies as a *davar she-be-ervah*.[33]

[31] *Sha'arei Yosher*, *sha'ar* 6, chap. 3, and *Ḥiddushei R. Shimon Yehuda ha-Kohen*, *Kiddushin*, no. 14, state that two witnesses are necessary to disqualify a person of a heretofore vested status because stripping a person of a privilege, e.g., to disqualify a person from testifying as a witness or from serving as a ritual slaughterer, is tantamount to exacting money from him. Deprivation of privileged status, he asserts, is analogous to relieving a person of property. However, according to *Sha'arei Yosher*, testimony of a single witness is sufficient to establish that a person is endowed with privileged status unless the matter is deemed to be a *davar she-be-ervah*.

Rabbi Farbstein, *Ein ha-Da'at*, pp. 374-375, states that two witnesses are necessary only to qualify a person for a particular status but not to deprive him of such status. Qualification is positive in nature and endows the individual with an otherwise nonexistent status. Disqualification, e.g., to testify that a woman is a divorcée, does not endow her with a new quality.

[32] *Sha'arei Yosher* observes that Rambam, *Hilkhot Sanhedrin* 16:13, fails to include a *ḥallal*, *viz.*, a child born to the wife of a disqualified *kohen*, from the category of matters for which a single witness is sufficient. *Shev Shem'ateta* explains that, since the child is disqualified from birth, the disqualification is necessary rather than accidental and, consequently, the two-witness rule applies.

[33] Rabbi Farbstein, *Ein ha-Da'at*, p. 377, finds no reason to distinguish between testimony that a person is a Jew by birth and testimony that he is a Jew by reason of conversion. Establishment of status as a Jew by birth, according to *Shev Shem'ateta*, is a question regarding natural status and requires two witnesses. Conversion, argues Rabbi Farbstein, represents a metamorphosis in the essential nature of a proselyte and therefore, he argues, testimony regarding conversion would require two witnesses even according to *Shev Shem'ateta*. Rabbi Samuel Shapiro, a member of the *bet din* of Jerusalem, is quoted as disagreeing with that distinction.

3. Status as a Jew Excluded from *Davar she-be-Ervah*

There are additional grounds upon which to conclude that, even if conversion is a *davar she-be-ervah*, testimony of a single witness regarding status as a natural-born Jew is to be regarded as testimony pertaining to an ordinary matter of Jewish law:

i) In the case of a woman who is known to have committed adultery *Noda bi-Yehudah, Even ha-Ezer*, *Mahadura Kamma*, no. 11 and no. 69, rules that a single witness is sufficient to testify that the wife was subject to *force majeure* and, consequently, that she is not forbidden to her husband. *Ḥemdat Shlomoh*, *Even ha-Ezer*, no. 15, sec. 24, explains that testimony that will serve to disturb an existing marital relationship by rendering a woman forbidden to her husband is a *davar she-be-ervah* but testimony that serves to confirm an existing relationship is not a *davar she-be-ervah*.

Similarly, asserts Rabbi Litke, the position of the authorities such as *Shev Shem'ateta* who maintain that testimony of a single witness regarding status as a Jew is not acceptable is limited to situations in which the evidence serves to negate an already presumed status. Thus, such testimony would not be accepted regarding a person who is publicly recognized as a non-Jew when the purpose of the evidence is designed to show that the presumption is erroneous. However, in situations in which there is no such *ḥazakah*, the evidence is designed to resolve an unknown status rather than to disturb an existing status. Therefore, even according to *Shev Shem'ateta*, the two-witness rule would not apply.

In developing that argument, Rabbi Litke draws upon a novel concept of his own formulation. Quite independent of the implications for establishing the requisite standard of proof, Rabbi Litke, as will be shown,[34] is of the opinion that, although there certainly is a *ḥazakah* of Jewish identity, there is no parallel *ḥazakah* of non-Jewishness. Rabbi Litke maintains that, although in antiquity ethnic identity was readily established, subsequent to migrations, demographic upheavals, forced apostacy and intermarriage, a *ḥezkat akum*, or presumption of non-Jewishness, no longer exists.[35] In accordance with that position, Rabbi Litke concludes that all authorities would agree that establishing status as a Jew does not require two witnesses.

ii) *Pnei Yehoshu'a, Kiddushin* 63b and 65b, maintains that a single witness has credibility to contradict a *rov* even with regard to a *davar*

[34] Cf., *infra*, note 96 and accompanying text.

[35] That position, however, is subject to challenge. See *infra*, note 96 and accompanying text.

she-be-ervah. *Pnei Yehoshu'a* maintains that two witnesses are required only when there are no known exceptions to the *rov*. However, when it is known that two classes exist, i.e., a majority and minority class, and the issue is only clarification with regard to which of the two classes a particular person belongs, *Pnei Yehoshu'a* maintains that there is no two-witness rule. Since Jews and gentiles constitute distinct classes it should follow that a single witness is sufficient to assign a previously unidentified person to one of those classes.[36]

There is significant controversy regarding the question of whether a single witness has credibility regarding a *davar she-be-ervah* when there is no *ḥazakah* establishing the *davar she-be-ervah*. R. Meir Simchah ha-Kohen of Dvinsk, *Or Sameaḥ*, *Hilkhot Sanhedrin* 16:6, cites R. Isaac Bekhor David, *Divrei Emet*, *Kuntres Lavin*, who maintains that, absent a *ḥazakah*, the matter is not regarded as a *davar she-be-ervah* and hence a single witness has credibility. *Shev Shem'ateta*, *shem'ata* 6, chap. 3, reports that he would have been inclined to assume that a single witness has no credibility with regard to a *davar she-be-ervah* even if the testimony of that witness does not contradict a *ḥazakah*. He acknowledges, however, that *Teshuvot Maimuniyot*, *Hilkhot Ishut*, no. 3, does make that distinction.

R. Shimon Shkop, *Sha'arei Yosher*, *sha'ar* 6, chap. 2, and *Ḥiddushei R. Shimon Yehuda ha-Kohen*, *Ketubot* no. 14, distinguishes between a single witness whose testimony is designed to disturb a *ḥazakah* and a single witness who testifies that a person is a member of a minoritarian class. Testimony contradicting an established *ḥazakah*, he asserts, is a *davar she-be-ervah* whereas testimony that someone is a member of a minoritarian class does not really contradict the *rov*; such testimony merely serves to establish that the person in question is a member of the minoritarian class. *Rov*, by definition, admits of a minor class. A single witness may not contradict a *rov* but he may clarify the issue in question by relegating it to the minoritarian class whose existence is granted.

That reasoning would serve to provide a basis for accepting the testimony of a single witness when nothing is known regarding the genealogy of a person claiming to be a Jew. However, if the person was previously known as a non-Jew, such testimony would contradict a *ḥazakah* and be of no avail. However, as already stated, Rabbi Litke argues that the testimony of a single witness suffices in all cases because such testimony does not contradict a *ḥazakah*. In arriving at that conclusion, Rabbi Litke again follows his announced opinion that in our day there is no *ḥezkat akum*, i.e., there is no longer an established status as a non-Jew. Consequently, a

[36] See also *Sha'arei Yosher*, *sha'ar* 6, chap. 3.

single witness who testifies to Jewish ethnicity is not contradicting a *ḥazakah*. The witness is countermanding a *rov* that determines that an unknown person must be assigned to an unknown class. But, since the existence of a minor class has been established, that identification is not contradictory to the *rov*.

iii) Applying a similar distinction, *Shev Shem'ateta*, *shem'ata* 6, chap. 7, cites *Teshuvot Maimuniyot, Hilkhot Issut*, no. 3, in establishing the principle that even with regard to a *davar she-be-ervah* a single person has standing to testify that the *davar she-be-ervah* never existed, e.g., a presumed act of betrothal was not entered into. That testimony does not constitute a *davar she-be-ervah*; it establishes that there never was a *davar she-be-ervah*. That concept, argues *Shev Shem'ateta*, is similar to the notion that testimony to the effect that a person is a member of a minoritarian class does not contradict the *rov*; rather the testimony establishes that the *rov* is irrelevant and inapplicable.

Such a distinction is also drawn by *Teshuvot R. Akiva Eger*, no. 124, *s.v. gam yesh*. R. Akiva Eger addresses the case of a woman who entered into a second marriage without presenting evidence that her first husband had died. Subsequent to the birth of two children a single witness testified that her husband had died before she contracted the second marriage. Although, as earlier noted,[37] R. Akiva Eger ruled that testimony with regard to *mamzerut* is a *davar she-be-ervah*, he maintained that testimony of the witness was not with regard to the status of the children but to the effect that the first marriage was dissolved by death of the husband for which a single witness has credibility. Consequently, the testimony of the witness was not designed to address a *davar she-be-ervah* but to establish *ab initio* that a *davar she-be-ervah* never arose.[38] However, R. Akiva Eger finds that this distinction is contradicted by a number of early-day authorities.

Rabbi Litke finds support for application of that distinction with regard to all matters involving a *davar she-be-ervah*. The Gemara, *Gittin* 64a, speaks of a person who designates an agent to betroth a wife on his behalf and gives the agent untrammeled authority with regard to the choice of a bride. In the event that the agent dies without identifying a bride, the principal may not marry any woman. The concern is that in such a situation,

[37] See *supra*, note 7.

[38] The point is quite akin to Bertrand Russell's Theory of Types: A proposition describing a class of propositions is not a member of the class it describes. See Alasdair Urquhart, "The Theory of Types," *The Cambridge Companion to Bertrand Russell*, ed. Nicholas Griffin (Cambridge, 2003), pp. 286-309. Thus, testimony regarding membership in a class considered to be *ervah* is not itself a matter of *ervah*.

even absent the prohibition against polygamy, the principal may enter into a marital relationship with a prohibited female relative of an already existing wife, *viz.,* the unidentified bride betrothed on his behalf by the agent.[39] Ramban, *ad locum*, regards that prohibition as biblical in nature. Ramban adds that, if all female relatives who are members of the class of forbidden relatives testify that they were not betrothed by the deceased agent, the principal is free to marry any one of those relatives.

Ramban recognizes that the majority of all women are not forbidden to the principal. Nevertheless, the principal may not rely upon *rov* in contracting a marriage because the matter constitutes a *davar she-be-ervah* subject to the two-witness rule. Despite that categorization, relying upon her status as a single witness, any woman can establish her own eligibility to marry. That is so because, in asserting eligibility to marry, she is declaring that she is entirely removed from any matter pertaining to *ervah*. Ramban similarly maintains that the single-witness rule suffices to enable any particular woman to identify herself as a member of the majoritarian class even when the testimony is proffered with regard to a matter pertaining to consanguinity. Her testimony is designed, not to resolve a question pertaining to *ervah*, but to establish that she is a member of a class regarding which there can be no issue of *ervah*.[40]

Rabbi Litke argues that given the known existence of two distinct classes, *viz.*, Jews and non-Jews, a single witness is sufficient to establish a person's identity as a member of the class of Jews rather than the class of non-Jews.[41] The claim to be a Jew, argues Rabbi Litke, is not a claim with regard to any particular issue of *ervah*, but an assertion with regard to membership in a class to which various rules of *ervah* pertain.[42]

4. Applicable Standards of Evidence

Demonstrating that the testimony of a single witness is sufficient for confirming identity as a Jew establishes no more than that the two-witness

[39] For obvious reasons the prohibition does not apply in situations in which the woman whom the principal now seeks to marry has no female relatives of a forbidden degree.

[40] Cf., however, the conflicting view of Ran, *Gittin* 30a.

[41] Ramban, contrary to *Tosafot*, *Gittin* 64a, *s.v. assur*, assumes that, even as a matter of biblical law, a *rov* alone would be insufficient. It is unlikely, but perhaps arguable, that Ramban would agree that a *rov* coupled with testimony of a single witness is sufficient for a *davar she-be-ervah*. Of course, with regard to establishing identity as a Jew, *rov* is absent.

[42] Cf., *Iggerot Mosheh*'s explanation of why conversion is not a *davar she-be-ervah* as discussed in the introductory comments of this section.

rule does not apply. Establishing that the two-witness rule does not apply allows for the possibility that, apart from testimony of single witness, other forms of proof may suffice to establish identity as a Jew. It does not imply that circumstantial evidence is also sufficient for that purpose.

There is indeed a disagreement with regard to whether circumstantial evidence is acceptable even in matters of financial liability regarding which there is a presumption that a two-witness rule applies. The focus of disagreement with regard to admissibility of circumstantial evidence is the controversy recorded by the Gemara, *Bava Batra* 93a, *Sanhedrin* 23b and *Shevu'ot* 34a regarding tort liability in the death of a camel. The Gemara records a controversy between Rav Aḥa and the Sages in a situation involving a group of camels. One camel was observed kicking its legs and subsequently another camel was found mauled to death. Rav Aḥa accepts such circumstantial evidence in holding the violent camel's owner liable for damages. *Tosafot*, *Shevu'ot* 34a, *s.v. de'i*, maintain that Rav Aḥa would recognize the admissibility of comparable evidence in criminal prosecutions as well. Other early-day authorities regard R. Aḥa's view as limited to financial matters. In any event, many halakhic authorities rule in accordance with the majoritarian view of the Sages.[43] However, both Rambam, *Hilkhot Sanhedrin* 24:1-2 and *Shuḥlan Arukh*, *Ḥoshen Mishpat* 11:5, rule that the *bet din* is empowered to render judgment in financial matters even on the basis of its subjective contextual assessment of the truth.[44]

Rambam, followed by *Shulḥan Arukh*, apparently maintains that the evidentiary rule "at the mouth of two witnesses . . . shall the matter be established" (Deuteronomy 19:15) is limited to matters such as punitive sanctions, *davar she-be-ervah* and the like but that in financial disputes the applicable principle is "with justice shall you judge your fellow" (Leviticus 19:15). Interpersonal justice demands adjudication on the best grounds available. As Rambam emphasizes, failure to render judgment is not an option because judgment withheld is justice denied. Other areas of Halakhah are to be decided on the basis of appropriate standards of evidence. It does not automatically follow that circumstantial evidence, or an *umdena* that is less compelling than *anan sahadei*, is acceptable for other areas of Jewish law.

Rabbi Lau seeks to establish that *umdena* is sufficient to establish proof of Jewish identity as a conclusion that flows from the accepted rule that a person has standing to declare himself to be a Jew. The credibility

[43] See, *inter alia*, *Netivot ha-Mishpat* 15:2.

[44] See also *Teshuvot Ge'onei Batra'i*, no. 54; *Tumim* 90:14; and R. Elchanan Wasserman, *Kovez Shi'urim*, II, no. 38.

of a person to prove his own status as a Jew is based upon one of three halakhic rules: 1) According to *Tosafot*, *Yevamot* 47a, it is based upon the principle of *rov*, i.e., the majority of those who claim to be Jewish are in fact Jews. 2) According to Rambam, *Hilkhot Issurei Bi'ah* 13:9, it is based upon a *ḥezkat hanhagah*, or a *ḥazakah* to the effect that a person who comports himself in a certain manner is assumed to enjoy the status that would give rise to such comportment, i.e., the person who comports himself as a Jew is presumed to be a Jew. 3) According to Ritva and *Nimukei Yosef*, *Yevamot* 37a, a person is believed to declare himself to be a Jew because it is a *milta de-avida le-igluyei*, i.e., a person has credibility with regard to a matter that in the course of time is likely to become publicly known.[45] Each of those principles represents a separate and particular halakhic form of evidence. Neither singly nor in combination do they serve to establish that other forms of *umdena* in the nature of general circumstantial evidence are sufficient for that purpose. Be that as it may, Rabbi Lau himself acknowledges that evidence for the existence of a Jewish gene does not rise to the level of circumstantial evidence sufficiently credible as to constitute an *umdena*.

Whether DNA evidence in the form of the Jewish gene rises to any other appropriate standard of proof will be examined in the following sections.

III. THE "JEWISH" GENE AS A *SIMAN*

1. The Nature of a *Siman*

The more general question of whether, in general, the unique nature of DNA sequences qualifies as a *siman* for purposes of Jewish law has been discussed earlier.[46] It must further be established both that the "Jewish" gene is indeed a *siman* of Jewish identity and that a *siman* is acceptable proof of such identity. Employment of the Jewish gene to prove identity as a Jew presents a number of additional difficulties.

A *siman muvhak* has been defined as a identificatory mark that occurs with a frequency of less than one in a thousand[47] and a *siman beinoni*, or

[45] For an elucidation of *milta de-avida le-giluyeih* see J. David Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 3)," *Tradition*, vol. 52, no. 2 (Spring, 2020), p. 111.

[46] See J. David Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 2: *Agunah*)," *Tradition*, vol. 52, no. 1 (Winter, 2020), 97-101.

[47] Both Rabbi David Lau, *Berurei Yahadut*, p. 219 and Dr. Abraham Steinberg, *ibid*, p. 230, argue that focus upon the ratio of one in a thousand is misplaced. The

an intermediate identificatory mark, as a mark that occurs with a frequency of less than one in two hundred.[48] As has been shown, a *siman muvhak*, or a singular (i.e., highly reliable) identificatory mark, although far from infallible, is accepted for purposes of identifying a corpse. The issue is whether the Jewish gene constitutes a *siman* that is acceptable as proof of identity as a member of the Jewish community.[49]

In halakhic contexts, a *siman* is used to establish ownership of a lost object or identity of a missing person. In both cases, the concern is that the object was lost by another person who is in fact the rightful owner or that the body is the remains of a man other than the husband of the woman who seeks to prove her widowhood. As earlier explained,[50] in

earliest source for that definition of a *siman muvhak* is *Teshuvot Mas'at Binyamin*, no. 63, who defines a *siman muvhak* as "one in a thousand or one in two thousand." They regard *Mas'at Binyamin*'s lack of precision as an indication that the figure presented is hyperbolic and not to be understood literally. That criticism is misplaced for two reasons: 1) the ratio is cited definitively by *Bet Shmu'el, Even ha-Ezer* 17:72, has been repeated and accepted by countless authorities and has been disputed by none; 2) granted, *arguendo*, that the figure is imprecise, the phrase "one in a thousand or one in two thousand" certainly means "extremely rare" and clearly indicates a frequency of *less* than "one in a thousand" and perhaps even a frequency of "less than one in two thousand." See Bleich, "Validity of DNA Evidence (Part 2)," pp. 99-100 and *ibid*., note 2.

Dr. Steinberg chooses to vocalize *Mas'at Binyamin* as "one in a thousand or one in *alafim*" rather than "one in *alpayim*." If that reading is correct, the connotation would be "one in many thousands" making it even more clear that a frequency of greater than one in a thousand cannot be deemed a *siman*. Rabbi Lau assumes that *Mas'at Binyamin*'s phrase "one in a thousand" is hyperbolic because there is no source for that definition in the Gemara or in early-day authorities. That is not completely accurate. Rabbenu Yeruḥam, *Ḥelek Adam ve-Ḥavvah* 23:3, rules that an acceptable *siman* must be something certain (*barur*) "that cannot be found on another body." It is undoubtedly the case that *Mas'at Binyamin* sought to clarify Rabbenu Yeruḥam's definition because he believed that it should not be taken literally. If Dr. Steinberg's reading of *Mas'at Binyamin* is correct, the connotation of the definition "one in a thousand or thousands" would be identical to that of Rabbenu Yeruḥam. *Mas'at Binyamin* carefully stated "one in a thousand or two thousand" and not "one in *kammah alafim* (many thousands)" because he wished to remedy the literal impression left by Rabbenu Yeruḥam's statement and was quite precise in his employment of the phrase "one in a thousand or two thousand." See Bleich, *ibid*., p. 99.

[48] See Bleich, "Validity of DNA Evidence (Part 2: *Agunah*)," p. 100, note 4.

[49] Employment of a *siman* is encountered not only with regard to establishing the identity of an object or of a person but also with regard to membership in a class. The Gemara, *Ḥullin* 79a, permits breeding a male donkey with a female donkey and yoking both together as beasts of burden only if it can be demonstrated that the mother of each of the two animals was either a donkey or a horse. That is established, says the Gemara, by observation of *simanim, viz.,* in the comparison of the ears, tails and voices of the two animals.

[50] See Bleich, "Validity of DNA Evidence (Part 2: *Agunah*)," pp. 104-105.

every such instance the *siman* disproves the confluence of two events each having a probability of one in a thousand or one in two hundred, i.e., the probability that some other person manifesting the identical *siman* went missing during the same time period or that a similar object having the identical *siman* was lost by another person. The real probability of the confluence of both events is one in a thousand multiplied by one in a thousand or one in two hundred multiplied by one in two hundred. If that position is accepted, there is no room to entertain the possibility that the Jewish gene might serve as a *siman* because it would probably have to be the case that the frequency of the Jewish gene in the non-Jewish population is far too great for it to be considered even a *siman beinoni*.[51]

In *Berurei Yahadut*, chap. 4, Rabbi Barenbaum adopts a rather different position. He argues that a *siman* is effective as evidence solely because of the statistical probability it brings to bear. The question is what degree of statistical probability constitutes the threshold level of a *siman*. Rabbi Barenbaum points out that description of a *siman muvhak* as an identificatory mark that is known to be present in no more than one in 1,000 people serves to define a *siman muvhak* only when doubt exists with regard to a single individual, i.e., a doubt whether the single corpse that has been discovered is that of a husband whose whereabouts is unknown. Consider the same issue in a situation in which one hundred people have been involved in a common disaster. If one in 1,000 individuals carries a particular identificatory mark and one body is examined and is found to carry that mark, there is only an approximately 90% (90.99%) chance that the body is that of the woman's husband because each of the unexamined bodies might also carry the same mark. In other words, there is an approximately ten percent chance that the examined corpse having the identificatory mark is someone other than the husband. If ten thousand persons are involved in a common disaster it is likely that at least ten of those individuals share a common identificatory mark. It is possible that any one of those ten is the husband. Hence, if one body is examined and is found to bear the mark, the chance that he is the person whose whereabouts is unknown is only approximately one out of ten or

[51] Although some occurrences of the Jewish gene among non-Jews have been found, there has been no meaningful attempt to establish the rate of occurrence of such a gene among any non-Jewish population. See Behar, "MtDNA Evidence for a Genetic Bottleneck," p. 361 and *idem*, "The Matrilineal Ancestors of Ashkenazi Jewry," p. 489.

10% (9.09%).[52] The more individuals involved in the common disaster the less likely that the single person bearing the *siman* is the person we seek to identify. The proportion of one in a thousand would be meaningful only if all the bodies are examined and it is established that none of the other bodies carries the mark or that, by other means, those bodies could be excluded from the possibility of being the body of the person whose identity we seek to establish.[53] That leaves us with the problem of defining the minimum statistical probability that must be present for a *siman* to be effective.

Rabbi Barenbaum, *Berurei Yahadut*, chap. 4, regards a statistical probability of 99% or more as sufficient to establish identity as a Jew. He arrives at that conclusion in an interesting manner. There are a host of authorities who maintain that a *siman muvhak* is sufficient to sustain a financial claim against a *muḥzak*, i.e., a person in possession.[54] R. Jonathan Eybeschutz, *Tumim*, *Kelalei Migu*, *klal* 46,[55] explains that a *siman* is a "super *rov*" that admits only of a *miu'ta de-miu'ta* – literally, "a minority of a minority." He then cites Ritva, *Kiddushin* 80a, as well as a latter-day authority, R. Joseph Ber Soloveitchik, *Bet ha-Levi*, II, no. 68, sec. 4, who define a *miu'ta de-miu'ta* as 1%. Accordingly, Rabbi Barenbaum concludes that, since a *siman muvhak* is sufficient to establish personal identity, any statistical probability of 99% is also sufficient for that purpose. Rabbi Barenbaum further proposes that DNA evidence be combined with other forms of circumstantial evidence (which he does not define) so that a resultant 99% statistical

[52] These calculations involve application of Bayes' Theorem. See *Berurei Yahadut*, p. 93, and *ibid*., note 59.

[53] Cf., *Teshuvot Galya Mesakhet*, no. 8, sec. 9, who writes: "However, when a person who has been killed is found in a distant place such that from the place that [the husband] went missing until [the] place [where the corpse has been found] there are many, many thousands [of men] and among each thousand is possible that one person may be found with a *siman* such as this, how can [the woman] be permitted [to remarry] in this situation?" Cf., R. Ya'akov Kanievsky, *Kehillat Ya'akov*, *Yevamot*, no. 47. Cf., also, *Mishmeret Mosheh*, *Hilkhot Geirushin*, chap. 13 and *Pitḥei Teshuvah*, *Even ha-Ezer* 17:103. See also *Teshuvot Ḥelkat Ya'akov*, *Even ha-Ezer*, no. 15 and *Teshuvot ha-Elef Lekha Shlomoh*, *Even ha-Ezer*, no. 91.

[54] See *Shakh*, *Ḥoshen Mishpat* 297:1 and *Netivot ha-Mishpat* 46:8. See also *Teshuvot Divrei Ḥayyim*, *Even ha-Ezer*, no. 6 and no. 65; *Teshuvot Ḥelkat Yo'av*, *Even ha-Ezer*, no. 15; *Teshuvot Be'er Yiẓḥak*, *Even ha-Ezer*, no. 6 and no. 65 and *Teshuvot Divrei Malki'el*, V, no. 168. An opposing view is held by *Keẓot ha-Ḥoshen* 46:8 and 159:2. See also *Teshuvot Noda bi-Yehudah*, *Even ha-Ezer*, *Mahadura Kamma*, no. 51; *Teshuvot Sho'el u-Meshiv*, *Even ha-Ezer*, *Mahadura Kamma*, I, no. 257; and *Pri Megadim*, *Yoreh De'ah*, *Klalei Simanim u-Tevi'ut Ayin*, who regard a *siman muvhak* as reliable evidence even in capital cases.

[55] Cited also by *Bet Shmu'el* 60: addenda. See also *Bi'ur ha-Gra*, *Even ha-Ezer* 160:10 as well as *Tumim*, *Klalei Tefisah*, no. 123.

probability of Jewish parentage be regarded as sufficient evidence for purposes of Halakhah. In support of the last contention, he cites a number of authorities who maintain that, in some circumstances, a *siman beinoni* and, for some authorities, even a *siman ǧaru'a*, can rise to the level of a *siman muvhak*. A *siman ǧaru'a* is an inferior, i.e., an ordinary or conventional *siman*, that does not qualify as an identificatory mark.[56] One example: "tall" or "short" is a *siman ǧaru'a*. Nevertheless, *Pitḥei Teshuvah*, *Even ha-Ezer* 17:103, states that if a corpse can only be that of a particular husband or of but a single other individual in that locale who is "short" or "tall," that identificatory mark is regarded as a *siman muvhak*.

Rabbi Barenbaum's argument does not fully establish his point. The examples of a *siman* are not cast in concrete. The function of a *siman* is to serve as an identificatory mark. If 999 other people must be excluded in order to qualify as a *siman*, an identificatory mark must have a prevalence of less than one in a thousand. Many more than one in a thousand men are tall or short. However, if only two men are confined in a particular area and one is known to be tall and the other short, the identity of one can be established with certainty on the basis of height — an identificatory mark that would otherwise be of no significant meaning. In distinguishing between one of only two men physical stature is highly significant and, in context, becomes a *siman muvhak*.[57] There is significant controversy with regard to whether, in ordinary circumstances, even two *simanim beinonim* can be combined for purposes of identification.[58] If yes, it is because the two together taken in the aggregate become a *siman muvhak*. *Simanim muvhakim* are accepted as a discrete

[56] DNA evidence is based upon length and position of gene fragments. Size position are regarded as *simanim ǧeru'im*. See R. Mendel Senderovic, *Teshuvot Aẓei Besamim*, no. 16. Cf., R. Israel Barenbaum, *Berurei Yahadut le-Or Meḥkarim Genetiyim*, (n.p., 5777), chap. 6, implies that a combination of *simanim ǧeru'im*, or common identificatory marks, may be coincidental but that presence of alleles in each of countless numbers of different cells in which size and sequence of the genetic component is identical cannot be coincidental. That is not quite so because all cells of a human being are reproduced from a single template. Therefore, if the first appearance of a gene sequence is coincidental, that sequence will reproduce itself in all subsequently created cells and, consequently, such reproduction does not at all contribute to establishment of a *siman*. If the size and proximity of the components of an allele constitute a *siman*, it is because of the uniqueness of the pattern formed by those constituents rather than by the myriad repetitions of the sequence. See Bleich, "Validity of DNA Evidence (Part 1)," p. 109.

[57] Indeed, in this case, the evidence is far stronger than a *siman muvhak* and compelled on the basis of deductive logic: X is either A or B. X is not A and confirmed as not A by *tevi'ut ayin*. Therefore, X must be B.

[58] See *Bet Shmu'el*, *Even ha-Ezer* 17:73.

category of evidence. What is or is not a *siman* may be contextual but there is no evidence that a *siman* is nothing more than mere statistical probability or that it can be combined with other entirely different forms of circumstantial evidence in order to reach a threshold level of statistical probability.

Put somewhat differently: A necessary condition of a distinguishing mark that serves as a *siman* is that its frequency of occurrence must be less than one in a thousand. However, a statistical probability other than a *siman* of that or lesser magnitude is not necessarily tantamount to a *siman*. *Simanim* as a halakhic category are not reflective of tautological equivalences any more so than is the two-witness rule entirely reflective of an assessment of the statistical reliability of such evidence.

More significantly, Rabbi Barenbaum's demonstration that the threshold level of a *siman muvhak* is a statistical probability of 99% is not quite compelling. His sources demonstrate only that a minority of more than one percent is no longer a *miu'ta de-miu'ta*. *Simanim* may well be predicated upon the notion of a "super *rov*"[59] but that does not *ipso facto* establish that even a conventional *miu'ta de-miu'ta* does not vitiate the efficacy of a *siman*. Rabbi Barenbaum assumes that one in a thousand is really 99% rather than 99.9% because of the possibility, unknown to us, there may be more than one unidentified corpse and that the discovered corpse may be that of some person other than the husband who is one of the thousand who also bears an identical *siman*. Rabbi Barenbaum fails to take into account the observation of *Shulḥan Arukh ha-Rav* that our concern with regard to correct identification of the husband is cogent only if some other person may have also disappeared without a trace. Thus, the possibility that two people, both having an identical identificatory mark, disappeared without a trace is really one in a thousand times one in a thousand, or one in a million. Allowing for the unquantifiable but extremely low possibility that another undiscovered corpse exists, the statistical probability that the discovered corpse is not that of the husband, the resultant probability is still more than one in a million, but far less than one in a hundred. Why the Sages insisted upon not accepting *simanim* of a category statistically defined as a *miu'ta de-miu'ta* is an open question but it is nevertheless clear that the statistical certainty of a *siman muvhak* is greater than that of a *rov* that admits of a *miu'ta de-miu'ta*. The Sages certainly did not rely upon a conventional *rov* in order to allow a woman to remarry as a widow as evidenced by their refusal to allow such remarriage in instances in which a husband disappears in *mayim she-ein la-hem*

[59] See Bleich, "Validity of DNA Evidence (Part 1)," pp. 153-163.

sof despite the fact that a majority of people lost at sea have drowned.[60] Abrogation of the principle of *rov* in such cases is a stringency imposed by the Sages because of fear of adultery. That fear might well have prompted the Sages to disregard even a "super *rov*," defined as admitting of a *miu'ta de-miu'ta*, and having insisted upon criteria that reflect an even greater "super *rov*."

2. Bayes' Theorem

The author(s) of the article published in *Be-Mar'eh ha-Bazak*[61] reject(s) the notion that the Jewish gene can be accepted as a *siman* in order to establish identity as a Jew on the basis of *rov*. The fallacy, it is contended, becomes evident upon application of Bayes' Theorem. Bayes' Theorem is a mathematical formula used for calculating conditional probabilities.[62]

Ordinary probabilities are expressed on the basis of raw data. Often, there are other factors present that establish independent probabilities for other cohorts. The probability of including that cohort and the probability of the broader cohort excluding the narrower cohort may be quite different. When a large group is known to include a smaller group, the probability within the larger group must be reconfigured to take cognizance of the impact of the quite different probability of the smaller group.

For example, a *siman muvhak* is described as an identificatory sign with a likelihood of random occurrence of no more than one in a thousand. Thus, if one person in a thousand has a sunken nose and a person known to have a sunken nose goes missing and if an otherwise unidentifiable corpse is discovered and found to have a sunken nose, the corpse may be identified on the basis of the identificatory sign as that of the

[60] See *Tosafot*, *Yevamot* 36b, s.v. *ha lo*, *Yevamot* 121a, s.v. *ve-lo* and *Bava Meẓi'a* 20b, s.v. *issura*.

[61] P. 98, note 11. See also *Berurei Yahadut*, p. 93.

[62] Bayes' Theorem as it appears in the *Stanford Encyclopedia of Philosophy* is:

> The probability of a hypothesis H conditional on a given body of data E is the ratio of the unconditional probability of the conjunction of the hypothesis with the data to the unconditional probability of the data alone.
>
> **(1.1) Definition.**
>
> The probability of H conditional on E is defined as $P_E(H) = P(H\&E) / P(E)$, provided that both terms of this ratio exist and $P(E) > 0$.

For a full exposition see "Bayes' Theorem," *The Stanford Encyclopedia of Philosophy* (Spring, 2019), https://plato.stanford.edu/archives/spr2019/entries/bayes-theorem/.

missing person with a 99.9 percent degree of certainty. Such is the classic *agunah* case in which only one person has disappeared.

Suppose, however, that ten men have disappeared or have perished in a common disaster in a town of ten thousand inhabitants. One of those individuals is known to have had a sunken nose. Nothing is known regarding the other men. The corpse of one of the men is found and discovered to possess a sunken nose. Can the sunken nose serve as a *siman* to establish the identity of the corpse so that his wife may remarry?

The issue is: In any group of ten thousand men, the statistical probability is that ten men will each have a sunken nose (instead of only one man, as would be the case in a town of one thousand inhabitants). If only one corpse is discovered having a sunken nose, is the wife permitted to remarry?

In the first case, if all one thousand inhabitants have perished, only one of the thousand is likely to have had a sunken nose. Whether one person, ten people or a thousand people have perished is irrelevant; it is a statistical improbability that the corpse bearing a sunken nose is other than that of the person we seek to identify, i.e., the chance of misidentification is no more than one in one thousand.

In the second case, although the ratios of one in a thousand and ten in ten thousand are the same, the chance of misidentification is far greater. Since, statistically, we may anticipate that, were all corpses to be examined, ten corpses bearing sunken noses would be found, what is the probability that the corpse we have discovered is the one we are seeking rather than one of the other nine? The corpse that has been discovered is one among ten. The probability that the corpse we have found is the one we are seeking to identify is only one in ten. Under those circumstances, since there may be presumed to be nine other corpses bearing the same *siman*, the presence of a sunken nose can serve as positive identification with only a ten percent chance of accuracy. Bayes' Theorem expresses the quandary reflected in the second hypothetical and yields an equation designed to find an accurate degree of probability.

Consider the following hypothetical example: A clinical trial is designed to determine the therapeutic value of an experimental drug. That can be determined by administering the drug to a certain number of patients and determining the number of patients who are cured. The finding will be expressed as a fraction or a percentage determined by the number cured divided by the total number of patients. However, experience has taught that a certain number of patients recover from their illness spontaneously without intervention. The drug certainly cannot be credited with the cure of patients who would have recovered even in the

absence of any treatment. For the study to yield meaningful results it is necessary to subtract the number of patients who would have recovered even without treatment from the total number of participants and to divide the number of patients actually cured by the medication by the number of patients enrolled in the study minus the number of those who would have recovered in any event.

The mortality rate of the drug can be determined in a similar manner. Using actuarial tables, it is possible to anticipate how many participants may be expected to die of natural causes during the duration of the study. That number must be excluded from the calculation of the mortality rate of the drug by subtracting that number both from the total number of fatalities and from the original number of participants. The remainder of fatalities is then divided by the total number of participants whose demise can be attributed to the drug.

The implication of Bayes' Theorem is that in order to establish the Jewish gene as a *siman* it would be necessary to exclude the general rate of occurrence of the gene among the general population and then assess the rate of Jewish versus non-Jewish carriers of the gene.

If there are one thousand Jews in the world, each of whom carries the Jewish gene, but only one non-Jew endowed with that gene is in existence, and a stranger appears manifesting the Jewish gene, the statistical probability that the person in question is a Jew would be precisely one in one thousand, or 99.9 percent. But, in point of fact, only 40 percent of Jews are carriers of the Jewish gene and the percentage of non-Jews bearing that gene is not known with any degree of accuracy. The problem is: With what degree of statistical probability can we presume that a person presenting with the Jewish gene is a Jew rather than a randomly appearing non-Jew who happens to bear that gene?

Let us assume that: a) there exist one billion people of European descent and b) one percent are Jews, or ten million of that number are Jews. If so, the non-Jewish population of European descent is 990,000,000.

Let us further assume that: a) 40 percent or four million Jews possess the Jewish gene and b) only .1 percent or 990,000 non-Jews carry the gene.

In order to calculate the probability that a random person bearing the gene is a Jew, we must first calculate the likelihood that the person is a Jew and then calculate the likelihood that a Jew possesses the Jewish gene. The result must then be divided by the overall likelihood that any person, Jew or non-Jew, may bear the gene, i.e., the result must be divided by the addition of the probability of a Jew carrying the gene and of a non-Jew carrying the gene. That process is represented by the following equation:

$$P(Jewish \mid gene)$$

$$= \frac{P(Jewish) \times P(gene \mid Jewish)}{P(gene)}$$

$$= \frac{P(Jewish) \times P(gene \mid Jewish)}{P(Jewish) \times P(gene \mid Jewish) + P(not\ Jewish) \times P(gene \mid not\ Jewish)}$$

$$= \frac{0.1 \times .4}{0.1 \times .4 + .99 \times .001}$$

$$= .8016$$

Using the hypothetical figures presented above, the result will be that the likelihood of a random person bearing the Jewish gene is actually Jewish is .8016 or approximately 80 percent. That is far less than 99.9 percent, or even 99 percent, that is the hallmark of a *siman*. That is, if we assume that there are four million Jews who possess a Jewish gene and one million non-Jews who carry the gene, there is an 80% chance that a person selected at random from the total group of five million is Jewish.

It would be necessary to show that the prevalence of the gene among non-Jews is no more than .0004%, i.e. no more than four out of a million, in order to satisfy the 99.9 percent certainty requirement of a *siman* in order to entertain the Jewish gene as emblematic of Jewish identity.

A point closely parallel to the consideration underlying Bayes' Theorem is addressed by *Ḥiddushei R. Akiva Eger*, *Ketubot* 14b. The hypothetical situation addressed by R. Akiva Eger involves a situation in which a woman cohabited with one person among a group of one hundred and one men. Her paramour cannot be identified. Cohabiting with one or more of fifty-one of those men would not affect the woman's eligibility to marry a *kohen*; fifty of those men are members of a class of males with whom engaging in a sexual act would disqualify a woman from marrying a *kohen*. It might appear that the principle of *rov* would serve to render the woman permissible to a *kohen*. Nevertheless, R. Akiva Eger asserts that, if one of the fifty-one men is a *kohen* who knows full well that he has not consorted with the woman in question, he may not marry her.[63]

[63] The same principle is expressed in a different context by *Pnei Yehoshu'a*, *Bava Meẓi'a* 24a.

R. Akiva Eger's reason is that the *kohen* knows that he did not consort with the woman in question. Consequently, from his perspective, there are only one hundred men with whom she may have cohabited, not a hundred and one. Since, so far as he is concerned, each of the two groups is comprised of exactly fifty persons, there is no major class of men with whom cohabitation would not disqualify the woman in question from marrying a *kohen*.

R. Akiva Eger's thesis is limited to a situation in which the person seeking resolution of a halakhic doubt has excluded himself from the majoritarian class because he has excluded himself from both classes. Since he knows that he did not cohabit with the woman in question he has excluded himself from the class of persons with whom consortium would serve to disqualify a female partner from marrying a *kohen* as well as from the class of women with whom intercourse would have no effect upon eligibility to marrying a *kohen*. The underlying point is similar to the Fallacy of the Compound Question: "When did you stop beating your wife?" The question is premised upon the presumption that the person addressed has been beating his wife. The only question is whether such beating has or has not ceased. In the manner posed, the question has no meaning and hence no answer. Similarly, if cohabitation did not take place, there can be no logical question regarding determination of the status of the man's non-existent sexual partner.

R. Akiva Eger's point is that *rov* does not operate in a vacuum; it serves to resolve a problem for a person in light of salient facts. Since our chaste *kohen* knows that he did not engage in the sexual act subject to scrutiny, the question of whether that unconsummated act disqualifies the woman in question from marrying a *kohen* is nonsensical.

R. Akiva Eger can be cited for no more than the aforesaid. R. Akiva Eger addresses only a situation in which a person has subjective knowledge of a fact that defeats the *rov* insofar as he is concerned. Nevertheless, Bayes' Theorem is none else then R. Akiva Eger's point writ large. Bayes would argue that if it can be determined that one member of the class of fifty-one men, unknown to himself, was inebriated and temporarily impotent, he must be excluded from the calculus of the majoritarian and minoritarian classes and, moreover, that person must be excluded, even if his identity is forever unknown. That is tantamount to saying that, in assessing statistical mortality of a drug, one must exclude the actuarial probability of death due to other causes or that, in determining the statistical reliability of a gene as an identificatory mark of a Jew one must exclude the probability of its random occurrence in the non-Jewish population.

Reshash, *ad locum*, disagrees with R. Akiva Eger and maintains that, despite the foregoing, the presence of an objective *rov* renders the woman permissible to the chaste *kohen* who is the subject of R. Akiva Eger's hypothetical. Since *Reshash* rejects R. Akiva Eger's conclusion in instances in which a person is cognizant of the inapplicability of *rov* to himself, *a fortiori*, he would reject application of *rov* in circumstances in which the existence of an anonymous person excluded from the *rov* is known with certainty to all and sundry – a position that entails denial of Bayes' Theorem.

Moreover, it can be shown much more directly that Jewish law does not take halakhic cognizance of Bayes' Theorem. We need but examine the frame of reference used in establishing the *rov* that is applied in determining the status of a foundling discovered in a public area. Only fertile, non-pregnant women between the time of menarche and menopause can bear children. Were *rov* nothing other than statistical probability, identity of a foundling would depend solely upon whether the majority of women of child-bearing age are Jewish or not Jewish. However, that is not the case. The major and minor classes are determined not by the relative numbers of women of childbearing age, or even by the relative number of women inhabitants, but by the relative number of Jews versus non-Jews within the entire populace.[64] Thus, both Rambam, *Hilkhot Issurei Bi'ah* 15:25-26, and *Shulḥan Arukh, Even ha-Ezer* 4:33-34, carefully speak of "a city where there are a majority" of Jews and non-Jews.

Bayes' formulation of his theorem represents a determination of statistical probability with regard to which Bayes is certainly correct. But the halakhic principle of *rov* is not always coextensive with application of probability. *Rov* is a halakhic construct with its own rules and definitions and not merely an expression of probability theory.

That the principle of *rov* is not fully consistent with application of probability theory is evident upon examination of a number of applications of *kol de-parish*:

[64] See *Berurei Yahadut*, chap. 14, sec. 39. The sole limitation in establishing a *rov* as class-defining rather than idiosyncratic is that of R. Judah, *Makhshirin* 2:7, who declares that only persons "who abandon children," i.e., non-Jews, need be considered in determining parentage of a foundling because the term "who abandons children" is coextensive with the class of non-Jews. Similarly, the Mishnah, *Makhshirin* 2:8, rules that only the identity of bakers is considered with regard to the source of lost bread and *Makhshirin* 2:9, rules that the *kashrut* of meat the majoritarian and minoritarian classes are determined only from among persons "who eat meat" because those activities serve to define a class. Cf., however, *Ḥiddushei R. Akiva Eger*, Johannesburg 5622 edition, *Oraḥ Ḥayyim* 335:5, reprinted in *Shulḥan Arukh* in *Peirush R. Akiva Eger ha-Shalem* (Tel Aviv, 5778), *Ein ha-Gilyon*, *Oraḥ Ḥayyim* 335:5.

1) R. Shlomoh Zalman Auerbach, in his commentary on *Shev Shemateta* (Jerusalem, 5768), *shemata* 4, chap. 1, observes that the principle *kol de-parish* is a divine edict rather than simply application of a rational principle. Statistical probability establishes that in the case of ten butcher stores, six kosher and four non-kosher, a single piece of meat found in a public place is probably kosher. But, if by the same token, ten pieces of meat are found one after the other, four of those pieces should be presumed to be non-kosher.[65] It is nevertheless permitted to consume all ten pieces or to cook all of them in the same pot because the rule *kol de-parish* is applicable to each piece.
2) Similarly, in a city whose population is sixty percent Jewish and forty percent non-Jewish a foundling is regarded as Jewish. If ten foundlings are found they are all deemed to be Jewish. Suppose that years later, the ten foundlings, now adults, assemble for prayer. The ten constitute a valid quorum for congregational prayer despite the fact that rational application of statistical probability would render it highly improbable that all ten are Jews.[66]
3) In addition, as has been previously noted, in determining whether a foundling is a Jew or a non-Jew, the entire population rather than just women of childbearing age is taken into consideration in determining whether the majority are Jews or non-Jews.[67]

Indeed the very notion of *kavu'a* as an exception to *kol de-parish me-rubba parish* is hardly consistent with probability theory.

Similarly, Rabbi Barenbaum's basic assumption that any form of statistical probability above a certain threshold is tantamount to a *siman* is subject to challenge. The "one in a thousand" criterion of a *siman* is a necessary condition but there is no evidence that it is tautologically definitional of a *siman*.[68]

IV. *ROV*

A number of writers, including R. Asher Weiss, advance an interesting but quite different argument in support of accepting the presence of a "Jewish" gene as a determinative *siman* of Jewish identity. A *siman muvhak* is of sufficient reliability to allow a woman to contract a second marriage even

[65] The principle of nullification would not apply if the pieces are large enough to serve as a full portion (*ra'ui le-hitkabed*).
[66] See R. Shimon ha-Kohen Shkop, *Sha'arei Yosher*, *sha'ar* 4, no. 10.
[67] See *supra*, note 34 and accompanying text.
[68] See *supra*, notes 29 and 30 and accompanying text.

though, as indicated by *Tosafot*, *Yevamot* 37a, s.v. *ha lo, Yevamot* 12a, s.v. *ve-lo-hi*, *Bava Mezia* 20b, s.v. *issura* and *Bi'ur ha-Gra*, *Even ha-Ezer* 16:116, the presence of a *rov* is not sufficient to permit a woman to remarry. Clearly, a *siman muvhak* is more probative than a *rov. Ergo*, if *rov* is sufficient to establish identity as a Jew, *a fortiori*, a *siman muvhak* should suffice for that purpose as well.

However, although ostensibly compelling, that argument is a *non sequitur*. The function of a *siman* is identification rather than establishment of independent proof in and of itself. A *siman* found on a lost object only serves to identify that object as the selfsame object that has been lost. Ownership of the object prior to its loss must be established on other grounds. A *siman* found on a corpse serves to establish the identity of the body. Death of the individual who bears that *siman*—upon which license to remarry is contingent—is established by quite different physical criteria. Identification of the presence of the Jewish gene serves only to demonstrate that the person belongs to the class of individuals who are endowed with such a gene. The conclusion that people endowed with that particular gene are halakhically presumed to be Jews is based upon the recognition of the fact that persons identified in that manner are presumed to be Jews on the basis of some other halakhic presumption, e.g., *rov* or *ḥazakah*. The Jewish gene can serve as a *siman* only for purposes of identification; conclusions reached on the basis of such identification stand or fall upon attendant principles that are then brought to bear as proof.

Even if the Jewish gene cannot serve as intrinsic evidence of Jewish identity in the form of a *siman*, it is still possible that a person manifesting the Jewish gene can be regarded as a Jew on the basis of *rov*, i.e., that the majority of all known persons endowed with the allele are Jews. As has already been shown,[69] the presence of a *rov* is not dispositive for all halakhic purposes, e.g. it is insufficient to support a financial claim. The question to be addressed is: Is *rov* sufficient to support a claim of Jewish ancestry?

1. One *Rov* or Two *Rovs?*

The Gemara, *Ketubot* 15b, addresses at length the situation of a foundling abandoned in a city having both Jewish and non-Jewish inhabitants. Rambam, *Hilkhot Isurei Bi'ah* 15:25, followed by *Shulḥan Arukh*, *Even ha-Ezer* 4:53, rules that, for purposes of marriage, the infant's status as a

[69] See Bleich, "Validity of DNA Evidence (Part I)," pp. 147 and 160-164 and *idem*, "Validity of DNA Evidence (Part 2)," p. 111, note 23.

Jew is a matter of doubt regardless of whether the majority of the townspeople are Jews or gentiles. It would appear that, as a matter of rabbinic decree, a person's capacity to enter into marriage as a Jew cannot be determined simply by *rov*.[70] However, *Maggid Mishneh*, *ad locum*, cited by *Bet Yosef*, *Even ha-Ezer* 4:34, asserts that the principle of *rov* does not apply to a foundling. Since the infant has been abandoned, wherever the infant is found it is considered to be *kavu'a*, i.e., in a "permanent" place, because the foundling has not become "separated" from either a major or minor class. Rather, wherever the abandoned neonate is found is regarded as the infant's place of "permanence" and hence the rule of *rov* is not applicable.[71] The Sages did, however, permit marriage to a person of Jewish birth if two separate *rov*s indicating the foundling's Jewish parentage are present. There are two possibilities regarding the child's lineage. The infant may be the child of one of the townspeople or may be the issue of an itinerant wayfarer. Accordingly, the Sages required two *rov*s to establish Jewish lineage, *viz.*, a majority of the townspeople and a majority of the itinerant wayfarers. The purpose of that edict was to make it apparent that the child's status is not that of *kavu'a* and hence is adjudicated on the basis of *kol de-parish*.

Ḥazon Ish, *Even ha-Ezer* 7:7, notes that, according to some authorities, a single *rov* is sufficient to establish identification as a Jew in at least some situations. *Ḥazon Ish* explains that two *rov*s are necessary only in cases in which, depending upon the circumstances, the rule of *kavu'a* might potentially apply.[72] However, in some circumstances, for example

[70] Rashi, *Ketubot* 15a, s.v. *aval le-yuḥasin*, comments that a Jewish majority of townspeople is not sufficient to permit marriage of the child to a *kohen*. Rather, for that purpose the Sages required two majorities, *viz.*, a majority of townspeople and a majority of transient wayfarers. R. Ezekiel Landau, *Noda bi-Yehudah*, *Even ha-Ezer*, *Mahadura Kamma*, no. 7, understands Rashi literally and assumes that for the purpose of establishing identity as a Jew, and hence eligibility to marry a non-*kohen*, a single *rov* is sufficient. *Bet Me'ir*, *Even ha-Ezer* 4:26, understands Rashi as agreeing that a single *rov* is never sufficient to establish identity as a Jew for purposes of marriage but that, even though two *rov*s are necessary to sanction any marriage, the Gemara focuses upon the need for two *rov*s in order to establish eligibility for marriage to a *kohen* because, in the presence of but a single *rov*, conversion would be of no avail since a *kohen* may not marry a proselyte.

[71] *Bet Me'ir*, *Even ha-Ezer* 4:33, and *Arukh ha-Shulḥan*, *Even ha-Ezer* 4:54, aver that this is not an actual *kavu'a* but was treated as such by rabbinic decree.

[72] Cf., however, *Bet Shmu'el*, *Even ha-Ezer* 6:32, who argues that some early-day authorities understand the Gemara as declaring that the Sages required two *rov*s for purposes of marriage as a stringency not at all connected to the possibility of confusion between instances of *kavu'a* and instances of *kol de-parish*. Cf., *Bet Me'ir, Even ha-Ezer* 6:18 and *Ḥazon Ish*, *Even ha-Ezer*, no. 7, sec. 7.

in the situation of an unidentified person who appears before us and claims to be a Jew, the individual has perforce separated himself from all others who retain their earlier state of *kavu'a* and hence there is no reason to promulgate a rule requiring two *rov*s.

R. Moshe Mordecai Farbstein, *Teḥumin*, XII (5751), pp. 17-80, draws a distinction between a *rubba de-ita kamman* and a *rubba de-leita kamman*.[73] A *rubba de-ita kamman* is the formulation of a majoritarian rule in situations in which there is an identifiable major class and an identifiable minor class, e.g., there are ten establishments in the city that sell meat; nine of those establishments sell kosher meat and one of those establishments sells non-kosher meat. A piece of meat found in the surrounding area is presumed to have become "separated" from either the larger class of stores or the smaller class. The principle of *rov* establishes that the meat became separated from the major class. A *rubba de-leita kamman* encapsulates a general empirical principle, e.g., the majority of animals are not *treifot*. There is no class of "animals before us" containing a specific number of kosher animals nor is there a second class before us comprised of a smaller number of animals that are *treifot*. That *rov* is roughly comparable to general statistical probability, i.e., it is more likely than not that the animal in question is emblematic of the larger class. With regard to the second type of *rov*, Rabbi Farbstein cogently points out that, since it is in the nature of an empirical generalization involving both examined and unexamined animals, the notion of *kavu'a* is meaningless and hence inapplicable. Consequently, the Sages required a second *rov* only when the first *rov* is a *rubba de-ita kamman* but not when the first *rov* is a *rubba de-leita kamman*.

According to *Ḥazon Ish*, it is certainly arguable that, if the majority of individuals who share a common gene or one of a number of genes are otherwise known to be Jews, a person of unknown parentage who appears and claims to be a Jew might be deemed to be a Jew even in the absence of a second supporting *rov*. In that situation as well, the possibility of

Rabbi Litke, *Berurei Yahadut*, chap. 11, sec. 5, notes that *Bet Shmu'el*, *Even ha-Ezer* 4:39 and 6:17, states that two *rov*s are required only when "there are a minority of *pesulim* but when there is no minor class of *pesulim* two *rov*s are not required." He expresses doubt whether *Bet Shmu'el* means that it is known that there are no *pesulim* in the city, and hence there is no room for doubt because there is no minor class, or whether a second *rov* is unnecessary because there is doubt whether any *pesulim* are present within the city. In the present case it is not clear that a minor class exists consisting of carriers of the gene who are actually non-Jews because those ostensive non-Jews who carry the gene may actually be Jews.

[73] See Bleich, "Validity of DNA Evidence for Purposes of Halakhah (Part 3)," *Tradition*, vol. 52, no. 2 (Spring, 2020), p. 126, note 72.

kavu'a does not exist. Similarly, according to the thesis advanced by Rabbi Farbstein, a finding that the majority of individuals endowed with such genes are Jews establishes a *rubba de-leita kamman*[74] that arguably does not require support of a second *rov*.

2. *Kol de-Parish* versus *Kavu'a*

Talmudic exegesis, *Sanhedrin* 2a, infers from Exodus 23:2 that, although we are commanded not to "follow the majority to make a determination" for "evil," we are affirmatively commanded to follow the majority for "good." On the basis of that verse, the Gemara, *Berakhot* 28a and *Ketubot* 15a, declares, "Go according to the majority." The Gemara, *Ḥullin* 11a, expresses that concept in the form of the maxim "*Kol de-parish me-rubba parish*—All that separates, separates [itself] from the major set." That principle is fundamentally an application of set theory. Assuming that there are two antithetical sets, a major set and a minor set, and one comes upon an item of undetermined provenance that has somehow strayed or separated (*parish*) from one of the two sets but its origin remains in doubt, the entity of doubtful status is to be assigned to the major set. A classic example is meat that has been lost and subsequently a passerby chances to find it. Is the meat to be regarded as kosher or non-kosher? Applying the biblical principle "*Kol de-parish me-rubba parish*," the answer depends upon the relative number of known establishments that purvey kosher meat compared to the number of known establishments that sell non-kosher meat. If the majority of butcher stores sell kosher meat, the found meat is deemed to be kosher;[75] if the majority sell non-kosher meat, the found meat is to be deemed non-kosher.[76]

A principle that is the antonym of "*kol de-parish*" is "*Kol kavu'a kemaḥaẓah al maḥaẓah dami* – All that is stationary is considered to be half and half."[77] That principle, derived from Deuteronomy 19:11, is essentially an exception to the rule of *kol de-parish*.[78] *Rov* applies only to

[74] The author(s) of the article published in *Be-Ma'areh ha-Bazak*, vol. IX, no. 30 (5777), p. 97, note 8 (2), cite unnamed sources that maintain that there is no authority to posit a *ruba de-leita kamman* that was not formulated by the Sages.

[75] Nevertheless, a rabbinic edict that, in most cases, prohibits all meat that is "*nit'alem min ha-ayin*," i.e. that has been "concealed from the eye" of a Jew, even temporarily, will apply.

[76] See *Pesaḥim* 9b, *Ketubot* 15a, *Ḥullin* 95a and *Niddah* 18a.

[77] *Ketubot* 15a, *Bava Kamma* 44b and *Sanhedrin* 79a.

[78] *Kol kavu'a* is generally regarded as a *gezeirat ha-katuv*, or biblical rule, not necessarily grounded in any particular rational foundation. It may perhaps be suggested that an instance of *kol de-parish*, e.g., the loss of an item of property, is a random occurrence subject only to statistical probability, whereas *kol kavu'a* generally requires

situations in which a person or an entity has become separated from its set before a question of status arises. The principle of *kavu'a* applies in the case of a question or doubt that arises before any separation has occurred, i.e., in the entity's place of origin or "permanence." A classic example is a situation in which meat was purchased from a butcher store but the purchaser failed to ascertain, or forgot, whether he purchased the meat from a kosher store or from a non-kosher establishment. In such cases, the doubt arises before, or at the time of, "separation" and hence the principle of *kol kavu'a* applies.

Rabbi Barenbaum, *Berurei Yahadut*, chap. 1, raises a fundamental objection with regard to the applicability of the notion of the *rov* that is material in modern-day circumstances. As has been noted, the formulation of the archprinciple is "*Kol de-parish me-rubba parish* – All that become separated become separated from the major class." The *kashrut* of meat found in a public place is determined by the majority of establishments from which the meat might have been removed. However, meat purchased in a butcher store by a customer who has forgotten which establishment he patronized is categorized as *kavu'a* and hence is not subject to the rule of *rov*. The status of lost meat is irrelevant so long as it remains lost and hence no question arises with regard to the *kashrut* of such meat until it is found. At that point the meat has already become "separated" from its original location. In the case of meat purchased from an unknown purveyor the question arises when the meat is yet *kavu'a*, or stationary, i.e., the question is the nature of the establishment from which the meat was removed. Thus, the class of stores to which that establishment

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an overt act which by its nature, although not necessarily reasoned, is not random in the sense that it might be conditioned by psychological causes. For a strained attempt to predicate the distinction between *kol de-parish* as a distinction between "sets" and "classes," see Eliezar Ehrenpreis, "*Safek* and *Sefek Sefeika*: Their Relation to Scientific Observation," *Gesher*, vol. 8 (5741), 93-97. Ehrenpreis chooses to define a set as a collection of entities not subject to definitive observation in which membership is to be adjudicated on the basis of *rov*, i.e. probability. A class is defined as consisting of entities that have been observed in some way and hence identification is governed by *kol kavu'a* because subsequent to observation any further occurrence cannot be categorized as random. Ehrenpreis considers that distinction to be parallel to the distinction between unobserved events of classical mechanics and observed events of quantum mechanics. The distinction between an observed event and an unobserved event can hardly be halakhically considered as hard and fast. Consider an obstetrical ward shared by nine Jewish patients and one gentile patient, all of whom are unconscious and unattended. Presumably, *kol kavu'a* would apply to an unidentified neonate even though the birth has not been observed.

For a quite different explanation of this distinction, see R. Elchanan Wasserman, *Kovez Shi'urim*, I, *Bava Batra*, secs. 86-87.

belongs arises at the moment of purchase. The question of *kashrut* becomes actual at the time of purchase when the meat is still in its original location and has not yet been separated from its existing place of "permanence."

In days gone by, an immigrant or itinerant traveler appeared without "baggage," i.e., without a history of an already established identity. The question of ethnic or religious identity arose only in the locale in which the traveler presented himself. The question was from which of two groups had he "separated" himself, the larger group or the smaller group. Application of a *rov* based upon genetic criteria would appear to be appropriate. Consider, however, the situation of a census-taker who knocks on a door and makes inquiry regarding religious identity and seeks to apply appropriate principles of supporting substantiation. In that situation invocation of a *rov* would not dispose of the issue because the question arises in the respondent's place of domicile, i.e., a place that is *kavu'a*. The same would be the case even if the census-taker never leaves his office. The question presents itself with regard to a person in his place of "permanence," i.e., in his place of domicile. The same would be true if the individual whose status is in question were to travel to a neighboring village for his wedding with the intention of returning to his original home. That person is regarded as "stationary" because he intends to return to his original place of domicile.[79] The same is also the case in a situation in which an itinerant person's doubtful status travels with him because the doubt originally arose in his place of domicile, e.g., the already established doubtful status can be discovered by means of a phone call or written inquiry. Now that the entire world has become a global village it is often the case that even a cursory investigation would disclose the existence of a known ambiguity regarding religious identity in an individual's original place of domicile. The issue is: Where is the doubt born? If the doubt arose in the place of original domicile the issue involves a matter that is *kavu'a* and hence *rov* does not apply. Of course, if there is no communication with the place of emigration or if that locale is isolated, bereft of a Jewish population or the question of Jewish identity is of no material halakhic concern to anyone in that locale, the result is that the question first becomes apropos only after the person has become separated from his original domicile with no likelihood of return. It is only in such circumstances that application of *rov* becomes germane.[80]

[79] See *Nazir* 12a. See also *Tosafot*, *Ketubot* 15a, s.v. *dilma*.

[80] A similar interesting question arises with regard to immersion of utensils possibly manufactured by a non-Jew. The majority of utensils acquired on the open market

3. Establishing the Parameters of a *Rov*

In determining the existence of a *rov* it is perforce necessary to determine the ambit of the class of persons or entities to be separated into a major and minor classes. First, a general class of persons and objects to be divided into major and minor classes must be identified. Then, the characteristics of the major class must be delineated. For example, there exists a broad class of human beings. That class can be divided into major and minor classes, e.g., Mongolians and non-Mongolians. The majority of human beings are not Mongolians; a minority of human beings are Mongolians. It is also possible to describe the inhabitants of China as a distinct class and then to divide that class into two sub-classes, *viz.*, Mongolians and non-Mongolians. Thus, majority of human beings are non-Mongolians, but the same time, a Chinese national is far more likely to be a Mongolian than is a randomly chanced-upon human being. Before determining whether or not evidence of a Jewish gene can be utilized as the basis of establishing a *rov*, it is first necessary to establish that the majority of individuals endowed with the gene in question are indeed Jews. Since it is known that some non-Jews are also endowed with that gene. It is necessary to determine the ambit of the class of human beings that must be divided into sub-classes of Jews and non-Jews. In determining statistical probability of the carrier of the gene being a Jew rather than a non-Jew, how large is the total group that must be examined for relevant prevalence of the gene? Must one examine the populace of a city, province, country or of the entire world?

Shulḥan Arukh, *Yoreh De'ah* 1:4, discusses the case of fowl that are lost or stolen and later found to have been slaughtered in an halakhically proper manner. If the birds are found in a locale frequented by individuals the majority of whom are Jewish, the fowl may be deemed to be kosher. The issue is definition of the area within which a Jewish versus non-Jewish census is to be taken. *Shakh*, *Yoreh De'ah* 1:17, declares the matter to be contingent solely upon the relevant numbers of people who frequent the "place" in which the fowl are found. The relative number of Jews versus non-Jews who frequent the marketplace or who are found in the city is irrelevant. *Shakh* further declares that, in the event that an equal number

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are of non-Jewish provenance and have become "separated" from their place of origin. However, what is the status of a utensil that is clearly labeled as coming from a particular company but it is unknown whether the proprietor of that company is a Jew or a gentile? The doubt originates at the time of shipping from the seller to the buyer, i.e., at a time at which the utensil is *kavu'a* and hence *rov* would not apply. See *Makhon Hora'ah u-Mishpat*, published by the Belz community in Israel, vol. 2 (Nisan, 5771), pp. 87-90.

of Jews and non-Jews are to be found in that "place," the major and minor classes are established on the basis of their relative proportions in the marketplace; if each group has an equal presence in the marketplace, *rov* is determined on the basis of a census of the city. If it then proves to be the case that there are an equal number of Jews and non-Jews in the city, there is no *rov* and the fowl are forbidden as a matter of doubt. *Tevu'ot Shor* 63:4 explains that the majority of individuals present in the marketplace or in the city is determinative only if a *rov* cannot be ascertained on the basis of the relative numbers present in the more limited immediate area because the majority of persons present in the marketplace or the city is irrelevant if the status of the *rov* present in the "place" in which the question arises can be determined. However, unless more precise information is available, it is presumed that the relative numbers present in the "place" in which the birds are found reflects the proportional division of the populace found in the marketplace or in the city. Hence, determination of the *rov* found in the marketplace or in the city is an indirect mark for determining the *rov* present in the immediate area in which the fowl were found.

Pri Ḥadash, *ad locum*, objects that the Gemara, *Bava Batra* 23b, followed by Rambam, *Hilkhot Gezelah ve-Avedah,* 15:18, and *Shulḥan Arukh*, *Ḥoshen Mishpat* 260:8, establishes that, in cases in which application of the principle of *rov* would lead to one conclusion whereas application of the principle of *karov*, or "closest proximity,"[81] would lead to a contradictory finding, a determination is to be made on the basis of *rov* rather than proximity. If so, questions *Pri Ḥadash*, the determination of the *kashrut* of the fowl should always be made on the basis of a population count of the entire city rather than by adjudicating the matter on the basis of the number of persons of each class at the "place," or "closest" to the "place," at which the birds were found.[82]

[81] The principle of *karov* is derived from the rule prescribed in Deuteronomy 21:3 regarding determination of the city to be held accountable for an act of homicide when the perpetrator is unknown. See *infra*, note 82.

[82] *Shulḥan Arukh ha-Rav*, *Hilkhot Sheḥitah, siman* 1, *Kuntres Aḥaron*, sec. 10, responds to *Pri Ḥadash*'s objection by asserting that *Shakh* is describing a situation in which the persons in close proximity are Jews who also constitute the majority of individuals within the limited area; hence there is no contradiction between applying the principle of *rov* or applying the principle of proximity (*karov*). *Shulḥan Arukh ha-Rav*, in effect, severely constricts the geographic area to be used in determining major and minor classes as limited to the smallest definable area, *viz.*, the immediate proximity of the fowl.

Shulḥan Arukh ha-Rav limits the rule that *rov* prevails against a contradictory conclusion that would arise from applying the principle of proximity (*karov*) only to situations in which it is impossible to accept proximity as dispositive because of a countervailing *rov* at the place of proximity. The paradigm in establishing that principle is that

In order to resolve that problem, *Pri Ḥadash* propounds an interesting thesis. *Pri Ḥadash* regards *Shulḥan Arukh's* codification of the ruling as limited to a ghetto or a neighborhood inhabited exclusively by Jews and not traversed by gentiles. Such areas are regarded as tantamount to autonomous cities and major and minor classes are determined accordingly. However, if a thoroughfare frequented by non-Jews traverses that restricted area it is not to be regarded as a self-contained entity and determination of major and minor classes is made on the basis of the population of the dominant area, i.e., the entire city.

It may be concluded that, in order to invoke the principle of *rov* in establishing that a person of unknown ethnic origin who carries the Jewish gene is indeed of Jewish maternal lineage, it is necessary first to establish that the majority of the inhabitants endowed with the Jewish gene are indeed Jews. According to *Shakh* and *Tevu'ot Shor*, *rov* must be determined on the basis of the population of the narrowest definable area; according to *Pri Ḥadash* the determination must be made upon a census of the smallest quasi-autonomous area.

4. The Nature of *Rubba de-Leita Kamman*

A further problem remains: Allegedly, the majority of persons bearing the Jewish gene are known to be Jews. But that is not known actually to be the case. The entire populace of the world has not been examined to

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the rule with regard to the ceremony of breaking the neck of a heifer in a ceremony of expiation in the case of an unknown perpetrator of a homicide victim whose body is found between two cities. The *bet din* of the closest city must make atonement, but only if the city is located in a mountainous area not frequented by non-Jews. However, if it is not in an isolated, untraveled area the assumption is that the murderer was a passing traveler, one of the majority of the inhabitants of the world at large rather than an inhabitant of the closest city. *Shulḥan Arukh ha-Rav* explains that the area used to define the major class cannot be limited to the majority of those in close proximity who happen to be Jews because the majority of Jews are not murderers. The principle of *karov* is applied only because the cities in the mountainous area are "sealed off" from the rest of the world. Otherwise, it is *rov* of "the catchment area" that is determinant. Proximity, or *karov*, serves only to define the narrowest area within which *rov* must be determined and even then *rov* cannot be determined on the basis of that area alone if contradicted by a countervailing *rov*. In such cases the parameter of the area within which the *rov* is to be determined must be extended. According to *Shulḥan Arukh ha-Rav*, it is only because those in close proximity are excluded from the immediate *rov* that another *rov* is constructed. Put somewhat differently: The boundaries of the "catchment area" used are as narrow as can be defined, but only if each of the majority of the individuals within the defined area fits the criteria of the person being sought. When that is not the case, the "catchment area" must be broadened and defined as including the entire city. See also *Ḥiddushei R. Akiva Eger*, *Oraḥ Ḥayyim* 372:5. Cf., however, *Reshash*, *Ketubot* 14b.

establish that fact. Examinations have been carried out only upon a small sample of the world's population. Any extrapolation establishing an association between a specific gene and Jewishness is based upon transferring the findings based upon the examination of a representative sample to the global population. The effect is to use a *rubba de-ita kamman* as a representative sample to establish a more general *rubba de-leita kamman*. There is no evidence upon which to conclude that a *rubba de-leita kamman* can be constructed on the basis of a representative sample.[83]

Rabbi Litke, *Berurei Yahadut*, chap. 11, asserts that a *rubba de-ita kamman* can be established on the basis of empirical generalization from a known number of instances. That principle is then turned into a *rubba de-leita kamman* when applied in specific situations in which two *rov*s are not actually present. If so, we can extrapolate from the majority of examined cases in which the carrier of the gene is known to be a Jew to the general population and then apply that *rov* to any unknown case as a *rubba de-leita kamman*.[84] The counter argument is that the same can be said regarding the majority of the world who are non-Jews—a *rubba de-leita kamman*—to a specific individual on the basis of a *rubba de-ita kamman*.

The issue of whether there can be a *rubba de-leita kamman* that is based upon mere "accidents" or whether a *rubba de-leita kamman* can be established only as a reflection of a natural order phenomenon is the subject of disagreement between R. Eliyahu Levin and R. Zalman Nehemiah Goldberg, *Yeshurun*, XII (5763), 506-532. Rabbi Levin agrees that a *rubba de-leita kamman* can be established only as an expression of a natural phenomenon.[85] Rabbi Levin further regards the unique nature of DNA as merely an irrational matter of statistical probability and hence

[83] Cf., R. Moshe Mordecai Farbstein, *Even ha-Da'at* (Jerusalem, 5765), p. 323.

[84] See also *Berurei Yahadut*, chap. 1.

[85] Quite independent of this discussion, it is well established that the position that a *rubba de-leita kamman* is a principle of "reason" while a *rubba de-ita kamman* is a statistical probability at best. See *Shev Shemateta*, *shemata* 2, chap. 15, and *Kovez Shi'urim*, I, *Bava Batra*, sec. 86 and II, no. 45, secs. 11-12. See also, *Ḥiddushei R. Akiva Eger*, addenda, *Ketubot* 13b. Cf., however, *Noda bi-Yehudah, Even ha-Ezer*, *Mahadura Tinyana*, no. 42; *Pri Yiẓḥak*, II, no. 90; and R. Chaim Schmuelevitz, *Sha'arei Ḥayyim, Kiddushin*, no. 37.

Cf., R. Elchanan Wasserman, *Kovez Shi'urim*, *Bava Batra* secs. 85-86, who demonstrates that *rubba de-leita kamman* that is not based upon natural order presumption remains subject to the principle of *kavu'a*. Although they constitute only a minority of the population, *Kovez Shi'urim* points out that the Gemara, *Yevamot* 16b, regards the Ten Tribes as *kavu'a* in their places of habitat. Since no one knows whether he is or is not a member of the Ten Tribes, the fact that the majority of the world's population are not members of that class can only be a *rubba de-leita kamman*. Nevertheless, in their place of origin the Ten Tribes are deemed to be *kavu'a*. It is thus evident that

argues that a *rov* to the effect that the majority of bearers of the Jewish gene are Jews is not to be regarded as a *rubba de-leita kamman* and since no one has taken a census of all persons carrying the Jewish gene it cannot serve as a *rubba de-ita kamman*. Hence, the Jewish gene cannot give rise to any halakhically recognized *rov*, neither a *rubba de-leita kamman* nor a *rubba de-ita kamman*.

Rabbi Goldberg erroneously concedes that DNA can generate only a statistical *rov* and hence cannot establish a valid *rubba de-leita kamman*. Nevertheless, Rabbi Goldberg argues that the Jewish gene constitutes a *rubba de-ita kamman*. Rabbi Goldberg's categorization of the Jewish gene as a *rubba de-ita kamman* is somewhat unclear. Distinct classes comprised of persons endowed with the gene and persons lacking the gene have not been numerically identified; hence, the classes are not "before us." Rabbi Goldberg may assume that a *rubba de-ita kamman* can be established on the basis of a representative sample.[86]

Rabbi Litke, *Berurei Yahadut*, chap. 11, correctly argues that DNA patterns are not a matter of a rational, accidental statistical probability but reflects a law of nature governing transmission of genetic material. Although Rabbi Litke regards the establishment of a Jewish gene as a *rubba de-leita kamman* he seeks to confirm the basic point that a *rov* based upon mere statistical probability rather than upon a governing rational principle is not to be regarded as a *rubba de-leita kamman*. The Mishnah, *Yevamot* 119a, describes a woman whose husband died without issue. The woman was, of course, subject to levirate marital restrictions. The husband was an only son. In the absence of a surviving brother, the widow would have been eligible to remarry without restriction. However, at a much earlier time, the deceased husband's mother had relocated to a distant land. At the time of her departure the mother-in-law was presumed not to have been pregnant. The Gemara dismisses the consideration that she might subsequently have become pregnant and given birth to a second son. That contingency would have given rise to a requirement that the second son perform *ḥalizah* in order to release the childless widow from levirate bonds. The Mishnah disregards that possibility and permits the widow to remarry. The Gemara explains that the dismissal of the possibility of a subsequent pregnancy and birth is based upon a *rov*. Most women do become pregnant and bear children. However, a minority miscarry. Of

Rosh assumes that the rules of *rov* and *kavu'a* apply even to a *rubba de-leita kamman* that is not based upon a phenomenon of nature.

[86] If so, a *rov* comparable to "The majority of animals are not *treifot*" should also serve as a *rubba de-ita kamman*. Rabbi Goldberg would probably recognize that to be the case.

those that give birth fifty percent of the neonates are female. The net result is that there is less than a fifty percent chance that the woman gave birth to a viable male child whose existence would prohibit the widow from remarrying without *ḥaliẓah.*

The ruling of the Mishnah reflects the application of a *rubba de-leita kamman* and accurately reflects the realities of gestation. But one factor is ignored, *viz.,* the fact that over a period of years a woman may give birth to more than one child. Certainly, over a period of time, the majority of fertile woman do bear multiple children. Hence, the majority of women constituting the class of widows described by the Gemara would have given birth to more than one child with the result that there is an actual statistical *rov* leading to the conclusion that, over a period of time, the mother-in-law in question did indeed give birth to a second male child. Rabbi Litke reasons that, since the Gemara does not take cognizance of that concern, it must be concluded that the Gemara fails to take that contingency into consideration because there is no law of nature assuring that women bear multiple children. Hence, there exists no *rubba de-leita kamman*. However, experience does inform us that the majority of women do give birth to multiple children. Nevertheless, since not all women, or even not all members of the class of fertile women of childbearing age, have been examined or interviewed to determine that women who give birth to multiple children constitute the majoritarian class, a conclusion to that effect is predicated only upon knowledge derived from a representative sample of such women. Since the Gemara does not posit a *rov* to that effect, it must be concluded, argues Rabbi Litke, that the premise that the majority of women bear multiple children does not constitute a *rubba de-ita kamman*.

Rabbi Litke's line of reasoning is subject to challenge. Consequently, the issues of whether an "accidental" *rov* not based upon manifestation of laws of nature is recognized as a *rubba de-leita kamman* and whether a *rubba de-ita kamman* can be established on the basis of a representative sample remain open to question. Although it might appear that the likelihood of multiple births is a statistical probability but does not reflect any law of nature and hence is only an "accidental" statistical *rov*, that is not the case. Natural inclinations and biological principles dictate that the majority of women will become pregnant and give birth to a viable neonate; the same inclinations and principles augur for the likelihood that the majority of women will give birth to multiple children. The reason that a *rubba de-leita kamman* to that effect is not recognized must be that *rov* is not a matter of statistics applied to members of a class in the aggregate but a rule governing individual occurrences used to determine the nature

of each discrete event without at all simultaneously considering other occurrences of the same phenomenon.

The fact that a *rubba de-leita kamman* is not simply a matter of statistics is evidenced by our reliance in drinking milk upon the principle "The majority of animals are kosher." The majority of all animals are not *treifot*. Therefore, the milk of any cow is presumed to be the milk of a kosher animal. The problem is that although the majority of animals are kosher, two percent may well be *treifot*. It is the case that one part non-kosher milk becomes nullified in 60 parts kosher milk, but one part in 60 is only 1.6 percent. If two percent of the cows are non-kosher, two percent of their milk in the aggregate must be presumed to be non-kosher as well. Two percent is greater than the 1.6 percent that is subject to nullification. Nevertheless, the milk of fifty cows may be combined even though, statistically, there can be little doubt that there will be a quantity of un-nullified non-kosher milk in the aggregate.[87] That is so because each animal considered separately is kosher and hence its milk is kosher; statistics as applied to the aggregate have no bearing on antecedent halakhic determination of issues pertaining to particular matters or events contributing to the aggregate.[88]

In the case of the childless mother-in-law, the halakhic doubt is attendant upon each pregnancy, i.e., will the pregnancy result in the birth of a viable male child or will it not result in the birth of a viable male child. *Rov* establishes that, in any particular pregnancy, such will not be the result. The probability that, for the majority of women, a series of pregnancies in the aggregate will lead to such a result is ignored because, rather than apply *rov* retroactively in judging the aggregate, Halakhah invokes *rov* to dispose of issues surrounding each event *in seriam*. If so, the rule applied with regard to levirate obligations in the instance of the possible pregnancy of a presumably childless mother-in-law is not relevant.

Rosh, *Ḥullin* 7:37, maintains a similar view with regard to nullification of a foodstuff known to be non-kosher. Rosh's situation involves a dry piece of non-kosher meat mingled with two pieces of kosher meat in which the dry piece of non-kosher meat is nullified by the admixture of a majority of kosher pieces. Rosh rules that the non-kosher meat is not only nullified but that it is transmuted into kosher meat (*nehepakh ha-issur liheyot hetter*). As a result, even if additional pieces of meat are added subsequent

[87] See R. Menasheh Klein, *Ha-Be'er*, vol. 14, no. 3-4 (Nisan 5763), pp. 125-126 and R. Zalman Nechemiah Goldberg, *ibid.*, pp. 140-143.

[88] Thus, R. Elchanan Wasserman, *Kovez Shi'urim, Bava Batra*, sec. 86, that, although some animals are *tereifot*, if all animals in the world but one were slaughtered and consumed the single remaining animal would also be permissible.

to discovery of the original mixture so that together with the original non-kosher piece of meat there is no longer a majority of kosher pieces, the meat is nevertheless permissible. Rema, *Yoreh Deah* 109:1,[89] rules that, in time of need (*be-sha'at ha-deḥak*), Rosh's opinion may be relied upon.

Even the early-day authorities who do not recognize Rosh's principle of transmutation nevertheless acknowledge that, according to biblical law, a single person is permitted to consume all three pieces of meat even at a single sitting despite the fact that the person doing so unquestionably consumes non-kosher meat in the process.[90] Opinions regarding discarding one piece of meat, a need to divide the meat among different people or to consume the meat on different occasions[91] are not expressions of biblical law. It is clear that a person need have no compunction in partaking of non-kosher food rendered permissible by the rule of nullification.[92]

Rabbi Litke further takes note of the earlier-discussed positions of *Shulḥan Arukh ha-Rav*,[93] who maintains that the underlying rationale for accepting identificatory marks as proof of ownership for return of a lost object is the improbability that two persons each owned and lost an object having an identical identificatory mark. That *rov*, he argues, is nothing more than statistical negation of coincidence and contradicts the notion that a *rubba de-leita kamman* cannot be the product of a rational coincidence.

That proof, enticing as it may seem, also does not stand up under scrutiny. The position that a *rubba de-leita kamman* must rest upon some sort of rational principle is a reflection of a philosophical principle to the effect that the universe is governed by causality and, consequently, random occurrences either do not exist or, if they do exist, are few and far between. If so, it is obvious that statistics, in and of themselves, are of no logical significance and certainly of no predictive value. Yesterday's "accidental" statistics create no probability regarding tomorrow's events. It is precisely that negation of coincidence that demands the acceptance of *simanim*. The same rejection of statistics as mere coincidences because of a presumption that random occurrences, regardless of number, are of no

[89] See also *Bi'ur ha-Gra*, *Yoreh De'ah* 109:11.

[90] Cf., however, *Tosafot Rid, Bava Batra* 31b.

[91] See *Shulḥan Arukh, Yoreh De'ah* 109:1.

[92] For a discussion of possible resultant *timtum ha-lev* (moral corruption) see J. David Bleich, *Bioethical Dilemmas*, II, (Southfield, Michigan, 2006), p.160, note 32 and *idem*, *Contemporary Halakhic Problems*, VI, (Jersey City, New Jersey, 2012), p. 306, note 18.

[93] See Bleich, "Validity of DNA Evidence (Part 2: *Agunah*)," pp. 104-105.

predictive value dictates that the presence of identical *simanim*, at least in the majority of cases, is not a mere coincidence. If random coincidental occurrences are rare, it follows that *simanim* are precisely what they are purported to be. In effect, *simanim* reflect a rational meta-*rov* in the form of a *rubba de-leita kamman*, to the effect that in the majority of cases there are no coincidences. That itself is a philosophical formulation of a rational law of nature and rises to the level of a *rubba de-leita kamman*. In effect, *simanim* are predicated upon a rational negative *rubba de-leita kamman*, *viz.*, the vast majority of empirical phenomena are not coincidental. But coincidences do occur. Many people lose objects and, unfortunately, many people die. Their losses and deaths are unrelated. Unless there is reason to conclude otherwise, such discrete phenomena are not unusual and are unrelated in the sense that there is no causal nexus between such phenomena. *Simanim* constitute statistical probability in support of a veridical causal connection between two phenomena. That such a relationship exists is a rational *rubba de-leita kamman*. *Simanim* are dispositive because of the extreme unlikelihood that two people both owned and lost objects bearing the same identificatory mark. That is not a matter of mere statistics but reflects a rational principle similar to the rational basis that must underlie every *rubba de-leita kamman*. *Simanim* constitute a rational *rubba de-leita kamman* that serves to exclude coincidence.

5. Contradictory *Rovs*

Assuming both that the genetic evidence for the existence of a unique allele that might constitute a Jewish gene has been conclusively established and that available data would allow presence of the gene to qualify as an application of the principle of *rov* in instances of otherwise unknown Jewish identity, it is not clear that such evidence would be dispositive. It would appear that in many cases other evidentiary *rov*s must also be considered. Russians seeking to identify themselves as Jews may very well possess identity papers that declare another national identity. The majority of persons in possession of identity documents of that nature that are not stamped "*Ivreska*" are certainly not Jews. Also, many immigrants admitted pursuant to the Law of Return have spouses who are acknowledged to be non-Jews. Decades ago, R. Isaac Herzog, *Teshuvot Heikhal Yiẓḥak*, *Even ha-Ezer*, I, no. 17, suggested that *Tosafot*'s presumption that the majority of individuals who profess to be Jewish are indeed Jews does not apply in instances in which the person in question is married to a non-Jew. Rabbi Herzog noted that the majority of Jews do not

intermarry. The result is two contradictory *rov*s.[94] Rabbi Herzog's observation, while certainly correct when it was voiced, may unfortunately no longer be true. Whether the majority of Jewish immigrants to Israel of Russian extraction are also married to Jewish spouses is an empirical matter that must be ascertained.

Recognizing that the Jewish gene might determine identity as a Jew only on the basis of *rov*, Rabbi Ze'ev Litke, *Berurei Yahadut*, chap. 14, sec. 1, points out that the Jewish gene is always accompanied by a contradictory *rov* as well, *viz.*, the majority of the populace in virtually every locale in the Diaspora are non-Jews. If so, the status of the person endowed with the Jewish gene cannot be established on the basis of the fact that the majority of individuals harboring that gene are Jews because that *rov* is contradicted by an opposing *rov*. Rabbi Litke counters that those two *rov*s are fundamentally different in nature. That the majority of inhabitants are non-Jews is a *rubba de-ita kamman*, i.e., a conclusion based upon empirical observation. A *rov* of that nature is essentially an "accident," i.e., there is no compelling reason that it should or should not be so. On the other hand, the *rov* established on the basis of genetic comparison is based upon scientific considerations born of how the universe is regulated. That the majority of animals are not *treifot* is a biological observation of the nature of animal species rather than simply the product of a headcount. *Rov be'ilot aḥar ha-ba'al* is based, not simply upon frequency of access, but also reflects the nature of human behavior. The presence of a Jewish gene, since it is predicated upon scientific premises, leads to determination of the presence of a *rubba de-leita kamman*. The majoritarian nature of that type of *rov* is inherent in the nature of the universe. A *rubba de-leita kamman* is of greater evidentiary weight than a *rubba de-ita kamman* because it is compelled by nature rather than by mere happenstance. Since *rubba de-leita kamman* is rationally supported, such a *rov* should prevail over a *rov* limited to a series of unconnected occurrences. It then follows that the *rov* arising from the presence of a Jewish gene should prevail over a *rov* based only upon demographic occurrences.

Rabbi Barenbaum, *Berurei Yahadut*, chap. 8, sec. 1, finds an interesting ramification in the balancing of the two *rov*s in a situation in which there are two maternal brothers, one whose identity as a Jew has long been established and accepted in his native community while the non-Jewish status of the second brother has long been presumed and accepted

[94] That observation is similar to the contention of R. Chaim of Volozhin, *Ḥut ha-Meshulash*, no. 5, that *Tosafot*'s *rov* is not applicable if the individual claiming to be a Jew cannot speak Yiddish.

in the latter's community. It is factually certain that one brother cannot be a Jew and the other a non-Jew. Resolution of the status of both brothers will depend upon the superior strength of the evidence bolstering one of the conflicting claims. Rabbi Barenbaum assumes that the presumption of Jewishness of the "Jewish" brother is a *rubba de-leita kamman* and prevails over a presumption of non-Jewishness of the "non-Jewish" brother which is a *rubba de-ita kamman* based upon the fact that the majority of the population are non-Jews.

This writer does not perceive there to be two contradictory *rov*s. *Rov* applies only in situations of otherwise unresolved doubt. Persons known to be Jews on the basis of behavior and comportment retain their status as Jews even if the majority of the populace are non-Jews. There is no contradiction between acceptance of such individuals as Jews and recognition that a *rov* of the population are non-Jews; the persons accepted as Jews are recognized as being members of the known minoritarian class. Otherwise how could a person establish credentials as a Jew when, as is generally the case, the majority of the population in any locale is non-Jewish? There is no contradiction between acceptance of such individuals as Jews and recognition that *rov* of the population are non-Jews; the persons accepted as Jews are recognized as being members of the minoritarian class. *Rov* establishes status as a non-Jew only when less direct evidence is lacking. If carriers of the Jewish gene are presumed to be Jews, they are excluded from the class of unassigned individuals whose status is determined on the basis of *rov*. Since the status of the person carrying the Jewish gene has been determined by the presence of the gene, his status is no longer a matter of doubt to which *rov* need be applied. If Jewishness can be determined solely by the presence of a Jewish gene there is no contradictory *rov* because there is no longer a doubt requiring resolution on the basis of *rov*. Moreover, rather than contradictory *rov*s, there are two distinct *rov*s applied to different cohorts, *viz.*, 1) a cohort of people endowed with the gene; and 2) a cohort lacking the gene. The first cohort, i.e., the majority of those manifesting the Jewish gene, are determined to be Jews on the basis of the fact that the majority of individuals endowed with the gene are known to be Jews. The second cohort, i.e., the majority of inhabitants who are not endowed with the gene, are known to be non-Jews. The latter forms an entirely distinct class of whom the majority are non-Jews.[95]

[95] Rabbi Barenbaum's objection might equally be raised against *Tosafot*'s assertion that the majority of persons who claim to be Jews are indeed Jews. Rabbi Barenbaum might object that a contradictory *rov* exists, *viz.*, the majority of the populace are

The situation of two maternal brothers, one presumed to be a Jew and the second presumed to be a gentile, involves application of an entirely different principle. Neither of the brothers is an unknown person to whom *rov* must be applied for determination. Each of the brothers brings with him an established status, *viz.*, a *ḥazakah* – one as a Jew, the other as a non-Jew. The problem is that application of the principle of *ḥazakah* in the case of the two brothers leads to conclusions that are clearly contradictory. It would be logical to conclude that when there are conflicting *ḥazakot* they cancel one another with the result that, for all intents and purposes, there is no *ḥazakah*.

Rabbi Litke, *Berurei Yahadut*, chap. 13, secs. 5-10, resolves the dilemma by accepting that there is only one *ḥazakah*, not two. Rabbi Litke, of course, accepts the notion that there is a halakhically recognized *ḥazakah* of Jewishness. However, he denies the existence of a *ḥazakah* of non-Jewishness; the individual's comportment may result in the absence of a *ḥazakah* of Jewishness but, maintains Rabbi Litke, that does not establish a *ḥazakah* of non-Jewishness in an affirmative manner. Hence, according to Rabbi Litke the *ḥazakah* of Jewish identity manifested by one brother is not contradicted by the absence of the *ḥazakah* with regard to the second brother. The result, according to Rabbi Litke, is that the *ḥazakah* of the "Jewish" brother prevails with regard to the "non-Jewish" brother as well. Rabbi Barenbaum, *Berurei Yahadut*, chap. 8,[96] does not concur in defining that there is no *ḥazakah* of "non-Jewishness."

It seems to this writer that resolution of the quandary posed by the case of the two brothers depends upon whether the non-Jewish brother is affirmatively known to be a non-Jew or whether he only fails to be known as a Jew. A person who attends a non-Jewish house of worship or otherwise observes the tenets of another faith holds himself out as a non-Jew and is so regarded by members of the community in which he resides; a person whose religious identity is unknown has no established *ḥazakah* whatsoever. In the latter case, religious identity is a *tabula rasa* and established Jewish identity of one brother dictates the ethnic identity of the second brother as well. When each brother has a firmly established *ḥazakah* as belonging to different faith-communities it would seem that

non-Jews. The reply is: 1) The *rov* establishing that the majority of the populace are non-Jews admits of a minority. Asserting a claim of Jewish lineage establishes a claimant as a member of the minority. 2) There are really two cohorts: a) people who claim to be Jews; and b) people who do not claim to be Jews. The *rov* of the first cohort are Jews; the *rov* of the second cohort are not Jews.

[96] See also *Berurei Yahadut*, chap. 2.

the two *ḥazakot* do indeed cancel one another.[97] The case of the two brothers does not present a situation of contradictory *rov*s but it may reflect a case of contradictory *ḥazakot*.

Rabbi Litke, *Berurei Yahadut*, chap. 14, sec. 3, asserts that, in assessing the relevance of *rov* in establishing the Jewish gene as validation of identity as a Jew, the fact that the majority of the human population is comprised of non-Jews is to be ignored. His basic premise is that major and minor classes are established only upon the relevant criteria that serve to define the classes. The full text of the Mishnah, *Makhshirin* 2:7-9, reads:

> If an abandoned child was found there, if the majority were non-Jews, it must be deemed a non-Jew; if the majority were Jews, it must be deemed a Jew; if they were half and half it must be deemed a Jew. R. Judah says: we must consider who form the majority of those who abandon their children.

[97] The Gemara, *Niddah* 2a, describes a situation involving two people who travel along separate paths, one of which is blocked by a corpse, but neither remembers which path he traversed. Each of the parties is known to have previously been in a state of ritual purity. The *ḥezkat taharah* of each of the individuals dictates that both must continue to be regarded as undefiled even though, empirically, one must have become defiled. There is indeed a logical inconsistency when the two conclusions are taken together but the doubts confronting each of the two travelers are not intrinsically connected – nothing compelled either of them to travel the path in question and the fact that both did so is a sheer coincidence.

The case of the two brothers is comparable to the hypothetical presented by *Pri Ḥadash*, *Yoreh De'ah, Kuntres Aḥaron* 110, involving a quantity of unidentifiable sides of meat, one of which has been found to be non-kosher. Some of the non-kosher meat together with the meat of other kosher animals has already been sold; the balance remains in the slaughterhouse. The principle of *kol de-parish* applies to each piece of meat that has been purchased whereas the meat remaining in the slaughterhouse is *kavu'a*. However, the meat that has been sold cannot be kosher if the balance remaining in the slaughterhouse is non-kosher. The logical entailment between the two questions is intrinsic rather than coincidental. Some authorities rule that the principle of *kavu'a* is a divine edict that does not dovetail with, and even contradicts, the principle of *rov*. Hence, half the side of meat must be regarded as kosher whereas the other half must be regarded as non-kosher. The majority of decisors recognize the logical entailment of the two questions and declare all the meat to be doubtfully non-kosher. See *Shev Shemateta, Shemata* 4, chap. 3 and *Peleti* 110:30. It then follows that the intrinsic logical entailment that exists between the status of the two brothers serves to render *ḥazakah* inapplicable in the case of the brother claiming Jewish identity. *Pri Ḥadash* would presumably concede that, although mutually contradictory conclusions following upon application of *rov* and *kavu'a* can be accommodated, such conclusions cannot coexist in application of other principles in a manner leading to intrinsically connected but contradictory conclusions. Cf., *Berurei Yahadut*, chap. 8.

> If one found lost property there, if the majority were non-Jews, he need not announce it; if the majority were Jews, he must announce it; if they were half and half, he must announce it. If one found bread there, we must consider who form the majority of the bakers. If it was bread of pure flour, we must consider who form the majority of those who consume bread of pure flour. R. Judah says: if it was coarse bread, we must consider who form the majority of those who eat coarse bread.
> If one found meat there, we must consider who form the majority of the butchers. If it was cooked meat, we must consider who form the majority of those who eat cooked meat.

Indeed, in each case the factors used in establishing the parameters of the major and minor classes depend upon the relevance of those factors to the issue to be determined; other criteria are ignored as irrelevant. Thus, an unknown person newly arrived from a locale in which the population is predominantly non-Jewish would be determined to be Jewish on the basis of evidence that his grandmother was Jewish. If the person's forebears are known to have been Jews, the fact that the majority of populace of that person's city of origin are non-Jews is irrelevant. If it is established that the majority of individuals endowed with the Jewish gene are known to be Jews, the fact that an unknown person bearing the gene resides in an area in which the majority are non-Jews is irrelevant. The non-Jewish majority is irrelevant once it is established that the unknown person is a member of the class known to be endowed with the gene. The presence of the gene establishes the individual as a member of the family possessing a particular genotype. It is only in that group that major and minor classes can be defined. Others are not members of the "catchment group" within which major and minor classes can be defined. The situation is comparable to finding a piece of cooked meat as described in the Mishnah. The meat clearly came from a member of a class of people who eat cooked meat; it is only within the members of that group that majoritarian and minoritarian classes can be meaningful. It is taken as certain that the meat was not lost by a person who does not consume cooked meat; hence such persons are excluded from the census of persons from among whom a *rov* is to be established.

Finally, it is not at all clear that the majority of persons carrying the Jewish gene are Jews. Although only an extremely small percentage of non-Jews carry the Jewish gene, the gross number of non-Jewish carriers may be higher than the total number of Jews carrying the gene. Thus, contrary to Rabbi Litke's assertion, the existence of a *rov* establishing that the majority of carriers of the unique Jewish gene are Jews cannot be

confirmed until there is a full tally of the total number of non-Jews carrying the gene. If the majority of the carriers of the "Jewish" gene are non-Jews the putative Jewish gene is of no evidentiary value.

V. THE ROLE OF *ḤAZAKAH*

The Jewish gene can serve to establish Jewish identity only if it can be shown that the majority of those endowed with the gene are otherwise known to be Jews. It is possible for those individuals to have become known as Jews on the basis of *ḥazakah*, i.e., their identity as Jews has been independently established and accepted on the basis of conduct and comportment or because they had been known as descendants of ancestors earlier accepted as Jews. Only if it is demonstrated that the majority of those carrying the gene are known to be Jews would it be possible for an unknown person or a person whose status is a matter of doubt to establish Jewish identity solely on the basis of the *rov* upon which the evidentiary nature of the Jewish gene is predicated. That *rov* is effective only because it establishes a relationship with a forebear whose identity as a Jew was established on the basis of *ḥazakah*.

However, Rabbi Litke, *Berurei Yahadut*, chap. 13, points out there are non-Jews who are also endowed with the Jewish gene but who have established identities and been recognized by the public as non-Jews, i.e., their status as non-Jews has been accepted on the basis of *ḥazakah*. If that is so, he argues, presence of the Jewish gene cannot prove membership in either of the established classes because *rov* simply establishes membership of a class of individuals whose status is predicated upon *ḥazakah*. The Jewish gene is basically only a "marker" for a *ḥazakah* but since that gene is also carried by non-Jews it can be a "marker" for either of two antagonistic *ḥazakot*.

Rabbi Litke develops the thesis that the concept of *ḥazakah* can establish imputed identity as a Jew if it is known that an ancestress was a Jewess but that there is no corresponding notion of inherited status as a non-Jew based upon a general assumption that the person's forebears were known to be non-Jews. Rabbi Litke's basic point is that Jews can be known as Jews in an affirmative manner whereas non-Jews cannot be affirmatively known as gentiles. That is so because of apostasy and intermarriage. Non-Jews do not comport themselves as Jews and hence will not be mistakenly identified as Jews. On the other hand, assimilation of Jews into non-Jewish society is a well-established socio-religious phenomenon. Assimilated individuals become accepted as non-Jews by the general

society without attention being focused upon genealogical lineage or comportment. Hence, he concludes that there is no *ḥazakah* of non-Jewishness in the sense of non-Jewish ancestry.

It seems to this writer that Rabbi Litke's categorization is only partially correct. *Ḥazakah* is a halakhic presumption, not a certainty. A couple living together as man and wife project a general aura of a marital relationship. It is certainly the case that some unmarried partners have falsely held themselves out as husband and wife. It is also the case that there are individuals living in an adulterous relationship who have falsely sought to gain recognition as a lawfully married couple. Jewish apostates gain recognition as members of their newly adopted religion and, if not always at least ofttimes, the public assumption is that they are members of the newly adopted religious faith by virtue of having been born into that faith community rather than as the result of apostasy. The result is indeed a *ḥazakah* of non-Jewish extraction based upon comportment and behavior.

But that is only part of the scenario. There are, at least today, vast numbers of people who profess no religion and even more who are not publicly known as professing any religion. In many circumstances, there are no means to distinguish between a Jewish atheist and a non-Jewish atheist. For such persons there cannot be a *ḥazakah* of non-Jewishness.[98]

In other situations – and certainly in earlier times – a non-Jew could be readily identified as such because he frequented non-Jewish houses of worship. Such behavior or a display of similar distinctively non-Jewish practices testify to identity as a non-Jew by means of an affirmative *ḥazakah*. The societal presumption is certainly that adherents of a religious denomination are practitioners of their ancestral religion. The fact that, on occasion, a Jewish apostate may also engage in such conduct does not mar the presumption of inherited non-Jewishness in the eyes of society any more than the occasional ongoing adulterous relationship negates a matrimonial *ḥazakah* or that a foundling cared for by an adoptive mother mitigates the *ḥazakah* of biological maternity established by conduct leading to a presumption of a maternal-child relationship.[99]

[98] Although Rabbi Litke apparently disagrees, Rabbi Barenbaum, *Berurei Yahadut*, chap. 8, assumes that Jews have strong reason to preserve and project an aura of Jewish identity whereas non-Jews have no strong inclination to do so. See also *ibid*., chap 2.

[99] In support of his argument, Rabbi Litke cites a comment of *Tosafot*, *Ketubot* 29a, s.v. *ve-al ha-Kutit*. The Mishnah declares that the biblical fine imposed for rape of a virgin is imposed for the rape of a female *Kuti*. One opinion recorded in *Kiddushin* 77a is that the Samaritans are indeed valid converts to Judaism but marriage between

However, assuming the Jewish gene to be valid evidence of Jewish identity because of its association with Jews whose status is established on the basis of *ḥazakah*, there can be no corresponding *ḥazakah* of non-Jewishness established by non-Jews who carry the gene unless those individuals also engage in distinctive non-Jewish practices. But, if that is the case, the result is that the so-called Jewish gene is associated both with groups that are *muḥzak* as Jews and with other groups *muḥzak* as non-Jews. Genetic investigators have heretofore made no attempt to determine whether or not the relatively rare instances of the Jewish gene found among non-Jews occurred among gentiles who were "asymptomatic" as far as non-Jewishness is concerned or whether some of the examples were found among individuals who, on the basis of conduct and comportment, were assumed by the public to be of gentile lineage. It may be presumed that investigation would confirm the existence of the "Jewish" gene among the latter group as well.

Rabbi Litke argues that, in the absence of a contradictory *ḥezkat akum*, the presence of the Jewish gene becomes a *siman* of Jewishness. If so, the presence of the gene in a person whose lineage is unknown would be tantamount to a *siman* that the person is a Jew. Since there is no contradictory *ḥezkat akum*, any person having the gene would be deemed to be a Jew even in the absence of any known connection with the Jewish community. Nevertheless, it may be countered that the Jewish gene cannot be a *siman* of Jewishness because it is entirely possible that the ancestress who first manifested the gene was a proselyte who gave birth to

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a Jew and a Samaritan was nevertheless forbidden because Samaritans allowed a small number of slaves to become assimilated in their communities. *Tosafot* questions, since *rov* is not sufficient to establish proof of a plaintiff's claim in a monetary dispute, why should a *Kuti* who rapes a *Kuti* virgin be forced to pay the statutory penalty: "Let us tell her, 'Bring proof that you are not a female slave.'" Rabbi Litke's argument is that the *Kutit* maiden in question and her parents are *muḥzak*, i.e. have been accepted as *Kuti*s of legitimate birth. That *ḥazakah* should be sufficient grounds upon which to base a monetary claim and hence *Tosafot*'s query is groundless. Rabbi Litke resolves that quandary by advancing a thesis to the effect that there cannot be a *ḥazakah* when there is positive knowledge of the presence in the group of a person whose existence contradicts the *ḥazakah*, e.g., in the case of the *Kutim*, the presence of a female slave. Similarly, argues Rabbi Litke, the known existence of an assimilated Jew abrogates any *ḥazakah* that would otherwise confirm identity as a Jew. If correct, the logical conclusion of the known existence of an unidentified adoptee would negate the possibility of establishing a maternal-child relationship on the basis of comportment.

However, *Tosafot*'s objection is well taken. There was a positive *ḥazakah* establishing the existence of an identifiable female slave among the *Kutim*. *Tosafot*'s reply is that each individual *Kuti* enjoys a *ḥezkat kashrut* tracing back to a time prior to assimilation.

children both before and after conversion to Judaism. If so, an unidentified person who carries the gene must be presumed to be a non-Jew because, since the gene is of no evidentiary value, the petitioner must be presumed to be a member of a majoritarian class, i.e., a non-Jewish descendant of the Jewish grandmother but a descendant of the daughter of the "grandmother" born prior to the grandmother's conversion.

Rabbi Barenbaum, *Berurei Yahadut*, chap. 7, is not troubled by the fact that the Jewish gene may be shared by both Jews and non-Jews having a common ancestor provided that the majority of those possessing the gene are independently known to be Jews. He offers as a parallel the hypothetical situation in which a non-Jewish Spanish woman converted to Judaism prior to the expulsion of Spanish Jewry in 1492. The hypothetical woman had a physical anomaly caused by a dominant gene. The anomaly was, and continues to be, present in all of her descendants. She had sisters, aunts and cousins who carried the same gene. Every one of those women and each of their descendants carries the same dominant gene and hence manifests the same physical anomaly. The situation in Spain *circa* 1492 was such that the anomaly was certainly not a criterion of Jewishness. If anything, the majority of those suffering from that anomaly were not Jews. Many Jews fled the inquisition and settled in Turkey. Non-Jews had no reason to flee the Iberian peninsula. The anomaly in question did not exist among indigenous Turks. At that time, in Turkey, the only people who manifested that anomaly were Jewish refugees who were independently known to be Jews. In the decades following the expulsion some few of the converted woman's non-Jewish cousins made their way to Turkey. Some generations later, suggests Rabbi Barenbaum, a Turkish national of unknown lineage but possessing that anomaly might seek to establish a claim to identity as a Jew on the contention that, since the majority of persons then residing in Turkey possess that anomaly, that *rov* establishes him as a member of the majoritarian class. The question arises in Turkey and must be resolved in accordance with the relative number of members of the two classes residing in Turkey at that time.

The bottleneck that arose in the northward migration of Jews in the 14th century was quite similar in nature. The majority of those carrying the Jewish gene into the Rhine Basin were otherwise known to be Jews and hence effectively established a population in which the majority of those who carried the "Jewish" gene in that locale were Jews. Consequently, an unknown person bearing that gene and claiming to be a Jew must be recognized as a Jew on the basis of *rov*.

The problem with that analysis is that the hypothetical Turkish petitioner for recognition as a Jew was not an itinerant stranger to whom *kol*

de-parish is applicable. Rather, the petitioner and his forebears had resided in Turkey for generations. Was it a Jewish or a non-Jewish female ancestress who fled Spain and relocated in Turkey? The doubt arose at the time of removal from her native habitat, i.e., a place of "permanence," and, consequently, *rov* should be of no avail. The same is true of the significant number of Russian immigrants to Israel whose status was doubtful even in their place of birth.

Indeed, that is the position of *Teshuvot Maharit*, *Even ha-Ezer*, no. 18. Maharit refused to recognize North-African descendants of Marranos as Jews on the basis of application of any form of *rov* because the question was really the ethnic identity of the petitioner's "grandmother" as determined before she left Spain. At that time the grandmother was *kavu'a* and therefore Maharit ruled the presence of a *rov* among later generations of Marranos to be of no avail.

There are indeed a host of authorities who apparently disagree with Maharit.[100] Their position is that the status of ancestors is not the question before a latter-day *bet din*. The doubt to be adjudicated arises only with regard to descendants of the original Marranos. Those descendants became separated from their "mothers" who remained in their ancestral homeland. Accordingly, they regard the principle of *kol de-parish* to be applicable.

However, aside from the issue of the time at which the question arises, a problem remains. *Kol de-parish* would arguably apply if the persons in question had suddenly arrived as "foundlings" from an unknown place of origin. *Rov* is applicable when material facts previously known at the place of origin become beclouded at the time of "separation." In those cases the question arises only with regard to doubts that did not exist prior to the time of separation. However, the persons whose plight was addressed by Maharit did not arrive *sua sponte* and petition for the right to marry, or the like, as Jews. Rather, many, if not most, had been living in their communities for decades or longer with a known place of birth. Doubt with regard to ancestral relatives may no longer have been of practical significance and hence the *kavu'a* nature of previous generations may have been immaterial. But the doubt with regard to the status of a petitioner several generations later is a question with regard to the circumstances of that person's birth, or of his grandmother's birth, just as the question with regard to meat stored in a refrigerator whose provenance has been

[100] *See Teshuvot Maharibal*, I, *klal* 2, no. 16; *Teshuvot Mahari Beirav*, no. 39; *Teshuvot Maharashdam*, no. 112; *Teshuvot Yakhin u-Bo'az*, no. 31 and no. 3; as well as *Bet Yosef*, *Even ha-Ezer* 3.

forgotten is a question with regard to relevant contextual facts as they existed at the time of purchase, i.e. whether the meat was obtained from a kosher establishment or a non-kosher establishment. In such situations the question is with regard to facts known at the place of purchase or place of birth, i.e., identifiable places at which the facts were known, as opposed to a quantity of meat or a foundling discovered in the street, cases in which the place of origin or of birth is entirely unknown. A place of origin in which the relevant facts were unknown is tantamount to no origin.

Maharit's refusal to acknowledge the applicability of the principle of *rov* may be regarded as limited to the circumstances of his time. In times gone by, families established residence in a particular locale and remained there for generations. All salient genealogical information was known at the time that domicile was established. With the passage of time memories became hazy and much was forgotten but the status of *kavu'a* did not change. In modern times the situation is often quite different. People know that sometime in the past their progenitors relocated but do not know from where. Since they are ignorant of the family's place of origin they are in the position of *kol de-parish*.[101] Under such conditions Maharit would presumably agree that the "Jewish" gene serves to establish identity as a Jew on the basis of *kol de-parish*.

Accepting those basic principles it would follow that if the *rov* of a particular restricted area, e.g., a ghetto or street, is unknown or unattainable, it is necessary to examine the smallest expanded identifiable area in which a determination of a majority is feasible, i.e., the population of a city or, assuming that a determination of a majority in the city is also unfeasible, the population of the entire country. With regard to genetics, in Western society, the smallest discrete Jewish population for which determination of majoritarian and minoritarian classes can be made on the basis of a restrictive indigenous foundation proves to be Jews of Ashkenazic ancestry. It is then necessary to compare the genomes of that segment of the population with the genomes of the natives of the host countries of origin. The same principle would pertain to determination of majoritarian and minoritarian classes of Jewish communities of mid-East or north-African extraction.

[101] Indeed, it may be suggested that Maharit and his opponents were really describing what each believed to be a different set of circumstances and hence that there is no substantive halakhic dispute between them. Maharit was describing families that had a continuous presence in a particular locale dating from the time of the Spanish expulsion while those who ruled differently assumed that such was not known to be the case and that any claim to Jewish identity was supported only by oral tradition of descent from Marranos.

VI. ASCENDING *ḤAZAKAH*

As noted earlier, DNA can, at best, serve only to establish common origin of separate DNA alleles. After a common origin of DNA fragments or a relationship between individuals has been established on the basis of DNA comparison, other issues may be resolved by appeal to other halakhic prescriptions, e.g., *rov* or *ḥazakah*. Thus, if a maternal-filial relationship is established by DNA analysis, paternity can be ascribed to the woman's husband on the basis of the principle *rov be'ilot aḥar ha-ba'al*. Ordinarily, DNA evidence is employed to demonstrate that a person is a Jew because it is used to establish a relationship with a person who is otherwise known to be a Jew on the basis of *ḥazakah* or the like.

Identification of a Jewish gene comes about because it is established that the majority of persons endowed with that particular allele are known to be Jews. However, persons not known to be Jews who possess the same gene cannot *ipso facto* be presumed to be Jews. It is first necessary to show that the heretofore unacknowledged Jew is descended from the same mother as the member of the class of known Jews who are endowed with that particular gene. Ordinarily, once a *ḥazakah* is established, that *ḥazakah* is automatically passed on to subsequent generations by matrilineal succession. The Jewish gene does not establish the person's status but the status of an ancestress: if a person carries the gene, his grandmother must have carried that gene as well. If the majority of grandmothers who carried the gene were Jewesses, it follows that the identical status was transmitted to each grandmother's descendants. That is to say that known identity as a Jew is not, *mutatis mutandis*, transferred by the Jewish gene to that person's progeny but that the reverse, i.e., identification as a Jew by means of possession of the Jewish gene is ascendingly ascribed to progenitors and, only subsequent to doing so, transferred to all persons in the line of descent.[102] The halakhic principle is that status acquired

[102] Thus, R. Yoḥanan, *Ketubot* 13b, declares that "a mother's *ḥazakah* is effective for a daughter." E.g., a woman consorts with an unidentified man. The fact that the woman was previously presumed to be permitted to a *kohen* because of a *ḥezkat kashrut* leads to the conclusion that her paramour was not a member of a class that would disqualify her from marrying a *kohen*. Her as yet unborn child has no *ḥazakah*. However, the mother's *ḥazakah* logically entails that the daughter has also not been disqualified. In effect, the mother's *ḥazakah* is transmitted to the daughter. If so, there is recognized logical entailment with regard to consequences of a *ḥazakah*. However, in the case of the Jewish gene there is no logical entailment. The fact that the "granddaughter" possesses the Jewish gene does not necessarily entail that everyone of a long chain of grandmothers was also a natural-born Jewess. Any one of those ancestresses might have converted to Judaism, but only after already having

by means of *ḥazakah* is transmitted to progeny. There is no obvious halakhic rule providing for application of a reverse *ḥazakah* of that nature, i.e., a principle that would impute established status to progenitors.

Rabbi Barenbaum, *Berurei Yahadut*, chap. 2, astutely cites a talmudic discussion that would establish transmission of a *ḥazakah* even in the absence of direct halakhic entailment. The Gemara, *Ketubot* 26a and *Bava Batra* 32a, speaks of two witnesses who testify that a person heretofore presumed to be a *kohen* is actually the son of a divorcée while two other witnesses contradict their testimony. The Gemara declares that a son of that person is presumed to be a *kohen* because of the earlier established *ḥazakah* of the father as a *kohen*. In that case there is no logical entailment: the father was certainly a recognized *kohen* at one time. The son, if he were the child of a *kohen* who consorted with a divorcée would never have been a qualified *kohen*[103] but, nevertheless, the father's *ḥazakah* is also assigned to the son.[104] Neither the son nor his status is the subject of the testimony of the impeaching witness. However, R. Baruch Ber Leibowitz, *Birkhat Shmu'el*, *Ketubot*, no. 38, sec. 6, and *Hazon Ish, Even ha-Ezer* 2:25, explain that it is the *ḥezkat kashrut* of the father, rather than the heretofore presumption of priesthood, that is the applicable *ḥazakah*. Those authorities maintain that a progenitor's *ḥazakah* is not at all transferred to a child because of logical entailment but that the child enjoys an entirely different *ḥazakah*. They assert that the *ḥezkat kashrut* and the *ḥazakah* as a *kohen* are independent of one another. The father's *ḥazakah* as a *kohen*, when challenged, is of no avail to the son. A *ḥezkat kashrut*, however, is a different matter. The son held and continues to hold his own *ḥezkat kashrut*. That *ḥezkat kashrut* logically entails that the son is a legitimate *kohen* as well.[105] Absent such entailment, there would be no evidence that the *ḥazakah* of one person would be of any relevance to that person's child and certainly not to a progenitor. Thus, it follows that there is no "ascending *ḥazakah*" on the basis of logical entailment. The ancestor had no *ḥezkat kashrut*. Since the Jewish gene cannot establish a

giving birth to a non-Jewish daughter or daughters. If it cannot be established that the "grandmother" was a naturally born Jewess, any of her descendants endowed with her gene may well be one of her non-Jewish progeny.

[103] The issue of a *kohen* and a divorcée is known as a "*ḥallal*," or a "profaned priest" and is disqualified from serving as a *kohen*.

[104] Rashi, *Kiddushin* 66a, s.v. *semokh a-hani*, regards the case under discussion to be limited to a situation in which the eyewitnesses contradict one another with regard to whether a particular woman, i.e., the father's wife and mother of the child was a divorcée. If so, a similar logical entailment does exist.

[105] See Ritva, *Ketubot* 26a, *Bava Batra* 32a, and *Kiddushin* 66a.

ḥazakah for earlier generations there is no *ḥazakah* to transmit to later generations.

VII. *SEFEK SEFEIKA*

Rabbi Litke, *Berurei Yahadut*, chap. 13, secs. 26-39, examines another argument for ruling that a person bearing a Jewish gene is to be accorded recognition as a Jew, *viz.*, a *sefek sefeika*, or double doubt: 1) The person in question may be a Jew by birth because each of his or her female forebearers was a Jewess; and 2) even if the "great-grandmother" from whom he or she inherited the gene was not a Jewess by birth, she may have converted to Judaism and given birth to the petitioner's "grandmother" after her conversion to Judaism.

Whether a *sefek sefeika* of that nature is of halakhic import is a matter of significant controversy. A typical *sefek sefeika* arises when two separate and independent doubts are present, either one of which would serve to obviate a given prohibition. For example, a woman who willfully commits adultery is prohibited from continuing to live in a marital relationship with her husband. But consortium is forbidden only if adultery has been established. Having established that the sexual act took place it also necessary to establish that the adultery was consensual. It is further necessary to establish that the wife was not a minor at the time of the act. Accordingly, even if there is evidence of the sexual act, two doubts remain: 1) whether the act was consensual and 2) even if the act was consensual, whether the wife was a minor at the time of the adultery. Those are two separate doubts either one of which would obviate the sanction attendant upon an act of adultery.

In a case of an unknown person seeking recognition as a Jew the sole doubt is whether he is of Jewish ancestry. Since it is acknowledged that the petitioner did not himself convert to Judaism, there is only one way that he might be a Jew, *viz.*, that he was born to a mother known to be a Jewess. The mother may be a Jewess for one of two reasons: 1) unbroken matrilineal descent from a known Jewish ancestress; or 2) descent from a female proselyte. But those are "doubts" *mi-shem eḥad*, i.e., two different instrumental ways of establishing a single result, *viz.*, Jewish ancestry. The only pertinent fact is Jewish ancestry. Whether the ancestor's status as a Jew was by virtue of birth or by conversion is of no significance. Many authorities accept the validity of a *sefek sefeika*[106] of that nature and many

[106] See Rambam, *Hilkhot Issurei Bi'ah* 3:2 and *Kesef Mishneh, Hilkhot Sotah* 2:4. See also R. Yitzchak Elchanan Spektor, *Teshuvot Be'er Yiẓḥak*, *Even ha-Ezer*, no. 9,

do not.[107] Assuming that there is a valid *sefek sefeika* there is further controversy with regard to whether *sefek sefeika* prevails against a *rov* or vice versa.[108] In this case the *sefek sefeika* is contradicted by the *rov* arising from the fact that the majority of the world's population are non-Jews.

VIII. THE *KOHEN* GENE

Identification of a *kohen* gene is an enterprise quite different in nature from identification of a Jewish gene. Jewish identity is transmitted from generation to generation solely by matrilineal succession. Mitochondrial DNA is passed on from mother to daughter without recombination with

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sec. 7; *idem*, *Naḥal Yiẓḥak*, no. 38, sec. 4; *Minḥat Ya'akov*, *Klalei Sefek Sefeika*, sec. 10; R. Jonathan Eybeschutz, *Kereti u-Peleti*, *Kuntres Bet ha-Safek*, s.v. *amrinan*.

Many authorities accept a *sefek sefeika mi-shem eḥad* only if it involves two separate factual "doubts" rather than two halakhic doubts, each of which, if true, would independently lead to the same result. For example, if a bride is found not to be a virgin, there are two independent doubts: Consensual intercourse may have occurred prior to betrothal or she may have been raped. However, in this case, the petitioner can be a Jew only if his mother is a Jewess. How the mother became a Jewess is irrelevant. The situation is tantamount to a doubt with regard to whether the mother is a Jewess converted by *bet din* A or *bet din* B. The two possibilities that enter into the *sefek sefeika* are not separate procedures through which the person in question might have become a Jew, but two ways of resolving the single doubt of whether the person was born a Jew. Even if a *sefek sefeika mi-shem eḥad* is a valid *sefek sefeika*, that is because the doubts are instrumentally two ways of establishing a single halakhic status rather than two ways of proving that status. *Pri Megadim*, *Yoreh De'ah*, *Mishbeẓot Zahav* 17:2, seems to accept even the latter as a valid *sefek sefeika*. However, *Ḥiddushei R. Akiva Eger*, *Yoreh De'ah* 15:3, takes sharp issue with that position. See also Ritva and *Pnei Yeshoshu'a*, *Kiddushin* 73a, and *Teshuvot She'erit Yosef,* no. 5; Cf., *Teshuvot Be'er Yiẓḥak, Even ha-Ezer*, no. 7, *anaf* 9; *Teshuvot Maharit*, II, *Yoreh De'ah*, no. 2; *Shev Shemateta, Shemata* 3, chap. 20; *Sha'arei Torah*, I, *klal* 24, *Din Ne'emanut ha-Yuḥasin*, *Mamzerut ve-Yuḥasin*, sec. 17:7; and *Berurei Yahadut*, chap. 13, secs. 26-32.

[107] See primarily *Tosafot, Ketubot* 9a, s.v. *ve-i*.

[108] *Kereti*, *Kuntres Bet ha-Sefek*, regards the matter to be a subject of controversy among early-day authorities. *Kereti* cites *Teshuvot ha-Rashba*, I, no. 401 and Ra'avad, *Hilkhot Tum'at Met* 9:2, affirming the decisive weight of *Shev Shmatata* and *Tosafot, Ketubot*, s.v., *ve-i*, as disagreeing. *Ḥavvat Da'at*, *ibid*, sec. 27, disagrees with *Peleti*'s understanding of *Tosafot. Ḥavvat Da'at*, in his *Teshuvot R. Ya'akov mi-Lissa*, no. 57, rules that a *sefek sefeika* is decisive over a *rov* only in the presence of a *rubba de-leita kamman* but that a *rubba de-ita kamman* – as is the nature of a *rov* arising from the greater number of non-Jews in the world – prevails over a *sefek sefeika*. Cf., however, R. Jacob of Lissa's responsum published in *Teshuvot Ḥemdat Shlomoh*, *Even ha-Ezer*, no. 24, sec. 12, as well as *Kuntres ha-Sefekot*, *klal,* sec. 7. Cf., *Berurei Yahadut*, chap. 13, secs. 33-39.

male genetic material. In contrast, halakhic identity as a *kohen* is the product of patrilineal succession. Hence, any genetic evidence for a common ancestor as the progenitor of modern-day *kohanim* must be found on the Y-chromosome which, fortunately for genetic sleuths, with the exception of a small region of the chromosome, is not recombined.[109] Other than because of mutation, which occurs with great frequency, the Y-chromosome would be uniform among all male descendants of Adam. Such is the nature of the female counterpart of the purported Jewish gene found in mitochondrial DNA. If *kohanim* manifest a distinctive gene one might anticipate that the phenomenon would occur as the result of transmission of a mutant gene by a common ancestor some time in antiquity. That conclusion is bolstered by the similar frequency of occurrence found among *kohanim* of both Ashkenazic and Sephardic ancestry.

Curiously, the *kohen* gene is the relative absence, rather than the relative frequency, of particular haplotypes. In an early study, only 1.5% of *kohanim* were found to carry those distinctive alleles compared to 18.4% of other Jews.[110] Thus, a higher representation of that genetic pattern among non-*kohanim* would suggest that it is among that cohort that the mutation arose while *kohanim* carry earlier unmutated versions of the genetic material. Strangely, however, the frequency of occurrence among Levites[111] is comparable to those haplotypes' frequency of occurrence among Israelites rather than to their frequency among *kohanim*. That phenomenon suggests that the mutation came after the separation of Aaron the Priest and his progeny from the tribe of Levi.

If that assessment is correct, the identification of the *kohen* gene is of limited application. Identification of a *kohen*, even if scientifically sound, would be of scant halakhic consequence. For eligibility to participate in the Temple rites in the absence of established eligibility, the two-witness rule applies.[112] There is significant controversy with regard to whether a single witness is sufficient to permit a *kohen* to partake of *terumah*.[113] There is also considerable controversy among latter-day authorities regarding a person's capacity to declare himself to be a *kohen* for purposes of being permitted to confer the priestly benediction or being accorded

[109] See Karl Skorecki *et. al.*, "Y Chromosomes of Jewish Priests," *Nature*, vol. 385 (2 January, 1997), p. 32.

[110] *Loc. cit.*

[111] M. G. Thomas, *et. al.*, "Origins of Old Testament Priests," *Nature*, vol. 394 (1998), p. 139.

[112] See Rambam, *Hilkhot Issurei Bi'ah* 20:2 and *Encyclopedia Talmudit* (Jerusalem, 5767), XXVII, 223, note 754.

[113] See *ibid.*, pp. 231-233.

the honor of being the first person called to the reading of the Torah.[114] Although it is our practice to grant credence to a person's claim to kohanic descent for those purposes,[115] his credibility cannot be greater than the evidence upon which the person asserts his claim. Thus, a claim that information concerning his lineage was conveyed to him by his father is credible whereas a claim of subjective acceptance of conclusions advanced by geneticists is not.

The notion that lack of a gene would rebut any particular *kohen*'s claim to priesthood cannot be entertained even if only because the majority of *kohanim* carry no such identificatory mark. In light of the fact that the majority of *kohanim* do not carry such a gene it would be difficult to find grounds for a *kohen* who fails to manifest such a genetic pattern to be permitted to marry a divorcée or to defile himself by coming into contact with a corpse. Thus, the *kohen* gene can be of halakhic import only in the unlikely situation in which discovery of the presence of a *kohen* gene is the sole reason to regard the person as a *kohen*. Such a person may be forbidden to marry a divorcée, come into contact with a corpse, claim the privilege of pronouncing the priestly blessing or receive the first Torah honor. Since financial matters are not adjudicated on the basis of *rov*, an argument might perhaps be made for permitting such an individual to perform the rite of redeeming his own wife's firstborn while retaining the redemption fee for himself.

The principal value of establishing the existence of a unique *kohen* haplotype lies in demonstrating the veracity of the biblical description of *kohanim* as the descendants of Aaron the Priest. Indeed, in 1999, positing an assumed mutation rate and a presumption of 25 to 30 years between generations, some researchers estimated that the *kohen* gene appeared between 2,650 and 3,180 years earlier, i.e., some time between the Exodus and the destruction of the First Temple.[116] A number of later studies established the existence of unique Levite genetic material as well. There is less evidence regarding the dating of the original appearance of those genetic indicators.[117]

[114] See *Ketubot* 23b and *Encyclopedia Talmudit*, XXVII, 224-228.

[115] See Rabbenu Nissim, *Ketubot* 23b and *Maggid Mishneh, Hilkhot Issurei Bi'ah* 20:13. Cf., *Hagahot Ramakh* and *Maggid Mishneh*, *Hilkhot Issurei Bi'ah* 20:13 as well as *Yam shel Shlomoh*, *Ketubot* 2:44.

[116] See Thomas, "Origin of Old Testament Priests," p. 139.

[117] See Marta D. Costa *et al.*, "A Substantial Prehistoric European Ancestry Amongst Ashkenazi Maternal Lineages," *Nature Communications*, vol. 4 (October 8, 2013), p. 2453 and Doron N. Behar *et al.*, "The Genetic Variation in the R1a Clade Among the Ashkenazi Levites' Y Chromosome," *Scientific Reports*, vol. 7, no. 1 (November 2, 2017), pp. 1-11.

At best, the findings regarding a *kohen* gene do little to confirm the biblical account. The biblical report entails that the genetic mutations described, if they took place, would have occurred either prior to the birth of Aaron the Priest, or less likely, in Aaron himself – but certainly prior to the earliest date postulated by the scientific investigators. Even so, the absence of any higher frequency of occurrence among Levites is not compatible with biblical dating unless, of course, it was Aaron himself who was the first to carry the mutated gene.

A later study including a larger number of participants established that 50% of *kohanim* carry one of a limited number of alleles defined as the "Cohen Modal Haplotype."[118] That study, published in 2009, places the divergence time of *kohanim* as between 3190 and 1090 years earlier.

Some years ago, an intriguing report in the media concerning DNA analysis as evidence of a *kohen* gene led to widespread fascination with employment of the DNA gene as confirmation of Jewish ancestry.[119] There are many tribes in North Africa, chief among them the Falasha, who practice syncretistic forms of religion incorporating various Judaic practices. One heretofore obscure group numbering some fifty thousand members living primarily in Venda, one of the black homelands in the northeast corner of South Africa and an adjacent area in Zimbabwe. The members of that group practice a form of Christianity but profess themselves to be Jews descended from Falasha and, through the Falasha, from white Jewish ancestors. They practice ritual slaughter, circumcise their male children and refuse to eat flesh of the pig as well as of the hippopotamus, which they regard as a species of swine. They are known as Lemba, meaning "people who refuse." Their native tongue is Bantu. The Lemba are divided into ten clans and claim to stem from a city called Sena which they cannot identify but which a contemporary Lemba leader speculates is the Sena'ah of Nehemiah (7:38), a place that he presumed to be north of Jericho. A British scholar who has studied the Lemba, Dr. Tudor Parafitt, director of the Center for Jewish Studies at the School of Oriental and African Studies in London, believes Sena to be a town in Yemen.

[118] That study by Michael S. Hammer *et al.*, "Extended Y Chromosome Haplotypes Resolve Multiple and Unique Lineages of the Jewish Priesthood," *Human Genetics*, vol. 126, no. 5 (November, 2009), pp. 707-17, also involved 2099 non-Jewish men of diverse ancestry. The Cohen Modal Haplotype was remarkably absent in that group. Interestingly, that phenomenon would give rise to speculation with regard to whether the *kohen* gene might establish Jewish paternal ancestry. Such lineage would, however, be of no halakhic import since Jewish identity is born of matrilineal succession.

[119] See Nicholas Wade, "DNA Backs Tribe's Tradition of Early Descent From the Jews," *New York Times*, May 9, 1999, p. A6.

Subsequent to publication of Dr. Parafitt's travelogue recounting his search for Sena, *Journey to the Vanished City* (London, 1992), Dr. David Goldstein, a population geneticist and member of the faculty of Oxford University, who had been engaged in research concerning the Jewish gene, analyzed DNA samples collected from the Lemba. Dr. Goldstein reported that nine percent of Lemba males carry the *kohen* gene while among members of one group, the Buda clan, 53 percent had the distinctive kohanic sequences. Quite surprisingly, the latter figure closely approximates the worldwide figures for carriers of the *kohen* gene, *viz.*, 46 percent for Sephardic *kohanim* and 53 percent for Ashkenazic *kohanim*.[120] Presence of the *kohen* gene over a span of millennia as well as a presumed absence of unique mitochondrial DNA is readily attributed to the Lembas' acceptance of female converts, who must undergo a complicated and somewhat bizarre ritual, but concomitant steadfast persistence in refusing to accept any male convert whatsoever.

The Lembas' claim to descent from Falasha is unquestionably incorrect. However, it is entirely probable that they are descended from Jewish traders who, together with many other such traders, made their way to North Africa. That phenomenon also serves to explain elements of Mosaism that crept into the cultic practices of many North African tribes. The Lemba presumably traveled by boat directly from North Africa to their present homeland in South Africa.

The preponderance of *kohanim* among travelers of antiquity might seem odd.[121] Nevertheless, a remarkable parallel does exist in the demographic composition of the Jewish residents of Djerba, an island off the mainland off Tunisia, a community believed to have been established during the days of the First Temple.[122] The overwhelming majority of the Jewish population of Djerba is comprised of *kohanim*.[123] They are remarkably different from the Lemba—and indeed from other communities in the Diaspora—in that throughout those millennia they have practiced

[120] *Loc. cit.*

[121] Perhaps because *kohanim* owned no land and could not subsist on priestly emoluments?

[122] See F. Manni, *et. al.*, "A Y-Chromosome Portrait of the Population of Jerba (Tunisia) to Elucidate its Complex Demographic History," *Bulletins et Memoires de la Societe d'Anthropologie de Paris*, vol. 17, nos. 1-2 (2005).

[123] All the *kohanim* of Djerba whose DNA was sampled were found to possess the *kohen* gene. The same is true of *kohanim* residing in Jerusalem's Old City from whom samples were taken. See Yaakov Kleiman, *DNA and Tradition* (New York, 2004), p. 21. Cf., however, Manni, "A Y-Chromosome Portrait of the Population of Jerba (Tunisia)," who reports that 13 of 15 natives of Djerba carried the Cohen Modal Haplotype. It is not clear whether each of those 15 claimed to be a *kohen*.

strict endogamy and have uniformly exhibited consistent fidelity to Jewish law and tradition. The genealogical roots of both communities are probably identical. The difference lies in the Lembas' openness to marrying female natives, possibly because of a dearth of available Jewish women, that, in turn, is perhaps attributable to the vast geographical distance from any center of Jewish population, and to a steadfast resistance to intermarriage on the part of the Jewish settlers in Djerba.

The underlying issue presented in consideration of the *kohen* gene is the halakhic basis upon which evidentiary credence might be extended to genetic analysis in establishing identity as a *kohen*. Thus far, the sole halakhic issue involving genetic evidence of status as a *kohen* discussed in rabbinic literature does not arise from discovery of the *kohen* gene, but the more general question of whether genetic analysis can serve to establish kohanic paternity. A woman entered into a second marriage and three months thereafter gave birth to a male child. The child was surrendered for adoption. The court papers included an affidavit signed by both the mother and her second husband declaring that the identity of the child's father was unknown. A number of half-brothers were born during the course of each of the two marriages. The second husband was a *kohen*. Years later, the child who had been surrendered for adoption sought to identify his biological father on the basis of DNA analysis and, if the genetic evidence would establish that the second husband was his father, to be recognized as a *kohen*. A petition was submitted to the Jerusalem *Bet Din le-Berur Yahadut* and its brief decision was published in the *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Berur Yahadut*, IV (5756), 319-320.

Rema, *Even ha-Ezer* 3:9, rules that if an unmarried woman cohabits with a *kohen*, marries another man within a three-month period and gives birth to a son some six months thereafter, the child born in that early period of the marriage cannot be recognized as a *kohen*. *Ḥelkat Meḥokek, Even ha-Ezer* 3:12, questions why Rema does not apply the rule of *rov be'ilot* and concludes that the husband is the father of the child. The principle of *rov be'ilot* establishes that, because of frequency of access, even in an adulterous relationship, presumption of paternity lies with the lawfully married husband. *Ḥelkat Meḥokek* infers from a comment of Rashi, *Yevamot* 100b, s.v. *ela lav*, that such is indeed Rashi's view. *Ḥelkat Meḥokek* explains that Rema's ruling reflects a stringency applicable only to determination of priestly lineage.

Bet Shmu'el 3:16 disagrees with *Ḥelkat Meḥokek* and cogently explains that *rov be'ilot* is applicable only in the case of a married woman who engages in two sexual relationships within a single time frame. As between

the two men, she is presumed to cohabit with her husband more frequently than with the adulterer. Rema, however, addresses a situation in which the relationships were not simultaneous. There is no principle establishing that a husband and wife cohabit more frequently than an unmarried couple. Thus, there is no reason to assume that the couple cohabited more frequently subsequent to regularizing the relationship by marriage.

However, as noted, *Ḥelkat Meḥokek* maintains that *rov be'ilot* cannot be invoked to establish priestly descent. The members of the *bet din* found an apparent contradiction to *Ḥelkat Meḥokek*'s view. *Teshuvot ha-Rashba*, I, no. 207, declares that identity as a *kohen*, even for eligibility to participate in the sacrificial service, is established solely on the basis of paternal identity which, in turn, can be predicated only upon *rov be'ilot*. Thus, were the Sages to have excluded reliance upon *rov be'ilot* as proof of identity as *kohen*, there could be no recognized *kohanim*.

In an earlier decision, *Piskei Din shel Bet ha-Din le-Berur Yahadut*, III (5755), the Jerusalem *bet din* established that the principle of *rov be'ilot* is not a mere *rov* but a "super *rov*" regarded as virtual certainty. In the latter decision, the *bet din* declared that *Ḥelkat Meḥokek* fully recognized that to be the case but asserted that *Ḥelkat Meḥokek* regarded the virtual certainty to be factually correct only as between a married woman and a paramour. Thus, the issue of a *kohen* and his wife is regarded as a *kohen* on the basis of a "super *rov*." Frequency of intercourse, between husband and wife during the course of marriage, argued the *bet din*, is indeed greater than frequency of intercourse between unmarried parties, but not inordinately greater than between the same parties in a non-adulterous extra-marital relationship. Thus, the *rov* establishes that the couple cohabit more frequently after marriage than before marriage but not with sufficiently more frequency so as to establish the "super *rov*" necessary to confirm priestly identity. Thus, it is only the ordinary *rov* that Rema rules declares to be rejected as sufficient to establish priestly lineage; the "super-*rov*" reflected in frequency of intercourse between husband and wife, argues the *bet din*, does serve to confirm identity as a *kohen*.

In rejecting the petition for recognition as a *kohen*, the *bet din* cited numerous authorities who regard DNA evidence as constituting no more than a *rov* rather than a matter of scientific certainty[124] and asserted that priestly status can be confirmed only on the basis of absolute proof. That conclusion is certainly equally applicable to evidence based upon the *kohen* gene.

[124] See Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," p. 155.

R. Chaim Shmuelevitz, *Sha'arei Ḥayyim*, *Kiddushin*, no. 37, cites *Sanhedrin* 69a, which quotes the verse "*ve-hitzilu ha-edah* – and the congregation shall rescue" (Numbers 35:25) and interprets the term "the congregation (*ha-edah*)" as denoting the *bet din* and understands the verse as directing an acquittal in some set of circumstances in which application of conventional judicial rules would result in a guilty verdict. The Gemara suggests that "*ve-hitzilu ha-edah*" may be a directive to set aside the rule of *rov* in capital cases.

Ḥiddushei ha-Ran, *ad locum*, points out that such an inference would be contradicted by the declaration of the Gemara, *Ḥullin* 11b, to the effect that a person sentenced to death for smiting his father can be executed only if the existence of a paternal-filial relationship has been established. It is possible to prove the existence of such a relationship only on the basis of *rov be'ilot*. *Ḥiddushei ha-Ran* resolves that problem by stating that, since the Torah does provide the death penalty as punishment for that transgression, the Torah clearly demands the death penalty even if *rov* would be insufficient for conviction in other capital cases. Ran's resolution should probably be understood as an observation to the effect that the Gemara postulates that, if *rov* could not be relied upon in capital cases, it would be because the evidence of *rov* is regarded as insufficiently compelling. Consequently, demanding imposition of the death penalty for smiting one's father would indicate that the Torah does not require absolute proof of guilt in instances of smiting a father.

Sha'arei Ḥayyim, however, amplifies Ran's response in explaining that the thrust of Ran's comment is that *rov be'ilot* would suffice for conviction even if other forms of *rov* would not. According to *Sha'arei Ḥayyim*, the distinction is between *rov be'ilot* and other *rov*s, rather than between striking a father and other capital transgressions. The reason for the distinction, according to *Sha'arei Ḥayyim*, is that the Torah accepts *rov be'ilot*, unlike other *rov*s, as establishing paternity with virtual certainty. But, since the Gemara concludes that "*ve-hiẓilu ha-edah*" does not exclude other forms of *rov* in capital cases, the implication is that the Torah demands imposition of the death penalty on the basis of any applicable *rov*, regardless of whether or not the *rov* establishes absolute certainty.[125]

This writer's reading of *Ḥiddushei ha-Ran* is as presented above. If so, *Ḥiddushei ha-Ran* represents an early-day authority who contradicts *Sha'arei Ḥayyim*'s distinction between *rov be'ilot* and other *rov*s. Any answer that may be advanced in resolving Ran's perplexity reflects only the Gemara's *hava amina*, i.e. the Gemara's "early thinking" were it forced

[125] See also *Teshuvot R. Akiva Eger*, no. 107.

to accept "*ve- hiẓilu ha-edah*" as negating capital punishment on the basis of *rov* in other cases. There is no evidence that any premise of that nature is retained by the Gemara at the conclusion of its discussion.

Nevertheless, there is other evidence establishing that *rov be'ilot* is a unique *rov*. Rather than predicating paternity upon the principle of *rov be'ilot*, as depicted by the Gemara, *Ḥullin* 11b, the Palestinian Talmud, *Kiddushin* 4:10, posits the Torah's imposition of the death penalty as punishment for striking one's father as the source for the judicial presumption established by *ḥazakah*.[126] That terminology is also employed by Rambam, *Hilkhot Issurei Bi'ah* 1:20.[127] To the Palestinian Talmud, *rov be'ilot* is actually a *ḥazakah* rather than a *rov*.[128]

IX. A CONCLUDING REMARK

DNA analysis is firmly established as a medical tool and is invaluable in the study of hereditary diseases. DNA analysis has limited halakhic import, particularly in resolving some grievous *agunah* problems. The unique nature of the so-called Jewish gene can, at best, establish a *rov* and be dispositive in situations in which *rov* constitutes acceptable proof. The *kohen* gene, however, remains little more than a curiosity.

[126] See *Sidrei Taharah* 185:1 and *Teshuvot Ḥatam Sofer*, *Yoreh De'ah* no. 378 and *Even ha-Ezer*, I, no. 41.

[127] R. David Levanon, *Shurat ha-Din*, V, 58-69, similarly regards *rov be'ilot* as different from other *rov*s and categorizes *rov be'ilot* as an *umdena* or *anan sahadi*. See Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," p. 162.

[128] Cf., however, R. Chaim of Volozhin, *Ḥut ha-Meshulash*, no. 10, who regards the terms "*rov*" and "*ḥazakah*" as used in this context to be synonymous. See Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," p. 162 and cf., *ibid.*, note 70.