

## SURVEY OF RECENT HALAKHIC LITERATURE

### VALIDITY OF DNA EVIDENCE FOR HALAKHIC PURPOSES (PART 2): AGUNAH

#### *Evidentiary Standards*

Jewish law posits two fundamental principles regarding marriage: (1) A woman lacks capacity to contract a polyandrous marriage; (2) a marriage can be terminated, and the wife's capacity to contract a new marriage restored, only upon death of her husband or divorce. A woman known to have been married retains the status of a married woman until there is halakhically cognizable evidence of termination of the marriage. Agonizing situations of *igun* arise in which a woman is "chained" in a marriage in the sense that she is the bereft of the privileges and the prerogatives of marriage but is not free to seek another consort. The most tragic cases of *igun* are those in which the husband is presumed to be dead but there is no satisfactory proof that death has actually occurred. The wife is left an *agunah*, i.e., "a chained woman," ensnared by marital bonds but bereft of consortium with her partner. The problem became the focus of renewed attention in the aftermath of the destruction of the Twin Towers of the World Trade Center on September 11, 2001, in which a large number of bodies were incinerated or were no longer identifiable.

Ostensibly, biblical law would apply the two-witness rule and permit remarriage only on the basis of the testimony of two qualified witnesses who testify to personal knowledge of the husband's death. In practice, rabbinic enactments sanction remarriage upon the testimony of a single witness, hearsay testimony or some limited forms of circumstantial evidence. Those enactments do not constitute a repeal, modification or variance of biblical law; rather they involve changing "facts on the ground" so that less restrictive rules of evidence become applicable. As stated by the Gemara, *Yevamot* 93b and 115a, the enabling principle is *ishah daika*

\* The author wishes to express his thanks to Rabbi Joseph Cohen for his expert research assistance.

*u-minseva*, literally, “a woman investigates and [then] marries.” As the Gemara explains, a woman will not enter into a new marital relationship unless and until she is absolutely convinced that her husband is no longer alive. That is not to imply that such is the natural female wont. Quite to the contrary, the Sages enacted provisions that compelled women to become exceedingly cautious in remarrying, *viz.*, they legislated that, in the event of the reappearance of the first husband, the wife be forbidden to continue in a marital relationship with either of the two men, that future issue born of a relationship with either of the men be regarded as *mamzerim* and that she forfeits the *ketubah* together with all rights and prerogatives attendant upon a marital relationship. As explained by the Gemara, *Yevamot* 88a, a woman confronted by the stark prospect of such onerous consequences in case of error will exercise extreme caution in contracting a second marriage. The conditions legislated by the Sages served to ensure that no woman would remarry unless she were absolutely convinced that her first husband was no longer alive. The result is a *hazakah* equal in evidentiary probity to the reliability of two witnesses.

Rashba, *Ketubot* 3a, offers an alternative explanation in asserting that, when the relaxed rules of evidence are satisfied, the Sages remedied any resultant onerous error in declaring the husband to be deceased by employing their power to retroactively nullify the first marriage by confiscating the specie or other consideration whose conveyance to the bride is necessary for a marriage to come into existence. According to Rashba, the harsh conditions made consequent upon error in determining the husband’s death were designed to ensure that the wife not take advantage of relaxed rules of evidence and the ensuing nullification of her marriage unless she herself was convinced beyond all doubt that her husband was indeed dead.

### 1. *Simanim: Identificatory Marks*

DNA evidence is not required in order to establish that death has occurred. Rather, it serves to establish the identify of a body when death is no longer subject to doubt. The evidence is used to establish the identity of a corpse rather than the husband’s demise. In general, judicial proceedings cannot commence unless the parties are identified. The parties may declare their own identities or they may be identified by witnesses. Witnesses to an act, criminal or civil, testify not only to the act but to the identity of the actors, *i.e.*, that the person appearing before the *bet din* is one and the same as the person who performed the act that has become the subject of judicial proceedings. The primary method of establishing

widowhood is by means of testimony of witnesses who certify the death of the husband by testifying that they saw and recognized the corpse. Testimony regarding recognition of a corpse necessarily entails testimony that the witnesses had previously known the deceased and can identify the body on the basis of their recognition of the corpse as that of a particular individual known to them during his lifetime. Witnesses testify to the identity of a corpse based simply upon their innate power of recognition. Acceptance of testimony of that nature is predicated upon reliance upon the acknowledgement of the veridical nature of “*tevi’ut ayin*” or “discernment of the eye.”

In many situations, either there are no available witnesses who knew the deceased while he was yet alive, or the corpse has deteriorated and is no longer recognizable. DNA, if acceptable for the purpose of establishing the identity of the deceased, would be of singular benefit in alleviating the plight of women who would otherwise be *agunot*.

The Mishnah, *Yevamot* 120a, seemingly excludes all forms of identification other than facial recognition: “There can be no testimony other than with regard to the countenance of the face, including the nose, even though there are identificatory marks on the body or clothing.” The notion of “*simanim*,” or identificatory marks, in conjunction with the identification of a corpse is related to the halakhic category of identificatory marks that suffice to establish a rightful owner’s claim to lost property. That type of evidence suffices to establish proprietorship over lost property only because no other person with a claim of title is in possession of the lost object. *Simanim* do not suffice as evidence in other property disputes.

Nevertheless, the Gemara, *Yevamot* 120b, declares that the identificatory marks excluded by the Mishnah in establishing the identity of the corpse are limited to identificatory marks that are not “*muvhak*,” a term best translated in this context as “exclusive” or “singular,” but that a *siman muvhak* is acceptable for identification of a corpse. Thus, testimony regarding the presence of an identificatory mark that is highly unlikely to be present on another person’s body or clothing would be sufficient to declare the wife to be a widow. Nevertheless, in apparent contradiction, Rambam, *Hilkhot Gerushin* 13:21, rules that a corpse can be satisfactorily identified only if the “forehead, nose and facial countenance” are extant and recognized, whereas identificatory marks on the deceased’s body or clothing are not sufficient and even identification of a mole (*shuma*) on the body is insufficient to permit the wife to remarry. However, both *Maggid Mishneh* and *Kesef Mishneh* reconcile Rambam’s ruling with the statement of the Gemara by declaring that Rambam intended to exclude only “exclusive” identificatory marks but not “extraordinarily exclusive”

(*muvhak be-yoter*) identificatory marks. *Kesef Mishneh* adds that Rambam incorporates “*shuma*” in his ruling as an example of the type of identificatory mark that is excluded because, contrary to some authorities who regard *shuma* as more reliable, Rambam deems *shuma* to be merely an “ordinary” exclusive mark, but does not intend to exclude “extraordinarily” exclusive identificatory marks. That understanding of Rambam is reflected in the comments of a host of latter-day authorities.<sup>1</sup>

Left unclear is the precise distinction between a *siman muvhak* and a *siman muvhak be-yoter*. R. Elijah Mizrachi, *Teshuvot ha-Re'em*, no. 38, recognizes that there is no identificatory mark that may not also be present on the body of another person but, to be acceptable, the mark must be such that the *siman* in question is “strange” and extraordinary to the point that every person “be certain in his heart that it does not exist in another person in that land and that it has never been heard that another person possessed such a *siman*.” *Teshuvot ha-Re'em* adds that such a limitation does not imply that there can never be an instance in which two people share a common identificatory mark. *Teshuvot ha-Re'em* observes that even the testimony of two eyewitnesses is not infallible but is accepted nevertheless. Hence, it is not surprising that *simanim* are also biblically acceptable even though they are not completely infallible.

Rabbenu Yeruham, *Helek Adam ve-Havvah* 23:3, rules that, for purposes of establishing a husband’s death, only a singular *siman* in the nature of something certain (*barur*) “that cannot be found on another body” is acceptable. Taken literally, that statement can apply only to a null class because there is no conceivable way to determine that absolutely no other man exhibits an identical identificatory mark. *Teshuvot Mas'ei Binyamin*, no. 63, cited by *Bet Shmu'el*, *Even ha-Ezer* 17:72, regards that statement to be in the nature of hyperbole and that Rabbenu Yeruham intended to describe the requisite distinguishing mark “as strange and greatly bizarre to the point that it cannot be found in another person other than one in a thousand or two thousand.” Rabbenu Yeruham was understood literally by *Teshuvot Galya Masekhet*, *Even ha-Ezer*, no. 8 and *Shulhan Arukh ha-Rav*, *She'elot u-Teshuvot*, no. 28, s.v. *e efsar*, but those authorities reject Rabbenu Yeruham’s position as understood by them because of its extreme nature. *Teshuvot Mas'at Binyamin*’s “one in a

<sup>1</sup> Cf., however, R. David ben Yahyah, cited by R. Elijah Mizrachi, *Teshuvot ha-Re'em*, no. 37, who understands Rambam literally and citing Rambam, *Hilkhot Naḥalot* 7:3, explains Rambam as ruling that a *siman muvhak* is fully acceptable insofar as biblical law is concerned, but that the Sages limited acceptable evidence in ruling that only the testimony of at least one witness can be relied upon to the exclusion of even a *siman muvhak*. *Teshuvot ha-Re'em*, no. 38, refutes that interpretation of Rambam.

thousand” standard is widely cited by latter-day authorities as the threshold level of acceptable statistical improbability.<sup>2</sup>

As a paradigm of an acceptable *siman*, Rashba, *Bava Mezi'a* 28a, cites an example found in another context, *viz.*, “a hole next to a particular letter of a *get*,” that is acceptable for the purpose of returning the instrument to the wife for use as evidence that the divorce has been effectuated by delivery of the *get* to her because “there is no testimony clearer than this.” *Teshuvot Mahari Bruna*, no. 53, offers “a hole piercing a single tooth from one surface to another” as an example of a *siman muvhak*. *Terumat ha-Deshe*n, II, no. 224, portrays a “deeply sunken nose” as a *siman muvhak*.<sup>3</sup>

There is some dispute with regard to other physical anomalies. Me’iri, *Yevamot* 120a, describes an unnatural appendage or the absence of a limb as a *siman she-eino muvhak*. However, Ra’avad, cited by *Shitah Mekubbezet*, *Bava Mezi'a* 26b and *Teshuvot ha-Rosh*, *klal* 51, no. 6, followed by Rema, *Even ha-Ezer* 17:24, regard a missing limb or an additional digit as a *siman muvhak*.

Me’iri and *Maggid Mishneh* describe *simanim muvhakim* as the equivalent of eyewitness testimony by virtue of biblical law and accepted as such without doubt. The Gemara, *Bava Mezi'a* 18b and 27a as well as *Gittin* 28b, posits talmudic doubt with regard to whether *simanim* are valid as a matter of biblical law or are acceptable as establishing ownership of lost property solely on the basis of rabbinic legislation. Me’iri and *Maggid Mishneh* maintain that the talmudic controversy is limited to ordinary “*simanim muvhakim*” that later came to be known as “*simanim emza'im*,” or “*simanim beinonim*,” *i.e.*, “intermediate identificatory marks.”<sup>4</sup> The highest category of identificatory marks regarded as acceptable beyond cavil should appropriately be termed “*simanim muvhakim be-yoter*” or “extraordinary identificatory marks” but in the course of time have come to be termed “*simanim muvhakim*” in contradistinction to “*simanim emza'im*.”

Unlike determining identity of a corpse in order to permit a widow to remarry, which requires *simanim* of the highest category, property may

<sup>2</sup> Cf., R. David ben Yahyah cited in *Teshuvot ha-Re'em*, no. 37, who categorizes a *siman muvhak* as an identificatory mark that is “strange and idiosyncratic (*zar u-muflag*) to the point that it is clear in everyone’s mind that it is not at all to be found on another body in that land and that it has never been heard that another person had a comparable identificatory mark.” That definition is probably narrower than the “one in a thousand” criterion posited by *Mas'ei Binyamin*.

<sup>3</sup> See also R. Israel Isserlein, *Terumat ha-Deshe*n, I, no. 239.

<sup>4</sup> *Teshuvot Zemah Zedek*, *Even ha-Ezer*, no. 76., widely cited by later authorities, categorizes an intermediate identificatory mark as a characteristic whose frequency of occurrence is statistically no higher than “one in one hundred or in two hundred.”

be returned on the basis of intermediate *simanim*. The talmudic controversy is whether such evidence suffices for return of lost property as a matter of biblical law or whether its acceptability is the product of rabbinic edict based upon the rabbinic power of confiscation (*hefker bet din*).

## 2. DNA as a *Siman*

As noted in the earlier part of this discussion of DNA evidence,<sup>5</sup> *Keẓot ha-Hoshen* 46:8 asserts that evidence in the highest category of *simanim* is tantamount to testimony of two witnesses and is sufficient as evidence to sustain a plaintiff's financial claim against a person in possession. *Netivot ha-Mishpat* 46:8 accepts the categorization of the highest category of *simanim* as biblically acceptable evidence but nevertheless finds such evidence to be insufficient to support a financial claim against a *muhzak* or person in possession.

It is within that framework that one must examine the status of DNA evidence.<sup>6</sup> DNA sequences are idiosyncratically unique to a particular

<sup>5</sup> J. David Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part I)," *Tradition*, vol. 51, no. 4 (Fall 2019), p. 163.

<sup>6</sup> Writing within the context of the acceptability of blood typing in determining issues of paternity for purposes of consanguineous relationships and inheritance, R. Joshua Ehrenberg, *Teshuvot Dvar Yehoshu'a*, III, *Even ha-Ezer*, no. 5, summarily dismisses acceptability of scientific evidence regarding genetic transmission of blood types. In espousing that position, he cites *Teshuvot Rivash*, no. 447. See Bleich, "Validity of DNA Evidence (Part 1)," p. 144. In the course of that discussion, *Dvar Yehoshu'a* asserts, not only that blood typing cannot be accepted as a *siman*, but that it fails to give rise to a doubt "even for purposes of stringency." *Dvar Yehoshu'a* dismisses scientific evidence as inadmissible even when it is not contradicted by talmudic sources.

In addition, *Dvar Yehoshu'a* claims that the Sages asserted that the situations in which they declared paternity to be doubtful as involving a doubt that can never be resolved. The Palestinian Talmud, *Yevamot* 11:7, discusses a situation involving a child born seven months after consummation of his mother's second marriage. The child might be the prematurely-born son of the second husband or a term baby fathered by the first husband. If the child smites either of those two men, he cannot be held culpable because each one is only a doubtful father. But what is the result if he strikes both of them? The issue is whether *hatra'at safek* (a doubtful or conditional admonition) is a valid admonition. It would certainly seem that the second act establishes culpability with certainty since with the act of smiting the second man it becomes clear that the son has committed a capital transgression in performing one of those two acts. Which of the two acts engenders culpability should be irrelevant since, although each of the two admonitions in and of itself is doubtful, nevertheless, in smiting the second man the son knows with certainty that he is now culpable for one of those two acts. However, the Palestinian Talmud rejects this thesis on the basis of the principle that "it is impossible to determine the matter." The standard commentaries interpret that statement as establishing a novel principle, *viz.*, that there can be culpability only

person and hence should qualify as a *siman* or an identificatory mark. If found to be tantamount to the highest category of *simanim*, not only would DNA evidence suffice to permit a widow to remarry but, according to *Keẓot ha-Hoshen*, it would serve to establish paternal identity for purposes of child support as well. Clearly, the incidence of inaccuracy or error with regard to a properly performed DNA identification is far less than “one in a thousand or one in two thousand” posited by *Mas’at Binyamin*. Consequently, the accuracy of DNA evidence greatly exceeds the threshold of probability necessary to establish the status of DNA as a *siman muvhak be-yoter*.<sup>7</sup>

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if the transgressor knows for which of the acts he is being punished. An example lies in the case of a person who performs a forbidden act of labor on each of the two days of a festival observed in the Diaspora because of doubt. In that situation the day on which *Rosh Hodesh* was proclaimed later becomes known with certainty with the result that the transgressor becomes aware of which of the two acts engendered culpability. In the situation involving two possible fathers, the transgressor never discovers for which of the two acts he is held culpable and hence he cannot be punished. *Dvar Yehoshu’a* advances a novel interpretation in explaining that the Palestinian Talmud is not simply stating that, as a matter of fact, the transgressor will never discover which of the two men is his father because no means of determination was available but that it is impossible for him ever to know because, even if a scientifically accepted means of paternity testing were to become available, for halakhic purposes it would have no import.

As additional proof *Dvar Yehoshu’a* cites *Keritut* 17b. The Gemara establishes that a person who is confronted with two pieces of meat, one forbidden *helev* and the second entirely permissible and, because the forbidden status of the *helev* is unknown to him, proceeds to consume one of those two pieces of meat, he is required to offer an *asham taluy* as a sacrifice in tentative expiation of his possible transgression. (See *Keritut* 26b.) The Gemara explains that an *asham taluy* is appropriate only if it is possible that at some future time the status of the forbidden meat that he ate may be determined by as yet unavailable or unrecognized evidence. The Gemara states that, similarly, there is no obligation to offer an *asham taluy* if a person inadvertently struck one of the two men who might be his father. *Dvar Yehoshu’a* assumes that the Gemara is declaring that the rule applies not only in an era in which blood typing is unknown and, therefore, information regarding paternity will not become available during the lifetime of the transgressor but that such evidence, even when forthcoming, is of no consequence.

R. Ben-Zion Uziel, *Sba’arei Uzi’el, sha’ar* 40, chap. 18; R. Israel Veltz, *Teshuvot Divrei Yisra’el, Even ha-Ezer*, no. 18; R. Eliezer Waldenberg, *Ziz Eli’ezer*, XIII, no. 104; and R. Menasheh Klein, *Mishneh Halakhot*, III, no. 143 and IV, nos. 163 and 164, also refuse to accept the scientific basis of blood typing as a means of disproving paternity. Those authorities would probably dismiss DNA evidence as well. See also R. Moshe Sternbuch, *Teshuvot ve-Hanhagot*, I, no. 896 and *Piskei Din Rabbaniyim*, II, 123-124.

<sup>7</sup> DNA is also categorized as a *siman muvhak* by R. David Levanon, *Shurat ha-Din*, V, 82-83; R. Zalman Nehemiah Goldberg, *Kol Zvi*, IV (5762), reprinted in *Yeshurun*, XII (Nisan 5762) and *Tehumin*, XXIII (5763); R. Asher Weiss, *Teshuvot Minh’at Asher*, III, no. 87 and *idem, Oraḥ Mishpat* (Jerusalem, 5778), I, 182; and R. Eliezer Igra and

Nevertheless, R. Yigal Lerer, *Shurat ha-Din*, IX, 47, finds that not to be the case. Rabbi Lerer notes that DNA evidence, since it is not infallible, can be accepted only as a *rov* even though, statistically speaking, it may constitute a “super *rov*.”<sup>8</sup> Nevertheless, he finds that DNA can be assigned no greater weight than that assigned to *simanim emza'im* or intermediate identificatory characteristics. Rabbi Lerer distinguishes between the nature of DNA as a *siman* and other types of *simanim*. Other *simanim* Rabbi Lerer categorizes as instances of “a natural *rov*, known or perceived by all,” whereas the results of a DNA examination, based upon comparison of DNA samples, “is known only to the technician, since it is he himself who establishes the degree of evidence with regard to this test.” The presence of a *siman*, he argues, can be confirmed or disconfirmed by all and sundry whereas in determination of DNA evidence others must rely on the judgment and testimony of a technician.

That distinction might appear artificial. Nevertheless, Rabbi Lerer explains that other forms of *umdena*, although based upon comportment of the generality of the populace, are a matter of public knowledge applied by a *bet din* to a particular situation. However, although the general principles of DNA analysis and statistical probability of accuracy are available to any person who interests himself in such matters, in any particular case it is not applied by the *bet din* directly; instead, the *bet din* must rely upon interpretation of the data by a technician. Since the *umdena* established by the *rov* is not immediately known to the *bet din*, argues Rabbi Lerer, DNA comparison cannot be accepted as the equivalent of eyewitness testimony.

It may be objected that, even accepting Rabbi Lerer’s distinction, DNA evidence might be acceptable under certain limited circumstances, e.g., if the members of the *bet din* themselves acquire the technical proficiency necessary to perform DNA tests. Under those circumstances the *bet din* would be relying upon their own knowledge rather than upon the evaluation of an expert. Rabbi Lerer would probably counter that there is scant difference between reliance upon the expert skill of a technician and the *bet din*’s reliance upon their own technical expertise. In the latter case “the judge becomes the witness” but in both cases it is not the bare facts

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R. David Levanon, Rabbinical Supreme Court of Appeals, No. 927675/4, 4 Kislev 5777. R. Joseph Shalom Eliashiv endorsed a decision of a *bet din* convened for the purpose of permitting a resident of Monsey, New York, whose husband perished in the World Trade Center attack to remarry. DNA evidence figures prominently in that decision but is not explicitly categorized as a *siman muvhak* and was also accompanied by other evidence. See *Yeshurun*, XII p. 506.

<sup>8</sup> See Bleich, “Validity of DNA Evidence (Part 1),” p. 163.



## TRADITION

that establish the *rov* but the interpretation of the facts that establishes the *rov*. For reasons that he does not explicate, Rabbi Lerer asserts that a *bet din* can act only upon facts conveyed to them but cannot interpret those facts.

If so, the objection can be stated in a more fundamental manner. Other instances of *rov* involve matters that become subject to what is tantamount to judicial notice. The *rov* is the *rov* and 1) requires no further investigation for its acceptance and 2) although there are exceptions to the *rov*, once it has been established, the *rov* itself, as a majoritarian principle, is not subject to error. As has been shown, DNA evidence is subject to some element of subjective judgment in determining the acceptable margin of deviation of variability in determining precision in measurement of alleles and is subject to at least some judgmental error in recognizing a match. It must be emphasized that it is not the likelihood of error in establishing a match or even the subjective nature of the judgment *per se* that diminishes the evidentiary standing of DNA, but it is those aspects of its nature that distinguish DNA evidence from the testimony of witnesses. DNA evidence is based upon judgment rather than solely upon testimony regarding a direct visual phenomenon.<sup>9</sup>

R. Asher Weiss alludes to the fact that there is a fundamental difference between identification of a lost object or a corpse on the basis of *simanim* and reliance upon DNA for purposes of identification. The efficacy of *simanim* in identifying a lost object or an unidentified corpse is not contingent simply upon the unlikelihood that two persons or two objects would both manifest the same identificatory mark. That probability may be low, but not necessarily low enough to suffice for purposes of evidence. However, *simanim* are employed as evidence only in conjunction with another high improbability, namely, that two people or two objects not only possess an identical *siman* but also that both persons lost precisely those unique objects or that not only do two individuals share an identical distinctive mark but that the two people having the same mark disappear without a trace. In determining statistical probability of misidentification

<sup>9</sup> It is reported that DNA matching can now be performed by computer. If so, it might be argued that the element of subjective judgment is effectively eliminated. Nevertheless, it must be remembered that a “match” does not mean absolute identity in all respects. Absolute identity does not exist. Identity of length, for example, is defined with allowance for a small band of deviation. See Bleich, “Validity of DNA Evidence (Part 1),” p. 122. The amount of allowable deviation is a matter of judgment. That judgment is programmed into the computer and, consequently, the computer’s results must also be regarded as “subjective.” Other factors affecting reliability of DNA reported in that discussion apply to computerized matching as well. See *ibid.*, pp. 122-125 and pp. 152-153.

by means of *simanim*, there are two distinct probabilities, namely, a) common identificatory mark and b) loss of each object by different people or disappearance of two separate persons that must be considered. The probability of misidentification is equal to the probability of the first multiplied by the probability of the second, i.e., the probability of the existence of two items or two persons sharing a common identificatory mark multiplied by the probability that two people would lose objects having the same *siman* or multiplied by the probability that the identity of a person bearing that mark would be unknown at the time of his death. Such probabilities are highly remote. When the probability of such events occurring twice within a quite narrow timeframe is also considered, the resultant statistical probability of those chance occurrences occurring virtually simultaneously is so remote as to be absurd.<sup>10</sup> It is even conceivable that the probability of such an occurrence is less than the probability of two unrelated persons possessing matching strands of DNA.<sup>11</sup>

<sup>10</sup> This point was made much earlier by *Shulhan Arukh ha-Rav, Teshuvot*, no. 28, s.v. *ve-zu*.

<sup>11</sup> Rabbi Weiss also argues that if *simanim muvhakim be-yoter* were accepted by the Sages as the equivalent of eyewitness testimony on the basis of *sevara*, as was the position of *Shakh 267:7*, then DNA can also be accepted on the basis of *sevara*. However, since later decisors apparently fail to follow *Shakh's* view with regard to this matter, the point is moot. See *infra*, note 18.

R. Harel Devir and Eren Hendel, *Assia*, Nos. 107-108, vol. 27, no. 3-4 (Heshvan 5778), pp. 60-62, argue that the mere certainty of DNA matching rises to the level of an *umdena de-mukhah*, or clear circumstantial evidence. It is likely that R. Isaac Ha-Levi Herzog, in a letter cited by R. Aryeh Frimer and published in *Sefer Assia*, V, 196, also regarded DNA as a form of *umdena*. That surmise arises solely from the fact that Rabbi Herzog offers no analysis of the halakhic foundation of DNA evidence.

However, Rabbi Weiss does not regard *simanim* as a type of super *rov*. He accepts the position of those who maintain that *simanim* are biblically recognized as a novel type of evidence equivalent to the testimony of two witnesses, with the result that, in his opinion, *simanim* are sufficient evidence for all purposes, including substantiation of financial claims such as child support. He further accepts DNA as a *siman* rather than as an empirical generalization construed as a *rov*.

Nevertheless, Rabbi Weiss refuses to accept DNA evidence for the purpose of establishing *mamzerut* because *Teshuvot R. Akiva Eger*, no. 100, equates determination of *mamzerut* with criminal proceedings involving capital punishment.

However, it seems to this writer that a close reading of each of the sources that equate an *umdena de-mukhah* with eyewitness testimony employ that concept in establishing that a particular act has occurred, e.g., circumstantial evidence that intercourse has occurred or that a ring has been transferred from the groom to the bride. In each of those situations a conclusion of fact is drawn contextually with regard to the occurrence of a particular act. DNA comparison yields no evidence with regard to any act; it is a means of establishing identification. "The majority of animals are kosher" is not an *umdena*. It is an empirical generalization based upon observation. It is a *rov* rather than an expression of certainty. Both *umdena* and *rov* differ from "*anan*

### 3. Further Objections to Acceptance of DNA as a *Siman*

In a contribution to a symposium devoted to the issue of acceptability of DNA evidence published in *Yeshurun*, XII (Nisan 5762), pp. 493-495, Rabbis Samuel Mordecai Gersten and Judah Shereshevsky advance a number of possible objections to recognition of DNA matching as a *siman* of dispositive import:

(1a) DNA nucleoids are both infinitesimally small and colorless with the result that they cannot be directly perceived by visual observation. The issue is whether a characteristic that cannot be directly perceived can be regarded as a *siman*.

In response, it may be pointed out that there are numerous areas of Halakhah that are dependent upon visual observation. There is significant rabbinic literature demonstrating that in each of those areas optical enhancement or magnification in the form of corrective lenses, a magnifying glass, a telescope or a microscope is regarded as tantamount to direct visual observation and does not debar or vitiate the authenticity of the resultant visual phenomenon for matters of Halakhah.<sup>12</sup> Moreover, there are a host of authorities who find that identification of a corpse by means of a photograph of a body, or even comparison of a photograph of a body, with a photograph taken while the person is still alive, to be satisfactory.<sup>13</sup> Indeed,

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*sahadei* – we are witnesses” in that the latter is both a general principle and does not posit exception. DNA identification is made on the basis of applying a *rov* to a particular situation. But unless there is a logical basis that renders it impossible for any two people to possess identical DNA sequences (in which case the principle would rise in status to at least that of *umdena*) it cannot be concluded that such is not the case in any particular situation. In any particular situation there are no eyewitnesses and no circumstantial evidence establishing that the situation in question is not an exception of which the *rov* admits. The function of an *umdena de-mukbah* is to establish a particular occurrence. That is not possible with regard to any matter which admits of both a major and minor class and the issue is to which of the two classes a particular matter should be assigned. Categorizing DNA evidence as an *umdena de-mukbah* is tantamount to a claim that DNA establishes identity with certainty because no two people can have the same DNA.

<sup>12</sup> See *Contemporary Halakhic Problems*, I, (New York, 1977), pp. 213-215. See also *Petaḥ ha-Dvir*, no. 24, sec. 10, regarding pronouncing a blessing upon seeing a monarch through a telescope and R. Ya'akov Moshe Toledano, *Meshiv Nefesh*, II, no. 244, regarding the blessing pronounced upon observing through a telescope a site at which one has experienced a miracle. See also *Tiferet Yisra'el*, *Nega'im* 2:11; *Teshvuot Shem Aryeh*, *Even ha-Ezer*, no. 112; and R. Joseph Rosen, *Teshvuot Zofnat Pa'aneah*, no. 13. Cf., however, R. Betzalel Stern, *Be-Zel ha-Hokhmah*, II, no. 4, sec. 4

<sup>13</sup> See, *inter alia*, R. Naphtali Zevi Yehudah Berlin, *Teshvuot Meshiv Davar*, III, no. 23; R. Zevi Hirsch Orenstein, *Birkat Rezeh*, no. 3; R. Isaac Elchanan Spector,

the Israeli Defense Forces photograph fallen soldiers whenever there is a possibility that identification by visual inspection of the body may not be possible within the requisite three-day period before facial features change.<sup>14</sup>

(1b) In employing some methods of DNA analysis, the DNA, to be observed, must be treated with a radioactive material, with fluorescent materials that produce particular light waves or by staining the nucleoids. In such instances as well the issue is whether a characteristic that cannot be directly perceived qualifies as a *siman*.

Technically, this point is well taken. Nevertheless, a distinction does not always make a difference. The essential nature of a *siman* is that it is highly unlikely to be present on two bodies. Distinctive physical marks are the most prevalent of such criteria. Nevertheless, if any given object or person were to be endowed with a certain rare causative characteristic (in the case of a person both in life and in death), e.g., a natural capacity to glow in the dark, logically, that capacity should qualify as a *siman*. DNA analysis is based upon recognition that each person's DNA is unique in its ability to produce an idiosyncratic, albeit nonvisual, manifestation under certain given circumstances. Consequently, DNA evidence should logically also qualify as a *siman*.

(2) Two DNA samples taken from a single individual are not absolutely identical. Identification of two samples as coming from a single person is based upon the extremely high statistical improbability of the samples not having a common source.

As has already been explained, DNA evidence is generally regarded as predicated upon the principle of *rov*. The objection to employment of a *rov* in granting an *agunah* permission to marry will be discussed in conjunction with objection number 4.

(3) In their conventional form, *simanim* are found on a body and the body is judged to be that of a person known to have possessed an identificatory mark. Identification is made on the basis of the presumption

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*Teshuvot Ein Yizhak, Even ha-Ezer*, no. 31; R. Binyamin Aryeh Weiss, *Teshuvot Even Yekarah*, I, no. 19; as well as *Ozar ha-Poskim*, V, 17:24, secs. 40-45. Cf., R. Samuel Engel, *Teshuvot Maharash*, III, no. 11 and R. Ovadiah Yosef, *Teshuvot Yabi'a Omer*, VI, *Even ha-Ezer*, no. 3, sec. 3.

<sup>14</sup> See R. Alexander Joshua Levinson, *Sugyot be-Zava u-Mishtarah* (Jerusalem, 5763), p. 254.

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that no other person manifests a similar *siman*. DNA matching in cases of an unidentified corpse begins, not with examination of DNA taken from the decedent, but with DNA known to have been derived from a particular individual and serves as a *siman*. The DNA taken directly from the body is then compared with that *siman*. In conventional identification by means of a *siman*, the physical *siman* is first observed on the body itself rather than on a body or entity external to that which must be identified.

Indeed, comparison of two signatures of the same individual, a method employed for authenticating legal instruments, will show some slight discrepancies. Nevertheless, a signature can be authenticated by means of comparing it to another signature known to be that of a particular individual. In that case as well, it is the extraneous document which serves as the *siman*. However, in signature comparison the authenticity of the already identified signature is fully acknowledged. Any deviation is in comparing the as yet unauthenticated second signature to another already acknowledged signature whereas in DNA analysis even the fragment whose source is known with certainty manifests subtle internal variations with the result that there are minor variations within each of the two DNA segments.

In response it may be said that comparison of signatures is relied upon to authenticate legal documents despite the accepted fact that no two signatures of even a single individual are precisely the same. The underlying presumption is that such variations are so slight and so subtle as not to be recognized in the usual course of events. Presumably, there is not simply a single such variation between two signatures but multiple variations of that nature. If so, whether such variation takes place in one signature or in two signatures should be of no consequence. Arguably, then, infinitesimal variations even between different segments of a single DNA segment may also be ignored.

(4) Identification on the basis of DNA matching is based upon the presumption that no two people have identical DNA sequences. That, however, is an empirical generalization in the nature of a *rov*. The reliability of DNA analysis as a *siman* can be no stronger evidence than *rov* upon which it is based. However, *rov* is not a sufficient basis upon which to permit an *agunah* to remarry.

DNA evidence is indeed based upon the fact that, although there is no evidence that no two people can possibly have the same DNA sequences nor is there even a claim to that effect, it remains true that the likelihood of two people having identical DNA is remote in the extreme and hence

there is a *rov* to the effect that no two people share a common DNA pattern. But that is the nature of all *simanim*. It cannot be said that it is either logically or empirically impossible for two people to manifest an identical *siman* or DNA sequence.

Nevertheless, *Shakh* 266:7 maintains that *simanim muvhakim be-yoter*, e.g., a hole next to a particular letter in a *get*, were regarded by the Sages as tantamount to eyewitness testimony for purposes of identifying a *get* even though a *rov*, e.g., the majority of persons who enter a huge body of water and do not reappear must have perished, is not accepted. The distinction must lie in the fact that a “super *rov*” is as reliable as eyewitness testimony. If so, the *rov* involved in DNA analysis is comparable to the *rov* underlying acceptance of *simanim muvhakim be-yoter*. However, although *Shakh*’s position was accepted by *Netivot ha-Mishpat* 46:8, it was rejected by many major latter-day authorities.<sup>15</sup> *Rov* itself is insufficient proof for financial matters or for establishing the death of a husband.

(5) DNA analysis is based upon size and location of nucleoids. Size and location are categorized as “*simanim geru'im*” or “inferior identificatory marks.” Rema, *Even ha-Ezer*, 17:24, rules that the presence of “even a hundred” such identificatory marks in combination is insufficient proof.<sup>16</sup>

In rebuttal it may be argued that it is not size or location of nucleoids that constitute the *siman* but the repetition of sequences of particular size and location that is the *siman*.<sup>17</sup> Such repetition may well be a *siman muvhak*.<sup>18</sup>

R. Samuel ha-Levi Wosznor, *Tehumin*, XXI (5761), 123 and *Yeshurun*, XII, 505,<sup>19</sup> distinguishes between DNA taken from a cadaver that is matched with DNA known to have belonged to a particular person and DNA taken from a corpse and compared with that of a close relative. Matching DNA taken from a corpse with DNA known to have been that belonging to a relative he regards as a “*siman beinoni*” and “close to a

<sup>15</sup> See, *inter alia*, *Kezot ha-Hoshen* 46:8, 259:2 and 297:1 as well as *Teshuvot R. Akiva Eger*, no. 107. See also R. David Levanon, *Shurat ha-Din*, V (5759), 84 and R. Yigal Lerer, *Shurat ha-Din*, IX (5765), 46-47.

<sup>16</sup> See *infra*, note 41.

<sup>17</sup> A comparable example would be a birthmark or pigmented blotch on the skin. A single unremarkable spot of that nature is a *siman garu'a*, but an unusual pattern or configuration of such spots might be considered by some authorities as an acceptable *siman*. See *Ozar ha-Poskim* 17:24, sec. 71.

<sup>18</sup> Cf., R. Eliyahu Levine, *Yeshurun*, p. 504.

<sup>19</sup> Reprinted as well in *Seridim*, No. 20 (5762), pp. 18-21. Rabbi Wosznor’s statement also bears the endorsement of the late R. Nissim Karelitz of Bnei Brak. See also *Tehumim* XXXV (5775), 211.

*siman muvhak*.” In Rabbi Wozzner’s opinion such DNA comparison may be relied upon only if additional circumstantial evidence is available. Identification on the basis of comparison with a collateral DNA sample taken from a close relative is regarded by Rabbi Wozzner as only a “*siman beinoni*.”<sup>20</sup> R. Alexander Joshua Levinson, *Sugyot be-Zava u-Mishtarah* (Jerusalem, 5763), p. 277, reports that “In practice, the ruling is that [DNA] examination is considered to be close to a *siman muvhak*.” In context, Rabbi Levinson is referring to comparison of the DNA of a soldier with that of one of his parents.<sup>21</sup>

Thus we find 1) authorities who accept DNA analysis as a *siman muvhak*; 2) authorities who accept DNA analysis as a *siman beinoni*; 3) authorities who regard DNA analysis as a *siman beinoni* “*karov le-siman muvhak*” (approximating a *siman muvhak*); and 4) authorities who maintain that DNA does not at all rise to the level of a recognized *siman*.

#### 4. *Simanim as Distinct from Tevi’ut Ayin*

The acceptability of DNA evidence is also discussed by R. Zalman Nehemiah Goldberg in a contribution to *Kol Zvi*, IV (5762), in the context of the World Trade Center tragedy. That material is also published in *Yeshurun*, XII, 506-512, together with critical comments authored by Rabbi Eliyahu Levine and Rabbi Goldberg’s response.<sup>22</sup> Rabbi Goldberg regards DNA evidence as a *siman muvhak*, but his reasoning is not entirely clear to this writer because he seems to conflate two separate types of evidence, *viz.*, *simanim* and *tevi’ut ayin*.

Rabbi Goldberg introduces his discussion by noting that past experience renders the likelihood of error in DNA analysis infinitesimally small but cites the quite logical objection of an anonymous scholar to the effect that confirmatory results in the examination of even an extraordinarily high number of situations does not logically mandate the outcome of any subsequent case. In other words, empirical generalization is of limited predictive value.

<sup>20</sup> The distinction presumably lies in the fact that all DNA fragments derived from a common source will be completely identical. Relatives inherit DNA from different progenitors with the result that some parts of the DNA are identical while others are not. See, however, *infra*, note 49 and accompanying text.

<sup>21</sup> Similarly, in a decision of the Supreme Rabbinical Court of Appeals, No. 927675/4, 4 Kislev 5777, Rabbi Eliezer Igra categorizes comparison of the DNA of two brothers as a *siman muvhak*. Cf., R. David Levanon’s opinion in that case.

<sup>22</sup> The same material is presented by Rabbi Goldberg in an article published in *Tehumin*, XXIII (5763).

The response to that objection would seem to be that an empirical *rov* such as “The majority of animals are not *treifot*” is not predicated upon examination of every single animal. *Rov* does not require examination of every member of a class; it is a principle based upon examination of a limited number of representative members of a class and applied to the entire class as a frankly acknowledged empirical generalization. This type of *rov* is termed a “*rubba de-leta kaman* – a *rov* that is not present before us.” That is precisely why contemporary *batei din* have categorized DNA evidence acceptable only as an application of the principle of *rov* and, consequently, refuse to entertain such evidence in disputes regarding financial matters in support of a plaintiff’s claim.<sup>23</sup>

Instead, Rabbi Goldberg responds that DNA may be relied upon even though the presumption that no two people have identical DNA sequences is based solely upon an empirical generalization. In support of that position he cites the principle of *tevi’ut ayin*. Identification on the basis of facial features, which, asserts Rabbi Goldberg, is based upon the antecedent premise that the countenances of no two individuals are identical, although certainly no one has examined every human being in order to reach such a conclusion. The same, he claims, should be true of DNA evidence as well.

However, instead of providing an elucidation of the rationale for the acceptance of DNA he has drawn attention to a more formidable problem, namely, what is the conceptional basis for acceptance of *tevi’ut ayin*? The simplest resolution of that difficulty would be a candid recognition that acceptance of *tevi’ut ayin* with regard to identification constitutes halakhic acceptance of idiosyncratic physiognomy as akin to a law of nature. Two separate talmudic statements lend themselves to such an interpretation:

. . . For man stamps many coins with a single seal and all are like one another. But the Holy One blessed be He stamps every man with the seal of Adam and not a single one is identical to his fellow. . . . And why are those countenances unlike one another? So that a person should not see a beautiful domicile or beautiful woman and say, “It is mine.”  
(*Sanhedrin* 38a)

<sup>23</sup> See Bleich, “Validity of DNA Evidence (Part 1),” p. 147. See also *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yehadut*, V, 191ff. and 248ff. as well as VIII, 386; and *Tehumin* IV (5743), 431ff. and XXI (5761), 21ff. Cf., R. David Levanon, *Shurat ha-Din*, V, 82-83 and Rabbinical Supreme Court of Appeals, No. 927675/4, 4 Kislev 5777.



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One who sees multitudes of Israel recites, “Blessed is He who discerns secrets (*Hakham ha-Razim*)” for their intellects are not similar to one another and their countenances are not similar to one another. (*Berakhot* 58a)

Rabbi Goldberg, however, regards the notion that every person possesses unique facial features as no more than an uncompelled empirical generalization.

Nevertheless, Rabbi Goldberg does not recognize a fundamental qualitative difference between *simanim* and *tevi’ut ayin*. Instead, he analyzes the technical difference between *simanim* and *tevi’ut ayin* and depicts the difference as a variation of degree rather than a difference in kind. In effect, Rabbi Goldberg asserts that *tevi’ut ayin* is a more sophisticated and more precise type of *siman* and implies that a *siman* based upon such a high degree of precision is “a super *siman*” accorded its own classification and its own status as *tevi’ut ayin*.

But Rabbi Goldberg’s thesis does not serve to address the actual problem. If *tevi’ut ayin* is simply an amalgam of *simanim geru’im*, or weak identificatory marks, how can it be acceptable? How can DNA evidence acknowledged to be no more than an aggregate of *simanim geru’im* be entertained as evidence? As already noted, Rema, *Even ha-Ezer*, 17:24, rules that no number of *simanim geru’im* combine to serve as the equivalent of a single acceptable *siman*. Moreover, the very nature of a *siman* is that it is objective in nature, readily described and cognitively communicated.

Rather than resolving the doctrinal problem inherent in acceptance of *tevi’ut ayin*, Rabbi Goldberg presents an *argumentum ad absurdum* for accepting DNA evidence. In effect his argument seems to be that any apparent defect present in DNA evidence is also inherent in *tevi’ut ayin*. Hence, if DNA evidence is not acceptable, *tevi’ut ayin* should be unacceptable as well.

It seems to this writer that *tevi’ut ayin* is fundamentally different from *simanim* in both nature and function.<sup>24</sup> The resolution of the problem posed by Rabbi Goldberg must lie in the fact that *tevi’ut ayin* serves only to establish personal identity, i.e., that the person appearing before the *bet din* is the same person who is the subject of the testimony, or that the body witnesses have observed is the remains of a man whose whereabouts is otherwise unknown. Recognition of a *siman* in the form of a

<sup>24</sup> That distinction is supported by the fact that the Gemara, *Hullin* 95b, ponders which of the two is more reliable. The question implies that the two are different in kind rather than in degree.

hole adjacent to a particular letter of a *get* requires no knowledge of the size or shape of the hole. In contradistinction, recognition in the form of *tevi'ut ayin* is based upon recognition of a combination of characteristics, including size, shape and irregularity, etc. Put somewhat differently, *tevi'ut ayin* establishes that the person appearing before the *bet din* or the corpse that witnesses have identified manifests the *Gestalt* of the person they observed on an earlier occasion and not someone else. DNA evidence does not at all establish personal identity; it establishes either that two strands of DNA were taken from the same person or have a common progenitor. Those strands of DNA, however, remain discrete and distinct. Comparison of two DNA samples does not serve to establish the identity of either DNA sample. DNA is used to compare different entities so that inferences can be made and conclusions drawn; DNA is superfluous and redundant in terms of establishing the identity of any single entity. Hence, *tevi'ut ayin* is not relevant to understanding the nature of DNA as a *siman*.

Apart from being a legal provision established by Sinaitic law or rabbinic enactment establishing it as one of the manifold rules of evidence, *tevi'ut ayin* is a psychological phenomenon far more subtle than identification of *simanim*. It is inherently the case that two similar objects are more likely to share a common *siman* than a person is likely to misidentify an individual already known to him. *Tevi'ut ayin* is not at all comparable to identification of a suspect in a police lineup. In the latter case, the suspect is "identified" by a victim who may well have been traumatized during the commission of a criminal act, who may have caught a glimpse of the perpetrator for only a fleeting moment and who may have been subtly or not so subtly prompted to identify one of those presented for examination. *Tevi'ut ayin* as evidence accepted by Jewish law is not confounded by emotional experience or psychological pressure. *Tevi'ut ayin* is a nuanced process resulting from the presence of subliminal recognition of countless numbers of *simanim*, none of which is a *siman muvhak* or even definable, but in the aggregate those phenomena are much more reliable than even a *siman muvhak be-yoter*. Although any particular identification on the basis of *tevi'ut ayin* is based upon what the eye discerns, those visual phenomena need not, and usually cannot, be articulated by the person making the identification. Identification by means of *tevi'ut ayin* is an intuitive phenomenon rather than a rational process and is accorded greater evidentiary deference than mere *simanim*.

The distinction of *tevi'ut ayin* is fully supported by the scientific literature. Facial recognition requires the combined activity of a large-scale neuro network. The neuro activity and cognitive mechanism of face

recognition have been the subject of intense study by neuroscientists.<sup>25</sup> It is estimated that a person can remember and recognize some five-thousand faces.<sup>26</sup> Much of what is known regarding the process and mechanism of facial recognition has been learned from the study of prosopagnosia, also known as face blindness. Prosopagnosia is derived from the Greek words “*prosopon*,” meaning face,<sup>27</sup> and “*agnosia*,” the medical term for recognition impairment. It is estimated that as many as one in fifty individuals suffers from some form of the malady.<sup>28</sup> The malady, which may be congenital or the result of brain damage, was known in antiquity and was extensively described by Dr. Joachim Bodamer in a landmark study of two individuals with face recognition deficits.<sup>29</sup>

Prosopagnosia is a disorder in the recognition of faces while the perception of them is retained. The disorder may be more or less severe but involves disruption of perception of faces that are seen but not recognized as faces belonging to a particular person. In another manifestation of the illness some individuals have no trouble recognizing faces but cannot identify objects. Halakhah also recognizes *tevi’ut ayin* with regard to objects and provides for return of a lost object to a *talmid hakham* on the basis of *tevi’ut ayin*. Bodamer cites a much earlier writer who, in 1876, described a person who was unable to recognize people but recognized and identified an object correctly.<sup>30</sup>

Bodamer observed that the presence of prosopagnosia as a malady enables us to deduce that in the normal process of perception there must be a stratum of function that carries out the perception of faces without

<sup>25</sup> See V. Bruce, and A. Young, “Understanding Face Recognition,” *British Journal of Psychology*, vol. 77, no. 3 (1986), pp. 305-327; R. Jenkins *et al.*, “How Many Faces Do People Know?” *Proceedings of the Royal Society: Biological Sciences*, vol. 285, 1888 (10 Oct. 2018), doi 10.1098/rspb.s018.1319; B. Rossion “Understanding Face Perception by Means of Prosopagnosia and Neuroimaging,” *Frontiers in Bioscience (Elite Edition)*, vol. 6, no. 2 (2014), pp. 258-307; J. V. Haxby, *et al.*, “the Distributed Human Neural System for Face Perception,” *Trends in Cognitive Science* vol. 4, no. 6 (2000) pp. 223-33; J. V. Haxby, *et al.*, editors, *Oxford Handbook of Face Perception* (New York, 2011); and K. Grill-Spector *et al.*, “The Functional Neuroanatomy of Human Face Perception,” *Annual Review of Vision*, vol. 3 (2017), pp. 167-96.

<sup>26</sup> See “How Many Faces Do People Know?” See *supra*, note 16.

<sup>27</sup> Jastrow regards the word “*parzof*” in the Mishnah to be an adaptation of the Greek “*prosopon*.”

<sup>28</sup> See “Understanding Prosopagnosia,” Faceblind.Org. [www.faceblind.org/research/1/6,2/6](http://www.faceblind.org/research/1/6,2/6), accessed September 9, 2019.

<sup>29</sup> See Joachim Bodamer, “Die Prosopagnosia,” *Archiv fur Psychiatrie und Nervenkrankheiten*, vol. 179 (1947), pp. 6-53. A partial translation and commentary authored by Hadyn D. Ellis and Melanie Florence, “Bodamer’s (1947) Paper on Prosopagnosia” was published in *Cognitive Neurology*, vol. 7, no. 2 (1990), pp. 81-105.

<sup>30</sup> *Ibid.*, p. 82.

distinguishing between the acts of seeing and recognition. A person suffering from this disorder has no difficulty perceiving a nose, lips, mouth, etc., which together constitute a physiognomy, but is incapable of perceiving them as a structured picture singling out a particular person. Bodamer theorizes that the perception of faces is possible only through operation of a particular independent structure of the occipital brain. Bodamer describes cases in which sufferers have no trouble recognizing faces and people but have object agnosia. Bodamer takes this phenomenon as evidence that recognition of objects and faces belong to different visual-gnostic categories that can be disturbed separately or together.<sup>31</sup>

The two patients described in detail by Bodamer were victims of trauma that resulted in bilateral occipital damage. In all subsequent cases in which a postmortem exam was carried out, bilateral occipital temporal lesions were found.<sup>32</sup> Bodamer argues that a normally functioning brain is endowed with specific face-processing and object-processing mechanisms, making it possible to recognize particular individuals and objects.<sup>33</sup>

If so, acceptance of *tevi'ut ayin* as a basic and independent form of evidence is readily understood. As Bodamer also realized, facial recognition is meaningful only if it is antecedently assumed that physiognomy is idiosyncratic. The very notion of halakhic acceptability of *tevi'ut ayin* impliedly relies on that concept as an antecedent premise. This does not at all imply that *tevi'ut ayin* is infallible. Halakhah mandates acceptance of eye-witness testimony despite candid recognition that witnesses may err or commit perjury. The same is true with regard to *tevi'ut ayin*.

This serves to illuminate the rule requiring return of lost objects to a *talmid hakham* upon identification of an object by means of *tevi'ut ayin*. *Tevi'ut ayin* with regard to objects is the product of a particular visual-gnostic formation. As such, *tevi'ut ayin* constitutes a form of evidence comparable to eyewitness testimony. All persons would have credibility to identify lost objects and demand their return but for the consideration that there is a strong motive to falsely identify an object for pecuniary gain and thereby preclude return of the lost object to its rightful owner. A *talmid hakham* is not suspected of a falsehood. Nevertheless, no person can testify with regard to a matter in which he has a pecuniary interest. Consequently, a *talmid hakham* cannot prevail on the basis of *tevi'ut ayin* against a person in possession with claim of title. But the finder of a lost

<sup>31</sup> *Ibid.*, p. 96.

<sup>32</sup> See J. C. Meadows, "The Anatomical Basis of Prosopagnosia," *Journal of Neurology, Neurosurgery, and Psychiatry*, vol. 37, no. 5 (1974), pp. 489-501.

<sup>33</sup> "Bodamer's (1947) Paper," pp. 83 and 91.

object has no claim of title and, typically, no other individual has asserted a claim of title; hence, a *talmid ḥakham* may recover his property upon recognition in the form of *tevi'ut ayin*.

It cannot be objected that a DNA technician's testimony based upon *tevi'ut ayin* should not be accepted because such credibility is extended only to a *talmid ḥakham*. Acceptance of *tevi'ut ayin* in validation of a claim to a lost object is limited to a claimant who is a *talmid ḥakham* not because only a *talmid ḥakham* has the capacity of *tevi'ut ayin*; others possess that ability as well, but others are suspected of advancing a false claim in anticipation of acquiring personal gain. A DNA technician has no potential for such gain; hence the *tevi'ut ayin* of a technician who is not a *talmid ḥakham* should also be acceptable. The *tevi'ut ayin* involved in DNA evidence is, of course, a form of object recognition rather than facial recognition.

There is little question that *simanim* and *tevi'ut ayin* are disparate forms of evidence<sup>34</sup> and hence Rabbi Goldberg's transposition of principles of *tevi'ut ayin* to *simanim* is not appropriate.<sup>35</sup> The distinction between the two is pithily expressed by R. Iser Zalman Meltzer, *Yagdil Torah*, vol. 1, no. 2 (Tevet 5669), who categorizes *simanim* as "evidence" (*ra'ayah*) whereas *tevi'ut ayin* he categorizes as "recognition and knowledge of the matter itself" (*yedi'ah be-ezem ha-davar*). Requiring elucidation, however, is the distinction drawn by Reb Iser Zalman between *ra'ayah* and *yedi'ah*. Undoubtedly, *ra'ayah* connotes evidence in the form of establishing facts from which inferences may be drawn whereas *yedi'ah* refers to facts immediately known either by *a priori* cognition or by means of sensory perception.

Perception of a *siman*, in and of itself, is no more than a visual phenomenon. The value of a *siman* lies in the fact that its presence enables conclusory judgments to be made. A *siman*'s rarity of occurrence combined

<sup>34</sup> Cf., however, the cryptic comments of *Pri Megadim*, Introduction to *Hilkhot Ta'arovot, Klal Simanim u-Tvi'ut Ayin*, s.v. *ve-da*.

<sup>35</sup> Cf., R. Ezekiel Landau, *Teshuvot Noda bi-Yehudah, Even ha-Ezer, Mahadura Kamma*, no. 51, who comments, "But in truth a *siman muvhak be-yoter* is considered to be exactly as *tevi'ut ayin* . . . and there is no difference between them even in executing a murderer." In that statement, *Noda bi-Yehudah* is equating the efficacy of two types of evidence rather than their intrinsic nature. See also Rashi, *Hullin* 79a, s.v. *simanim*, who writes, "There is no clearer evidence than a *siman muvhak*." R. Eliyahu Mizrachi, *Teshuvot ha-Re'em*, no. 38, understands Rashi as stating that *simanim muvhakim* are tantamount to witnesses. *Shakh, Hoshen Mishpat* 167:7; *Teshuvot R. Akiva Eger*, no. 107; R. Joseph Saul Nathanson, *Teshuvot Sho'el u-Meshiv, Mahadura Kamma*, I, no. 146, disagree with *Noda bi-Yehudah* and rule that a *siman muvhak* is not admissible in capital cases.

with other knowledge enables further conclusions to be drawn. Thus, if *siman* X is present on a corpse and only Y is known to possess such a physical characteristic, it may be concluded that the corpse is the body of Y. The same is the case in a situation in which an identificatory mark is present in a lost object and a person comes forward claiming to have lost an object bearing an identificatory mark of that nature. Since the *siman* is rare and its presence unlikely to be known to anyone other than the object's rightful owner, the lost object is deemed to be the property of the individual presenting the *siman*. In each of these examples the scenario begins with a visual perception which sets in motion a process of reasoning. Thus, the *siman* serves as a *ra'ayah* or evidence from which a conclusion may be drawn.

*Tevi'ut ayin* is a quite different phenomenon. One looks at a face or an object and immediately realizes the identity of the person or object. No mediating reasoning process is required. The distinction is comparable to the different ways of determining that an object is yellow in color. One may measure the wavelength of light reflected by an object and identify that wavelength with the wavelength known to be reflected by the color yellow. One can thereby identify the color of the object as yellow without ever having seen the object. Or, one may simply gaze at the object and pronounce, "This is yellow." The first method involves an intricate reasoning process; the second requires no reasoning whatsoever. J. S. Mill described color and the like as "simple qualities" because they are perceived immediately without mediation of reason.<sup>36</sup>

*Tevi'ut ayin* is loosely comparable to a simple quality: It is a perception, but it is more than a perception. "Yellow" is the word we assign to a particular visual phenomenon. The perception is the same for all people, including those who speak no language and have heretofore never seen a yellow object. *Tevi'ut ayin* is a perception, but it is a perception immediately associated by the brain with an earlier perception of the same qualitative nature. Think of a person who sees a yellow object and describes it as "canary yellow." That more nuanced identification of the color is not a deduction; it is an immediate identification of a present visual perception with an earlier perception of the same nature.

Put somewhat differently, a *Gestalt* is an amalgam of countless minor and subliminal *simanim* immediately perceived by the brain. A *siman* is clearly recognized and can be readily articulated. *Tevi'ut ayin* is the

<sup>36</sup> See John Stuart Mill, *A System of Logic, Ratiocinative and Inductive, Book III Of Induction, Chapter XXII, Of Uniformities of Co-Existence Not Dependent on Causation*, sec. VI.

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product of countless indescribable phenomena that are subliminal in nature but which in the aggregate is far greater than the sum of its parts. Such a perception is synonymous with *yedi'ah*, i.e., immediate awareness or knowledge, in contradistinction to *ra'ayah*, or evidence from which knowledge can be gleaned.

All eyewitness testimony is based upon witnesses' knowledge that the accused is indeed one and the same as the perpetrator whose act they observed. This is dramatized in the courtroom when the prosecuting attorney asks a witness if the accused is in the courtroom and, if so, to point him out to the members of the jury. Little wonder, then, that *tevi'ut ayin* is depicted as tantamount to eyewitness testimony. The subject matter of eyewitness testimony is communication of knowledge acquired by sensory perception, not of the witnesses' conclusion based on such perceptions.

It is indeed the case that only people have *tevi'ut ayin* that is recognized by Halakhah and that machines such as computers cannot have *tevi'ut ayin*. That is certainly true if *tevi'ut ayin* is a neuro-phenomenon. If so, it may well be objected that if a computer is used to establish a DNA match the results cannot be accepted as evidence in the nature of *tevi'ut ayin*. While that may be so, it would seem that *tevi'ut ayin* might still be applied if, after identification by means of computer, the match is confirmed visually. The function of the computer would serve to spare much time and effort necessary to eliminate possible matches. The function of the computer would be to identify the samples which could be presented to a human observer for purposes of a determination of whether or not they match by application of *tevi'ut ayin*. It would be the confirmatory judgment of the human observer that would be admissible in a *bet din*.

In part I of this endeavor it was shown that in various decisions the Israeli Rabbinical Courts have ruled that the conclusions of DNA analysis can be accepted only on the basis of the principle of *rov*.<sup>37</sup> One of the implications of that position is that DNA cannot be used in financial disputes to substantiate a plaintiff's claim. Similarly, a *rov* cannot establish a presumption that a man has perished and hence that his wife is free to remarry. Thus, although the majority of persons who enter a seemingly boundless body of water (*mayim she-ein lahem sof*) and do not emerge fail to do so because they have drowned in the water, still the wife is not permitted to remarry because some such individuals may survive and emerge on a far distant bank beyond eyesight. *Simanim muvhakim* are defined as identificatory marks that are not present in more than one person in a

<sup>37</sup> Bleich, "Validity of DNA Evidence (Part 1)," pp. 153-155.

thousand. If so, *simanim muvhakim* represent no more than a *rov*. If *simanim* establish no more than a *rov*, how can *simanim* suffice to permit a widow to remarry?<sup>38</sup>

R. Moshe Zev Ya'avetz, *Mar'ot ha-Zove'ot* 17:24, cites a number of early-day authorities who regard *simanim* to be as reliable as eyewitness testimony. *Mar'ot ha-Zove'ot* himself suggests that the acceptability of *simanim muvhakim* is based upon an explicit biblical source. The Gemara, *Bava Mezi'a* 27a, declares that the inclusion of the word "hamor" (donkey) in Deuteronomy 22:3, the biblical passage regarding return of lost objects, teaches that a donkey must be returned upon an identification of its saddle despite the fact that a person other than the owner may have found the saddle and placed it upon his own donkey and then proceeded to lose both donkey and saddle or that the saddle alone might have been lent to another person who lost it. If so, *simanim* constitute a novel form of evidence limited to return of lost objects.

### 5. DNA and Fingerprint Evidence as *Tevi'ut Ayin*

Despite the foregoing, it seems to this writer that DNA can be accepted, neither as a *siman muvhak* nor as a *siman* analogous to *tevi'ut ayin*, but as actual *tevi'ut ayin*. Putting aside questions of credibility, *tevi'ut ayin*, as stated earlier, is an independent and discrete category of evidence whose halakhic efficacy is comparable to eyewitness testimony. The validity of *tevi'ut ayin* extends to objects no less so than to people. Accordingly, it is arguable that DNA should be accepted as simply another instance of *tevi'ut ayin*. Recognition of the repeated appearances of an idiosyncratic

<sup>38</sup> *Noda bi-Yehudah, Even ha-Ezer, Mahadura Kamma*, no. 51, s.v. *ve-ho'il*, asserts that only *simanim muvhakim* are biblically acceptable, i.e., *simanim muvhakim* constitute a novel, biblically established form of evidence that stands on par with testimony of eyewitnesses by virtue of biblical fiat.

*Noda bi-Yehudah* proceeds to raise the objection that, if such is indeed the case, the testimony of witnesses who do not recognize the perpetrator but identify him on the basis of physical *simanim muvhakim* should suffice for conviction. *Noda bi-Yehudah* responds that reliability of *simanim muvhakim* constitutes a novel category of evidence derived from the biblical obligation to return lost property on the basis of *simanim*. Hence, *simanim muvhakim* are accepted only in situations analogous to those present with regard to restoration of lost property, namely, where no party is in a position to assert with any degree of certainty that the conclusion reached on the basis of proffered *simanim* is false. *Simanim* are accepted to establish widowhood precisely because no one has any basis to proclaim that the corpse has been misidentified. However, an alleged perpetrator, identified solely by *simanim*, is in a position to deny with certainty that the identification is correct.

According to *Noda bi-Yehudah's* novel view, it might be argued that DNA comparison would be acceptable as a *siman* in establishing the identity of a corpse as well.



DNA sequence in a strand of DNA is comparable to, and no less reliable than, recognition of a phenotype of a facial countenance. Although computers are used to match size, position and other characteristics of the various alleles, that process is necessary in order to limit the time and travail necessary to examine countless matching possibilities. Once the computer has found a match human confirmation is not required. However, it seems to be the case that if two DNA fragments are placed side by side a trained eye would have no difficulty in declaring them either to match or not to match. Indeed, at the end of the process of identification, images of the DNA fragments being compared are available. Such an identification process is no different from identification by means of comparing two photographs; it is, however, far more accurate. DNA recognition is actually *tevi'ut ayin* on the microcosmic level.<sup>39</sup>

Acceptance of DNA analysis as *tevi'ut ayin* serves to obviate the objection that DNA evidence represents a form of *rov* which is not acceptable evidence for permitting remarriage but also dispels the second major problem with regard to acceptance of DNA as a *siman*, i.e., that an identificatory sign such as measurement, weight or location is termed a "*siman garu'a*" and unacceptable as evidence no matter how many such congruent factors may be present.<sup>40</sup>

<sup>39</sup> It has earlier been contended that enhancement of an image by means of magnification, staining or the like does not preclude identification by means of a *siman*. The same should be true of comparison of two samples of any substance even when both are enhanced in an identical manner. Any measurements that are taken serve only to confirm that there is no error in the visual identification.

<sup>40</sup> A *siman beinoni*, or intermediate *siman*, is also not acceptable but there is significant controversy with regard to the acceptance of a coalescence of several such *simanim*. *Teshuvot ha-Bah ha-Hadashot*, no. 65, cites the son of *Mas'at Binyamin* who rejects not only a combination of *simanim geru'im*, but even multiple intermediate identificatory marks for purposes of permitting an *agunah* to remarry. However, *Bet Shemu'el*, *Even ha-Ezer* 17:73, citing *Mas'at Binyamin*, rules that the presence of a multiple number of *simanim beinonim* is sufficient, as do *Taz*, *Even ha-Ezer* 17:30, and *Kezat ha-Hosben* 65:11. *Bet Shmu'el* cites *Helkat Mehokek* as disagreeing. Cf., however, *Helkat Mehokek* 17:43. *Noda bi-Yehudah*, *Even ha-Ezer*, *Mahadura Tinyana*, no. 66, also accepts that view provided that the *simanim* are "*kezat muvhakim*," i.e., somewhat idiosyncratic, and gives as an example the instance of a person whose right ear was disproportionate to his left ear and who was also missing a finger on the right hand. See also R. Isaac Elchanan Spektor, *Teshuvot Ein Yizhak*, *Even ha-Ezer*, no. 20, *anaf* 3, sec. 12. Those authorities maintain that two intermediate *simanim*, taken together, constitute a *siman muvhak*. For additional sources see *Pithei Teshuvah*, *Even ha-Ezer* 17:106.

Presumably, the rationale for accepting a combination of two intermediate *simanim* is that there is a significantly low statistical probability that two people manifest any particular intermediate *siman*. Hence, the likelihood that two individuals manifest two separate *simanim beinonim* is the probability of the occurrence of the first *siman*

The essence of DNA evidence is identity of size and location of the allele. Each of those characteristics is a *siman garu'a*. Earlier it was noted that if DNA is regarded as a *siman muvhak* it is only because of the unique, repetitive sequencing of multiple alleles. The notion that a particular sequence and repetition of what are otherwise *simanim geru'im* is not without precedent but cannot be regarded as unassailable.<sup>41</sup>

However, recognition of DNA matching as a form of *tevi'ut ayin* obviates the problem. DNA analysis is tantamount to visual comparison of diverse DNA strands under a microscope. A positive identification appears when the strands appear to be identical to the eyes of the technician; his measurements serve merely to confirm his presumption. The perception is not of measurement of a number of alleles but is a form of comparison quite similar to *tevi'ut ayin* with regard to a countenance. A countenance is distinctive because of unique size, arrangement and contour of myriad portions of the face. No aspect of any portion of the countenance qualifies either as a *siman muvhak* or as the subject of *tevi'ut ayin*, but the countenance is uniquely identifiable as a whole even though individually the parts are not unique and even nondescript. If so, DNA comparison is actually a form of *tevi'ut ayin* rather than a *siman*.

It further seems to this writer that fingerprint evidence is no different from DNA. Although fingerprint identification is often categorized as a *siman muvhak*,<sup>42</sup> such categorization is subject to objections akin to those that have been expressed with regard to DNA evidence. In particular it may be objected that the presumption that no two people possess an identical fingerprint is no more than an empirical generalization in the

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in two people multiplied by the probability of the occurrence of the second *siman* in two people. For example, *Zemah Zedek, Even ha-Ezer*, no. 76, regards inordinate height as a *siman beinoni*. As defined earlier, the frequency of occurrence of a *siman beinoni* must be less than one in a hundred or one in two hundred. Presumably, inordinate obesity also constitutes a *siman beinoni*. The chances that two individuals manifest both of those *simanim*, i.e., extraordinary height as well as inordinate obesity, equals one in a hundred multiplied by one in a hundred, or one in ten thousand. Thus, the presence of two *simanim beinonim* has the statistical reliability of at least as great as that of a *siman muvhak* which is defined by *Mas'at Binyamin* as one in a thousand or one in two thousand. Hence, for many authorities two such *simanim* combine to become one *siman muvhak*.

<sup>41</sup> See *supra*, note 16.

<sup>42</sup> See *Ozar ha-Poskim*, V, 24:17, sec. 62. See also R. Yehoshu'a Moshe Meriminsky, *Ha-Pardes*, Tishri 5714. Cf., *Sugyot be-Zava u-Mishtarah*, pp. 296-297. R. Ovadiah Yosef, *Teshuvot Yabi'a Omer*, VI, no. 3, sec. 20, relies upon fingerprint comparison only in conjunction with other circumstantial evidence. A similar view is attributed to Rabbi Joseph Shalom Eliashiv in *Sugyot be-Zava u-Mishtarah*, p. 295.

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nature of a *rov*. Fingerprint comparison is, however, actually a form of *tevi'ut ayin* rather than a *siman*.<sup>43</sup>

It may be surprising to some, but fingerprint evidence is fundamentally a product of visual judgment on the part of highly trained human examiners. Little is known concerning the perceptual or neural processes involved in making those comparisons or even about which characteristics of fingerprint pairs make comparisons easy or difficult. The early steps involved in fingerprint analysis are manual and automated. The vast number of fingerprints with which a latent print must be compared make it necessary to submit a fingerprint to a database for automated preliminary comparison. The computer returns a list of potential matches many or most of which can be quickly excluded. The rest require scrutiny by a human observer. The examiner must look closely at a latent print, compare it to the print found in the database and decide whether the prints match or do not match.

There is no formalized process for those steps. “There is no method or metric, or specification of which features should be used for comparison, or any general measure for what counts as sufficient information to make a decision. Examiners rely on their experience and training rather than formal methods or quantified rubrics at each stage of the process.”<sup>44</sup>

Fingerprint examination is similar in nature to the reading of an electrocardiogram by a cardiologist. The electrocardiogram records the electrical activity of each heartbeat in what a layman might term a series of hills, ridges, valleys and bumps. The trained eye of a physician can readily determine that the pattern is unexceptional because he recognizes as identical to the countless normal heartbeats he has previously observed on similar cardiograms; he may spot anomalies that lead him to diagnose underlying problems; or, putting the patient’s cardiogram side by side with earlier recorded cardiograms, he can readily determine how they differ and draw appropriate conclusions. In examining the cardiogram, the cardiologist is applying cardiac *tevi'ut ayin*. However, unlike other forms of *tevi'ut ayin*, only a *talmid hakham* – that is, a cardiologist or fingerprint specialist – has such *tevi'ut ayin*.

<sup>43</sup> R. David Levanon in a parenthetical comment, *Shurat ha-Din*, V, 82, questions why fingerprint evidence should not be regarded as actual *tevi'ut ayin*. He leaves the question as a matter requiring investigation (*zarikh iyun*). Strangely, Rabbi Levanon does not raise the same question with regard to DNA matching.

<sup>44</sup> Philip J. Kelman *et al.*, “Forensic Comparison Matching of Fingerprints: Using Quantitative Image Measures for Estimating Error Rates through Understanding and Predicting Difficulty,” *PLOS One*. 2014; 9(5): e94617.

In short, fingerprint analysis is not an exact or precise scientific process; it is remarkably similar to the *tevi'ut ayin* involved in facial recognition. One recent study revealed a false positive rate of 3%.<sup>45</sup> The rate of error reflects the subjective nature of fingerprint evaluation; it is precisely the subjective nature of the process that constitutes *tevi'ut ayin*. Paradoxically, subjective *tevi'ut ayin* is of greater halakhic evidentiary value than an empirical generalization.

Regardless of the merits of the conflicting views, it is quite apparent that significant disagreement exists with regard to whether DNA analysis is tantamount to a *siman muvhak*. Rabbinic scholars who have addressed the issue have not taken into account the consideration that, empirically, both fingerprint comparison and DNA matching are actually forms of *tevi'ut ayin* – a factor that would free a woman from the bonds of *igun* beyond cavil.

## 6. Identification by Means of Collateral DNA

Rabbi Woszner's distinction between identification on the basis of different samples of DNA derived from the same person and collateral identification on the basis of DNA shared by blood relatives appears tenuous.<sup>46</sup>

<sup>45</sup> *Ibid.*

It should be noted that recent studies have confirmed the role of bias in fingerprint matching. Bias may arise because of awareness of the seriousness of the matter under consideration, time constraints, knowledge of previous determinations by another examiner, stereotypical preconceptions and a host of other factors. See Sarah Stevenage and Alice Bennett, "A Biased Opinion: Demonstration of Cognitive Bias on a Fingerprint Matching Task Through Knowledge of DNA Test Results," *Forensic Science International*, 276 (July 2017), 93-106. Such bias also exists in comparing facial components of a perpetrator and a suspect if the observer is led to believe that the suspect is guilty. See S. D. Charman *et al.*, "Exploring the Diagnostic Utility of Facial Composites: Beliefs of Guilt Can Bias Perceived Similarity Between Composite and Suspect," *Journal of Experimental Psychology: Applied*, 15 (2009), 76-90. A natural and well-intentioned bias to free an *agunah* cannot be denied and should not be overlooked. Measures, some obvious and some not so obvious, can be taken to eliminate bias. See S. M. Kassin *et al.*, "The Forensic Confirmation Bias: Problems, Perspectives, and Proposed Solutions," *Journal of Applied Research in Memory and Cognition*, 2 (1) (2013), 42-52 and "Cognitive Bias Effects Relevant to Forensic Science Examinations," *Forensic Science Regulator* FSR-G-217 Issue 1 (2015). Hopefully, it is not necessary to emphasize that the members of a *bet din* relying upon the *tevi'ut ayin* herein described will consult with experts in order to assure that measures have been taken to eliminate all possible bias. See S. A. Cole, Implementing Counter-Measures Against Confirmation Bias in Forensic Science, *Journal of Applied Research in Memory and Cognition*, 2, (2013), 61-62. See also Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," p. 135, note 24.

<sup>46</sup> See *infra*, note 49.

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Assuming that a *siman muvhak* is an identificatory sign not found with the frequency of more than one in a thousand, reliability of DNA matching with accuracy of more than one in a thousand would qualify as a *siman muvhak*. Current estimates of reliability of DNA matching both for establishing identity and for establishing a consanguineous relationship are far higher.

However, if DNA is accepted as *tevi'ut ayin* rather than as a *siman*, that distinction becomes entirely cogent. Facial recognition is defined by the Mishnah as recognition of the "countenance and nose," i.e., an entire phenotype. Alleles, as has been argued, are the microscopic analogue of a countenance and, as such, identifiable on the basis of *tevi'ut ayin*. Two fragments of DNA taken from the same person will be identical and immediately recognized as such by a trained observer. However, DNA samples taken from a father and a son will never be identical because a child inherits only one half of the complement of chromosomes from his father; consequently, there cannot be more than a fifty percent match between DNA of parent and child. The percentage of DNA shared by more distant relatives can be readily predicted by applying elementary principles of genetics but will steadily attenuate with the reduced degree of consanguinity. While comparison of full complements of identical alleles and recognition of their identification can be categorized as *tevi'ut ayin*, comparison of only a number of alleles cannot be categorized in that manner any more so than comparison of half a face with a full face can qualify as *tevi'ut ayin*.<sup>47</sup>

The reason is rooted in the very nature of *tevi'ut ayin* as distinct from other forms of cognition. As has been explained, *tevi'ut ayin* involves a particular neuro-mechanism that renders such recognition the equivalent of perception of a simple quality such as the color yellow. Neither the power of deduction nor the faculty of reason nor the gift of imagination is involved. Recognition is intuitive; it is not mediated by the intellectual faculty. Recognition arrived at by the perception of less than a full physiognomy involves fleshing out the immediate perception by deduction, analogy and/or imagination. That type of recognition is an entirely different neuro-phenomenon and involves different regions of the brain. It is not akin to an immediate sensory perception. Comparing a full set of alleles with a set in which only half or less are identical gives pause to the neuro-mechanisms involved. The cognitive conclusion is not immediate; the brain must first sort out the common alleles from among the disparate ones. That process involves rational analysis of whether the common alleles that are present meet the criteria for identification and degree of

<sup>47</sup> See *Shulhan Arukh, Even ha-Ezer* 17:24 and *Helkat Mehokek* 17:41.

relationship. That process involves discernment and judgment that cannot be spontaneous. In short, that process is qualitatively different than *tevi'ut ayin* and one must assume that it involves different neuro-centers within the brain. It is certainly not akin to the simple quality of yellow described by J. S. Mill or to the knowledge of *ezem ha-davar* postulated by R. Iser Zalman Meltzer.<sup>48</sup>

Despite the foregoing, it can be argued that comparison of a lesser number of alleles shared by a father and a son, by two brothers etc., may be halakhically acceptable as sufficient to establish a familial relationship — not on the basis of *tevi'ut ayin* alone but on quite different grounds.

The earlier-cited text of *Sanhedrin* 38a declares:

. . . For man stamps many coins with a single seal and all are like one another. But the Holy One blessed be He stamps every man with the seal of Adam and not a single one is identical to his fellow. . .

One may ask: Are the Sages informing us that the Omnipotent One utilizes a single mold but, unlike a comparable humanly-fashioned artifact, He manipulates that artifact to create dissimilar beings each time He gives life to a human child or are the Sages declaring that, at the time of creation the divine mold was originally fashioned or “programmed” to produce an idiosyncratic countenance each time a child is endowed with a phenotype?<sup>49</sup>

<sup>48</sup> It is indeed the case that, strictly speaking, DNA contained with each of the chromosomes that comprise the entire genome should be required to make an absolutely positive identification on the basis of *tevi'ut ayin* just as only the physiognomy of the entire face must be compared with the picture of previous perceptions of that physiognomy stored in a person's memory makes *tevi'ut ayin* possible. But surely one can conceive of a neuro-system in which comparison of a profile with a profile, rather than a full countenance with a full countenance, would be equally reliable because a more highly developed neuro-system would be capable of experiencing the same neuro-perception even when exposed to a lesser stimulus or “trigger.” Only a small number of alleles are actually compared in DNA matching because research has determined that comparison of a greater number of alleles does not result in a higher degree of accuracy. Assume that visual perception of eyebrows alone, ears alone, or a nose alone were as accurate as perception of a full countenance including the nose. Certainly, were that the reality, *tevi'ut ayin* would have been defined by the Mishnah as predicated upon observing that aspect of the countenance alone. That is indeed the conclusion that science has reached in its determination of microscopic *tevi'ut ayin* of genetic material, *viz.*, perception of x number of alleles is as reliable for purposes of immediate recognition and examination of additional “features,” *i.e.*, additional alleles, because additional alleles contribute little to the phenomenon of visual identification.

<sup>49</sup> Unique countenances were not necessarily a hallmark of human beings in the earliest generations of man. Since Eve was created from Adam's rib it would seem that they shared a single genotype. Change, including change in the chromosome

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It is generally assumed by medieval Jewish philosophers that, subject to miraculous and providential intervention, laws of nature were embedded in the universe from the moment of creation. The dictum of the Sages concerning the idiosyncratic nature of human physiognomy is quite consistent with that scheme. The appearance of individual countenances is controlled by multiple genes. Because of random combination of multiple genes and the phenomenon of genetic mutation of individual genes, facial appearance changes from generation to generation albeit while usually preserving familial resemblance to a greater or lesser extent. Man was created with forty-six chromosomes. Laws of nature ordained by the Deity provide for every child to inherit twenty-two matching chromosomes from each parent plus an additional chromosome from each parent that determines gender. Diversity among human beings is largely attributable to the random nature in which those matching pairs of chromosomes are divided so that only twenty-three chromosomes are present within each somatic cell and by which matching pairs of chromosomes are reassembled in the fusion of sperm and ovum. The randomness of inheritance of the multiple genes governing physical appearance guarantees a near infinity of possible phenotypes. Man was created and made subject to the rules of genetic inheritance, so that, *inter alia*, each person's appearance must be unique.

It has earlier been shown<sup>50</sup> that *Tosafot*, *Shevu'ot* 43a, establishes the principle that, given the laws of nature as postulated premises, circumstantial evidence in the form of necessary deductive conclusions based upon those laws constitutes proof positive for all halakhic purposes. *Tosafot's* assertion is manifest in the distinction between *mayim she-yesh lahem sof* and *mayim she-ein lahem sof* as reflected in the following scenarios: A man enters a body of water and does not emerge. If the opposite shore is beyond visual perception, we do not permit the woman to remarry because of the possibility that the husband may have survived, emerged on the opposite side and then absconded. However, if the opposite bank is within sight and the husband does not reappear, we conclude as a matter of certainty that he perished in the water and permit his wife to contract a new marriage. In neither case has anyone seen a dead body. In the first

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controlling gender, presumably occurred by means of genetic mutation. Mutations which are rather common in genetic transmission occurred over a period of generations. The Gemara, *Bava Mezi'a* 87a, makes it quite clear that in the days of Abraham individual physiognomy was unique and that it was necessary for God to "change" Isaac's countenance so that he became immediately recognizable as the child of Abraham.

<sup>50</sup> Bleich, "Validity of DNA Evidence for Halakhic Purposes (Part 1)," pp. 125-131.

case, it is highly unlikely that the husband swam across a body of water so vast that the other side is not within eyeshot, emerged alive, and later disappeared without a trace. Although circumstantial evidence of the husband's death is compelling, nevertheless, since it is within the realm of possibility that the husband is still alive, the wife cannot be declared a widow. In the second case, since were the husband to have emerged on the other side of the body of water he would have been seen, the circumstantial evidence of his non-appearance is acceptable. What assurance is there that the husband has not survived and is yet alive under water? Perhaps the husband tunneled under the opposite bank and emerged beyond eyesight. Perhaps the husband emerged but became invisible. Since those hypothetical conclusions are rendered impossible by the laws of nature, the circumstantial evidence dictates the only logical conclusion that is consistent with those laws, namely, that the husband drowned in the water but the body has not been found.

The laws of genetics dictate that an equal number of chromosomes are derived from each parent and that each of a paired set of chromosomes is contributed randomly by each parent. Accordingly, it is possible to determine in advance how many of the original chromosomes present in any particular progenitor will be present in each member of every succeeding generation. Consequently, the phenomenon of a particular number of identical DNA alleles shared by two individuals serves to establish not only the existence of a blood relationship but also the degree of that relationship.

A conclusion of that nature does not have the immediacy of *tevi'ut ayin*. It does arise from the *tevi'ut ayin* that establishes the commonality of a certain number of alleles. However, since such comparison is analogous to comparing half a countenance with half a countenance that comparison, in itself, proves nothing. However, reflection upon the number of alleles perceived to be shared in the context of known patterns of genetic behavior allows reason to make certain deductions. Those conclusions are logically deduced from the laws of nature governing genetic transmission. The result is a form of deductive evidence based upon established laws of nature that *Tosafot* declare to be recognized by Halakhah as universal truths for all purposes. If so, DNA evidence in instances of DNA comparison of samples derived from different individuals, although it is not valid as a simple form of *tevi'ut ayin*, serves as the basis for applying deductive reasoning brought to bear upon information gleaned by *tevi'ut ayin*.