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Survey of Recent Halakhic Literature

VALIDITY OF DNA EVIDENCE FOR HALAKHIC PURPOSES (PART 1)

I. THE NATURE OF DNA EVIDENCE

Deoxyribonucleic (DNA) testing is most often associated with attempts to identify criminal perpetrators or to exonerate persons accused of a crime. Identification by means of DNA is particularly useful in placing a suspect at the scene of a crime. Except for identical twins no two persons are known to possess identical DNA. In 1984 scientists developed a means of isolating DNA in a sample provided by a crime suspect or victim and comparing it with a sample recovered from a crime scene or from clothing worn by the suspect. Although the presence of DNA does not in itself conclusively prove the guilt of a suspect, it is a crucial factor in establishing guilt by means of circumstantial evidence.

DNA evidence is, logically speaking, most compelling in establishing paternity since a shared DNA profile constitutes extremely strong statistical evidence of a paternal-filial relationship. In paternity cases, a partial overlap of some DNA structures in different individuals is evidence that the persons compared had at least one common progenitor and hence are related.

Establishing a reliable DNA match is fraught with difficulty. One earlier commonly employed method in DNA testing is termed DNA fingerprinting or DNA profiling. The method involves a technique known as restriction fragment length polymorphism (RFLP) analysis in which long strands of DNA are extracted from body tissue and broken into fragments. Those fragments vary in length from person to person. If two samples contain fragments of different lengths they cannot have a common source. In order to reduce the likelihood that two people might each have a fragment of common length, a number of different fragments that have been

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discovered to be subject to a great degree of variability are measured. Those fragments are known as variable number tandem repeats (VNTRs). VNTRs of different lengths are presumed to have come from different individuals, Much as is the case with regard to fingerprints, VNTRs of equal length located at a similar position on a chromosome indicates that the two samples came from the same individual.[1] RFLP of a minimum of six VNTRs yields profiles that are believed to be unique to each person. Acceptance of RFLP analysis relies upon adequate standards and controls necessary to assure reliability of the test, diligence and skill in determining that the DNA profiles do indeed match as well as the veracity of assumptions concerning the unique nature of DNA profiles.[2]

A second method of DNA testing involves a technique known as polymerase chain reaction (PCR). An area of DNA in which there are variations from person to person is selected and the DNA strands are caused to replicate themselves multiple times. Enhanced samples are then typed by use of genetic probes engineered to detect specific forms or alleles of a given gene. Those probes are termed "allele specific gene oligonucleotide probes." If two samples have the same type they may have a common source; if they do not have the same type they cannot have a common source. This method may be susceptible to error caused by inadvertent contamination of samples and also because some alleles may be amplified to a greater extent than others. There is also evidence that particular combinations of alleles are far more common in some demographic groups than in others. If so, the statistical chance of a match in a specific group is far greater.[3]

[1] It has been suggested that the introduction of a chemical, ethidium bromide, during the measuring process causes unpredictable shifts in position and thus calls the reliability of this test into question. See Committee on DNA Technology in Forensic Science, "National Research Council, 1992 DNA Technology," *Forensic Science,* VII (1992), pp. 57-58 and 68 (hereinafter *NRC Report*) and Paul Hagerman, *Loading Variability and the Use of Ethidium Bromide: Implications of the Reliability of the FBI's Methodology for DNA Typing*, cited in *United States* v. *Yee* 129 F.R.D. 629 (N.D. Ohio 1990).

[2] The difficulties involved in distinguishing matching and non-matching DNA was a matter of concern in *People* v. *Castro*, N.Y.S. 2d 985 (N.Y. Sup. Ct. 1989). For a report of disagreement among experts see *People* v. *Kramer* N.Y.S. 2d 773 (N.Y. Sup. Ct. 1992). For a list of reviews of the controversy surrounding the reliability of DNA evidence see William C. Thompson, "Evaluating the Admissibility of New Genetic Identification Tests: Lessons from the 'DNA War,'" *Journal of Criminal Law and Criminology*, vol. 84, no. 1 (Spring, 1993), p. 22, note 3.

[3] This description of DNA testing is largely based upon Thompson, "Evaluating the Admissibility of New Genetic Identification Tests," pp. 26-30 and 33-42. For extensive citations regarding the dispute surrounding the reliability of DNA evidence and its admissibility in judicial proceedings see pp. 22-23, notes 3-5. For a comprehensive discussion of the reliability of DNA evidence see William C. Thompson and

Next Generation Sequencing (NGS), also known as Massively Parallel Sequencing, is the newest available technique. This technique allows for simultaneous sequencing of thousands of overlapping locations in the DNA. Massive amounts of data can be generated and reassembled in order to recognize overlapping sequential fragments.

A DNA profile appears as a pattern of black bands on an X-ray plate known as an autoradiogram or autorad. The bands indicate the relative lengths of the DNA fragments being compared. Using a complex process the fragments are arranged according to size and bound to a nylon membrane and then X-rayed. The positions of the bands correspond to the positions of the VNTR fragments. Different lengths indicate that the samples come from different individuals. Matching is difficult because bands may be obscured, spurious dark spots may easily be mistaken for bands and the print may be faint or blurred. Even when computer-assisted imaging is employed, determination is often the product of subjective judgment on the part of laboratory technicians. Moreover, the number and position of bands in a single person's DNA may change slightly depending on the quality of the biological sample and the testing conditions.[4] Thus, DNA prints of the same person may not always be identical. Laboratories have developed quantitative matching rules that specify how closely bands in two DNA prints must align in order to be regarded a match.[5] Hence, as might be anticipated, experts have differed with regard to whether a particular test has or has not reliably established a match. That issue figured significantly in two prominent court cases, *People* v. *Castro*[6] and *People* v. *Kramer*.[7]

Matching DNA samples can indicate the likelihood that they come from a single individual only if the probability that two persons do not share a single DNA profile can be determined. It is presumed that the possibility of two people having an identical DNA profile of a single allele is remote while the probability that they might share identical profiles of multiple alleles is infinitesimally small. Thus a match is declared only if a sufficient number of profiles are found to be identical. Generally, four or

Simon Ford, "DNA Typing: Acceptance and Weight of the New Genetic Identification Tests," *Virginia Law Review*, vol. 75, no. 1 (February, 1989), pp. 45-108.

[4] See William C. Thompson and Simon Ford, "The Meaning of a Match: Sources of Ambiguity in the Interpretation of DNA Prints," *Forensic DNA Technology*, ed. Mark Farley and James Harrington (Chelsea, Michigan 1991), pp. 73-95 and William M. Shields, "Forensic DNA Typing as Evidence in Criminal Proceedings: Some Problems and Potential Solutions," *Proceedings of the Third International Symposium on Human Identification* (1992), pp. 1-50.

[5] See *NRC Report*, pp. 51-73.

[6] 545 N.Y.S. 2d 1985 (N.Y. Sup. Ct. 1989).

[7] 591 N.Y.S. 2d 733 (N.Y. Sup. Ct. 1992).

six alleles are matched in determining identification. If the position and length of multiple DNA profiles found in two samples match they are deemed to have belonged to a single person. Since any single set of matching DNA segments may well have come from different sources, it is only in the aggregate of matching different segments that the possibility of a second source can be eliminated.

Determining the statistical probability that the samples may have come from different persons begins with determining the frequency of each band in a database containing DNA profiles of a large number of individuals. For comparison of DNA profiles of members of various racial or ethnic groups to be meaningful, the database must assure that it is representative of the entire population. The major concern is that the frequency of alleles may vary among different ethnic groups. For example, the frequency of particular alleles may be higher among certain central African black tribes than among coastal African tribes. The blacks in the database may be disproportionately greater for a particular black group with the result that the likelihood of a match with a member of a different subgroup effectively excluded from the database may be much higher.

A second concern is that the statistical analysis depends upon combining the frequency of occurrences of different alleles. Thus, for example, if one allele is present in 10% of the population there is a 10% chance that two identical samples come from the same person. That would present a very weak statistical indicator. If another allele is present in the same sample and it also occurs in 10% percent of the population, the presence of the second allele by itself is no stronger evidence than the presence of the first. But, if both are present, the likelihood that both did not come from the same person is $1/10 \times 1/10$ or $1/100$—a far lower statistical probability that the match is a random coincidental occurrence rather than coming from a single source. However, that is true only if it assumed that the alleles are statistically independent, i.e., a particular person having a particular allele is in no way affected by the presence or absence of the other allele. If, however, 50% of those having the first allele also have the second allele, the presence of the second allele in 50% of the database adds much less to the likelihood that the two samples have a common source.[8] The fact that 50% of those having the first allele also have the second allele means that 50% of the linkage is not a random occurrence. It is only the independent occurrence of the second allele that is of

[8] Large differences have been shown to exist among groups of American Indians. See J.R. Kidd *et al*, "Studies of Three Amerindian Populations Using Nuclear DNA Polymorphisms," *Human Biology*, vol. 63, no. 6 (December, 1991), pp. 775-794.

statistical importance. Thus, the random likelihood that the samples have a common source is increased from 1/10 × 1/10 or 1/100 to 1/10 × 1/2 or to 1/20. Put somewhat differently: If the two probabilities are independent, the random likelihood that the samples have a common source is 1/10 × 1/10, or 1%. If the two probabilities are dependent on one another as above, where 50% of those having one allele have the other, the random likelihood that he samples have a common source is 1/10 × 1/2, or 5%. Whether or not the alleles in the DNA profile are in fact statistically independent is crucial and such independence must be established with every allele included in the profile.

It must be remembered that alleles occur in pairs, one allele inherited from the father and one from the mother. Together they constitute a genotype. Those alleles usually have different frequencies. The frequency of any pair of alleles is the frequency of one allele multiplied by the frequency of the other allele and then multiplied by two since each allele may come from a different parent. But determination of the genotype frequency is valid only if allele frequencies are not interdependent. If, however, the two alleles are common in a particular subgroup and members of that subgroup engage in endogamous mating, i.e., people in the subgroup tend to mate with each other, the allele frequency will be higher than in the general population, making it more likely that the samples containing the different alleles come from different individuals.[9]

DNA testing involves comparing various genotypes. In order sharply to reduce the statistical probability that they came from the same individual multiple genotypes are compared. The more genotypes compared, the less likely it is that two individuals share all of those alleles. This again assumes that there is no interdependence between separate genotypes. If such a linkage exists the presence of multiple genotypes becomes less significant. At present, scant information is available with regard to such interdependence.

Identical DNA profiles have been found in at least one study. The comparison of Karitian Indians of Brazil found an over twenty percent match in four or more probes. In at least one case there was a six-probe match. In addition, a six-probe match was discovered between one Karitian Indian and a member of a different group, a Maya Indian.[10]

[9] By way of analogy, ten percent of Europeans have blond hair, ten percent have blue eyes and ten percent have fair skin. Multiplying those frequencies would mean that only 1 in 1,000 Europeans have blond hair, blue eyes, and fair skin. The actual frequency, particularly among Scandinavians, is much higher. That is so because there is a definite linkage, probably because of endogamous marriage, in the genetic factors responsible for those traits. See *NRC Report*, p. 76.

[10] See Laurence Mueller, "The Use of DNA Typing in Forensic Science," *Accountability in Research,* vol. 3, no. 1 (November, 1993), pp. 55-57.

Thus, DNA testing constitutes far less than infallible proof. Unsurprisingly, there have been numerous challenges in United States courts to admissibility to DNA evidence. Most jurisdictions have applied the Frye doctrine, first established in *Frye* v. *United States*,[11] that allows scientific evidence to be presented to a jury if the court determines that it has gained "general acceptance in the particular field in which it belongs." [12] The Frye standard was abrogated insofar as federal courts are concerned by a decision of the U.S. Supreme Court in *Daubert* v. *Marshall Dow Pharmaceuticals, Inc*.[13] The Supreme Court ruled that expert testimony is governed by the more expansive federal rule of evidence that states:

> If scientific, technical or other specialized knowledge will assist the trier of fact to understand the evidence or determine a fact at issue, a witness qualified as an expert by knowledge, skill, experience, training, or education may testify thereto in the form of an opinion or otherwise.[14]

Without identifying any factor as controlling, the Court enumerated a number of considerations that must be weighed, including whether the theory or technique has been tested, subjected to peer review and publication, its estimated rate of error and, probably most significantly, its acceptance in the relevant scientific community.

Consequently, courts have differed with regard to admissibility of DNA evidence both because of questionable procedures and safeguards employed by various laboratories and because of applicable legal standards.[15] For obvious reasons, DNA evidence is more likely to assist in exonerating a suspect than in convicting a defendant.

II. CIRCUMSTANTIAL EVIDENCE IN HALAKHAH

A. Two Types of Circumstantial Evidence

Judaism's two-witness rule requiring the testimony of two unimpeached witnesses is not based upon the presumption that eyewitnesses are infallible. That is made abundantly clear by Rambam in *Hilkhot*

[11] 293 F 1013 (D.C. Circuit 1923).
[12] *Ibid*., p. 1014.
[13] 113 U.S. Supreme Court 2786 (1993).
[14] *Federal Rules of Evidence*, Rule 72.
[15] See Thompson, "Evaluating the Admissibility of New Genetic Identification Tests," pp. 42-51.

Yesodei ha-Torah 7:7. Rambam spells out the criteria that must be met by a person seeking credibility as a prophet. Upon listing the relevant criteria, Rambam adds that it is not beyond the sphere of the possible that a charlatan might establish himself as a prophet but, despite that possibility, a person who has satisfied those criteria must be accepted as such because "thus have we been commanded." Almost gratuitously, Rambam adds a parallel comment to the effect that we are commanded to obey the prophet "just as we have been commanded to determine the verdict on the basis of two qualified witnesses even though it is possible that they testified falsely…." Rambam reiterates that point in *Hilkhot Sanhedrin* 24:1: "…for when [two witnesses] come before the judge he shall judge on the basis of their testimony even though he does not know whether they testified truthfully or falsely."

The object of the criminal law system established by the Torah is not necessarily to convict and punish every perpetrator. As reported by the Mishnah, *Makkot* 7a, the requirements for conviction are so rigorous that execution was a rarity. But there must be provision for punishment, if only to serve as a deterrent or to express a pedagogical message. The divine Lawgiver, declares Rambam, in His wisdom, ordained the two-witness rule with full realization that undiscoverable perjury is a distinct possibility. At the same time He excluded other types of evidence despite their compelling nature.

Western societies recognize that certainty in criminal prosecutions is virtually impossible. Consequently, they have adopted a "beyond a reasonable doubt" standard. What is "reasonable doubt"? Whatever doubt a juror perceives to be reasonable. Doubt almost always exists; the sole issue is the "reasonableness" of such doubt. What one person finds reasonable another finds absurd. What one finds so remote as to defy credulity another finds to be within at least the outer limits of reasonableness. At the risk of being branded a sophist, one may argue that any and all doubts are reasonable; otherwise, the reservation could not be truthfully articulated as a doubt. The very act of formulating, articulating and meaningfully expressing the psychological phenomenon of doubt demonstrates its existence. Doubt expressed by a rational being and cognitively communicated must be reasonable. The same doubt attends upon eyewitness testimony as well but the divine Legislator chose to impose the two-witness standard upon us.

Circumstantial evidence, by its very nature, is subject to doubt. The prosecutor has the burden of convincing the trier of fact that the likelihood of any alternative explanation is so remote that it need not be "reasonably" considered. Epistemologists recognize that there are varying

degrees of certainty. Propositions of logic are regarded as certain, but only because the human mind is incapable of fathoming otherwise. Parallel lines do not ever converge but only because the human mind is incapable of picturing lines that are both parallel and convergent. Indeed, some philosophers would argue that the proposition "Parallel lines do not converge" is nothing more than a tautology, a matter of semantic notation, that tells us something about linguistic expression but nothing about the universe. The human mind is incapable of conjuring a geometric object endowed with both the properties of a circle and the properties of a square. It is simply impossible to conceive of an object that both exists and does not exist at the same time.

Similarly, deductive logic is forced upon all rational beings. Aristotelian logic dictates, not the empirical truth of certain arguments, but the incontrovertibility of certain argument forms. "All men are mortal. Socrates is a man. Therefore Socrates is mortal." One simply cannot affirm the truth of both the major and minor premises and deny the conclusion that some men are mortal. Perhaps not all men are mortal. Perhaps Socrates is the name of a cat. But a person who accepts the original premises as stated and refuses to acknowledge that Socrates is mortal is either a liar or mentally deficient, i.e., "irrational." The human mind is constrained, or "programmed," to think, i.e., to reason, in a certain way and is denied the freedom to do otherwise.

Other than tautologies, propositions outside of deductive logic and mathematics are accepted with greater or lesser degree of certainty depending upon antecedent experience, compatibility with earlier gleaned information, credibility of the speaker, etc. But those propositions always admit of an element of doubt, however remote. To declare otherwise is to be "unreasonable" in the technical, if not in the colloquial, sense of the term.

Deductive reasoning is valid as a matter of necessity in the sense of rational compulsion; inductive reasoning is always subject to a measure of doubt, even if the doubt is *de minimis*, and can never be regarded as absolutely certain. Empirical generalities are the building blocks of science. Laymen come to think of some scientific principles as immutable but philosophers of science correctly recognize such principles as nothing more than working hypotheses subject to disconfirmation at any time by the appearance of even a single contradictory phenomenon. Discovery of the law of gravity can be categorized by a fictional narrative: One may conjecture that Sir Isaac Newton had occasion to observe apples falling from a tree. In the course of that and similar observations he recognized an unvarying pattern: Apples, when separated from the tree, did not rise

to the sky but fell to the ground. One may surmise that he would have made the identical observation with regard to oranges, peaches, pears and coconuts. Indeed, other people did make the same observations but it was Newton who first realized that there is a common element manifest in each of those phenomena. Although each fruit required a certain period of time to reach the ground, the rate of fall of each fruit reflected a certain uniformity, i.e., the speed of each fall was relative to the weight of the falling object. It then occurred to him that he was not observing haphazard phenomena but that all bodies possessing mass are attracted by the earth's gravitational field. Thus was born the law of gravity, applicable to all bodies possessing mass.

We have come to accept the phenomenon of gravity as an immutable law of nature. It may be the case that matter is endowed with a "mysterious" force called gravity and that defiance of the law of gravity requires a miracle. However, our formulation of the law of gravity is the product of mere empirical generalization. We have observed uniform behavior on numerous occasions and have yet to observe a single instance of contradictory behavior. Those experiences have led us to conclude that what we have observed is not a series of discrete, independent coincidences but the mandated effect of a causal principle. A single disconfirming event would force us either to reject the law of gravity as false or to reformulate the rule by modifying it to account for an otherwise aberrant phenomenon.

There is controversy among philosophers with regard to the propositions of mathematics. Is two plus two equals four an immutable rule akin to a postulate of Euclidian geometry or is it merely an empirical generalization? No scientist would dismiss evidence contradicting the law of gravity out of hand; no philosopher would give credence to an eyewitness account of parallel lines that actually converge. Consider a report of the synthesis of a new element accompanied by an announcement that the molecules of the new element behave in a peculiar way. When two molecules of that element are added to two other molecules of the same element the result is five molecules of the same element. If submitted to a jury of philosophers, the jury would have to decide whether the report is unworthy of investigation or whether time, effort and societal resources should be invested in analyzing the novel phenomenon that carries the potential of being harnessed and used for the betterment of the human condition and for the welfare of society. The votes of the various members of the panel would reflect their respective views regarding the nature of mathematics.

Halakhah does accept laws of nature as immutable, barring miracles. And it does accept mathematics as akin to application of the rules of logic.

But, when confronted with circumstantial evidence, it is more than skeptical. However, one must exercise caution in defining the notion of circumstantial evidence subject to such skepticism. *Tosafot*, *Shevu'ot* 34a, s.v. *de'i*, regard some forms of circumstantial evidence as admissible even in criminal cases.[16] The Gemara, *Sanhedrin* 37b and *Shevu'ot* 34a, states:

> R. Simon ben Shetaḥ said: "May I not see the consolation of Zion if I did not see a man running after his fellow into a ruin and I ran after him and found him with a sword in his hand, blood dripping and the victim in death throes. I said to him, "Wicked one! Who killed this man, I or you? But what can I do since your blood is not given into my hand for the Torah said, 'by the mouth of two witnesses or three witnesses shall he who is to die be put to death.'"

Although Me'iri, *Shevu'ot* 34a, and *Yad Ramah*, *Sanhedrin* 37b, disagree, *Tosafot*, *Shevu'ot* 34a, s.v. *de'i*, regard such evidence as sufficient even in capital cases. For example, if witnesses testify that only two people were in a confined space without possibility of unobserved entry or egress and one is found to have sustained a mortal wound that could not possibly have been self-inflicted, his sole companion may be judged guilty of causing the victim's death despite the absence of eyewitness testimony to the actual act of homicide.[17]

Tosafot, in effect, draw an epistemological distinction between two types of circumstantial evidence. Circumstantial evidence involves circumstances in which a trier of fact apprised of the known facts draws certain conclusions. Given a single mauling camel among a group of docile camels and a carcass in their midst, a reasonable person would certainly conclude that responsibility lies with the aggressive camel. The certainty of that conclusion may be open to question but it is reached on the basis of an *umdena*, i.e., an assessment of contextual circumstances. Certainly,

[16] This also appears to be the opinion of Rambam, *Hilkhot Ḥovel u-Mazik* 5:5. Cf., however, R. Jacob Fester, *Ha-Pardes*, Kislev 5730, p. 17, reprinted in his *Birkat Ya'akov*, no. 14.

[17] The testimony of two eyewitnesses is the normative standard of evidence with regard to criminal matters. Nevertheless, the Gemara, *Bava Batra* 93a, *Sanhedrin* 37b and *Shevu'ot* 34a, records a controversy between Rav Aḥa and the Sages in a situation involving a group of camels. One camel was observed kicking its legs and subsequently another camel was found mauled to death. R. Aḥa accepts such circumstantial evidence as sufficient to hold the aggressive camel's owner liable in tort. *Tosafot*, *Shevu'ot* 34a, s.v. *de'i*, maintain that R. Aḥa would recognize the admissibility of comparable evidence in criminal prosecutions as well. Other early authorities regard R. Aḥa's view as limited to financial matters. In any event, the halakhic decisors rule in accordance with the majoritarian view of the Sages.

some circumstances may be more compelling than others. At times, a conclusion may be accepted because it is regarded as true beyond reasonable doubt, at times because the evidence is clear and compelling and at times because the conclusion is regarded as more likely than not. There is certainly no way to draw clear and precise boundaries between the three standards of proof. The result is a slippery slope. In the words of Rambam, *Sefer Ha-Miẓvot*, *lo ta'aseh*, no. 290:

> A judge is commanded not to determine matters on the basis of strong inclination even if it approaches [absolute] truth…. For of matters in the realm of possibility there are some that are highly probable, some that are highly improbable and some intermediate between the two. The realm of the possible is extremely broad. If the Torah would have allowed determination of guilt in capital cases on the basis of the highest degree of probability that might exist…we would breach the barrier [by accepting evidence] a bit distant [from that degree of certainty] and [then] also by accepting evidence exceedingly distant until the barriers are [entirely] breached and people put to death on the basis of scanty assessment according to the judge's surmise and thinking. Therefore, the exalted One closed the door and declared that punishment not be determined unless witnesses testify that they know with certainty, without doubt and without any assessment at all.

Circumstantial evidence of such nature, i.e., based upon *umdena*, can, at the very most, establish conclusions in a manner approaching certainty but never with absolute certainty.

Other situations may present facts that would lead to inescapable deductive conclusions. A victim is found in a cave with a knife wound in his back. The only other person in the cave is holding a knife dripping with blood. A knife wound cannot occur spontaneously. If the wound could not be self-inflicted, and it has been established that no other person was present and that it would have been impossible for any other perpetrator to enter or exit the space, the lethal wound could not possibly have been caused other than at the hands of the individual whose presence in the confined space has been established. Given the laws of natural science that govern both man and matter, no other conclusion is possible.[18]

In those circumstances, culpability has been established not only beyond reasonable doubt but also beyond all cogent doubt. The identity of

[18] Deductive inferences are integral to testimony of witnesses and conclusions of a *bet din*. The point formulated by *Tosafot* – and disputed by *Yad Ramah* and Me'iri – is that accepted laws of nature established by empirical science can also serve as premises to which deductive reasoning may be applied.

the murderer is known with the same degree of logical certainty as is attendant upon the conclusion of an Aristotelian syllogism. The facts are amenable to one interpretation and to one interpretation only. The conclusion is undeniably compelled by canons of logic and hence is known to be valid with absolute certainty. Indeed, circumstantial evidence of that nature is not simply the equivalent of, but superior to, eyewitness testimony. Eyewitness testimony is not infallible; deductions based upon known rules of nature are compelling barring some form of miraculous intervention, the possibility of which is not a factor in legal determinations.[19]

Rabbinical courts have not administered statutory capital punishment or forty stripes since forty years prior to the destruction of the Second Temple.[20] Consequently, the admissibility of circumstantial evidence in criminal cases is not an issue of immediate concern. Nevertheless, reliability of circumstantial evidence in general, and of DNA evidence in particular, is of importance in a wide variety of matters:

1. Observance of mourning rituals.
2. Identification of body parts for burial in a single grave.
3. Establishing a paternal-filial relationship for the purpose of the obligation of honoring a parent.
4. Proof of paternity in order to exempt a widow from levirate obligations.
5. Rebuttal of a father's presumptive credibility in disclaiming a paternal relationship.
6. Confirmation or negation of paternity for purposes of custody and/or child support.
7. Determination of the status of a child as a *mamzer*.
8. Establishing eligibility of a daughter of an unwed mother to marry a *kohen* in situations in which such a marriage is not permitted because of doubtful paternity.
9. Evidence of death of a spouse in order to establish capacity to enter into a new marriage.

[19] Indeed, the Gemara, *Rosh ha-Shanah* 25b and *Bekhorot* 20b, declares that testimony of witnesses to phenomena inconsistent with the dictates of the laws of nature are to be dismissed as false. For a more immediate application see R. Zevi Ashkenazi, *Teshuvot Ḥakham Ẓevi*, no. 77, who declares that he would dismiss testimony of witnesses to the absence of a heart in a chicken as contrary to the laws of nature and the rejoinder of R. Jonathan Eibeschutz, *Kereti u-Peleti* 40:4, to the effect that, although this is the case with regard to the vast majority of chickens, such testimony is plausible because the particular chicken may have had a malformed or unrecognizable organ that performed the functions of the heart.

[20] See *Sanhedrin* 41a.

10. Establishing identity in instances of possible inadvertent exchange of infants.
11. Establishment or denial of a right of inheritance.
12. Establishing status as the son of a *kohen* or a levite for purposes of religious law.
13. Determination of paternity for the purpose of marrying a woman pregnant with another person's child or a woman within the twenty-four month period following birth of such child. Many authorities forbid marriage even if the prospective husband acknowledges paternity. However, when there is acceptable proof of paternity, the father is permitted to marry the woman in question.
14. Establishing a person's identity as a Jew for purposes of privileges and benefits arising from religious law or the Israeli Law of Return.
15. Status as a *kohen* on the basis of the presence or absence of the so-called "*kohen* gene." Presence of the gene is significant only for establishing entitlement to ritual privileges and honors due a *kohen*. However, the effect of absence of the gene, if dispositive, would eliminate the restrictions to which a *kohen* is subject such as coming in contact with the body of a deceased person or marrying a divorcee.[21]

B. Fingerprint Evidence

Modern science and technology have introduced a number of novel forms of evidence that, because of their scientific nature, are regarded as highly reliable and certainly more credible than the testimony of eyewitnesses. Those forms of evidence include: fingerprints, blood types, and DNA. Of those, reliance upon fingerprint evidence for matters of Halakhah, despite its scientific basis, is particularly problematic.

Deductive inferences are based upon laws of nature. Those laws are presumed to regulate natural occurrences by means of principles and forces that are regular, orderly and inviolate. It is regularity of sequential occurrence that causes observers to formulate hypotheses that account for such regularity and which then may be used to predict future occurrences. The human mind regards regularity of occurrence as evidence of an underlying law of nature. The cause is inferred from its effect. The direction and velocity of falling objects leads to postulation of the law of gravity to explain that phenomenon; the attraction of iron filings by, and

[21] Not all of these questions will be addressed in detail in this endeavor. A number of these issues will be left for another occasion.

their adaptation to, the shape of certain metals leads to postulating the existence of a magnetic field. In the absence of contradictory explanations of such phenomena, we regard these hypotheses as proven precisely because regularity of occurrence gives rise to the assumption that there is an identifiable cause responsible for that regularity. We reify the cause by giving it a name even when the causal force or principle cannot be perceived directly. Perception of regularity in the operation of nature is the meta-hypothesis that makes all scientific hypotheses possible.

The widespread acceptance of fingerprint evidence lies in the fact that, despite phenomenally large databases, no two prints have ever been found to be identical. If it were to be assumed with certainty that nature dictates assignment of unique fingerprints to each individual it might be conclusively determined that fingerprints found on any object must be ascribed to the individual whose fingers match those prints. The crucial point is that uniformity of occurrence is either the product of causal connection or mere happenstance. When the statistical probability of identical random occurrence is beyond credulity, the only alternative is the presence of a causal connection. Such an invariable causal connection leads to recognition of a law of nature that is manifested in such events. The identified law of nature, assuming it is veridical, is readily apprehended by the intellect and, once established, is accepted as a guarantee of future reiteration. The guarantee is not the cumulative effect of statistical improbability of past events having been random, but the underlying "law" which unifies the observed phenomena in a causal manner thereby negating mere coincidence. Thus, the law acquires predicative reliability.

Fingerprint evidence is not of such nature. To be sure, millions of individuals have been fingerprinted; no two individuals have been found to have the same fingerprint. Ergo, 1) there is some principle of nature that precludes such a result; 2) the phenomenon, incredible as it may seem to be, is a colossal coincidence; or 3) the Creator, for reasons best known to Himself, has decided to stamp each of His creatures with individuality in the form of a unique set of fingerprints. Science has failed to discern any natural rule that would mandate that each person be endowed with a unique set of fingerprints. Hence, past experience has no reliable predictive value. By way of example, in tossing a coin, the chances in each toss that it will result in heads is 50% and the chance that it will result in tails is 50%. If one sets out to perform ten tosses the statistical probability that all ten tosses will result in heads is extremely remote. The probability that all ten tosses will result in heads is $1/2^{10}$, or one in 1024 to be precise. Given those odds, a prudent person will refuse to wager that the coin will land on heads ten times in succession. But, if nine already completed

tosses have already resulted in heads, the chance that the tenth toss will also result in heads is no different from the probability that the first toss would result in heads. In each individual instance the probability is one out of two. Of course, if the coin is weighted in a particular manner, the probability of tossing a head may approach or equal 100%. That is tantamount to saying that the result is not random but attributable to some "law" or causal factor. The problem is formulating an hypothesis, i.e., identifying a law, that explains the observed phenomena.

Science has yet to discover a rational explanation for the idiosyncratic nature of fingerprints. We may suspect that such an undiscerned cause is present but the phenomenon, at least at present, is not ascribable to any physical or biological factor. The presence of a contradictory occurrence invalidates a hypothesis, but absence of a contradictory phenomenon proves nothing. The remarkably high incidence of unique fingerprints marked by the absence of even a single matching set may lead us to assume that there is some law in our universe governing fingerprints that we have not perceived. But absent apprehension of such a principle, the possibility of wildly improbable random occurrences cannot rationally be excluded. Hence the claim that matching fingerprints "proves" anything regarding the source of such fingerprints is invalid. [22] At best, it represents an educated guess, but not a proof.

The difference between random, temporally sequential occurrences and manifestation of an inherent law of nature is the presence of an underlying force or principle that endows physical events with causality. When the human intellect succeeds in positing a rational explanation that establishes causal connections between empirical phenomena we rely upon that principle as a prescriptive, and hence predictive, law of nature.[23] If we are unable to explain the temporal sequences in a manner reflecting an underlying rule of nature we cannot but consider them to be discrete phenomena that occur haphazardly and hence of no logically predictive value.

[22] See *infra*, note 25.

[23] For purposes of this discussion there is no need to explore Ramban's position asserting that there are no laws of nature but that what we perceive as natural causality is merely the manifestation of discreet "miraculous" acts of the Deity. Ramban uses the term "*nes nistar*," or "hidden miracle," to describe such phenomena precisely because the human intellect (erroneously) perceives them as immutable cause and effect occurrences. According to Ramban, overt miracles were performed in order to cause us to reflect and recognize that natural phenomena are also miraculous. See Ramban, *Commentary on the Bible*, Exodus 13:17. It seems correct to say that, for Ramban, the halakhic system is predicated upon how the world appears to man rather than upon ontological reality.

The classic example of the latter lies in the belief held by some tribes in Africa to the effect that the reappearance of the sun following a solar eclipse is dependent upon their beating of tom toms. Each time there is an eclipse of the sun, they beat the tom-toms and, lo and behold, the sun reappears. They are convinced that there is a causal connection between those events such that if they were to withhold the beating of tom-toms the sun would not reappear. The result would be catastrophic; hence, their reluctance to refrain from beating the tom-toms.

Neither they nor the scientific community can elucidate a causal connection between the beating of tom toms and the reappearance of the sun. An ascription of such a connection between those phenomena is a classic example of the logical fallacy *post hoc ergo proptor hoc*, or "after this, therefore because of this." The difference between a logical fallacy and a veridical manifestation of causality lies in identification of an inherent, identifiable causal law. The practical difference is predictability and reliability. When a causal factor is present the law will dictate future events and make them absolutely predictable. When there is no law we may marvel at the regularity but must fully recognize that there is no inherent logical reason that past phenomena should have predictive value for future events. Science has not been capable of formulating a theory to explain the existence of a law dictating idiosyncratic individual fingerprints. In the absence of a scientific explanation we cannot affirm with any degree of certainty that the fingerprints of two individuals cannot be identical. The assumption that they can never be identical is logically fallacious.[24]

[24] Cf., R. Chaim David Regensberg, *Mishmeret Ḥayyim*, no. 37, who accepts fingerprint evidence as admitting of no exception and hence infallible to the point of asserting that testimony to the contrary must be dismissed as perjury. See *supra*, note 20. See the response of R. Jacob Fester, *Ha-Pardes*, Tammuz 5729 and Kislev 5730. For further discussion of fingerprint evidence see R. Shlomoh Fisher, *No'am*, II (5719), 21-222, and sources cited by Prof. Nahum Rakover, *Ozar ha-Mishpat* (Jerusalem, 5735), p. 252; R. Joshua Aaronberg, *Teshuvot Dvar Yehoshu'a* III, *Even ha-Ezer*, no. 4 and R. Gad Navon, *Dine Yisra'el*, VII (5737), 129-144.

Implicit reliance upon fingerprint evidence fails to take notice of bias and error of judgment in comparing prints. A celebrated case of that nature involved identification of the Madrid Bomber who detonated ten bombs on trains in Madrid in 2004. A latent fingerprint was found on the bag of detonators and matched with that of an American attorney whose fingerprints had been entered into the automated fingerprint identification system. Three FBI analysts confirmed the identification and the attorney was subsequently held in custody for two weeks. The attorney had never been to Spain and did not possess a US passport. He was, however, a Muslim and had earlier defended a known terrorist. The real bomber was later identified and apprehended by Spanish police. See Sarah V. 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*, vol. 276 (July, 2017), pp. 93-106.

III. PATERNITY

A. Halakhic Presumptions

There are a number of basic halakhic principles employed in determining paternity. The most fundamental is the principle that in cases involving a married couple the lawfully wedded husband is presumed to be the father of any child born during the marriage provided that the husband had access to the wife within a twelve-month period preceding birth of the child. The wife's ascription of pregnancy to an adulterous relationship is not given credence. That principle is quite similar to the common law rule that no person has standing to challenge the paternity of a child so long as the father was present "within the five seas of England" during the requisite period of time. That rule has been modified in many jurisdictions to allow for rebuttal on the basis of incompatible blood types and the like. In those jurisdictions the principle retains a *prima facie* validity as a rebuttable presumption of law.

The common law rule was based on considerations of public policy rather than upon factual considerations. The law refused to hear challenges to presumed paternity because of a policy designed to preserve the marital relationship and to quell allegations of adultery which, whether or not based on fact, would have the certain effect of damaging marital tranquility, sullying reputations, defamation of character, public embarrassment and humiliation as well as social ostracism. Additionally, the policy was designed to preserve orderly disposition of estates by applying anticipated principles of inheritance. Were allegations of bastardy to be entertained, ultimate disposition of an estate would be subject to an element of uncertainty both during and after the lifetime of the decedent. Accordingly, even a factually correct allegation of bastardy was to be dismissed as a matter of law. Suppression of evidence of bastardy made it far less likely for the allegation to be made in a public forum and thus nipped social and legal problems at their point of inception.

The Jewish law principle is based on a general empirical presumption rather than upon policy considerations. The halakhic principle is the majoritarian rule of *rov*. That general rule is employed to determine questions of status. Given the existence of two distinct sets, a major set and a minor set, when doubt arises with regard to the status of a particular person or entity, the person or entity whose status is in doubt is assigned to the major set. Thus, for example, although some animals are *treifot*, the majority of all animals are not *treifot*. Consequently, if a question

arises with regard to the status of a particular animal, the animal is presumed to belong to the major set of animals that are not *treifot*.

A child of a married woman sired by a man other than her husband is a *mamzer*. Status of a *mamzer* is dependent upon determination of identity of the participants in the conjugal act leading to conception. Based upon opportunity of access, the husband is in a position to engage in conjugal acts more frequently than a paramour. Since the husband's acts are presumed to be more frequent and regular than those of other sexual partners, conception of the child is deemed to have resulted from one of the major set of conjugal acts.[25] Accordingly, the husband is halakhically regarded as the father of any child born to his wife. That, however, is only a *prima facie* assumption, subject to rebuttal.

A countervailing consideration is the biblical principle of *yakkir* that arises from Deuteronomy 21:17, "…rather, he shall recognize the firstborn to give him a double portion…."[26] At the very minimum, that halakhic rule accords the husband authority to disclaim paternity of a child otherwise presumed to be his by declaring a younger child to be the firstborn and thereby establishing the status of the older child as a *mamzer*. Thus, the effective rule is presumption of a paternal-filial relationship with regard to progeny born to a lawfully wedded wife unless disclaimed by the putative father. Neither the principle of *rov* nor the rule of *yakkir* pertain in the case of a child born to an unwed mother.

[25] The talmudic formulation is "*Rov be'ilot aḥar ha-ba'al* -- the majority of conjugal acts – stem from the husband" (*Sotah* 27a). R. Pinchas ha-Levi Horowitz, *Panim Yafot*, *Parashat Aḥarei Mot*, s.v. *ervat aḥotekha*, observes that since we find no statement in early-day compendia limiting the rule to demonstrable frequency of access, the rule seems to apply even if the couple were known to have secluded themselves only once. *Panim Yafot* interprets the *rov*, not as a reference to frequency of access, and hence frequency of intercourse, but a somewhat different notion to the effect that the majority of sexually active women are impregnated by their husbands. In effect, *Panim Yafot* interprets "*rov be'ilot*" as "*rov be'ulot*."

[26] For a discussion of the nature of the father's credibility see R. Joseph Rosen, *Ẓofnat Pa'aneaḥ*, *Hilkhot Issurei Bi'ah* 15:12 and R. Naftali Trop, *Ḥiddushei ha-Granat*, *Ketubot*, no. 37; *Bet Shmu'el*, *Even ha-Ezer* 6:26 and 7:15; *Shev Shemateta*, *Shemata* 2, chap. 20; and *Avnei Miluim* 6:5 maintain that the rule of *yakkir* applies even if the husband has no personal knowledge but relies upon his wife's account. The Jerusalem *bet din*, *Piskei Din*: *Dinei Mamonot u-Birurei Yuḥasin*, VIII, 382, expressed doubt with regard to whether such credibility extends to a husband whose knowledge is based upon DNA analysis. *Bet Me'ir*, *Even ha-Ezer* 6:13; *Teshuvot Bet Shlomoh, Even ha-Ezer*, no. 74; *Teshuvot Ḥavaẓelet ha-Sharon*, no. 20; and R. Eleazar Menachem Shach, *Avi Ezri*, *Hilkhot Yibum* 3:4; disagree with the fundamental position and rule that the husband's credibility is limited to allegations based upon his own knowledge.

Many authorities significantly limit the ambit of *yakkir*:

1. *Ba'al Halakhot Gedolot* limits the credibility of the father to the circumstances explicitly spelled out in Deuteronomy 22:15-17, i.e., the father does not directly deny paternity but recognizes a younger son as his firstborn thereby implicitly denying that the older child is his.
2. *Ri'az*, following *Sefer ha-Makhri'a*, no. 64, cited by *Shiltei Gibborim*, *Kiddushin* 78b, limits the credibility of the father to situations in which the father acknowledges paternity but asserts that the child is a *mamzer* for reasons other than having been born of an adulterous relationship, e.g., the issue of a consanguineous union. This is also the position of *Yam shel Shlomoh*, *Kiddushin*, 4:15.[27]
3. *Tosafot Rid* maintains that the husband's assertion is given credence only if it is not contradicted by his wife.
4. Many authorities maintain that the husband's credibility is limited to an allegation that his wife was forcibly raped but that he has no credibility to claim the child is the issue of consensual adultery. In the latter case, his declaration is regarded by those authorities as suspect. Since a willful adulteress may not consort with her husband, the husband's statement is suspect because he may be motivated by a desire for divorce.[28]
5. *Teshuvot Shivat Ẓion*, no. 6, asserts that Rambam maintains that the father's credibility is limited to an assertion regarding a fetus but that he lacks credibility once the child has been born and has acquired a *ḥezkat kashrut*, i.e., an attendant presumption of legitimacy. R. Akiva Eger, *Ḥoshen Mishpat* 277:7 and *Teshuvot R. Akiva Eger*, no. 128 as well as *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, 1, no. 26, express an opposing view to the effect that the father has no credibility with regard to a fetus.
6. *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, I, no. 13, observes that the strength of the father's testimony cannot be stronger than the testimony of eyewitnesses. Thus, since witnesses must testify solely on

[27] Citing this controversy the Jerusalem *bet din* ruled that the usual situation in which a husband disclaims paternity creates a situation of halakhic doubt with the result that the child is a *safek mamzer*. See *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yahadut*, IV, 324.

[28] See *Tevushot Ḥavazelet ha-Sharon*, *Even ha-Ezer*, no. 10; *Teshuvot Mishkan Aryeh Kiryat Arba*, no. 17; *Teshuvot Maharsham*, IV, no. 26; *Teshuvot Imrei Yosher*, II, no. 114; and *Piskei Din Rabbaniyim*, V, 104. Cf., the contradictory opinion of *Avi Ezri*, *Hilkhot Naḥalot* 14:6.

the basis of actual knowledge, but not on the basis of conjecture or circumstantial evidence, the father must similarly testify on the basis of knowledge rather than on the basis of an unsubstantiated surmise or circumstantial evidence.

7. Similarly, asserting that the father's credibility can be no greater than the credibility of two witnesses, *Ḥatam Sofer*, *Even ha-Ezer*, I, no. 76, s.v *u-bar min dein*, followed by *Teshuvot Binyan Olam*, no. 6, sec. 11, maintains that the father has no credibility in situations in which it is in the father's self-interest to deny paternity. That view is contradicted by *Tashbaẓ*, II, no. 90, and *Teshuvot Rivash*, no. 41, who extend that credibility to the father even when his assertion is in the context of a denial of an obligation of child support.[29]
8. *Tosafot R. Akiva Eger*, *Yevamot* 2:26, expresses doubt with regard to whether the rule of *yakkir* extends to transgressors who are disqualified from offering testimony as witnesses.[30]
9. Apart from the question of *mamzerut*, *Keẓot ha-Ḥoshen* 277:2, cites *Tosafot* and Rashbam who limit the father's credibility to situations in which the child is already presumed to be his son. This is also the position of *Tashbaẓ*, II, no. 19. Even though Ramban and Rosh disagree as does *Teshuvot Rivash*, no. 41, *Keẓot* rules in accordance with *Tosafot* and Rashbam.

[29] It is likely that the issue is contingent upon the rationale underlying disqualification of an interested party. The disqualification of an interested party is predicated upon either 1) being regarded as a quasi-litigant who is disqualified, not because of lack of credibility, but because a person is his own closest relative or 2) his truthfulness is suspect. If a self-interested party is regarded as a quasi-litigant, the father, who is accorded credibility even though he is a "relative," should have credibility even in cases of self-interest; if an interested party is disqualified because of lack of credibility (unlike a relative who is disqualified simply on statutory grounds), it should follow that a father who has a personal interest should be disqualified. See *Piskei Din Rabbaniyim*, V, 349.

[30] *Keẓot ha- Ḥoshen* 46:13 maintains that a person disqualified because of a transgression of religious law is not disqualified because of lack of probity but because of statutory disqualification rooted in the passage "You shall not put your hand with a wicked man to be a false witness" (Exodus 23:1). If so, the father would have credibility even if he is a transgressor. However, *Netivot ha-Mishpat*, 46:17, asserts that all transgressors are suspected of a predilection for offering false testimony. According to *Netivot*, a father who is a transgressor would not have the credibility of *yakkir*. Consequently, a father found to have been a transgressor with regard to financial matters who is disqualified for reason of lack of credibility would be disqualified according to all authorities.

B. Incompatible Blood Types and HLAs

1. Blood Test Evidence

Blood typing can serve to disprove paternity by applying principles of Mendelian genetics. Human beings are endowed with three basic blood types, A, B, and O, each of which indicates the presence of a different antigen on the surface of red blood cells. Every person inherits two alleles, one from each parent, that become encoded on a single chromosome. The A allele and the B allele are codominant whereas the O allele is recessive. A person whose blood type is O must inherit two O alleles, otherwise the A or B allele would be dominant. A person whose blood type is A may have either two A alleles or one A allele and one O allele. In the latter case, the O allele is not expressed since the A allele is dominant. Similarly, if a person has type B blood he has either two B alleles or one B allele and one O allele. Since A and B alleles are codominant, a person may have type AB blood as a result of inheriting an A allele from one parent and a B from the other parent.

It is thus readily evident that a male whose blood type is AB could not be the father of a child with type O blood since all of his children would inherit either an A or a B allele from him. Even if the child inherited an O allele from the mother the child could not have type O blood because A and B are dominant. Identification of inherited blood antigens such as the Rh factor makes it possible further to exclude the possibility of paternity on the basis of applicable Mendelian principles.

Introduction in the 1970s of testing for human leukocyte antigens, or HLAs, added a further distinguishing factor that makes it possible to exclude with 80% effectiveness individual men as the father of a specific child. The genes responsible for HLA are responsible for antigen presentation to T cells. The HLA system is highly polymorphic, with well over 3,000 different alleles having been identified thus far. Analysis of HLA alleles is essentially a form of DNA testing and carries with it a remarkably high statistical probability. Unlike evidence based upon comparison of blood types, HLA testing can be used both to confirm and to disprove paternity.[31] The halakhic perspective regarding DNA evidence will be discussed in a later section.

[31] James Robinson *et al.*, "IMGT/HLA and IMGT/MHC: Sequence Databases for the Study of Major Histocompatibility Complex," *Nucleic Acids Research*, vol. 31, no. 1 (January, 2003), pp. 311-314 and T.M. Williams, "Human Leukocyte Antigen Gene Polymorphism and the Histocompatibility Laboratory," *Journal of Molecular Diagnosis*, vol. 3, no. 3 (August, 2001), pp. 98-104.

The earliest reference in rabbinic sources to recognition of scientific, or pseudoscientific, blood test evidence is found in *Sefer Ḥasidim* (Jerusalem, 5717), no. 232, in the report of an anecdote involving R. Sa'adia Ga'on. Leaving his pregnant wife at home, a person of significant means is reported to have journeyed to a distant land together with his servant. With the passage of time the master died leaving an extensive estate. The slave seized the master's estate claiming, "I am his son." A son born in the interim appeared and asserted that he was the rightful heir. The king charged R. Sa'adia with adjudicating the dispute. R Sa'adia directed each of the litigants to let blood into separate bowls. R. Sa'adia took a bone from the deceased and placed it in the slave's bowl of blood. The bone failed to absorb blood. R. Sa'adia then took the same bone and placed it in the son's bowl where it did absorb blood. Thereupon, R. Sa'adia awarded the estate to the son whose blood was absorbed by the father's bone.[32]

The modern day parallel would be blood typing. Blood typing cannot establish a paternal relationship but incompatible blood types do conclusively establish the absence of a paternal relationship. Acceptance of evidence in the form of incompatible blood types in order to avoid the husband's obligation of child support has long been a subject of controversy.

The reported decision of R. Sa'adia Ga'on is widely cited as precedent for relying upon incompatibility of blood types. Nevertheless, the anecdote should not be regarded as either precedent or paradigm.[33] R. Sa'adia was not sitting as a judge in a rabbinic court. He was delegated by a non-Jewish monarch to employ his sagacity in adjudicating a controversy in an *ultra vires* manner, perhaps even with the consent of the litigants. *Eliyahu Rabbah*, *Or ha-Ḥayyim* 568:15, points to a comparable incident recorded in *Bava Batra* 58a reporting that a certain individual directed that his estate be given to one of his ten sons but did not specify which son. His wife declared that her husband was the biological father of only one of her sons, whom she identified. R. Bena'ah directed each of the claimants to strike the father's grave until the father would appear and reveal which of them is actually his son.

One of the sons refused to participate in that indecorous procedure and declined to ignominiously strike his father's grave. R. Bena'ah

[32] See *Teshuvot ha-Rosh, klal 78,* chap. 3. See also *Teshuvot ha-Rosh, klal 68,* chap. 23 and R. Simon ben Ẓemaḥ Duran, *Tashbaẓ*, I, no. 80.

[33] R. Eliezer Waldenberg, *Ẓiẓ Eli'ezer,* XIII, no. 104, sec. 3, comments that R. Sa'adia's test cannot be employed in our day for two reasons: 1) it is not mentioned in the Gemara or in any halakhic work; and 2) we have no knowledge of the manner in which the test was carried out.

declared that son to be the sole heir and awarded him the entire estate.[34] *Eliyahu Rabbah* queries, if R. Sa'adia's test is available, why did R. Bena'ah not employ it to resolve the issue?[35]

2. Blood Type Evidence in Decisions of Batei Din

Acceptance of incompatibility of blood types as a means of disproving paternity and of DNA evidence for confirming or disproving paternity rest to a large extent upon common issues. Primary sources are a number of decrees of Rabbinical District Courts in Israel. The earlier cases include a discussion of the Haifa *bet din* authored by Rabbi Yisra'el Dov Rosenthal, dated 24 Ḥeshvan 5717, *Piskei Din Rabbaniyim*, II, 112-124 and a decision of the Tel Aviv *bet din* authored by Rabbi M. Schlesinger, dated 3 Av 5725, *Piskei Din Rabbaniyim*, V, 342-352. Both decisions address negation of paternity on the basis of incompatibility of blood types. DNA evidence is discussed in a decision of the *bet din* of Ashdod issued some twenty years later, on 19 Sivan 5742, authored by R. Shlomoh Deichovsky, *Batei Din Rabbaniyim*, XIII, 51-68, and reprinted in *Sefer Assia*, V, 163-178.[36] Subsequent opinions by R. David Levanon and R. Yigal Levor appear in *Shurat ha-Din*, V, 70-94 and *Shurat ha-Din*, IX, 44-93 respectively. The issue is also addressed in a number of decisions of the Jerusalem *bet in*, *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yahadut*, and published in its collected decisions, vol. II, 259-268; III, 323-325; IV, 319-323; V, 187-195 and 241-250; VI ,193-197, 217-228 and 245-249; and VIII, 379-383.[37]

[34] See Rashba, *ad locum*, who comments that, in the context presented, a *bet din* would have had total discretion in assigning the estate because none of the parties was in possession of the estate.

[35] Cf., *Reshash, ad locum*. In response it may be argued that R. Bena'ah did not have the halakhic option of disinterring the body for a postmortem analysis to support a claim of an heir. See *Bava Batra* 154a. Cf., Rabbi Menasheh Klein, *Mishneh Halakhot,* IV, no. 164.

[36] Additional unpublished decisions of the *Batei Din Rabbaniyim* include: Rabbinical District Court of Netanya, No. 29336/2, 20 Sivan 5771; Rabbinical District Court of Petach Tikvah, No. 870160/1, 28 Iyar 5772; Rabbinical District Court of Haifa, No. 954915-1, 20 Kislev 5773; Rabbinical District Court of Haifa, No. 569557/8, 12 Adar 5775; Rabbinical District Court of Haifa, No. 565897/3, 25 Kislev 5777; Rabbinical Supreme Court of Appeals, No. 1060062/1, 29 Tevet 5779.

[37] R. Shlomoh Aviner presents a valuable prècis of the various halakhic positions in conjunction with a discussion of whether one is required to disclose negative results of a paternity test. Overviews of the topic, both from the scientific and halakhic vantage points, are presented by Prof. Dov Frimer, *Shenaton ha-Mishpat ha-Ivri*, V (5738), 219-242 and Assia, No. 35, vol. 9, no. 3 (Shevat 5743), reprinted in *Sefer Assia*, V (5746), 185-209 as well as by Rabbi Mordecai Halpern *et al.*, *Teḥumin*, IV (5743),

The first authority to address the issue of halakhic reliability of blood tests was R. Ben-Zion Uziel. *Sha'arei Uzi'el*, II, *sha'ar* 40, 1:18, who dismisses the reliability of blood tests showing incompatibility between father and son in the context of litigation involving child support.[38] Rabbi Uziel and R. Ovadiah Yosef, *Yabi'a Omer*, *Even ha-Ezer*, no. 18, rely upon a variant reading of *Niddah* 31a that declares:

> There are three parties in [the conception of] man: the Holy One, blessed be He, the father and the mother. The father provides the white which develops bones, tendons, nails and the brain in its head, the mother the red which develops skin, hair, and the black [iris] of the eye and the Holy One, blessed be He, bestows the spirit, the soul upon him.

She'iltot de-Rav Aḥai Ga'on, *Parashat Yitro*, *She'ilta* 56 includes blood among the contributions of the mother[39] as does R. Elijah of Vilna in a gloss on *Niddah* 31a and in his *Bi'ur ha-Gra*, *Yoreh De'ah* 263:4. That declaration of the Sages apparently contradicts the scientific assumption that at least some portion of the blood can be traced to the father.[40]

Ostensibly, the halakhic applicability of that statement is the subject of controversy between *Shulḥan Arukh* and Rema, *Yoreh De'ah* 263:2. Death of two brothers subsequent to circumcision is presumptive evidence of hemophilia and since hemophilia is hereditary in nature those deaths preclude the circumcision of a third child who may be similarly afflicted. *Shulḥan Arukh* adds a clause indicating that the rule applies even if children are born to different mothers. Rema comments that some

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431-450, reprinted in *Torah u-Madda*, X (Sivan 5744), 6-27. An English version of Professor Frimer's article, "Establishing Paternity by Means of Blood Type Testing in Jewish Law and Israeli Legislation," *ASSIA – Jewish Medical Ethics*, vol. I, no. 2 (May, 1989), pp. 20-35.

[38] *Sha'arei Uzi'el* is cited and relied upon in the decision published in *Piskei Din Rabbaniyim*, II, 123.

[39] See also *Tosafot*, *Zevaḥim* 69b, s.v. *kal va-ḥomer*.

[40] See *Piskei Din Rabbaniyim*, II, 124; Jerusalem *bet din*, *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yahadut*, VI, 195; *Teshuvot Dvar Yehoshu'a*, II, no. 13 and III, *Even ha-Ezer*, no. 5, secs. 2-4; *Mishneh Halakhot*, IV, no. 164; *Teshuvot Ẓiẓ Eli'ezer*, III, no. 104 and XIII, no. 104; R. Ovadiah Yosef, *Yabi'a Omer*, *Even ha-Ezer*, no. 13; and R. Israel Veltz, *Teshuvot Divrei Yisra'el*, *Even ha-Ezer*, no. 8. However, R. Shlomoh Zalman Auerbach is cited by Dr. Abraham S. Abraham, *Lev Avraham*, II, 17, and *idem*, *Nishmat Avraham*, III (Jerusalem, 5738), *Even ha-Ezer* 4:13, sec. 1, as dismissing that conclusion. R. Aurerbach apparently regarded that statement as aggadic in nature and apparently also regarded the statement as limited to blood plasma but not necessarily inclusive of cells responsible for blood types. See also *Kovez Torah u-Madda*, X, no. 744, and *Shenaton ha-Mishpat ha-Ivri*, V, 219 and *Sefer Assia*, V, 195.

authorities disagree and limit the rule to the death of maternal siblings. *Taz*, *Yoreh De'ah* 263:1, and *Bi'ur ha-Gra*, *Yoreh De'ah* 263:4, explain that the controversy is rooted in the halakhic applicability of the statement in *Niddah* indicating that the blood of a child is derived from the father.[41] The authors of several decisions of Israeli rabbinical courts regard halakhic reliability of scientific evidence to be the subject of controversy between Rambam, *Guide of the Perplexed*, Part II, chap. 13, followed by R. Shimon ben Zemaḥ Duran, *Teshuvot Tashbaẓ*, I, nos. 163-165, and R. Isaac ben Sheshet, *Teshuvot Rivash*, no. 447.[42] Rambam writes, "for the science of mathematics was deficient in their time; they did not speak with regard to mathematics on the basis of a tradition received from the prophets regarding such matters. Rather, [they spoke of such matters] because they were the wise men of those generations or on the basis of what they heard from the wise men of those generations."[43] Rivash, however, declares that scientists cannot be relied upon when they contradict the Sages of the Talmud.[44]

In point of fact, there is no clear evidence that such a controversy exists. Rivash, addressing pronouncements that are clearly halakhic in nature but which seem to be contradicted by scientific knowledge, firmly asserts that halakhic directives are not subject to change on the basis of scientific findings. Rambam clearly addresses matters of pure science exclusively in stating that the Sages had no *masorah* with regard to science. They clearly had a *masorah* with regard to Halakhah. Rambam does not at all address apparent conflicts between Halakhah and science.[45]

Rivash states, "We rely upon our Sages of blessed memory…for they received the truth and elucidation of the commandments one from the mouth of another back to Moses our teacher, peace be upon him." Rivash

[41] See R. Moshe Sofer, *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, I, no. 136, who suggests a different basis for the ruling of *Shulḥan Arukh*.

[42] See *Piskei Din Rabbaniyim*, II, 193; V, and XII, 57. See also *Teshuvot ha-Rashba*, 1, no. 98 and *Teshuvot Rashbash*, no. 513.

[43] See also R. Menachem Kasher, *Torah Shelemah, Bereshit* 1:21, secs. 150-151; R. Abraham Price, *Mishnat Avraham*, *Sefer Ḥasidim*, I, no. 291; *Mishmeret Ḥayyim*, no. 37; R. Ephraim Fishel Weinberger, *Yad Efrayim*, no. 7, See *Yad Efrayim*, no. 7, sec. 8, who unconvincingly endeavors to show that there is a talmudic dispute with regard to this point.

[44] See also R. Joseph Karo, *Teshuvot Avkat Rokhel*, no. 210; R. Joseph Rosen, *Mefa'aneaḥ Ẓefunot*, *ma'amar* 7, chap. 7:2; R. Abraham I. Kook, *Da'at Kohen*, nos. 79, 94, and 140-142; *idem*, *Ezrat Kohen*, no. 104; *Teshuvot Mishneh Halakhot*, V, no. 214; as well as sources cited in *Sefer Assia*, V, 193, note 55.

[45] See J. David Bleich, "Scientific Hypotheses and Halakhic Inerrancy," *Contemporary Halakhic Problems*, VII (Jerusalem, 2016), 73-100. Cf., Rabbi Moshe Meiselman's book-length study of this issue, *Torah, Chazal and Science* (Jerusalem, 2013).

further criticizes the Greek and Muslim scholars "who spoke only on the basis of their conjecture or on the basis of some experiment without paying attention to the many doubts that may arise from that experiment."

Rivash does add a further comment to the effect that the scholars of antiquity disagreed with the Sages regarding many matters surrounding "the mystery of the creation." Rivash includes among them the statement of *Niddah* concerning the respective contribution of each parent whereas the scholars of antiquity maintained that material cause of the fetus comes from the mother while the function "of the seed of the father is to transform the seed of the wife," as is the function of rennet to milk. Rivash, however, stops short of asserting that non-halakhic statements of that nature are part of that received *masorah*.[46]

The statement of the Gemara, *Niddah* 31a, to the effect that blood is contributed to the fetus by the mother, was first adduced in conjunction with blood typing by R. Ben-Zion Uziel, *Sha'arei Uzi'el*, chap.1, sec. 18. Rabbi Uziel peremptorily dismisses the evidentiary value of blood tests in establishing paternity as being contradictory to the teaching of the Sages. Rabbi Uziel's opinion is cited in an early case brought before the Rabbinical District Court of Haifa.[47] The purpose of the proceedings in that case is somewhat unclear. The case involved three petitioners: a married couple and a third person who claimed to be the father of the child born to the wife during her marriage. Both husband and wife requested a divorce. Both the wife and the third party claimed that the latter was the child's biological father. All three joined in a petition for a declaratory judgment confirming their claim that the third party was the biological father of the child. The husband had no reason to presume that he was not the father of the child, but claimed to rely upon his wife's narrative. There seems to have been no dispute between the parties. The third party certainly recognized that if his claim to paternity were to be recognized

[46] See *Teḥumin*, IV, 433. Many latter-day authorities state that scientists have credibility with regard to general scientific findings. See *Teshuvot Ḥatam Sofer*, *Yoreh De'ah*, nos. 158 and 175; *Pitḥei Teshuvah*, *Yoreh De'ah*, 187:30 as well as sources cited by R. Yitzchak Ya'akov Weisz, *Teshuvot Minḥat Yiẓḥak*, I, no. 125, sec. 6 and no. 127, sec. 2 as well as by *Sedei Ḥemed*, *ma'arekhet tet*, *klal* 5.

[47] This rejection of scientific evidence is also endorsed by R. Ovadiah Yosef in a decision of the Supreme Rabbinical Court of Appeals, dated 19 Tevet 5747 and published in Rabbi Yosef's *Teshuvot Yabi'a Omer*, X, *Even ha-Ezer*, no. 13. See also the letter of Rabbi Ovadiah Yosef published in *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yahadut*, V, 194 and *Sefer Zikaron le-ha-Ga'on Rav Shiloh Refael* (Jerusalem, 5758), p. 496. *Ẓiẓ Eli'ezer*, XIII, no. 104, similarly declares that results of "scientific tests" are not to be accepted when they contradict "the trusted tradition of the Sages." See also R. Abraham Akiva Rodner, *No'am*, IV (5761), 59.

he could be held liable for child support. The husband does not appear to have demanded custody or to have expressed a desire to avoid child support. Of course, the implication of their common position was that the child is a *mamzer*.[48] There is no indication of why the parties petitioned for a declaratory judgment determining paternity of the child. Of course, an issue did exist with regard to amending the child's birth certificate to register proper paternal identity. That issue, however, is not mentioned nor is it at all clear that the *bet din's* finding would cause the Ministry of Health to amend the birth certificate.

The Haifa *bet din* did not find the scientific foundation of blood typing to be contradicted by the Gemara. Astonishingly, citing *Tur Shulḥan Arukh*, *Even ha-Ezer* 136, the *bet din* suggested that the hematological disorder responsible for fatality as a result of circumcision might be the result of improper conjugation of the blood caused by "weakness of the blood vessels."[49] Furthermore, they opined that the Gemara's statement is limited to blood plasma but does not necessarily extend to cells or genes that may well be contributed by the father.[50] Nevertheless, the primary finding of the *bet din* was that legal ramifications of paternity cannot be adjudicated "on the basis of scientific principles that change from period to period."[51]

Other authorities adopted a diametrically opposite position. In a letter reproduced in *Assia*, V, 196-197, dated 2 Sivan 5714, R. Isaac ha-Levi Herzog declares in quite forceful language that science has conclusively established the reliability of blood test evidence and that it should be accepted as dispositive by rabbinical courts. R. Chaim David Regensberg, *Mishmeret Ḥayyim*, no. 37, accepts blood test results as incontrovertible proof that the husband could not be the father of the child whose paternity is in dispute.[52] R. Abraham Price, *Sefer Ḥasidim*, I, *Mishnat Avraham*, no. 232, similarly regards hematological evidence as conclusive.[53]

[48] That, however, need not necessarily be the case. The wife's paramour may have been a non-Jew; if so, the child would not be a *mamzer*. See *Even ha-Ezer* 4:29 and *infra*, note 56.

[49] See also *Piskei Din Rabbaniyim*, V, 350-352. Cf., *Sefer Assia*, V, 194.

[50] *Nishmat Avraham*, III, *Even ha-Ezer* 4:13, sec. 1, observes that the Gemara may be referring to red blood cells whereas HLA testing includes white blood cells which may not be part of the "red" material contributed by the mother.

[51] The Haifa *bet din* rejected a claim of denial of paternity on the basis of the principle of *yakkir* because it was based upon unsubstantiated conjecture and conclusions rather than upon actual knowledge. See *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, I, no. 13.

[52] See *supra*, note 25.

[53] R. Shlomoh Zalman Auerbach is cited in Dr. Abraham S. Abraham, *Nishmat Avraham*, III, *Even ha-Ezer* 4:35, sec. 6, as having stated:

R. Ovadiah Hedaya, *Yaskil Avdi*, V, *Even ha-Ezer*, no. 13, cites an earlier unpublished decision of the Rabbinical Supreme Court of Appeals, dated 5 Iyar 5714, directing the parties to undergo blood tests. The *bet din* indicated that if the tests conclusively established an absence of paternity it would exempt the husband from child support.[54]

Later, a more nuanced position was espoused by the Rabbinical District Court of Tel Aviv, *Piskei Din Rabbaniyim*, V, 350-351, in an opinion dated 3 Av 5572. That case involved a husband's contention that he should not be held liable for child support on the grounds that he was not the child's father. The Tel Aviv *bet din* failed to find that science has conclusively established that a child can acquire a blood type solely by inheriting it from a parent. The *bet din* regarded any presumption to that effect to be a statistical probability based solely upon the fact that no one has ever been found to possess a blood type different from both parents. As such, all that can be concluded is that in the majority of cases such a phenomenon does not occur. Ordinarily, a *rov*, i.e., a majority of that nature would be dispositive. However, presumption of paternity is also based on a *rov*, *viz.*, so long as a husband has access, the majority of the wife's conjugal acts are with her husband as partner. As indicated, a disclaimer of paternity on the basis of incompatible blood types is supported only by application of the principle of *rov*. But, when the child is born to a married woman there exists a contradictory *rov* that serves to identify the husband as the father. In effect, the two principles of *rov* cancel one another. In a petition for child support, the burden of proof is on the plaintiff. If the results of a blood test are not regarded as disproving paternity with certainty, those results can serve only as countervailing evidence against the presumption of the husband's paternity. But, since child support can be demanded of the husband only if the plaintiff's burden of

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> However if this test is [or becomes?] widely known and accepted in the entire world as true and certain on the basis of many clear-cut experiments, it is logical that it may be relied upon also for purposes of Halakhah.

Particularly in light of Rabbi Auerbach's earlier announced view that such evidence cannot be accepted with certainty, as cited by *Nishmat Avraham*, *Even ha-Ezer* 4:13, sec. 1, and *Sefer Assia*, V, 195, note 61, it is not clear to this writer that those criteria have been met. See *infra*, note 57. Cf., R. Mordecai Halpern, *Assia*, No. 67-68, vol. 17, no. 3-4 (Shevat 5761), p. 101.

[54] There is nothing in Rabbi Hedaya's discussion indicating that the blood test findings would be recognized by the *bet din* as conclusive proof. As recognized by the Tel Aviv *bet din*, blood type incompatibility may establish only doubt with regard to paternity in order to counter a claim for child support. Cf., *Sefer Assia*, V, 197 and R. Shlomoh Aviner, *Assia*, No. 67-68, vol. 17, no. 3-4, p. 100. For a discussion regarding whether the husband can compel testing of the child see *infra*, section V.

proof is substantiated with certainty, there can be no such award in the face of blood types shown to be incompatible.

In a matter not involving child support, the Jerusalem *bet din*, *Piskei Din le-Birur Yahadut*, IV, 324, cited a gloss of R. Akiva Eger, *Yevamot* 4:20, sec. 46, ruling that in a matter involving conflicting *rov*s a *ḥazakah* in the form of behavior and comportment is decisive. Accordingly, in cases in which the child has been publicly regarded as the issue of a married couple, the child is not to be considered a *safek mamzer*. R. Elchanan Wasserman, *Kovez Shi'urim, Bava Batra*, sec. 82, demonstrates that the question of whether *ḥazakah* is dispositive in a case of contradicting *rov*s is a controversy among early-day authorities. In light of the controversy a *bet din* could not hold the father liable for child support even in such circumstances.

A finding that the *rov* established by the presence of incompatible blood types is contradicted by an antithetical *rov* in the form of *rov be'ilot* would have been sufficient to nonsuit a plaintiff claiming child support on the grounds that the question of paternity remains unsettled. The Tel Aviv *bet din*, however, found additional grounds auguring against the father's denial of paternity. *Tosafot*, *Ḥullin* 11b, s.v. *kegon*, points to the fact that the mother enjoys a *ḥezkat ẓadeket*, i.e., a presumption that she is a "righteous" woman who would not engage in an adulterous act. In light of the presence of contradictory expressions of *rov*, neither *rov* is dispositive. The *bet din* concluded that the mother's *ḥezkat ẓadeket* should govern and lead to a conclusion confirming the husband's paternity. The *bet din* added what it regarded to be a somewhat novel finding to the effect that, in a situation in which the mother's comportment has compromised her *ḥezkat ẓadeket*, incompatibility of blood types would render the child a doubtful *mamzer*.

However, the Tel Aviv *bet din* was not at all sanguine with regard to application of the mother's *ḥezkat ẓadeket* as the deciding criterion. *Maharsha*, *Ḥullin* 11b, comments that later in its discussion the Gemara establishes that the possibility of forcible rape can never be excluded. If so, the mother's *ḥezkat ẓadeket* cannot lead to exclusion of the possibility of a conception resulting from rape. Consequently, the mother's *ḥezkat ẓadeket* could not dispel doubt resulting from a conflict between a *rov* based upon incompatible blood types and the *rov* of *rov be'ilot*. The *bet din* seems to ignore its own parenthetical citation of *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, I, nos. 9 and 10, to the effect that the possibility of rape need not be considered in the case of a married woman who is under the protection of her husband.

Despite the *bet din*'s conclusion regarding doubtful paternity, the *bet din*, while recognizing that child support cannot be awarded against the husband in instances of doubt, refused to issue a decision regarding the doubtful legitimacy of the child and stated that "because blood testing is a novel matter and has as yet not been clarified and is not found in [the writings of] decisors" the *bet din* would not make a final determination with regard to the child's legitimacy.[55] The clear implication is that if DNA evidence suffices to generate a doubt a *bet din* would be forced to declare the child to be a doubtful *mamzer*. As will be shown subsequently, some later scholars concluded that such a determination would be unwarranted.[56]

IV. DNA EVIDENCE

A. The Nature of DNA Evidence for Establishing Paternity

Putting aside the statement of the Gemara declaring that the mother is the source of the fetus' blood, a much stronger case could be made for acceptance of incompatibility of blood types as an absolute proof of non-paternity than can be made for acceptance of DNA evidence. The empirical evidence indicating that a child's blood type is inherited from one of its parents leads to formulation of a scientific hypothesis explaining why that must be the case. Since no disconfirming instance of a father and child having incompatible blood types has ever been detected, there is strong reason to accept the principle, not simply as a *rov*, but as an absolute rational principle establishing that such incompatibility can never exist. Thus, that hypothesis represents a scientifically demonstrated immutable law of nature that has predictive validity. In contradistinction, DNA evidence indicating that two DNA prints belong to the same person because no two individuals share identical DNA[57] is no more than an

[55] The Tel Aviv *bet din* declined to extend credibility to the father on the basis of *yakkir* because of the positions of *Ri'az*, *Ba'al Halakhot Gedolot*, *Tosafot Rid* and the authorities who maintain that self-interest in seeking to avoid child support disqualifies the father's testimony as cited *supra*, note 27 and accompanying text. The *bet din* also discussed the likelihood that the father might be a non-Jew, particularly in a city in which a majority of males are non-Jews, in which case the child is not a *mamzer*. See *Piskei Din Rabbaniyyim*, V, 248-289.

[56] See *infra*, section IV, C.

[57] Surprisingly, this is essentially correct even with regard to identical twins. Formerly, differences between identical twins could be discovered only on the basis of

empirical generalization from which no exception has been found but with regard to which science has not succeeded in formulating an explanation for why that must be so. Consequently, the absence of any two individuals possessing identical DNA must be regarded as a remarkable coincidence rather than the result of an immutable law of nature. Much as is the case with regard to fingerprints, there is no basis for declaring the strength of DNA evidence to be greater than that of a *rov*.

If one assumes that the statistical probability that two people have identical DNA prints is so remote that it may be ignored and that two such prints can be precisely matched, DNA analysis can effectively verify that the two prints have a single source. DNA evidence demonstrating a parental relationship – or any other familial relationship – is another matter entirely. Parents and children demonstratively do not have identical DNA prints. Although DNA analysis can be employed to establish parentage with an extremely high probability the underlying rationale is complex. The fundamental premise of the DNA verification of parentage paradigm is that all heritable information passed from parents to offspring is contained within a complex molecule called deoxyribonucleic acid. The DNA paradigm is made up of a set of concepts which describe the structure of DNA and the way in which it functions as a repository of genetic information.

The structure of DNA is similar to a long, twisted ladder. The sides of the ladder, which are composed of phosphate and sugar molecules, are linked by "rungs" consisting of pairs of molecules called "bases." The order of the four bases along the DNA ladder, known as the DNA

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cumbersome whole-genome sequencing which revealed differences in a very limited number of Single Nucleotide Polymorphisms (SNPs). See J. Weber-Lehmann *et al.*, "Finding the Needle in the Haystack: Differentiating Identical Twins in Paternity Testing and Forensics by Ultra-Deep Next Generation Sequencing," *Forensic Science International: Genetics*, vol. 9 (March 2014), pp. 42-46. Later a process was developed involving the study of DNA fragments modified with sodium bisulfite and subjected to methylation. The results show different DNA methylation patterns. See Jose Javier Marqueta-Gracia *et al.*, "Differentially Methylated CpG Regions Analyzed by PCR-High Resolution Melting for Monozygotic Twin Pair Discrimination," *Forensic Science International: Genetics*, vol. 37 (November 2018), pp. 1-9. More recent studies show that MicroRNAs (miRNAs) can be sued to discriminate between identical twins. MicroRNAs are non-coding RNA molecules that exist in a variety of eukaryotic cells that serve to regulate gene expression. See Chen Fang *et al.*, "MicroRNA Profile Analysis for Discrimination of Monozygotic Twins Using Massively Paralleled Sequencing and Real-Time PCR," *Forensic Science International: Genetics*, vol. 38 (January 2019), pp. 23-31 and Chao Xiao *et al.*, "Differences of MicroRNA Expression Profiles Between Monozygotic Twins' Blood Samples," *Forensic Science International: Genetics*, vol. 41 (July 2019), pp. 152-158.

sequence, constitutes a genetic code. This code carries the information required for producing the many proteins which make up the human body. Most sections of the DNA ladder vary little from one individual to another within a given species. Certain sections, however, are variable or polymorphic, meaning they may take different forms in different individuals. These polymorphic sections are the basis of DNA typing. A sequence of bases which is responsible for producing a particular protein is called a gene. Some genes are polymorphic, i.e., they have two or more different versions called alleles. For example, the genes responsible for producing proteins and antigens in the blood are polymorphic; consequently, they produce a number of distinct blood types in the human population.

The DNA ladder can be disassembled in various ways. The long chain of DNA molecules can be broken into shorter fragments. Also, the two sides of the DNA ladder can "unzip" into two single strands of DNA. A single, unzipped strand of DNA is attracted to other single strands. Two strands which can pair up together according to the base-pair rule are called "complementary strands." Such strands will gravitate toward each other and "zip" together to create a double-stranded molecule in a process called "hybridization."

The DNA molecule consists of two strands wrapped around one another forming a double helix. Within the backbone formed by this double helix are the small, molecular groups or bases that link one strand to the other. There are four such nucleotides, generally referred to by their initials A, T, G and C. The bases are paired according to the "base-pair rule." Due to electrical forces mutually attracting A to T and G to C, the A on one strand only pairs with T on the other and the G bonds only to C. A molecule of DNA is extremely long and may have millions of pairs of bases. The two complementary strands will gravitate toward each other and zip together to create a double-stranded molecule in a process called hybridization.

One writer has suggested that it may be helpful to think of the basis as four colors, azure, tangerine, green and cyan, strung on a necklace in a particular order. A molecule of DNA is like two necklaces wrapped together, with the azure bead from one always touching the tangerine on the other and a green bead always matched on a cyan. In order to obtain a second double necklace with beads in the same order as the original it is necessary always to pull the strands of the two necklaces apart and to give each strand to a separate craftsman. The two craftsmen can then take the two single stranded necklaces and fashion a new strand with complementary colored beads. The result will be two double stranded necklaces whose beads are in the same order as in the original duplex necklace.

Each cell divides into two cells in this fashion, reproducing the original chromosomes within a human. Humans have 23 pairs of chromosomes. At conception each parent contributes a single specialized cell that has only 23 chromosomes rather than the full complement of 23 pairs of chromosomes. At fertilization these two cells – the ovum and the sperm – combine to form a cell with the full complement of 46 chromosomes – one set of 23 contributed by the father and the other set of 23 contributed by the mother. This single cell divides to form two cells with equivalent sets of chromosomes.

DNA analysis involves examination and comparison of fragments of DNA within a chromosome. Bases within each chromosome are frequently arranged in a particular repetitive sequence. Each repeated sequence contains between eleven and sixty bases. The points of sequence of base pairs within a chromosome vary from individual to individual. Those polymorphisms are inherited. Since variations in the DNA at any given site are inherited, if a child possess a variation that the mother lacks, the variation must have been contributed by the father. If the husband lacks the variation he cannot be the father; if he possesses that variation he is a possible father. DNA testing involves examining DNA acquired from a mother, a child and the putative father. The DNA is sequenced, i.e., the order of all base pairs are determined.

It is relatively easy to disprove paternity on the basis of DNA analysis. A positive determination of paternity depends upon a sufficient number of sequences matching those of the father. Many people might share any particular sequence of base pairs but the greater the number of matches of sequenced base pairs the less likely it becomes that some individual shares each of those sequences. The statistical probability that some other man is the father becomes infinitesimally small.[58]

Moreover, there are a number of factors that may affect the results of DNA analyses, rendering them less than foolproof. One such factor is the possible occurrence of unequal crossing-over during spermatogonial or oogonial miosis. If this takes place close to, or at the site where, restriction enzyme cleavage would normally occur it will lead to the appearance of a banding pattern in the child's DNA profile different from that

[58] For comprehensive discussions of DNA testing in determining parentage see Harry D. Krause, "Scientific Evidence and the Ascertainment of Paternity," *Family Law Quarterly*, vol. 5, no. 2 (June, 1971), pp. 252-281; Thompson and Ford, "DNA Typing: Acceptance and Weight of the New Genetic Identification Tests," pp. 45-108; D. H. Kaye, "Presumptions, Probability and Paternity," *Jurimetrics*, vol. 30, no. 3 (Spring, 1990), pp. 323-349; and D. H. Kaye, "DNA Paternity Probabilities," *Family Law Quarterly*, vol. 24, no. 3 (Fall, 1990), pp. 279-304.

expected on the basis of analogy of parental DNA. The frequency of unequal crossing-over has been determined through surveys of families where parentage is not in dispute. Those studies show that an average of one offspring fragment in three hundred cannot be detected in either parent. This circumstance could lead to the erroneous conclusion that the biological parents are not related to the child.[59]

A second problem can arise from occurrence of mutation in gamete-forming cells if a mutation occurs in a restriction-enzyme cleavage site on a chromosome. It will result in a unique DNA fragment in an offspring's profile and thereby confuse parental determination.

A third factor that can produce an ambiguous situation is the formation of a zygote in uniparental disomy, i.e., both members of a particular numbered chromosome pair are derived from one parent. In the first such verified case, which did not involve disputed parentage, the child inherited two identical copies of chromosome seven from her mother. Both mutations and uniparental disomy have a relatively rare rate of occurrence. But the fact that they can and do occur bolsters the conclusion that DNA testing can only establish a *rov* with regard to parentage.[60]

B. DNA in the Decisions of *Batei Din*

If the position formulated by the Tel Aviv *bet din* to the effect that, as a matter of Halakhah, blood type evidence cannot disprove paternity with certainty but serves only to establish doubt, the same is certainly true with regard to DNA evidence as well. In both cases the observed phenomena lead to an empirical generalization in the nature of a *rov* but cannot result in absolute certainty. Although, generally, *rov* would be sufficient to resolve matters of paternity, in the case of a married woman it is contradicted by *rov be'ilot* with the result that the status of the child remains a matter of doubt. The countervailing argument that hematological evidence must be disregarded because the Sages declared that blood comes solely from the mother does not have a counterpart with regard to DNA. Accordingly, the many scholars who reject out of hand incompatible blood types as a factor in disproving paternity would have no reason to adopt a similar stance with regard to DNA evidence.

As shown earlier, *Tosafot* recognize circumstantial evidence as definitive when such evidence is based on deductive inference from established

[59] See A. J. Jeffreys, "Highly Variable Minisatellites and DNA Fingerprints," *Biochemical Society Transactions*, vol. 15, no. 3 (June, 1987), pp. 309-317.

[60] See Louis Levine and Lawrence Kobilinsky, "DNA Typing and Parentage," *BioScience*, vol. 39, no. 9 (October, 1989), pp. 588-589.

laws of nature. A law of nature is a hypothesis that serves to explain the causal nature and hence the regularity of occurrence of particular phenomena. At least at this juncture of scientific development, a scientific hypothesis explaining the presumption that no two people can have identical fingerprints is simply not available. As is the case with fingerprint evidence, DNA proof begins with the assumption that every person's genotype is unique. But unlike fingerprints, there is good reason to assume that uniqueness is not coincidental. Unlike fingerprints that, insofar as we know, are not influenced by genetic factors, each individual DNA genotype is inherited. Those genotypes are passed on randomly much as tossing a coin randomly results in a head or a tail.

DNA proof is not predicated upon the notion that two identical samples cannot possibly come from two different individuals but rather that the likelihood that such is the case is infinitesimally small. Statistical probability is invoked, not to show that no other person's DNA can match an identified person's, but to show the high degree of statistical improbability that two individuals share repeated multiple random occurrences of multiple DNA. The issue is acceptance of statistical improbability of a common source, an improbability whose nature is readily grasped.

If the position formulated by the Tel Aviv *bet din* to the effect that, as a matter of Halakhah, blood test evidence cannot disconfirm paternity with certainty but serves only to establish doubt is accepted, the same would be true with regard to DNA evidence as well. In both cases the observed phenomena lead to an empirical generalization in the nature of a *rov* but cannot result in absolute certainty. Although, generally, *rov* would be sufficient to resolve matters of paternity, in the case of a married woman the *rov* established by DNA evidence is contradicted by *rov be'ilot* with the result that the status of the child remains a matter of doubt. The countervailing argument that the Sages declared that blood comes solely from the mother and hence paternal-filial blood type incompatibility is of no halakhic consequence does not have a counterpart with regard to DNA. Accordingly, the many scholars who reject hematological evidence out of hand would have no reason to adopt a similar stance with regard to DNA evidence.

Were it possible to test for every single sequence present in every chromosome and a one hundred percent match was found, parental identity would be established on the basis of deductive inference predicated upon on the rational principles of genetics. Ostensibly, such proof would be in the nature of deductive inference accepted by *Tosafot*, *Shevuot* 34a. Nevertheless, there would still remain the highly unlikely possibility that there might be another male whose DNA profile is identical to that of the

putative father and that it is that individual who is, in fact, the biological father.[61] However, such a person would, in terms of genetics, be an identical biological twin. The possibility is not as far-fetched as it may seem. DNA analysis cannot exclude the existence of an actual identical twin who may have been separated at birth and whose existence is unknown.

Beginning with the *bet din* of Ashdod, *Piskei Din Rabbaniyim*, 13, 53-68, the decisions of the various *batei din* that address admissibility of DNA evidence regard such evidence only as establishing a *rov*[62] and recognize, as did the Tel Aviv *bet din* with regard to hematological evidence, that it is contradicted by *rov be'ilot*. If so, since one *rov* is contradicted by another *rov*, the result should be an unresolved doubt. The implications of establishing doubtful paternity are that a claim to child support must be denied but the status of the child, if born to a married woman, is that of a *safek mamzer*, or *mamzer* doubtful. However, the authors of those decisions advance a number of considerations in arguing that *rov be'ilot* should be discounted when contradicted by the *rov* inherent in DNA evidence. Those considerations would also serve to establish that the *rov* established by incompatibility of blood types should prevail against *rov be'ilot*.

1. DNA as Superior to Rov Be'ilot

a) The Affirmative View

The Jerusalem *Bet Din le-Birur Yahadut*, cites *Sha'arei Ẓion*, *Kiddushin*, no. 27, who maintains that some forms of *rov* are of sufficient weight to establish particular facts with halakhic certainty. If so, that type of *rov* might be compelling even in financial matters. That is so, not because of the unique nature of the *rov*, but because they are the *sine qua non* of halakhic institutions they support in the sense that they serve as antecedent premises making the declared halakhic rules feasible. For example, there could not be capital punishment for homicide unless the victim is determined not to be a *treifah*. Thus, there could be no punishment other than upon reliance of the attendant *rov* that the majority of people are not *treifot*.

[61] It is this writer's impression that it is this quality of DNA evidence that R. Shlomoh Zalman Auerbach envisioned in the statement attributed to him cited *supra*, note 54.

[62] See also R. Mordecai Eliyahu, *Ginekologiyah, Genetikah, Poriyut ve-Yeludim le-Or ha-Halakhah*, ed. Joel Catane (Jerusalem, 5760), II, 110 ff.

The biblical statute imposing capital punishment for the crime of homicide is possible only because the Torah mandates reliance upon that *rov*. In establishing culpability for murder, that *rov* has the halakhic effect of establishing the status of the victim with certainty. Similarly, the biblical provision of punishment for striking a father presumes halakhic recognition of a paternal relationship. Antecedent establishment of a paternal-filial relationship must be predicated upon *rov be'ilot*. If so, the biblical provision for punishment of a child who strikes his father has endowed that *rov* with certainty for halakhic purposes. Accordingly, maintains *Sha'arei Ẓion*, since the *rov* of *rov be'ilot* is endowed with certainty it acquires a privileged status and prevails over other forms of *rov*.[63]

In a later decision the *Bet Din le-Birur Yahadut*, VI, the *bet din* addressed the case of a man who claimed to be the father of a child conceived by a married woman. The putative father submitted DNA evidence supporting his allegation. Without providing a detailed analysis, the Jerusalem *bet din* invoked the principle of *rov be'ilot* in permitting the son to marry a woman of legitimate birth and reports that R. Ovadiah Yosef endorsed their decision.

Unlike the *batei din* of Tel Aviv and Ashdod that had earlier accepted scientific evidence as establishing only a *rov* rather than as being absolutely dispositive, Rabbi Levanon, in his discussion of child support, does not dwell upon the consideration that the evidentiary value of *rov* is canceled by an antagonistic *rov* based upon the husband's frequency of access, *viz.*, *rov be'ilot holkhim aḥar ha-ba'al*. Instead, he endeavors to show that the nature of the *rov* presented by DNA typing is either tantamount to the testimony of two witnesses or is of no value whatsoever at least insofar as financial claims are concerned, thereby avoiding a discussion of *rov be'ilot* in conjunction with that matter.

Rabbi Levanon's position is that, although DNA evidence can be regarded only as proof in the nature of *rov*, nevertheless, the statistical probability of identical DNA being present in unrelated people is so extremely remote that it constitutes a *mi'uta de-mi'uta* or a "minority of a minority," i.e., a miniscule minority. He further opines that a *rov* admitting of only infinitesimal exceptions is more complex than a conventional *rov* and since it constitutes a "super *rov*" it should be acceptable proof even in situations in which a conventional *rov* is not sufficient.

Nevertheless, Rabbi Levanon concedes that acceptance of a super *rov* for purposes of substantiating a financial claim is a matter of controversy

[63] Cf., *Teshuvot R. Akiva Eger*, no. 107. See also *Piskei Din Rabbaniyim*, III, 320 and VIII, 382.

among early-day authorities. The Gemara, *Gittin* 2b, declares that court scribes are presumed to be proficient in their knowledge of regulations pertaining to drafting a *get*. *Tosafot*, *loc. cit.*, s.v. *stam*, indicate that the exceptions are a *mi'uta de-mi'uta*.[64] *Pnei Yehoshu'a* infers that Rashi, *ad loc.*, disagrees and assumes that a super *rov* is no different from an ordinary *rov* and cannot be employed as satisfying a plaintiff's burden of proof in financial matters. Therefore, according to *Pnei Yehoshu'a*, Rashi found it necessary to interpret the Gemara as declaring that all scribes are proficient in the requisite regulations.

b) The Negative View

Rabbi Deichovsky advances a contradictory position in asserting that the *rov* established by DNA analysis is superior to *rov be'ilot*. Ramban, *Milḥamot ha-Shem*, *Kiddushin* 50b, distinguishes between a *rov* that is empirical in nature and a *rov* born of human conduct. The former reflects a natural state of affairs and is not subject to variation whereas the latter is dependent upon human action and is subject to an individual's determination to comport himself in accordance with the majority. Many authorities maintain that an empirical or natural *rov* prevails over a volitional *rov*.[65] If so, the empirical *rov* of DNA evidence would prevail over *rov be'ilot*.

There is, however, some evidence that *rov be'ilot* establishes a presumption greater than that established by other forms of *rov* for yet another reason. *Shulḥan Arukh*, *Even ha-Ezer* 4:14, rules that a child is not deemed to be a *mamzer* unless the husband lacked access to his wife for a full twelve months prior to the birth of the child. That is so despite the fact that the majority of women give birth upon culmination of nine months of gestation. In that situation as well, antagonistic principles of *rov* are present, *viz.*, *rov be'ilot* versus the majority of pregnancies that are no longer than nine months in duration. Ostensibly, the result should be that, if the husband lacked access for longer than the nine months of normal pregnancy, the child should have the status of a doubtful *mamzer*.

[64] However, the Gemara, *Ḥullin* 11b, argues that the principle of *rov* is derived from license to eat meat of an animal that has been properly slaughtered even though it is possible that the animal had a preexisting perforation of the esophagus. Failure to take that contingency into consideration shows that it is possible to rely upon a *rov*. The Gemara does not object that the possibility that the slaughterer's incision was superimposed upon an existing perforation is so slight that the presumption that there is no such perforation constitutes a super *rov* and hence we may deduce only that a super *rov* may be relied upon.

[65] See *Shev Shema'teta, shema'ta* 4, chap. 6

Since the child is regarded as being entirely without stigma, it must be the case that *rov be'ilot* prevails over other forms of *rov*. Why is that so?

The Gemara, *Ḥullin* 11a, seeks a scriptural basis substantiating the probative value of the principle of *rov*. The Gemara points to the various commandments involving a paternal relationship. Since there cannot be direct eyewitness testimony establishing such a relationship, the Gemara deduces that a paternal-filial relationship must be regarded as having been established on the basis of *rov be'ilot*.

R. Elijah of Vilna, *Bi'ur ha-Gra*, *Even ha-Ezer* 4:57, challenges the cogency of that inference. Might it not be the case that all commandments predicated upon establishment of paternal identity are limited to situations in which the paternal relationship is acknowledged by the father? As earlier noted, quite independent of the principle of *rov*, Halakhah recognizes a husband's prerogative to confirm or to disavow paternity. Granting the husband capacity to disavow paternity implies that there exists a presumption of paternity that will prevail unless paternity is disavowed. That presumption must arise from the principle of *rov be'ilot*. If so, argues *Bi'ur ha-Gra*, the principle of *rov* could readily be inferred from the rule of *yakkir* and further scriptural support is redundant.

There is a fundamental controversy with regard to the ambit of a principle of *yakkir*. There is controversy among early-day authorities whether it applies when there is no prior presumption of paternity, as is usually the case when the parents have not been living as a couple. Rashbam and *Tosafot*, *Bava Batra* 134b, maintain that such credibility is extended only in the context of an established filial relationship, *viz.*, the child is known and accepted by the public at large as the child of a certain individual on the basis of behavior and comportment. Rambam, *Hilkhot Naḥalot* 2:14, and Rosh, *Bava Batra* 8:39, maintain that a person has such credibility even if there is no previous basis for assuming the existence of a paternal-filial relationship. *Keẓot ha-Ḥoshen* 277:2 rules in accordance with Rambam and *Tosafot*.

Citing R. Moshe Skolvsky, *Imrei Mosheh* no. 11, Rabbi Lerer asserts that even according to Rambam a person has no authority to declare a total stranger to be his bastard son. Rather, he has such credibility only when the paternal relationship has been antecedently established. He understands *Tashbaẓ*, II, no.19, as stating that, according to Rambam a person is accorded credibility to declare a younger child to be his first-born only for purposes of primogeniture but not for the purpose of rendering an older child a *mamzer*.

Bi'ur ha-Gra concludes that a husband has no independent authority to acknowledge paternity. The father's credibility is predicated entirely

upon *rov be'ilot*. Thus, it is the father's authority that itself proves the principle of *rov*. Accordingly, it has been asserted that if DNA evidence is to be entertained as presumptively establishing its conclusions on the basis of *rov*, it follows that, when DNA tests contradict the father's acknowledgement of paternity, the father should not have credibility to declare the child to be a *mamzer* certain. Rather, the two antagonistic principles, *viz.*, the *rov* of DNA versus *rov be'ilot* should give rise to an unresolved doubt with the result that the status of the child would be that of a doubtful *mamzer*.[66]

In a situation in which the husband disclaims paternity (generally because he wants to avoid child support) but DNA evidence contradicts his assertion and shows a paternal-filial relationship, the halakhic resolution is somewhat different. If the matter involved simply one *rov* contradicted by another *rov* the child would be a doubtful *mamzer* in that situation as well.

However, if the husband disclaims paternity, the principle of *yakkir* confers credibility upon the husband in declaring his wife's child to be a *mamzer* certain despite the seemingly contradictory evidence of *rov be'ilot*. The situation appears to be paradoxical. The husband's credibility is anchored in the principle of *rov be'ilot* yet in declaring the child to be a *mamzer* the child is denying the very *rov* upon which his credibility is predicated.

Rabbi Levanon contends that there is no paradox because there is no absolute contradiction between the husband's disclaimer and that which is established by the *rov*. *Rov*, by its nature, recognizes both an existing major class and an existing minor class. *Rov* assigns doubtful instances to the major class. Even when challenged by the husband, the *rov* remains correct with regard to the majority of situations. The husband's claim is only that he knows with certainty that this particular child is an exception to the rule of *rov* by virtue of being a member of the minor class. Thus the husband's assertion is entirely consistent with *rov be'ilot* being an accurate depiction of the majority of cases.

Accordingly, contends Rabbi Levanon, since the Torah extends credibility to a husband to declare that a particular child is not a member of the major class, i.e., the class of children sired by the husband, *mutatis mutandis*, the husband has the same standing to declare that the child is similarly not a member of another class defined by the principle of *rov*, *viz.*, the class of children who inherit DNA from a parent, but is a member of the minor class comprised of children who do not inherit DNA

[66] 62 Cf., however, *infra*, section IV, C.

from a parent. Hence, even in the face of contradictory evidence, the child is to be regarded as a *mamzer* certain on the basis of the father's testimony. That conclusion is congruent with the assertion that, for purposes of Halakhah, DNA evidence is not regarded as reflecting an immutable principle and hence is not assigned absolute probative value, but is accepted as being true in at least the majority of instances and thereby establishing presumptive proof on the basis of *rov*.

That conclusion is subject to objection on two grounds. The Torah assigns credibility to the husband to contradict the particular *rov* of *rov be'ilot* by virtue of his claim to personal knowledge identifying an exception to that rule. But what evidence is there that it also assigns similar recognition to the husband's testimony in contradicting any other *rov*? Moreover, when a husband disclaims paternity, he contradicts the single *rov* of *rov be'ilot* and is granted credibility to do so but it does not necessarily follow that the husband is also accorded credibility when his declaration contradicts two separate *rov*s, *viz.*, *rov be'ilot* substantiated by a second *rov* based upon DNA evidence.

Rabbi David Levanon, *Shurat ha-Din*, V, 58-69, accepts DNA evidence as demonstrating that a paternal relationship does not exist in the majority of cases in which DNA of the presumed father does not match that of the child. Rabbi Levanon accepts a finding that a conclusion based on the evidence of *rov* is sufficient to negate a claim to child support, to share in the putative father's estate, for entitlement to the privileges of priesthood and to rebut a contention that a claim to filial identity would serve to negate any levirate obligations that might devolve upon the putative father's widow. Rabbi Levanon also concludes that, in the case of an unwed mother, if there is a match between a *mamzer* or a consanguineous relative and that of the child, the *rov* established by DNA evidence is sufficient to establish paternity and hence the child is to be declared a *mamzer vadai*, i.e., a *mamzer* certain, or an unequivocal *mamzer*, rather than a doubtful *mamzer*.[67]

2. DNA as Anan Sahadei

Rabbi Levanon and Rabbi Yigal Lerer both assert that the concept of *rov* as invoked with regard to the idiosyncratic nature of DNA is different from other types of *rov* and consequently can be invoked to substantiate

[67] Rabbi Levanon fails to address the possibility that the father may have been a non-Jew in which case the progeny are not *mamzerim*. And hence, a locale in which a majority of males are non-Jews the child would not necessarily be a *mamzer*. Cf., *Mishmeret Ḥayyim*, no. 37 and *infra*, section IV, C.

a monetary claim. The Gemara, *Bava Batra*, 93a, states that Rav Aḥa's presumption that it is the aggressive camel that is responsible for the death of its companion is based upon a *ḥazakah*, i.e., an *umdena* or presumption in the nature of a common sense conclusion. Such a conclusion, although not a matter of certainty, rises to the level of a conviction similar in nature to the notion of "we are witnesses." That standard is roughly equivalent to certainty "beyond a reasonable doubt."

Rabbi Lerer, *Shurat ha-Din*, IX, cites *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, I, no. 101, who states that the Sages disagreed with R. Aḥa because they did not accept the circumstantial evidence of a "kicking camel" as sufficiently compelling to generate an *umdena de-mukhaḥ* (self-evident *umdena*). Accordingly, they regarded such evidence as no stronger than a conventional *rov*. However, *Shulḥan Arukh Ḥoshen Mishpat* 15:4, rules that "a proficient judge who is singular in his generation" may adjudicate on the basis of an *umdena de-mukhaḥ*. DNA evidence is certainly in the category of an *umdena de-mukhaḥ*.[68]

Rabbi Levanon further argues that the Sages who disagreed with Rav Aḥa and refused to assess tort damages against the owner of the kicking camel disagreed only because there are countless other camels in the world who might be responsible for the death of one of the camels. Thus, according to the majoritarian opinion of the Sages, there is a "majority" that contradicts the *ḥazakah*, i.e., our intuitive assessment, and generates halakhic doubt.

Consequently, argues Rabbi Levanon, were other camels to have been physically barred from coming into contact with the mauled camel, even the Sages would agree that responsibility must be assigned to the aggressive camel despite the lack of absolute proof. The Sages disagree with Rav Aḥa only because of a *rov* contradicting our intuitive presumption.

Tosafot, *Shevu'ot* 34a, s.v. *de'i*, rule that, according to Rav Aḥa, comparable circumstantial evidence is sufficient for conviction even in capital cases. If so, if the Sages disagree only because of a contradictory *rov*, when such a contradictory *rov* is not present they would concede that an *umdena* of such nature is sufficient for conviction in capital cases as well. However, as noted earlier, *Me'iri* and *Yad Ramah* disagree in maintaining that even conclusive and irrefutable circumstantial evidence is not admissible. Wherein lies the controversy?

[68] Cf., *Ginat Veradim*, *klal* 5, chap. 1, who declares that a *bet din* cannot find for the plaintiff other than upon "an assessment recorded in the Talmud or upon an exceedingly compelling *umdena* (*umdena de-mukhaḥ tefei*)." DNA evidence certainly meets even that higher threshold.

The controversy certainly centers upon the question of whether eyewitness testimony is a *sine qua non* in criminal cases because the Torah has decreed that even absolute certainty is insufficient in the absence of eyewitness testimony. A comparable situation exists in which two persons witness a criminal act but do not see each other, *viz.*, *edut meyuḥedet*. There can be no question of the truth of the witnesses' testimony but the requirement for eyewitnesses includes a requirement that the witnesses witness each other in addition to witnessing the act. In civil matters there is no such requirement because "knowledge" in the nature of certainty is sufficient.[69]

Rabbi Levanon asserts that a *rov* in the nature of *rov be'ilot* is also more than a *rov* – it actually constitutes an *umdena* or *anan sahadei*. Indeed, the Palestinian Talmud, *Kiddushin* 4:8, describes a husband's paternity as established on the basis of *ḥazakah* rather than on the basis of *rov be'ilot*. Rambam, *Hilkhot Issurei Bi'ah* 1:20, follows the Palestinian Talmud in stating that all consanguineous relationships are established on the basis of *ḥazakah* "even though there is no absolute proof." R. Chaim of Volozhin, *Teshuvot Ḥut ha-Meshulash,* no. 5, comments that the *ḥazakah* depicted by the Palestinian Talmud is identical to the *rov be'ilot* of the Babylonian Talmud. The Palestinian Talmud is simply stating that a *rov* of that nature rises to the level of *umdena* or an *anan sahadei* and hence is categorized as a *ḥazakah*.[70] A similar *ḥazakah* is the *ḥazakah* that a person does not pay a debt before it is due. That *ḥazakah* is also born of an awareness that the vast majority of people comport themselves in that manner and thereby creates a presumption with regard to human conduct.[71]

The term "*ḥazakah*" is used in such contexts in the sense of "common knowledge." Such common knowledge is born of our awareness of the nature of the marital relationship, *viz.*, that a husband enjoys frequency of access, coupled with the presumption posited by the Gemara, *Yevamot* 35a, that a woman who engages in an extramarital liaison takes

[69] Thus, in civil matters two witnesses need not even testify to a single act. If one witness testifies to a loan extended one day and the second testifies to the same amount of money loaned on another day, they constitute two witnesses to a single obligation. Each one has "knowledge" of a loan. Together they satisfy the two-witness rule with regard to knowledge of at least a single loan.

[70] Rabbi Deichovsky takes note of the contradiction between the Babylonian Talmud's establishment of a paternal relationship on the basis of *rov be'ilot* and the Palestinian Talmud's invocation of the concept of *ḥazakah* establishing the same position and asserts that the latter term is used simply to indicate that the *rov* arises from conventional behavior.

[71] See *Bi'ur ha-Gra*, *Ḥoshen Mishpat* 78:17.

measures to assure that she not become pregnant. Those factors establish with near certainty the "common knowledge" that the husband is the father of all children born to his wife. Although a *rov* cannot be invoked in support of a monetary claim, a *ḥazakah* is dispositive in such matters. In the absence of contrary evidence, such a *ḥazakah* leaves no room for doubt and hence can be relied upon even in support of a monetary claim. Consistent with that thesis, Rabbi Levanon explains that DNA evidence (and logically, fingerprint evidence as well) constitutes a "super *rov*" that rises to the level of *anan sahadei* and hence is acceptable for all purposes.

Rabbi Levanon suggests that the underlying concept is the subject of a controversy between the *Keẓot ha-Ḥoshen* 46:8 and *Netivot ha-Mishpat* 46:8. A found object must be restored to its rightful owner if the latter can identify it by means of a *siman*, i.e., a distinctive mark or feature, the presence of which would not be known to others. *Tosafot*, *Ḥullin* 96a, s.v. *planya*, comment that evidence in the form of a *siman* is of no avail in an attempt to compel a person to disgorge an object if the person in possession claims that the object in dispute was not a lost object that he happened to find but that he is the original rightful owner. *Keẓot* observes that, although eyewitnesses are competent to identify a defendant on the basis of direct observation of his countenance, they cannot do so by means of a *siman*, i.e., by identification of a particular birthmark or other individual feature, no matter how distinct. Similarly, argues *Keẓot*, no *siman* is sufficient in itself to establish a claim of ownership in a suit against a person in possession; a *siman* is sufficient only when the person in possession acknowledges that the object was found, i.e., that his possession is legally meaningless insofar as a claim of title is concerned.

Netivot disagrees and points to the fact that a promissory note is actionable against the obligee on the basis of the assumption that the person bearing that name is the debtor named in the instrument. There is no need for the witnesses on the note to offer testimony confirming the identity of the named debtor on the basis of physical recognition. In the absence of known existence of another person bearing the same name, identification by means of a given name and a patronym constitutes a *siman muvhak*. A *siman muvhak*, rules *Netivot*, although not acceptable as evidence in penal proceedings, is sufficient to support a monetary claim. *Tosafot*'s comment to the contrary, asserts *Netivot*, must be understood as limited to an ordinary *siman*. The distinction lies in the fact that in criminal matters there is a statutory requirement for eyewitness testimony whereas knowledge regarded as certain, however it is acquired, is sufficient in adjudicating financial disputes.

Rabbi Levanon regards DNA evidence to be in the nature of a *siman muvhak* and hence, according to *Netivot*, acceptable for matters such as substantiating a claim for child support. Nevertheless, Rabbi Levanon acknowledges that, in light of the contradictory position of *Kezot*, a *bet din* could not award child support on the basis of such evidence.

3. Multiple Applications of Rov

The general rule in a civil case is that a plaintiff cannot secure an award on the basis of *rov*. Thus, for example, absent contextual evidence, a person who purchases a bull that proves to be aggressive cannot invalidate the sale on the grounds that such an animal is not suitable for farm work even though the majority of purchasers seek to acquire animals for that purpose rather than for slaughter.[72] *Hafla'ah*, *Ketubot* 15b, points to a seeming inconsistency in the application of *rov*. The father of a young woman unjustly accused by her husband of committing adultery subsequent to *eirusin*, i.e., the preliminary marriage ceremony, but before consummation, is fined one hundred silver coins payable to the father.[73] The existence of a paternal relationship, and hence the father's monetary claim, can be established only on the basis of *rov*. Similarly, the owner of an ox that has been gored is entitled to compensation for the animal's full value despite the fact that, were it possible to demonstrate that the animal is a *treifah*, its value would be far less. That provision is based upon the fact that the majority of animals are not born with a congenital anomaly nor have suffered a trauma that would render the animal a *treifah*, whose meat is forbidden.

Hafla'ah responds by formulating the thesis that *rov* can only be invoked when applied specifically for purposes of exacting financial compensation. However, when ancillary religious issues are also in question, *rov* may be invoked for all purposes.[74] The reasoning is that acceptance as evidence for purpose of religious law is acknowledgement of an empirical fact; logic then dictates that the same fact be recognized in civil matters

[72] See *Bava Batra* 92b.

[73] See Deuteronomy 22:13-16.

[74] See also *Teshuvot R. Akiva Eger*, *mahadura tinyana*, no. 129; *Ḥiddushei Ḥatam Sofer*, *Bava Kamma* 27b; *Yeshu'ot Ya'akov*, *Yoreh De'ah*, no. 1, sec. 2; and *Binyan Ẓion,* I, no. 104. R. Abraham Benjamin Samuel Sofer, *Teshuvot Ktav Sofer*, *Yoreh De'ah*, no. 145, demonstrates that the position of *Hafla'ah* is reflected in the position of *Tosafot*, *Bekhorot* 20a, s.v. *ve-Rabbi Yehoshu'a*, but is contradicted by the view of Ramban and Rosh, *Ketubot* 15b. R. Ovadiah Yosef, *Moriah*, Sivan 5739 cites a number of other early-day authorities who disagree with the position of *Tosafot*, including Rashba, Re'ah, Me'iri and *Shitah Mekubbezet*, *Ketubot* 15b, as well as *Maggid Mishneh*, *Hilkhot Issurei Bi'ah* 1528.

as well. Establishing that an animal is not a *treifah* is necessary for religious matters far removed from the question of the animal's market value; consequently, its market value for purposes of tort recovery is that of a healthy animal. Establishment of paternity is significant for a host of nonmonetary purposes. Consequently, paternity is recognized as having been established for financial matters as well.

Shev Shema'teta, *shema'ta*, 4, chap. 8, earlier expressed the same concept in somewhat different terms on the basis of analogy to the probity of a single witness.[75] The testimony of two witnesses is required in order to convict a person of a capital or corporal transgression. Nevertheless, the testimony of only a single witness is sufficient to establish that a piece of meat is non-kosher and may not be consumed. Rambam, *Sanhedrin* 16:6, rules that if a single witness testifies to the forbidden nature of a food product the appropriate punishment may be administered, provided that two witnesses subsequently testify to the act of consumption. Punishment can be imposed only upon the testimony of two witnesses who have observed the prohibited act, but the antecedent status of the object used in committing that transgression is entirely distinct from the issue of punishment and can be established even by a single witness. Similarly, status as a father or as a non-*treifah* may be determined antecedently by means of *rov*. Once such status is established for other purposes it is recognized for monetary purposes as well. Thus, argues Rabbi Levanon, since DNA is sufficient in establishing identity on the basis of *rov* for a variety of matters entirely dissociated from financial affairs, it may also be accepted for determining financial issues.[76] *Hafla'ah* goes beyond *Shev Shema'teta* in that

[75] A similar preposition is advanced by *Teshuvot R. Akiva Eger*, *mahadura tinyana*, no. 108.

[76] Rabbi Lerer, *Shurat ha-Din* IX, questions whether, assuming the father can determine the status of the child on the basis of the principle of *yakkir*, there is indeed any other issue that is to be decided simultaneously with the issue of child support that would make it possible to apply *Hafla'ah*'s position regarding simultaneous application of *rov* for a monetary issue together with a non-financial issue. Nevertheless, Rabbi Lerer finds one other issue regarding which the *rov* established by DNA evidence dispositive. An unwed mother has credibility to assert that her child's father was not a person in the category of those that would render the child a *mamzer*. *Bet Shmu'el*, *Even ha-Ezer* 6:31, rules that the child is also eligible to marry a *kohen*. However *Bet Me'ir*, in concluding remarks to *Even ha-Ezer* 6, citing *Teshuvot Rema*, no. 24 and *Teshuvot Maharshal*, no. 17, expresses doubt to regard to that matter. Similarly, *Teshuvot R. Akiva Eger*, no. 91, expresses doubt to with regard to the child's status *viz-à-viz* marriage to a *kohen* when the putative father denies paternity. If so, argues Rabbi Lerer, the *rov* established by DNA would be the determinant factor in rendering a daughter permissible to a *kohen*. Thus, the *rov* established by DNA would be simultaneously applicable to determination of both a non-financial issue and to child support.

Shev Shema'teta speaks of antecedent determination for purposes of religious law on the basis of a single witness or *rov* and later applying that determination in adjudicating financial matters while *Hafla'ah* formulates his thesis as applying even when those disparate issues arise simultaneously. However, *Hafla'ah* himself concedes that his thesis is a matter of dispute among early-day authorities.

4. DNA Evidence as Sufficient to Compel an Oath Denying Paternity

Rabbi Lerer takes note of the right of a plaintiff to demand an oath denying a claim and its application to situations involving an allegation of paternity for purposes of child support and the impact of DNA evidence upon such demand.

The Sages assumed that a person would not institute a frivolous claim before a *bet din* that is entirely without basis in fact. Accordingly, they imposed a *shevu'at heset*, i.e. a rabbinic oath, upon the defendant compelling him to deny the basis of the claim under oath. Consistent with that rule, an unwed mother who claims child support should be entitled to impose an oath of that nature upon the alleged father compelling him to deny paternity.

Teshuvot Rivash, no. 41, distinguishes a suit based upon an allegation of paternity from other claims and rules that such an oath cannot be demanded for three reasons: 1) In establishing the principle of *yakkir* the Torah gave absolute credibility to a presumed father to deny paternity even when such denial confirms the child's status as a *mamzer*. The Sages, contends Rivash, imposed an oath only when both litigants are equally credible and the only issue is satisfying the burden of proof borne by the plaintiff. However, if the claim against the father fails, not because of lack of proof, but because of credibility extended to him by biblical law, the Sages did not attempt to compromise that credibility. 2) A plaintiff can demand an oath only if his claim is based upon an allegation advanced with certainty; he cannot demand an oath to deny a tentative or doubtful claim. The mother may claim with certainty that no person other than the named defendant could have caused her to become pregnant but she is not the claimant in her own right. It is the child who is entitled to support and, in instituting a suit against the father, the mother advances the claim on behalf of her child. The child is in no position to identify his father with certainty. 3) A defendant who concedes that he has cohabited with the plaintiff is nevertheless entitled to the defense that cohabitation is not proof of paternity but an oath to that effect cannot be demanded of him since he cannot attest to a matter that is doubtful. *Mishneh le-Melekh*,

Hilkhot Naḥalot 4:2, adds that in some circumstances a defendant may be required to swear that he has no knowledge of any fact that would support the plaintiff's claim, but only because the plaintiff claims that the defendant is privy to such knowledge. However, in a paternity suit it is not possible for the cohabiting male to know with certainty that he is not the father. An oath cannot be demanded to attest to that which is already known.

Tashbaz, II, nos. 18-19, takes issue with Rivash in arguing that the mother may assert, *inter alia*, her own claim for compensation for her services as a wet-nurse. *Tashbaz* acknowledges that the Torah extends credibility to the father to acknowledge or to deny paternity but argues that such credibility is a) only with regard to matters pertaining to the son and b) only because the son cannot deny the father's assertion. However, the dispute for compensation is between the putative father and the mother and she is in a position to advance her allegation with certainty. In response to the argument that there cannot be an oath to support that which is already known, in this case that the defendant cannot know that he is not the father, *Tashbaz* replies that he may demand that, before allowing the case to continue, the mother state under penalty of *herem* that she did not consort with any other male.

Citing *Teshuvot Ḥatam Sofer*, *Even ha-Ezer*, II, no. 105, *Pitḥei Teshuvah*, *Even ha-Ezer* 177:12, concludes that in light of the controversy an oath is administered in such circumstances only on the basis of custom and only if there are grounds (*raglayim la-davar*) for assuming that there was a sexual relationship between the parties.

It would appear that even if DNA evidence of paternity cannot be accepted as proof of an obligation of child support such evidence certainly constitutes *raglayim le-davar* that are more than ample to warrant imposition of an oath. In practice, *batei din* do not impose oaths but in lieu of an oath they do impose a solemn *ḥerem*[77] and when they are empowered to do so they may award a settlement equal to a third of the claim.[78]

C. Status of the Child

As shown earlier, the father has standing to declare his child to be a *mamzer* certain on the basis of the principle of *yakkir*. There is a significant controversy among early-day authorities with regard to whether a father enjoys credibility on the basis of *yakkir* even when his statement is

[77] See R. Yechiel Michel Epstein, *Arukh ha-Shulḥan*, *Ḥoshen Mishpat* 87:18.
[78] See R. Malkiel Tennenbaum, *Teshuvot Divrei Malki'el*, II, no. 133.

contradicted by witnesses. Assuming that DNA evidence were to be accepted as proving or disproving a potential relationship with certainty Rabbi Lerer shows that there would be reason to question whether or not the same controversy would extend to a father's assertion in face of contradictory DNA evidence. However, assuming that DNA evidence is no stronger than a *rov* that issue is moot.

If, however, the husband affirmatively claims paternity in face of contradictory DNA or hematological evidence, the situation becomes more complex. The *rov* serves to establish that the child is a *mamzer*. Ostensibly, the principle of *yakkir* would serve to establish the father's standing to affirm paternity and confirm the legitimacy of the child despite the contradictory *rov*.

Rabbi Deichovsky formulates an argument to the effect that if a question arises with regard to a child's legitimacy on the basis of DNA evidence that doubt can be resolved on the basis of *ḥazakah*. The argument is that *rov be'ilot* and DNA evidence are contradictory *rov*s that render a child a *mamzer* doubtful. However, if the child was accepted as the child of the husband on the basis of behavior and comportment, that in itself establishes a *ḥazakah* having the effect of resolving the doubt and establishing the husband as the father. That is so because, prior to the doubt created by DNA analysis, there existed a presumption of paternity based upon behavior and comportment in the wake of the father's earlier acknowledgment of paternity.

Rabbi Deichovsky rejects that position in arguing that a *ḥazakah* established in error is not a *ḥazakah*. To put the matter somewhat differently, he maintains that a *ḥazakah* based upon a presumption later shown to be erroneous must retroactively be recognized as an erroneous *ḥazakah*. The father's acknowledgement, his behavior *vis-á-vis* the child, as well as public perception of a paternal-filial relationship, all came about in error as established by later DNA evidence.

R. Ya'akov Eliezrov, another member of the Ashdod *bet din*, followed by Rabbi Levanon took issue with Rabbi Deichovsky's contention that DNA evidence has the effect of negating a previously established presumption of paternity based on *ḥazakah*. Although they concede that an erroneously established *ḥazakah* is of no effect, they nevertheless maintain that unless the *ḥazakah* is demonstrated with certainty to have been established in error it remains effective. When a presumption established by *ḥazakah* has not been disproved but has merely become a subject of doubt, the previously established *ḥazakah* has not been eradicated and therefore has not lost its efficacy. The *rov* reflected in DNA analysis, since it is contradicted by *rov be'ilot*, does not definitively demonstrate that the

previous *ḥazakah* was established in error. Hence, the earlier *ḥazakah* remains effective and, consequently, the father retains credibility with regard to establishing or denying the legitimacy of the child by virtue of the principle of *yakkir*.

As noted earlier, the Tel Aviv *bet din* recognized the logical entailment of the issues of child support and *mamzerut*, i.e., that if DNA evidence is to be accepted as establishing paternity for purposes of child support DNA evidence should also be recognized for purposes of negating paternity with the result that the child must be regarded as a *mamzer*. On the other hand, if DNA analysis creates a doubt that cannot be resolved with the consequence that a claim for child support is dismissed only because the claim has not been established with certainty, in the case of a married woman, the same evidence should render the child a *mamzer* doubtful.

Later, in a decision of the Jerusalem *bet din*, *Piskei Din shel Bet ha-Din le-Dinei Mamonot u-le-Birur Yahadut*, V, pp. 187-193, Rabbi Shalom Mashash makes the point that a *bet din* must perforce recognize that there are respected authorities who reject the position that DNA evidence must be accepted as a matter of certainty. If so, as a matter of halakhic decision-making, recognition of the controversy prevents a *bet din* from according such evidence more than doubtful status.

Nevertheless, R. Shalom Mashash declares that, although DNA evidence is sufficient to create doubt and hence to relieve the husband of obligatory child support, it does not lead to a determination that the child is a *mamzer* certain. *Bet Shmu'el*, *Even ha-Ezer* 4:29, declares that in the absence of the father's declaration that his son is a *mamzer*, a child known to have been born of an adulterous relationship is a *mamzer* doubtful rather than a *mamzer* certain. Rabbi Mashash explains that doubt arises because it is not known whether the wife's paramour was a Jew or a gentile. If the father was a non-Jew the child is not a *mamzer*.[79] Consequently, the status of the child is a *mamzer* doubtful. Rabbi Mashash explains that such is the case even in a locale in which the majority of men are Jews. A number of authorities, including *Pnei Yehoshu'a*, *Kiddushin* 73a, maintain that, although *rov* is a deciding principle, it does not establish a prohibition with certainty. Matters that are decided on the basis of *rov* are prohibited on the basis of doubt rather than on the basis of certainty. With regard to biblical law only a *mamzer* certain is prohibited, but not a *mamzer* doubtful. It is indeed the case that the Sages prohibited as well marriage between a *mamzer* doubtful and a person of

[79] See *supra*, note 68.

legitimate birth but they did not prohibit such marriage in cases of *sefek sefeka*, or "double doubt."

Consequently, argues Rabbi Mashash, if DNA evidence contradicts the presumption that the husband is the father the result is a double doubt: 1) DNA serves only as a *rov* establishing that in the majority of instances the husband is not the father, but the possibility remains that the husband is indeed the father. 2) If the husband is not the father perhaps the person who impregnated the wife was a non-Jew. A *safek mamzer* may not marry a woman of legitimate birth but a child whose *mamzerut* is a matter of *sefek sefeka* is not subject to such a restriction. In a letter appended to that decision, R. Ovadiah Yosef concurs in Rabbi Mashash's conclusion.

V. REFUSAL TO AGREE TO DNA TESTING

Assuming that negative DNA evidence is sufficient to absolve the husband from the obligation of child support, in situations in which the husband does not deny paternity with certainty, is the husband entitled to demand a DNA test to substantiate the claim against him? *Teshuvot ha-Rosh*, *klal* 32, chap. 2. and *Shulḥan Arukh*, *Even ha-Ezer* 117:2, rule that a woman who has been found to be physically incapable of engaging in marital relations is not entitled to the financial benefits of the marriage. A husband who makes such an allegation may refuse to provide support and maintenance unless and until his contention is refuted by physical examination. Apparently, then, a defendant may demand that dispositive empirical evidence, which, if it exists, would be available upon investigation, be produced to support a claim against him.

However, that precedent serves to establish only that a defendant is entitled to demand a readily obtainable proof to support his denial of a claim against him when such evidence, if forthcoming, would establish the veracity of his denial with certainty. It does not necessarily establish a right to demand evidence that would only cast doubt upon the claimant's allegation. It is certainly true that, in order for a defendant to prevail, it is sufficient for him to produce evidence casting doubt upon the plaintiff's claim; the defendant need not prove his defense with certainty since the burden of proof is on the plaintiff. But there is no precedent establishing that the defendant may demand cooperation in producing evidence that merely raises doubt, but does not conclusively refute, the defendant's denial of the claim. Again, it is presumed that, halakhically, DNA evidence can only cast doubt upon the presumption of the husband's paternity that

arises from *rov be'ilot* but that DNA evidence cannot conclusively refute the husband's denial of paternity.[80]

There is, however, a talmudic source that has a direct bearing upon this issue. The Gemara, *Bava Batra* 154a, records a dispute involving the sale of a parcel of real estate by an adolescent who died shortly thereafter. The seller's heirs sought to invalidate the sale upon the claim that the seller had the status of a minor because he had not developed public hair prior to his death. One of the litigants demanded exhumation of the body to establish whether or not the decedent had pubic hair and hence whether or not he had legal capacity to transfer property. From the ensuing talmudic discussion there emerges a principle to the effect that, when there is presumptive evidence favoring a litigant, the opposing party is not entitled to demand confirmation in the form of an examination to uncover further evidence that might either confirm or refute the claim.[81] Similarly, concludes Rabbi Levanon, when there exists presumptive evidence of paternity in the form of *rov be'ilot*, the husband cannot demand cooperation in the form of DNA testing of the child[82] on the claim that such evidence might refute his denial of paternity. [83]

VI. CONCLUSION

As any epistemologist would attest, knowledge and ignorance are not dichotomous categories. Knowledge admits of subtlety and degree ranging from mere conjecture to absolute certainty. Legal systems demand varying degrees of certainty for diverse purposes. Halakhah posits variegated standards of evidence, each appropriate to the purpose for which it is employed. DNA analysis, when properly carried out, is not infallible

[80] This issue was not addressed in the decision of the earlier-cited decision of the Rabbinical Supreme Court of Appeals. See *supra*, note 56 and accompanying text.

[81] The inference is from the Gemara's statement that, if the purchasers had an authenticated deed, that itself establishes a presumption of regularity in the transaction and consequently the demand for exhumation to confirm their claim should be summarily dismissed. The same discussion establishes that when no evidence exists, i.e., the purchasers are in possession but have no substantiating proof of purchase, barring other considerations, the plaintiffs would be entitled to demand cooperation in an investigation to provide evidence substantiating their claim to invalidate the sale.

[82] The additional argument advanced to the effect that a paternity test involves an invasive procedure that constitutes a form of "wounding" is simply incorrect. Unlike a blood test, a DNA sample can be obtained without invasion of the child's body.

[83] Cf., R. Levi Yehudah Ben-Ya'akov's discussion of compelling DNA testing to establish a right of inheritance in *Teḥumin*, XXII (5762).

but can establish an extremely high degree of certainty. *Teḥumin*, XXI (5761), 121-123, contains a concise statement in the name of the late R. Samuel ha-Levi Wosner of Bnei Brak detailing the manner in which DNA tests should be performed and the purpose for which properly conducted DNA analysis may be regarded as decisive and purposes for which it must be disregarded. It seems to this writer that those conclusions reflect the consensus of opinion of contemporary halakhic decisors. The statement fails to present a conclusion with regard to child support and omits reference to enforcement of an undertaking to be bound by the findings of a DNA test.

Most significant is the statement that DNA evidence cannot establish status as a *mamzer* or be used to impose penal sanctions "even though from the scientific perspective [DNA] congruity is an absolute determination." DNA evidence can be used for purposes of identifying body parts for burial and identity of a corpse for commencement of prescribed periods of mourning. The statement appropriately qualifies that conclusion in instances in which the deceased leaves a wife who must be declared a widow having halakhic capacity to contract a new marriage. When there is a surviving widow, Halakhah does not permit mourning rituals to commence until there is a finding that the wife is permitted to remarry. Use of DNA evidence to resolve the problem of an *agunah* and for purposes of inheritance have not been addressed in this endeavor.