



The DNA Chain of Tradition

The discovery of the “Cohen gene”

By Rabbi Yaakov Kleiman

Dr. Karl Skorecki was attending synagogue services one morning. The Torah was removed from the ark and a *Cohen* was called up for the first *aliyah*. The *Cohen* summoned that particular morning was a visitor: a Sephardic Jew whose parents were from Morocco. Dr. Skorecki also has a tradition of being a *Cohen*, though of Ashkenazic background: His parents were born in Eastern Europe. He looked at the Sephardic *Cohen's* physical features and considered his own. They were significantly different in stature, skin coloration and hair and eye color.

A nephrologist and a top-level researcher at the University of Toronto and at the Rambam-Technion Medical Center in Haifa, Dr. Skorecki was involved in the breakthroughs in molecular genetics which are revolutionizing medicine and the study of the life-sciences. He was also aware of the newly developing application of DNA analysis to the study of history and population diversity.

Dr. Skorecki considered, “According

Cohanim and *Levi'im* interested in participating in the DNA research or receiving further information may contact: Center For *Cohanim*, 3 Rehov HaMekubalim, Old City Jerusalem, Israel. Phone/Fax: (from the U.S.) 011-972-2-628-9243; Email: kaldeb@netvision.net.il

to tradition, this *Sephardi* and I are both direct descendants of one man — *Aharon HaCohen*.^{*} Could this line have been maintained since Sinai and throughout the long exile of the Jewish people?” As a scientist, he wondered, could such a claim be tested?

He considered a hypothesis: If all *Cohanim* are descendants of one man, they should have a common set of genetic markers, a common haplotype — that of their common ancestor; in this case, *Aharon HaCohen*.

A genetic marker is a variation in the nucleotide sequence of the DNA, known as a mutation. Mutations which occur within genes — a part of the DNA which codes for a protein — usually cause a malfunction or disease, and is lost due to selection in succeeding generations. However, mutations found in so-called “non-coding regions” of the DNA tend to persist.

Since the (male) Y chromosome consists almost entirely of non-coding DNA, it would tend to accumulate mutations. Since it is passed from father to son without recombination, the genetic information on a Y chromosome of a man living today is basically the same as that of his ancient male ancestors, except for the rare mutations that occur along the hereditary line. A combination of these neutral mutations, known as a haplotype, can serve as a genetic signature of a man’s male

**Jewish tradition, based on the Torah, is that all Cohanim are direct descendants of Aharon, the original Cohen. The line of the Cohanim is patrilineal: it has been passed from father to son without interruption from Aharon, for 3,300 years, or more than 100 generations.*

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ancestry. Maternal genealogies are also being studied by means of the m-DNA (mitochondrial DNA), which is inherited only from the mother.

Dr. Skorecki then made contact with Professor Michael Hammer of the University of Arizona, a leading researcher in molecular genetics and a pioneer in Y chromosome research. Professor Hammer uses DNA analysis to study the history of populations, their origins and migrations. His previous research included work on the origins of the Native American Indians and the development of the Japanese people.

A study was undertaken to test the hypothesis. If there is a common ancestor, the *Cohanim* should have common genetic markers at a higher frequency than the general Jewish population.

In the first study, as reported in the prestigious British science journal, *Nature* (January 2, 1997), 188 Jewish males were asked to contribute some cheek cells from which their DNA was extracted for study. Participants from Israel, England and North America were asked to specify whether they were a *Cohen*, *Levi* or *Yisrael*, and to identify their family background.

The results of the analysis of the Y chromosome markers of the *Cohanim* and non-*Cohanim* were indeed significant. A particular marker (YAP-), was detected in 98.5 percent of the *Cohanim*, and in a significantly lower percentage of non-*Cohanim*.

In a second study, Dr. Skorecki and associates gathered more DNA samples and expanded their selection of Y chromosome markers. Solidifying their hypothesis of the common ancestor of *Cohanim*, they found that a particular array of six chromosomal markers were found in 97 of the 106 *Cohanim* tested. This collection of markers has come to be known as the Cohen Modal Haplotype (CMH) — the standard genetic signature of the Jewish priestly family. The chances of these findings happening at random is greater than one in 10,000.

The finding of a common set of genetic markers in both Ashkenazic and Sephardic *Cohanim* worldwide

clearly indicates an origin pre-dating the separate development of the two communities around 1000 CE. Date calculation based on the variation of the mutations among *Cohanim* today yields a time frame of 106 generations from the ancestral founder of the line, some 3,300 years, the approximate time of the exodus from Egypt, the lifetime of *Aharon HaCohen*.

Professor Hammer was recently in Israel for the Jewish Genome Conference. He confirmed that his findings are consistent: over 80% of self-identified *Cohanim* have a common set of markers. The finding that less than one-third of the non-*Cohen* Jews who were tested possess these markers is not surprising to the geneticists. “Jewishness” is not defined genetically. Other Y chromosomes can enter the Jewish gene pool through conversion or through a non-Jewish father. Jewish status is determined by the mother. Tribe membership follows the father’s family line.

Calculations based on the high rate of genetic similarity of today’s *Cohanim* resulted in the highest “paternity-certainty” rate ever recorded in population genetics studies — a scientific testimony to family faithfulness.

Wider genetic studies of diverse present day Jewish communities show a remarkable genetic cohesiveness. Jews from Iran, Iraq, Yemen, North Africa and European Ashkenazim all cluster together with other Semitic groups, with their origin in the Middle East. A common geographical origin can be seen for all mainstream Jewish groups studied.

This genetic research has clearly refuted the once-current libel that Ashkenazic Jews are not related to the ancient Hebrews, but are descendants of the Kuzar tribe — a pre-10th century Turko-Asian empire which reportedly converted *en masse* to Judaism. Researchers compared the DNA signature of the Ashkenazic Jews against those of Turkish-derived people, and found no correspondence.

In their second published paper in *Nature* (July 9, 1998), the researchers included an unexpected finding.

Those Jews in the study who identified themselves as *Levi'im* did not show a common set of markers as did the *Cohanim*. The *Levi'im* clustered in three groupings, one of them the CMH. According to tradition, they should also show a genetic signature from a common patrilineal ancestor.

It is interesting to note that the tribe of Levi has a history of a lack of quantity. The census of *Bamidbar* shows Levi to be the smallest of the tribes. After the Babylonian exile, the *Levi'im* failed to return *en masse* to Jerusalem, though urged by Ezra the Scribe to do so. (They were therefore fined by losing their exclusive rights to *maaser*.) Though statistically, the *Levi'im* should be more numerous than *Cohanim*, in synagogues today it is not unusual to have a *minyan* with a surplus of *Cohanim*, yet not one *Levi*. Researchers are now focusing efforts on the study of the genetic make up of *Levi'im* to learn more about their history in the Diaspora.

Using the CMH as a DNA signature of the ancient Hebrews, researchers are pursuing a hunt for Jewish genes around the world. The search for lost tribes, whether the Biblical Ten Lost Tribes which were uprooted from *Eretz Yisrael* by the Assyrians, or other would-be Jews, Hebrews or “chosen peoples,” is not new. Using the genetic markers of the *Cohanim* as a yardstick, these genetic archaeologists are using DNA research to discover historical links to the Jewish people.

Many individual *Cohanim* and others have approached the researchers to be tested. The researchers’ policy is that the research is not a test of individuals, but an examination of the extended family. Having the CMH is not proof of one’s being a *Cohen*. At present, there are no halachic ramifications of this discovery. No one is certified nor disqualified because of his Y chromosome markers.

The research, which began with an idea in *shul*, has shown a clear genetic relationship amongst *Cohanim* and their direct lineage from a common ancestor. The research findings support the Torah statements that the line

of Aharon will last throughout history. That our Torah tradition is supported by these findings should be a reinforcement for *Cohanim* and for all those who know that the Torah is truth, and

that God surely keeps His promises. May we soon see *Cohanim* at their *Beit Hamikdash* service, *Levi'im* on their platform and *Yisraelim* at their places. **IA**



Photo: Jodi Sugar

Birkat Cohanim at the Kotel

Every Chol Hamoed Sukkot, Cohanim from all over the world converge at the Kotel Hamaaravi to recite the ancient Priestly Blessing together. Thousands of Jews fill the Kotel plaza, yet despite the festive buzz of so large a crowd, there is silence as the Cohanim lift their voices in blessing.

An Eternal Blessing

Just as the lineage of *Cohanim* spans more than 3,000 years, the Blessing which they deliver spans Jewish history. Since its inception at the inauguration of the *Mishkan* on Rosh Chodesh Nissan, 2449 (1311 BCE), the Blessing of the *Cohanim* has been recited daily by descendants of *Aharon HaCohen* somewhere in the world, every day.

It is a remnant of the *Beit Hamikdash* service which was never lost. After the destruction of the *Bayit Sheini* in approximately 70 CE, the *mishmarot* — family service groups of *Cohanim* — kept their tradition of knowing the week of their particular watch at the *Beit Hamikdash*. From the time of the Babylonian and Persian exile, Jewish communities have included the *Birkat Cohanim* in their communal service.

Sephardic custom, as written in the *Shulchan Aruch*, is for the *Cohanim* to bless the congregation every day. Following the Rema, the Ashkenazic custom became to perform the Blessing only on holidays. Presently in *Eretz Yisrael*, following a ruling of the Vilna Gaon, the custom has been restored to recite the *Birkat Cohanim* every day and twice on Shabbat, Rosh Chodesh and Yom Tov.

Cohanim Forever: From the Sources

God’s promise to Aharon and his sons of an everlasting priesthood throughout all generations is mentioned repeatedly in the Written Torah, the Prophets and the Oral Torah. A few examples:

“And they shall have the priesthood as a statute forever, and you shall consecrate Aharon and his sons.” (Exodus 29:9)

Some other Torah sources: Exodus 28:1; 40:15; Numbers 18:17; 18:19; 25:13; Deuteronomy 18:5

“For the *Cohen’s* lips shall keep knowledge, and Torah you shall seek from his mouth, for he is a messenger of God.” (Malachi 2:7)

Some other sources from the Prophets: Ezekiel 44:15; Malachi 3:21

“The *Sanhedrin* [high court] sat and judged the *Cohanim*. If no disqualifications were found, they made a holiday and proclaimed, ‘Blessed is God, that no disqualification was found in the descendants of Aharon, and blessed is He Who chose Aharon and his sons to stand and serve before Him in the Holy Temple.’” (Mishnah Middot 5:4)