JACOB AND THE SPOTTED SHEEP:
THE ROLE OF PRENATAL NUTRITION ON EPIGENETICS OF FUR COLOR

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Genesis 30:37-40 describes how Jacob induced changes of color in the fur of his sheep by having them drink water in which the peeled branches of three different trees had been placed. While most geneticists ridiculed the idea that this was possible,[1,2] there have been some weak attempts to apply Mendelian genetics to the story by Jacob choosing spotted sheep that were homozygous (that is, two identical DNA sequences at one locus) rather than heterozygous (that is, two different alleles at one locus).[3,4,5] Classic Jewish commentators like Rabbenu Bachya, Haktav v'HaKabbalah, and the Chatam Sofer deemed the story to be miraculous. Interestingly, both Rashbam and Radak stress how Jacob placed the peeled sticks into the water. The Etz Yosef commentary on Midrash Rabbah also stresses that it was the drinking of the water by the sheep that induced the changes in fur color and fertility.

It is only with the recent advent of epigenetics that the story can finally be understood, especially in prenatal nutritional effects on epigenetic gene regulation of fur color. But first, a brief excursus on epigenetics.

EPIGENETICS

Epigenetics is the study of heritable changes in gene expression that occur without a change in DNA sequence, and are phenomena which violate Mendelian principles. These non-DNA variations can be transmitted in the cell and organismal lineages.[6] What is particularly intriguing is the extensive literature on the role of prenatal nutrition on epigenetic events.[7] What is most relevant to the biblical story of Jacob and the sheep is the research on early nutritional influences on the Agouti gene affecting coat color of fur in sheep and mice.[8,9]

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THE TREE BRANCHES IN GENESIS 30:37

The three trees whose bark was peeled were *livneh lach, luz,* and *armon*, names translated by the NJPS as poplar, almond, and plane. This botanic identification has been verified by Rabinowitz.[10] The question remains whether there are specific free amino acids such as methionine and choline in their bark. Dr. Josh Klein, a plant pathologist and expert on plant fungi at the Volcani Research Institute of the Israeli Ministry of Agriculture, suggested that there are fungi as filaments under the bark of these trees that would contain these specific amino acids. He stated that these fungi are very host-specific. Peeling the bark could make these fungi available for water extraction of their components.

THE TEXT

Now let us examine the text. A careful analysis demonstrates how Jacob selected specific plants, peeled their bark, and placed them in the water of the trough where the sheep drank.

> *Jacob then got fresh shoots of poplar, and of almond and plane, and peeled white stripes in them, laying bare the white of the shoots. The rods that he had peeled he set up in front of the flocks in troughs: the water receptacles that the flocks came to drink from; their mating occurred when they came to drink* (Gen. 30:37-38).

THE RED HEIFER *PARAH ADUMAH*

The red heifer [*parah adumah*] is mentioned in Numbers 19:2-10: *Instruct the Israelite people to bring you a red cow without blemish, in which there is no defect and on which no yoke has been laid* (v. 19:2). The red heifer was slaughtered and its body burned. The ash was placed in water and sprinkled on one who was defiled (ritually contaminated) by contact with a corpse. The ash of the red heifer in water purified the one who was defiled.

The Talmud (Avoda Zara 24b) has a curious story on how the red heifer was engendered: a cup of red liquid was passed in front of a pregnant normal colored cow. Virtually all the commentaries gloss over the topic. It is only Yaavetz (Rabbi Yaakov Emden, 18th-century Germany) who in his commentary makes the cryptic remark: "just like with the story of Jacob and the

sheep." Could the pregnant cow have **drunk** the red liquid? This remains to be seen.

NOTES

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5. J.D. Pearson, "A Mendelian Interpretation of Jacob's Sheep," *Science and Christian Belief* 2001;13:51-58.
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10. Louis B. Rabinowitz, *Torah and Flora* (New York: Sanhedrin Press, 1977) pp. 14-15.