The wisdom of the rabbis

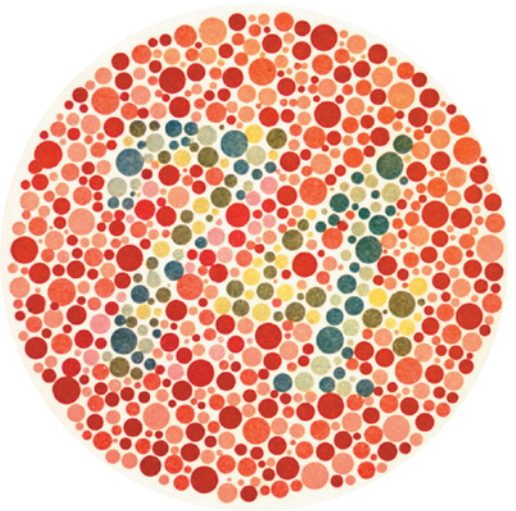
In the Middle Eastern desert of 1,800 years ago, the rabbi faced a dilemma. A Jewish woman had given birth to a son. As required by the laws set down by God's commandment to Abraham almost 2,000 years previously and later reiterated by Moses, the mother brought her 8-day-old son to the rabbi for ritual penile circumcision. The rabbi knew that the woman's two previous sons had bled to death when their foreskins were cut. Yet the biblical commandment remained: unless he was circumcised, the boy could not be counted among those with whom God had made His solemn covenant. After consultation with other rabbis, it was decided to exempt this, the third son.

Almost a thousand years later, in the twelfth century, the physician and biblical commentator Moses Maimonides reviewed this and numerous other cases in the rabbinical literature and stated that in such instances the third son should not be circumcised. Furthermore, the exemption should apply whether the mother's son was «from her first husband or from her second husband.» The bleeding disorder, he reasoned, was clearly carried by the mother and passed on to her sons.

Without any knowledge of our modern concepts of genes and genetics, the rabbis had linked a human disease (which we now know as hemophilia A) to a pattern of inheritance (which we now know as sex linkage). Only in the past few decades have the precise biochemical nature of hemophilia A and its genetic determination been worked out.

Humans normally have two copies each of 22 of the 23 chromosomes in the human karyotype. Thus, even if a given gene on one of the chromosomes is mutant, the normal gene on the second copy of that chromosome can usually produce a functional protein. But one pair of chromosomes is different. In the case of X and Y chromosomes, males receive only one copy of each; females receive two copies of the X chromosome (but no Y chromosome). The genetic mutation that causes the blood clotting malfunction of hemophilia is located on the X chromosome, and males carrying the mutation have no «back-up» normal gene. Color blindness, a physical condition with only minor ramifications for most individuals who suffer from it, has a similar pattern of transmission.

How do we account for and predict such patterns of inheritance? Much about inheritance was intuited even before scientists and scholars knew that genes and chromosomes existed—as proven by the ruling of that wise rabbi almost two thousand years ago. Indeed, the foundations of the science of inheritance and genetic transmission were laid in the 1860s by some of the most amazing experiments and feats of data analysis in the history of biological science. It was almost 50 years before the significance of these experiments and their analyses by Gregor Mendel was recognized by the scientific community. Once that recognition was finally achieved, however, natural science and medicine began to move forward at an unprecedented pace.



Test for a sex-linked trait Like hemophilia, the mutant allele for red-green color blindness is carried on the X chromosome. Unlike hemophilia, however, this condition is not usually deleterious. In the simple test shown here, a person with normal color vision sees the number 74; people with the most typical type of color blindness see 21; and severely color blind people cannot distinguish any numeral.

An ancient ritual A male infant undergoes ritual circumcision in accordance with Jewish laws. Sons of Jewish mothers who carry the gene for hemophilia may be exempted from this ritual.

Answer the questions.

- Why did the rabbi face a dilemma?
- How did he solve it?

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