

# Girl, Boy, or Somewhere in Between?

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For centuries, the development of the embryo remained a mystery. Ancient civilizations conceived of innumerable theories to explain the phenomenon, including the worshipping of females as the source of life, or, as the Greek Pythagoras of Samos believed, the sperm contained a fully-formed person that grew when it encountered the egg [1]. Though modern hindsight proves such theories false, a quick glance at an ancient Judaic text dating back to Tanaic times, called a b'raitā, provides an incredibly accurate insight into human embryologic development.

This particular b'raitā, as understood by Rashi (B'rachot 60a), enumerates a chronological list of prayers for the husband to recite immediately following sexual intercourse. For the first three days, the husband prays for a sperm to be received by the egg. From day three until forty after conception, the husband prays for the fetus to be male. From the fortieth day until the conclusion of three months, the husband prays for healthy fetal development, while from the conclusion of the third to the conclusion of the sixth month, he prays for no miscarriage. Finally, during the final three months, the husband prays that the fetus's exit from the womb should be in peace (i.e., an uncomplicated birth).

According to this b'raitā, gender is established by the fortieth day, yet, in a different tractate (Niddah 30b), Rabbi Yishmael notes that it takes eighty days from conception for the fetal sex to fully develop, which seems to contradict the b'raitā [1]. Thankfully, the Torah U'Madda approach can resolve this supposed contradiction by incorporating modern science's understanding of human embryologic development. All somatic cells of a female fetus have two X chromosomes, while those of a male fetus have one X chromosome and one Y chromosome. Internally, in early embryologic development, the developing fetus has bipotential gonads, which have the potential to develop either into testes or ovaries. It is the presence of a Y chromosome that determines the sex of the fetus.

The Y chromosome contains the gene, sex-determining region of the Y (SRY), which, when activated, encodes a protein (testes determining factor, or TDF) that programs the undifferentiated fetal gonads to develop as testes. TDF, a transcription factor, thereby stimulates the development of testes, which in turn secrete testosterone, leading to the development of internal and external male reproductive structures. In the absence of a Y chromosome, or more specifically in the absence of the SRY gene, by default, the undifferentiated gonads develop as ovaries and the fetus is female. Stated simply, the gender of a fetus is determined by the presence or absence of the SRY gene [2, 3].

Returning to the supposed contradiction, the b'raitā implies that it took forty days from conception until the fetus was directed to maleness. What is so special about 40 days after conception? Apparently, activation of the SRY gene occurs at about the 6<sup>th</sup> week of gestation. Once activated, the biochemical processes are ignited towards maleness, and praying for a male child after this time is useless. However, as Rabbi Yishmael claims in the tractate of Niddah, 80 days after conception is the critical time. It is now known that the fetus is female (i.e., XX, without a Y chromosome), therefore, by default, at about day 80 after conception, when the undifferentiated gonads are programmed to develop as ovaries. Between these forty and eighty days, as the fetus, through the SRY gene, has had the potential to form as a male but did not, flaws could still occur on the chromosomes. Consequently, when Rabbi Yishmael states that one can determine the sex of a female gender only by the 80<sup>th</sup> day, it does not imply that the fetus is gender-less for those forty days, but rather by the 80<sup>th</sup> day the fetus is officially established to have developed as a female, without any errors on the chromosomes. As modern science's understandings of embryonic development advance, a Torah U'Madda approach makes it apparent that there was no contradiction between the b'raitā and the statements of Rabbi Yishmael.

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## References:

- [1] Poltorak, L., (2009). On the Embryological Foresight of the Talmud. B'Or HaTorah, 19: Pgs 19-24
- [2] <http://ghr.nlm.nih.gov/gene/SRY>
- [3] Lewis. R., 2008, Human Genetics, 8<sup>th</sup> edition, McGraw-Hill Higher Education, NY, NY.