

# Cleopatra's Children's Chromosomes: A Halachic Biological Debate

By Merav  
Gold

In narrating the birth of the tribes, the Torah mentions as an afterthought to the birth of Leah's sons, "And afterwards [Leah] gave birth to a daughter, and she named her Dina" (Genesis 30:21). The Talmud Bavli (*Brachot* 60a) picks up on this strange language and relates the following *midrash*. Rachel and Leah were each destined to have a baby of the other gender - Leah a boy and Rachel a girl. After analyzing and estimating the number of children each wife of Yaakov would have, Leah prayed that she should give birth to a girl, so that her sister should not have fewer sons than a maidservant. Based on this occurrence, the *midrash* reflects the fact that it is *halachically* permissible for parents to pray for a desired sex of their child for 40 days after conception [1]. However, this begs the question- where does this timeframe come from?

Fetal development has been a topic of interest that has been studied by various cultures. The Talmud Bavli (*Nida* 30b) relates the story of Cleopatra VII and her quest to establish when the sexual development of a fetus begins. The Talmud recounts that she condemned rebellious maidservants to death, but only followed through with the punishment 41 days after they had cohabitated with a man. After the maidservants' death, Cleopatra performed autopsies and discovered one maidservant who was pregnant with a boy, and another who was pregnant with a girl. From this experiment, she proved that males and females develop along the same timespan *in utero*.

Rabbi Yishmael, a third generation *tana*, rejects the conclusion of Cleopatra, stating "I bring proof from the Torah, and you disprove me from imbeciles?" (*Nida* 30b). Rabbi Yishmael himself is of the opinion that a male baby is fully developed by 40 days, and a female by 80 days. As Shlomo *HaMelech* aptly said, "There is nothing new under the sun" (Kohelet 1:9), which in this case proves to be true, since science gives proof to Rabbi Yishmael's opinion. Biologically, the key difference between males and females is due to the 23<sup>rd</sup> pair of chromosomes. In females, each of the two sex chromosomes looks like the letter X, and therefore is called an X chromosome. In males however, there is only one X chromosome; the other chromosome has the appearance of a Y. Fittingly, it is called a Y chromosome. Each child gets one chromosome from each parent. The mother passes one X chromosome to her offspring through her egg, and the father will transmit either an X or a Y chromosome in his sperm. The joining of the two cells creates the zygote, which will either have its 23<sup>rd</sup> pair of chromosomes as XX or XY. Remarkably, aberrations on this will still follow the same distinct pattern. If a zygote carries XXY, it will develop into a male, and if it carries XO, it will develop into a female [2]. The

lack of variability in allosomes leads us to wonder how it is possible that male and female fetuses develop at different rates. Furthermore, if the allosomes are determined at conception, how can parents pray for the sex of his baby at any time after conception?

The development of gonads in a fetus, like most events that occur in humans, is predicated on the translation of the genetic code into proteins. In this case, the gene of interest is the SRY gene, the sex-determining region of the Y chromosome which is located on the Y chromosome. When SRY is activated, it encodes for testis-determining factor (TDF), the transcription factor that initiates the development of male gonads. Interestingly, SRY expression is first detected in a fetus at 41 days, and is detectable until day 52 of the pregnancy [3]. This phenomenon would explain Rabbi Yishmael's statement. While he could not have known about SRY expression, his calculations that a male is developed after 40 days are not completely off target. But, he is inaccurate in regard to his statement that male development is *finished* after 40 days; modern science reveals that it *starts* after day 40. The *halacha* allowing a parent to pray for the sex of the child until day 40 is logical regardless of whether sexual development of the fetus starts or ends by day 40. By that time, even though the sex was already determined based on which allosome was present in the sperm, the actual physical development of the child's sex is fully underway. It is after that point that *halacha* deems it impermissible to ask God for a miracle and "switch" the sex of the child, similar to the miracle performed for Leah and Rachel.

Yet, the debate between Cleopatra and Rabbi Yishmael is not yet resolved. The real dispute between Cleopatra and Rabbi Yishmael is not about male development, which they both agree is completed after 40 days, but rather, it concerns female development. Cleopatra claims that females develop on the same timeline as males and are also sexually developed by 40 days. Rabbi Yishmael, however, uses the amount of time the Torah commands a woman to keep the laws of *tumah* and *tabara* after the birth of the baby to calculate that female development is completed after 80 days of fetal development.

As far as we know, maleness is determined by the expression of SRY, but what about femaleness? Is it just the lack of maleness, or are other genes transcribed and other events occurring in the forming female? Rabbi Yishmael does not seem to equate female development with the lack of male development, rather it is its own occurrence that happens to occur later in the pregnancy [1]. Rabbi Yishmael is, in fact, correct in this assessment. Biologically speaking, the basic developmental pathway of

---

gonads from stem cells would end in the development of ovaries [3]. It is only the transcription of SRY that changes the developmental pathway to develop the male urogenital system.

Physically, the absence of maleness would mean that if SRY is not expressed by day 41 the zygote will immediately begin developing a female urogenital system. If Cleopatra were to emerge from the debate victorious, femaleness would be the absence of maleness. However, femaleness is not just the absence of maleness. The ability to identify the development of the female urogenital system is not immediate. It occurs during the 12<sup>th</sup> week, or about 80 days of fetal development [3]. This occurs 30-days after SRY stops expressing, proving that, in fact, females and males do not develop at the same time, and Rabbi Yishmael is the victor.

An additional proof against Cleopatra causes Rabbi Yishmael to say "...and you bring me proof from the imbeciles?!" The harshness of his answer comes not from the fact that his contemporaries rejected his math, but it comes from the proof of Cleopatra herself. She claimed to have autopsied two women who conceived a child at the

same time and they each carried one of each gender. There is a glaring error in this scientific experiment: At day 40 the gonads are not developed to look different from each other. SRY is only beginning to be expressed at day 40. Prior to this, only undifferentiated gonads are found, along with sets of both female and male internal duct systems. Regardless of the angle the fetus is looked at, it is impossible to identify its sex at such a young age of development [4]. Truly, Rabbi Yishmael emerges from the debate, victorious in his knowledge of human fetal development.

### Acknowledgements

I would like to thank my parents for supporting me in my pursuit of learning both Torah and *Madda*. I would like to thank Dr. Babich for providing me with most of the articles sourced in this paper, and for being a constant source of inspiration to find the true junction of Torah *U'Madda*. I would also like to thank Rabbi Dr. Richard Weiss for taking the time to read over this article, and his guidance in both Torah and *Madda* content of the article.

---

### References

- [1] Poltorak, L. (2009). On the Embryological Foresight of the Talmud. B'Or Ha'Torah 19:19-24
- [2] Cummings, M.R., 2011, Human Heredity, 9<sup>th</sup> edition, Brooks/Cole, Belmont, CA
- [3] Schoenwolf, G.C, and Larsen, W.J. (2009). Development of the Urogenital System in Larsen's Human Embryology. 4<sup>th</sup> Edition. Churchill Livingstone, New York, pp 503-515  
[https://www.innerbaia.com/Embryo/hum\\_emb.htm](https://www.innerbaia.com/Embryo/hum_emb.htm) (Retrieved October 14, 2015)