What’s the Truth about … Coinciding Birthdays?

By Ari Z. Zivotofsky

Misconception: A person’s Hebrew and English birthdays coincide once every 19 years.

Fact: There is a 19-year cycle within the Jewish calendar, but it only determines which years are “regular” years and which are leap years. The calendar does not precisely repeat every 19 years, and birthdays do not necessarily coincide (mine did not).

Background: The subject of the Jewish calendar is daunting to some people, but it need not be. This article provides a brief overview of only those points related to the misconception, but even an in-depth analysis of the Jewish calendar should not intimidate.

Rambam (Kiddush Hachodesh 11:4) says that a schoolchild can master the details of this subject in three or four days. One should take pride in studying this material, as the Talmud (Shabbat 75a) states that it is praiseworthy to calculate the tekuftot (solar seasons), and that when the Torah says “for this is your wisdom and understanding in the eyes of the nations,” it is referring to knowledge of the Jewish calendar (Devarim 4:6).

In order to examine the alignment of the Jewish and the secular calendar systems, it is first necessary to understand something about the nature and the workings of each of them. A calendrical system is an innovation to help track time and temporally relate events. In theory, it is possible to simply count days. Thus, if one had started counting from Creation (assumed to be September 7, 3761 BCE), January 1, 2000 was the date 2,103,548, and my birth date would be the easy-to-remember date 2,090,299.

Most calendrical systems, however, have some sort of cyclical nature, usually one that relates to a natural phenomenon. The Torah states that the sun and moon were created to provide a means to differentiate day from night and to determine holidays, days and years (Bereishit 1:14), and in the re-established covenant with Man after the Flood, God vowed to never again disrupt the flow of the seasons or of day and night (Bereishit 8:22). There are three primary natural cycles: a day, which corresponds to the earth’s rotation on its axis; a month, which corresponds to the moon’s revolution around the earth, and a year, which corresponds to the revolution of the earth around the sun. God, in His infinite wisdom (and with His sense of humor), arranged that none of these is a simple multiple of any other.

The Jewish calendar is linked to both the solar and lunar phenomena. The intrinsically unrelated lunar and solar cycles must be aligned so that the months follow the waxing and waning of the moon, with each month commencing with the appearance of the new moon (unlike the secular calendar in which months begin at random times within the lunar cycle), while the yearly holidays and individual months occur in a specific solar season (unlike the Muslim calendar in which months and holidays drift through the seasons).

Although we are mandated by the Torah (Rambam, Sefer Hamitzvot, aseh 153) to synchronize the two different cycles, the calendar did not always exist in its current, familiar form. In the Second Temple and Tana’itic periods, the beit din in Yerushalayim had almost complete control over the calendar and modified it, using certain guidelines, as needed. Thus, the first day of each month was determined by witnesses who testified to the appearance of the new moon and who were then cross-examined by the beit din, which had already calculated when, where and how the new moon would appear. After cross-examining the witnesses, the beit din could choose to accept or reject their testimony, but every month was either 29 or 30 days long, with, in general, no pre-set rules. In order to maintain the calendar fixed within the solar cycle, the beit din would periodically insert an additional month (intercalate) between Adar and Nisan. Here, too, there was no predetermined cycle. The beit din would consider several factors in order to maintain the calendar fixed.
within the solar cycle (see Rambam, Kiddush HaChodesh 4:1-5, for the three main and several ancillary factors) and make a year-by-year determination as to whether to add the extra month.

No matter how small the Jewish population in Eretz Yisrael might be, it is always the center of the Jewish universe and remains responsible for the calendar. Thus, when the Jewish population in Eretz Yisrael began to dwindle in the fifth century, it was decided to establish the calendar as we know it. This process began in the fifth century and was not completed until the tenth century.2

The fixed calendar involved impressive computations. Because a lunar month is approximately 29 1/2 days, the basic, non-leap year has 12 months that alternate between 29 and 30 days. The solar year is approximately 365 1/4 days, and thus, cannot be made of an integral number of lunar months. To compensate for the disparity of approximately 11 days’ and keep the lunar months aligned with the solar seasons, a leap month is added (an extra Adar) to 7 of every 19 years.3

The determination of when to add a leap month is no longer based on agricultural or meteorological indicators, but depends solely on the year within the 19-year cycle; a leap year occurs in years 3, 6, 8, 11, 14, 17 and 19.5 This cycle is known as a machazar katan;6 or the Metonic cycle;7 and was also used by the ancient Babylonians, and by the Chinese for their civil calendar.

In addition to leap years, other refinements are made to the calendar so that it complies with additional rules, such as the well-known rule that the first day of Rosh Hashanah cannot fall on Sunday, Wednesday or Friday. These are made with the aid of two months with variable lengths, Marcheshvan8 and Kislev, both of which can have either 29 or 30 days.

In order to create the calendar, one also needs to know when Rosh Hashanah occurs. The basic rule is that Rosh Hashanah is on the molad of Tishrei (calculated average new moon),9 unless one of four specific dechiyot (conditions that push it off)10 occurs, in which case Rosh Hashanah is postponed.11 Once the days of Rosh Hashanah for the current year and for the following year are determined, and the leap status is known based on the year in the Metonic cycle, the status of the two variable months is automatically determined, and the calendar is set.

Note that this calendar has no internal cycles, or periodicity. The 19-year Metonic cycle does not determine the length of the two variable months, and hence the lengths of the various years within the cycle are not fixed. The only cyclical characteristic relating to the 19-year period is the sequence of regular and leap years (such that all 19-year cycles have 235 months). Because of the variations in Marcheshvan and Kislev, a 19-year cycle can be either 6,939, 6,940, 6,941 or 6,942 days long. Thus, the Jewish calendar does not repeat every 19 years.

A longer cycle is possible. After thirteen 19-year cycles, i.e., 247 years, a period known as Igul de Rav Nachshon Gaon,12 the molad returns very close to its initial value, nearly yielding a “period.” But the 247-year cycle, too, is inexact.13 It is short by 905 chalakim (about 3016.67 seconds or about 50.278 minutes). Mistaking this near-cycle for an exact cycle can lead to very serious errors according to the Pri Chadash (OC 428, immediately before the detailed table).14

The secular calendar used in the Western World today is known as the Gregorian calendar, which is an updated version of the Julian calendar instituted by Julius Caesar in 45 BCE. A regular Julian year had 365 days, and every fourth year was a leap year with 366 days. This would have been perfect if the solar year was exactly 365.25 days long. But God did not make things so easy. The solar year is closer to 365.242 days. Because of this slight discrepancy of 11 minutes and 14 seconds (0.0078 days) each year, the Julian calendar accumulates an error of about one day every 128 years or 7.8 days every 1,000 years. Although not obvious at first, this inaccuracy started to be noticeable with the drift of the equinoxes. By the sixteenth century, the slip in the calendar had reached 10 days, and Pope Gregory XIII decided that something had to be done. On February 24, 1582, the pope issued a papal bull inaugurating the current calendar. In order to correct the 10 days the calendar had slipped, he simply dropped 10 days from that year. October 4, 1582 became October 15, 1582, and the calendar was back in sync. To prevent future calendrical slips, the pope knocked out 3 leap years every 400 years by removing leap years at century boundaries, except when they are divisible by 400. Thus, 1800 and 1900 were not leap years, although they are divisible by four, but 2000 was a leap year. With this correction, the average year is 365.2425 days long; the calendar will lose only one day every 3,000 or so years. Not everyone immediately embraced this Gregorian sleight of hand. Great Britain and its American colonies kept the Julian calendar until
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To talk of having two birth-
day. While in the secu-
ations in transitioning from one day to
every 19 years is the different conven-
river and secular birthdays can
also coincide in fewer than 19 years. The
19-year cycle incorporates two less
accurate sub-cycles: an 8-year cycle and an
11-year cycle. The 8-year sub-cycle, an
octaeteris, contains 99 synodic lunar
months, and produces an error of one
day every 5 years. The 11-year sub-cycle
is 136 lunations, and produces an error
of one day every 7.3 years. Because of
these mini-cycles within the calendar,
there is the possibility of synchrony in
years that are multiples of 19 plus or
minus 8 or 11 years, such as 27 or 30
years. This is because in 8 lunar years in
which there are 3 leap years (there could
also be 2), there are 99 months and
between 2,922 and 2,925 days. The
solar years during that period will
always have 2,922 days. In 11 lunar
years in which there are 4 leap years
(there could also be 5), there will be
between 4,015 and 4,017 days, while
the 11 solar years can have either 4,017
or 4,018 days, again allowing for the
possibility of coinciding birthdays.

Take, for example, someone born
on Monday, Sivan 9, 5749/June 12,
1989. Eleven years later his birthday
was Monday, Sivan 9, 5760/June 12,
2000. Again, only 8 years later June 12
and Sivan 9 coincide in 5768/2008,
and again 11 years after that in
5779/2019. Thus, his thirtieth birthday
will be his third with coinciding birth-
days!

By far the most common interval
of coincidence occurs every 19 years,
and this explains why people are under
the misconception that the coincidence
must occur every 19 years. Most people
are not aware of the fact that it can
occur in shorter intervals and that it
does not always occur after 19 years. In
a 120-year lifetime the median number
of coinciding Hebrew and English
birthdays on a multiple of 19 years will
be 3, with another 1 or 2 occurring on
a multiple of 19 plus or minus 8 or 11
years. (I thank Phil Chernofsky for the
statistics.)

The discussion of the topic also
highlights the fact that as practicing
Jews in the twenty-first century, we are
attempting, and in a large way succeed-
ing, to simultaneously live in two
worlds. To talk of having two birth-
days that do or do not coincide in-
dicates an awareness of, and a dwelling in,
two disparate worlds: a Torah-oriented
Jewish world and a secular Western one.
While we are engaged in this delicate
balancing act, it should always be clear
that they are indeed two different cul-
tures and worldviews, which, like their
respective calendars, do not often coin-
cide. Just as at all times one needs to be
aware of the “date” in both systems,”
and is acutely aware that they differ, one
must also maintain an awareness of the
difference in values between the two
systems. The twenty-first-century Jew,
while balancing two complex, separate
worlds, must recognize that, like their
independent calendars, these worlds
often do not coincide, and their syn-
chrony is rare.

Notes
1. Rabbeinu Bachaya (Shemot
12:2) cites an opinion (in the name of
Rabbeinu Chananel; it is also attributed
to Rav S’aadia Gaon) that the essence of
the mitzvah of declaring the new month
is via calculation and not by
witnesses, and he notes that during the 40 years
the Jews were in the desert, Rosh
Chodesh was determined by calculation
(as in the fixed calendar) and not by
observation, because the heavens were
blocked by the protective Clouds of
Glory. However, see Rambam’s negative
reaction to this opinion in his commentary
to Mishnah Rosh Hashanah 2:7.

2. See Shu”t Rashba 4:254.
Throughout that period, from the fifth
to the tenth century, the calendar for
the coming year was publicly pro-
claimed by the head of the community
in Eretz Yisrael on Hoshana Rabbah
from Har Hazemit. In the year 920,
Rabbi Aharon Ben Meir set off a major controversy when his announced dates differed from those of Rav Sa’adia Gaon. On this incident, which led to the final fixing of the calendric rules, see Yosef Gavriel Bechhofer with Ari Z. Zivotofsky, “The Rabbi Sa’adia Gaon—Rabbi Aharon ben Meir Controversy,” Jewish Observer 33:4 (Nisan 5760/April 2000): 40-44.

3. Rambam (Hilchet Kiddush Hachodesh 10:1) quantifies it as 10 days, 21 hours, 121 chalakim (see note 9) and 48 regaim (1/76 of a chelek).

4. The 13-month year is known as “gravid” in English or a “shanah meuberet” in Hebrew.

5. This is remembered by the Hebrew mnemonic GUCHADZaT, standing for the Hebrew letters gimmel-vav-cher-aleph-dalet-zayin-tet.

6. As opposed to the machzor gadol, the 28-year solar cycle.

7. Named after the fifth-century BCE Greek astronomer Meton, who is said to have discovered that 235 lunar periods brought the solar year into very close synchronization with the lunar year.


9. The molad is calculated by adding to the original molad the mean length of a month for each month that has elapsed since the first molad. The first molad is taken as molad Tishrei in year 1, at day 2, 5 hours and 204 chalakim (a chalak is a part equaling 1/1080 of an hour, which equals 1/18 of a minute, which equals 3 1/3 seconds). (See Tur, OC 464 for these facts and a primer in calculating the molad.)

10. Without too much detail, the 4 dechiyot are: 1. if the molad is on Sunday, Wednesday or Friday; 2. if the molad is after noon; 3. if the molad of a non-leap year is on Tuesday—or or after 9 hours and 204 chalakim; 4. if the molad following a leap year is on Monday—or after 15 hours and 589 chalakim (this rare dechiya, used about once every 186 years, applied last year, 5766).

11. Note that the only molad that is of significance in determining the calendar is the molad of Tishrei, and that is the only one that is not announced in shul.

12. Rav Nachshon ben Rav Tzaddok’s connection to this cycle is unclear. About Rav Nachson (d. 4640 [879]), see Encyclopaedia Judaica 12:793.

13. According to Leo Levi, the Hebrew calendar precisely repeats itself after the ridiculously long period of 36,288 cycles of 19 years, or 689,472 Hebrew years, a period with no practical application; see Yehudah (Leo) Levi, Jewish Chrononomy (New York, 1967), 7-8.

14. The Encyclopaedia Judaica (12:793) erroneously states that “the Jewish calendar repeats itself exactly every 247 years.” According to R. Sar-Shalom, Shelharim Laluch Ha’ivry [Tel Aviv, 5744], 51-52 the almost 1,000-year calendar printed in the Tur following OC 428 contains errors in 24 of the years, most recently in 5662 (1902) because of this erroneous assumption. See Pe’er Hadar 1, p. 179, regarding how the Chazon Ish made the calculations to show that the Pri Chadash was correct regarding 1902, but also claimed that there really is no debate between the Pri Chadash and the Tur, rather a printing error had crept into the Tur’s words. Thanks to Rabbi Matis Greenblatt, literary editor of Jewish Action, for providing this source.

15. To be precise, out of the larger 689,472-year cycle, 675,716 years of the 247-year cycles have 90,216 days, 10,317 have 90,214 days (1.5 percent), and only 3,429 (0.48 percent) have 90,215 days.

16. The kernel for the rest of this paragraph was planted after reading Michael J. Brody, “Truth-Seeking as the Mission,” My Yeshiva College: 75 Years of Memories, ed. Menachem Butler and Zev Nagel (New York, 2006), 325-327.

17. One needs to be aware of the Jewish system because, among other reasons, it is a Biblical commandment to count the months from Nisan (as well as to link the days of the week to Shabbat). Furthermore, some authorities think it is wrong to use the Christian counting. One needs to be aware of the secular system just because it is necessary in order to take care of one’s daily activities. Note that in Israel this may not be the case because one may use the Jewish date for all business and financial activities, and pursuant to a law the Knesset passed in 5758, all government documents must include the Jewish date.