

THE JEWISH CALENDAR

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It all starts with the sun and the moon and the earth. It takes 24 hours for the earth to rotate on its own axis, so we have 24-hour days. These are divided into hours for "day" in the meaning of daylight and for "night," the proportion of those hours depending on the seasons.

This usage of "day" in the generic sense, and "day" in the limited sense of the time of daylight, is also found in the Hebrew. "*Yom*" means the 24-hour day, as in Genesis 1:5: *Vayehi erev vayehi boker yom echad* [And there was evening and there was morning a first day], and *Laor kara yom velachoshekha kara layla* [called the light day and called the darkness night].

It is more complicated when we get to the month. In a solar calendar, a month is calculated by dividing the 365 days of the year into 12 roughly equal parts. Why 12? Here the solar calendar bows to the lunar calendar, just as the Jewish lunar calendar bows to the solar calendar, as we shall soon see. Twelve revolutions of the moon about the earth corresponds roughly to the four-season cycle of the year, which is determined by the sun in relation to the earth. Therefore, the year is divided into 12 months. In English, it is obvious that the word "month" comes from the word "moon." In Hebrew, *chodesh* [month] comes *chidush* [renewal], since the moon is "renewed" once a month, unlike the sun which is renewed every day.

Dividing 365 by 12 gives a little over 30-4/10. To avoid starting a new month in the middle of a day, the lengths of the months alternate, as in the old rhyme:

Thirty days hath September, April, June and November,
All the rest have 31, Except the second month alone,
To which 28 we assign, And leap year gives it 29.

Four months of 30 days, plus 7 months of 31 days, plus a single month of 28 days comes to a total of 365 days for the year.

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Why does February in the secular calendar have an extra day every four years? Because the revolution of the earth around the sun is not exactly 365 days, but 365-1/4. If the discrepancy of one-quarter of a day were disregarded, the real solar year would run ahead of the solar calendar. The connection between the seasons of nature and the months of the calendar would be constantly changing. Farmers would be confused. Religious observances, with their emphasis on special days in the month, would become disconnected from the seasons associated with them. Therefore, the Julian Calendar of ancient Rome, later corrected and refined by the Gregorian Calendar of 16th-century Europe, added one day to February every four years, thus making up for four annual discrepancies of one-quarter of a day each.

The biblical calendar gives primacy to the moon, but the sun also has to be considered, since festivals are linked to seasons of the solar year. A lunar month is approximately 29-1/2 days, so 12 months come to a year of 354 days. This makes a discrepancy between the lunar year and the solar year of 11 days, accumulating from year to year. The holidays fixed to the months would in very short order be disconnected from their appropriate seasons. In time, Passover would come in the winter instead of in the spring.

THE 19-YEAR CYCLE

The Hebrew calendar solves this problem by adding a whole month 7 times in every cycle of 19 years. Here is the arithmetic:

$$\text{solar year of 365 days} \times 19 \text{ years} = 6935 \text{ days}$$

$$\underline{\text{lunar year of 354 days}} \times 19 \text{ years} = 6726 \text{ days.}$$

$$\text{discrepancy} \quad \quad \quad = 209 \text{ days}$$

How do we make up for these 209 days? By adding 7 leap years in the 19-year cycle; years known in Hebrew as *shanim meubarot* [pregnant years]. The addition in each leap year is a 13th month, inserted after Adar, the 12th month, and called *Adar Sheni* [Adar II]. These 7 extra months of 30 days each add up to 210 days, a number close enough to compensate for the differences between the solar and lunar years.

Adar II creates some curious anomalies in the calendar. For example, if one boy is born on the 20th day of Adar, and another is born on the 10th day of Adar II, they will each be Bar Mitzvah in a year with only one Adar. But the

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younger boy will be Bar Mitzvah first, on the 10th of the month, and the older boy not until the 20th of the month.

KIDDUSH HALEVANAH AND KIDDUSH HAHAMAH

Kiddush or *Chidush HaLevanah* is the blessing for the new moon, recited in the courtyard of the synagogue on the Saturday night following the appearance of the new moon.

Besides this ceremony of *Birkat HaLevanah*, a blessing for the moon, there is also a ceremony of *Birkat HaHamah*, a blessing for the sun. While the first occurs every month, the second occurs only once every 28 years. It celebrates the occasion when the sun returns to the position where it stood at Creation, held on the same day of the week and the same hour of the day. Genesis 1 states that the sun was created on the fourth day. Light was created on the first day, but it was not until the fourth day that the luminaries of sun, moon and stars are created and hung in the sky.

Rabbi Eliezer says: "The world was created in Tishri." That is why when the shofar is blown on Rosh HaShanah it is said *HaYom Harat Olom* [Today is the Birth of the World]. However, Rabbi Joshua says: "The world was created in Nisan." Since the days grow longer and longer in Nisan, the idea of the sun being created in Nisan won over the idea of its being created in Tishri, when the days shrink shorter and shorter. So we have the sun created in Nisan, the beginning of spring. The sun was created on the fourth day. In terms of the modern civil calendar, that would be equivalent to Tuesday evening and Wednesday morning and afternoon. It is assumed that it was created at the beginning of that day, which would be in the evening when the new day begins; *vayehi erev vayehi boker, yom revii* [It was evening, it was morning, the fourth day].

The Talmud refers to an equinox as *tekufah*, and the vernal equinox is *Tekufat Nisan*. It assumes that the creation of the sun took place at the moment of the vernal equinox. Therefore, according to the Genesis, the sun was created when the fourth day began, equivalent to Tuesday at 6:00 p.m.

In the Talmud, in Berakhot 59b, we have the following:

He who sees the sun at the *tekufah*, should say: Blessed be the Maker of Creation. And when is that? Every 28 years when the cycle is repeated,

and *Tekufat Nisan* falls in Saturn, on the evening of Tuesday, going into Wednesday.

THE SMALL AND THE GREAT CYCLE

Where do the 28 years come in? The Talmud, in Eruvin 56a, gives the calculation of the seasons: the solar year of 365-1/4 days is divided into four parts for the four seasons, each part being approximately 91 days plus 7-1/2 hours. *Tekufat Nisan*, the beginning of spring, comes at the vernal equinox. In this calculation, it comes at exactly 6:00 a.m., Wednesday morning, or at noon, or at 6:00 p.m., or at midnight, in rotation. If it occurs one year at 6:00 p.m., it will occur the next year (365-1/4 days later) at midnight. The quarter of a day would always push it ahead by six hours a year. This four-year cycle is called *Machzor Katan* [Small Cycle]. After four years, the equinox returns to the same hour of the day, but not the same day of the week. There are 52 weeks in the year, and 7 days in the week, coming to 364 days, instead of the 365 of the solar year. Hence, the calendar falls behind, in terms of the days of the week, by one day every year. In four years, if we count the fraction of a quarter of a day, we end up with a discrepancy of five days.

It takes seven such Small Cycles to return, not only to the same hour but also to the same day of the week. The *Machzor Gadol* [Great Cycle] is the four-year cycle multiplied by the seven days of the week. It comes to 28 years, and that is why every 28 years we observe the anniversary of the Creation of the Sun. On that day, when the cycle comes around to 6:00 p.m. on the Wednesday following the vernal equinox.

The 200th Great Cycle since the Year One of Creation ended in the year 5600, corresponding to the year 1840 C.E. The most recent time that *Birkat HaHamah* was recited was in 5740 (1980). The current cycle will conclude, and the blessing will be recited again, in 5768 [2008].