

Rabbinical Mathematics and Astronomy

Adapted Excerpts from *Rabbinical Mathematics and Astronomy* by W. M. Feldman

Published in London by M. L. Cailingold, 6, OLD MONTAGUE STREET, E.1 in 1931 A.D.

The Examination of Witnesses

“At the mouth of two Witnesses shall the matter be established”

The Calendar Council

The Calendar Council¹ at first consisted of priests who examined the evidence of witnesses who reported having seen the new moon.² At a later period, the priests were replaced by three members of the Sanhedrin,³ who were specially qualified by their mathematical and astronomical skill, and one of whom was the Nasi - or President of the Sanhedrin. In the absence of unanimity, the Court increased to five, and, if necessary, to seven members.⁴ In addition to their duty to examine witnesses, the Calendar Council also had to decide which year was to be made a leap year (or embolistic year). The question was originally decided by the state of the crop.⁵ For since the lunar year - consisting as it does of 12 lunar months, i.e., of 12 lunations of average duration of about 29 ½ days - lasts 354 days, while the solar year lasts about 365 days, the lunar is shorter than the solar year by about 11 days. After about 3 years, therefore, there is a discrepancy of more than a month between the two kinds of year, so that Passover, for instance, occurring as it does in Nisan - which should be the first spring month (Deuteronomy 16:1) - would actually be in winter. Hence, if any year the crop was found to be still too unripe to allow the Omar to be offered at the proper time (16 Nisan), the Calendar Council intercalated an extra month between Adar and Nisan - although it is also recorded that an extra month was sometimes inserted between Av and Elul instead of between Adar and Nisan.⁶

At a later period the actual position of the sun in the ecliptic was also taken into account, and if observation, or calculation, showed that the vernal equinox would fall after the 16th of Nisan, a leap year was intercalated.⁷

The extra intercalated month contained either 29 or 30 days.⁸ It is owing to this particular function of intercalation that the King and High Priest were excluded from membership of the Calendar Council: the King might be biased in favor of too many leap years in order to save expenditure in connection with the Army, which is paid by the year; whilst the High Priest, who has to immerse his body in spring water (*Mikvah*) five times on the Day of Atonement, might oppose intercalation in order to bring about the falling of that day during the warm period of the year.⁹

The Council was called *Sod Haibbur*, but this name was also given to the secret method in use for calculating whether an extra month was, or was not, necessary to be intercalated.¹⁰

¹ Babylonian Talmud - Kethuboth 112A When R. Eleazar went up to the Land of Israel he remarked, 'I have escaped [one penalty]'. When he was ordained he said, 'I have now escaped two [penalties]'. When he was given a seat on the council for intercalation he exclaimed, 'I have escaped the three [penalties]'; for it is said in Scripture, *And My hand shall be against the prophets that see vanity etc. They shall not be in the council of My people, which refers to the council for intercalation; neither shall they be written in the register of the house of Israel [Ezekiel 13:9]*, refers to ordination; *neither shall they enter into the land of Israel [Ezekiel 13:9]* [is to be understood] in accordance with its plain meaning.

² Mishna - Rosh Hashanah 1.7 A father and his son who saw the new moon should go [to beis din]. Not that they can be paired together [as witnesses], but [so that] if one of them is disqualified, the second may be paired with another. R' Shimon says: A father and his son, and all relatives are eligible for testimony about the new moon. Said R. Yose, 'It happened that Toviah the physician saw the new moon in Jerusalem - he, his son, and his freed slave, and the Kohanim accepted him and his son, and disqualified his slave. But when they came before the beis din, they accepted him and his slave, and disqualified his son.'

³ Mishna - Sanhedrin 1.2 The intercalating of the month is by three.

⁴ Mishna - Sanhedrin 1.3 Rabban Shimon ben Gamliel says: It is begun with three, discussed by five, and concluded by seven. If they concluded with three it is valid.

⁵ Babylonian Talmud - Sanhedrin 11A-B Our rabbis taught: A year may be intercalated on three grounds: on account of the premature state of the corn crops; or that of the fruit trees; or on account of the lateness of the *Tekufah* [Literally 'cycle', 'season']. Any two of these reasons can justify intercalation, but not one alone. All, however, are glad when the state of spring-crop is one of them.

⁶ Babylonian Talmud - Sanhedrin 12A The Members of the Assembly, however, met and established a *Nezib* in the month in which Aaron the Priest died? The month of Av. It is thus seen that the decision to intercalate may, in case of an emergency, be made before the New Year, i.e. before Tishri.

⁷ Babylonian Talmud - Rosh Hashanah 21A R. Huna b. Abin sent an instruction to Raba: When you see that the cycle of Tebeth extends to the sixteenth of Nisan, declare that year a leap year and have no scruples, since it is written, *Observe the month [Hodesh] of Abib*, which signifies, See to it that the Abib of the cycle should commence in the earlier half [Hodesh] of Nisan. In other words, if the vernal equinox is known by calculation to fall after the sixteenth of Nisan, a leap year is proclaimed.

⁸ Babylonian Talmud - Rosh Hashanah 19B 'How long is the period of the prolongation of the year? Thirty days. Simeon b. Gamaliel, however, says a month' (29 days). But why should only [the one who says] thirty days [require no messengers to be sent]? Because, you say, people in this case know when the month ends? If the period is a month, they also know! - R. Papa said: The one who said 'a month' holds that [the Beth din may prolong the year] either by thirty days or by a month at their option.

⁹ Babylonian Talmud - Sanhedrin 18B The text [states]: 'The king may not be given a seat on the Sanhedrin,' nor may the king or the High Priest be members of the board for the intercalation of the year. 'The king [may not be given a seat] in the Sanhedrin,' - because it is written, *Thou shalt not speak* [Exodus 23:2], meaning, thou shalt not speak against the *rab* chief of the judges [i.e. if the king were a member of the Sanhedrin, other members would be inclined to suppress their opinions in deference to him]. Again, 'nor may the king or the High Priest be members of the board for the intercalation of the year.' The king on account of 'Afsanya' [the upkeep of the army] [As it would be to his interest sometimes to intercalate and sometimes not to intercalate the year, according as the payment of the army is by the year or by the month]; the High Priest, because of the [autumnal] cold [Since he might be biased against intercalation which, by placing the Day of Atonement later in the autumn, would make the several ritual baths which he has to take on that day (five immersions in all) rather cold].

¹⁰ Babylonian Talmud - Rosh Hashanah 20B Said Abba the father of R. Simlai to Samuel: Does the Master know [the meaning] of this remark which occurs in [the Baraita known as] the secret of the Calendar?

The Council sat in Jerusalem at a court called *Beth Yaazek* on the 30th of each month, to receive witnesses. The Rabbis also established another court in a southern province *Ain Tab*.¹ If after cross-examination and further confirmation of their evidence by mathematical calculation, the Council concluded that the new moon was, indeed, seen by witnesses at the time they mentioned, that day was declared to be the first of the new month. If no witnesses arrived by the 30th day, then the 31st day was declared to be the first month without any further waiting. If, therefore, people who saw the new moon on the 29th day, lived more than a day's journey from the Calendar Council, there was not need for them to come to attest.²

A month of 29 days was called a defective month, and one of 30 days was a full month. It was possible for 3 months to be consecutively full if - owing to unfavorable atmospheric conditions - the new moon was not visible. If, however, no witnesses appeared for 3 months, then the beginning of the next month was determined by calculation alone. No year was allowed to have more than 8, or less than 4, full months,³ so that no lunar year lasted more than 356 or less than 352 days. It would appear that the Council had mathematical specialists to act as their assessors.⁴

Character of the Witnesses

No evidence was considered valid unless it was given by at least two reputable male witnesses; gamblers, usurers, slaves, and others, whose reputation was not beyond reproach, were disqualified. The reason was that certain evil-minded people, in order to upset the Jewish Calendar, sometimes bribed people deliberately to deceive the Court.⁵ At a later date R. Judah Hanasi allowed criminals to give evidence before the Calendar Council, although they would have been disqualified as witnesses in a Court of Justice. He also accepted 'hearsay' evidence⁶ - thus showing that he practically entirely relied upon calculation alone.

Examination of the Witnesses

It was the religious duty for any one who saw the new moon, and who lived within 24 hours' journey of Jerusalem, to come and testify; as an encouragement, such witnesses were entertained to a sumptuous meal and given certain privileges. Questions were asked of them regarding the position of the moon in relation to the Sun:

- 1) Whether the moon was East or West of it
- 2) Whether the moon was North or South of the West point
- 3) What was its altitude and azimuth
- 4) What were the direction of the crescent's horns
- 5) What was the width of the crescent

Position of Moon in relation to the Sun

Since the moon and sun travel in the same direction from West to East and the former gets ahead of the latter at the rate of about 12 1/5 degrees a day, it follows that, starting from a conjunction, the new moon will be ahead of the sun (i.e. east of it) until the elongation is 180 degrees (at full moon), after which it will be west of the sun (i.e. behind it). But the diurnal rotation of the heavens being from East to West, it is clear that *the new moon - being east of the Sun will appear at the eastern horizon after sunrise, and will set at the western horizon after sunset; the reverse being the case with the waning moon.* Hence - as the above passage concludes - "if the witness stated that he saw the moon sink at the western horizon before sunset, his evidence is worthless."

For the same reason evidence to the effect that the moon was seen to rise in the morning before sunrise and to set in the evening after sunset could not be reliable, because it must necessarily refer to the waning moon in the morning and the new moon in the evening. For the moon to be visible at all, its true elongation must be not less than 9 degrees; but at the rate at which elongation increases - viz., about 1/2 degree per hour - it must take about 18 hours on either side of a true conjunction for the moon to cover such an arc, so that an interval of about 36 hours must elapse between the disappearance of the crescent of the old and the appearance of that of the new moon. R. Zera, in the name of R. Nachaman gave the minimum period of invisibility of the moon as 24 hours.⁷ Maimonides gives the period of invisibility of the moon as *about 2 days*.⁸

¹ Babylonian Talmud - Rosh Hashanah 25A R. Hiyya once saw the [old] moon in the heavens on the morning of the twenty-ninth day. He took a clod of earth and threw it at it, saying, Tonight we want to sanctify you, and are you still here! Go and hide yourself. Rabbi thereupon said to R. Hiyya, Go to En Tob and sanctify the month, and send me the watch-word, 'David king of Israel is alive and vigorous'.

² See Maimonides, Hilchoth Kiddush Hachodesh 3.1

³ Mishna - Arachin, 2.2 We do not make less than four intercalated months in a year, and it does not appear [correct to make] more than eight.

⁴ Yerushalmi Talmud - Succah 4.1

⁵ Mishna - Rosh Hashanah 2.1 If they [the beis din] do not know him, they send another [pair of witnesses] with him to testify about him. Originally they accepted testimony about the new moon from anyone, [but] after the heretics did harm, they [the Sages] enacted that they [the beis din] should not accept [testimony] except from known people.

⁶ Yerushalmi Talmud - Rosh Hashanah 2.1

⁷ Babylonian Talmud - Rosh Hashanah 20B R. Zera said in the name of R. Nahman: The moon is invisible for twenty-four hours [round about new moon]. For us [in Babylon] six of these belong to the old moon and eighteen to the new; for them [in Palestine] six to the new and eighteen to the old. What is the practical value of this remark? R. Ashi said: To confute the witnesses.

⁸ See Maimonides, Hilchoth Kiddush Hachodesh 2.6

Was the Moon North or South of the Sun?

When the moon's latitude is positive, the moon is of course North of the Sun (so that the witness facing the western horizon should have seen the moon to the right of the sun). When the latitude is zero (i.e., the moon is at a node in the ecliptic), the moon and sun are seen to set at the same point of the horizon. When the latitude is negative, the moon is seen south (i.e., to the left) of the sun. It is possible for the moon's latitude to be north and yet for the moon to be left of the sun, but if the moon's latitude is south, it must be to the left of the sun (in the northern geographical latitudes), just before setting.

According to one anonymous rabbi, the moon is always North of the sun, so that if a witness says that he saw it South of the sun his evidence is valueless, while according to another anonymous authority the opposite is the case. The Talmud reconciles the two statements by saying that in the summer the moon is North of the sun, while in winter is South of the sun.¹ Rashi gives a long explanation of why this should be so. As a matter of fact, all these statements, including Rashi's explanation, are incorrect. It is true - as Rashi points out, that between the spring and autumn equinoxes the sun is North of the equator (and therefore rises North of East and sets North of West), while between the autumn and spring equinoxes, it is South of the equator (and therefore rises South of East and sets south of West), but this gives no information as to whether during these periods the moon will be North or West of the sun; for the latitude of the moon depending, as we have seen it to do, on the movement and position of the node has no relation to the seasons.

The Altitude and Amplitude of the Moon

The Talmud says that if one witness gives the altitude as two *Mardeoth* and the other gives it as three, their evidence is not necessarily inconsistent. If, however, there is a difference of two *Mardeoth* (one saying 3 and the other 5), the discrepancy is too great to be overlooked.

Direction of the Horns of the Crescent

As the moon receives its light from the sun, it is obvious that the horns of the crescent must always point away from the sun, so that in the language of R. Yochanan "the sun has never seen the concavity of the lunar crescent."² Hence, when the new moon is seen above the horizon after the sunset its horns must point away from the horizon. On the other hand, the horns of the waning moon will point towards the horizon - i.e., also away from the sun.

The Width of the Crescent

Rabbi Gamliel had charts of the moon's crescent in different phases, and he used to ask witnesses to point to the particular phase resembling the crescent they stated to have seen.³

Dissemination of the News

When the court was satisfied that the new moon had actually been seen, the President declared the new moon to be consecrated⁴ and the news was spread to people outside Jerusalem by means of bonfires, or beacons, on the tops of mountains. When the awaited signal was observed at neighboring mountains, similar fire signals were lit, and thus the information was transmitted to distant places. This method was continued until a deliberate attempt to confuse the Judeans was made by the Cuthites, (Samaritans), who maliciously lit signals at improper times.⁵ Since then these fire signals were altogether abolished by R. Judah Hanasi, and messengers or couriers, to convey the tidings, were sent out instead.⁶

¹ Babylonian Talmud - Rosh Hashanah 24A HOW HIGH WAS IT AND IN WHICH DIRECTION WAS IT INCLINED. One Tanna taught: [If he says], To the north, his evidence is accepted; [if he says], To the south, his evidence is rejected. But it has been taught to the opposite effect: '[If he says], To the south, his evidence is accepted; [if he says], To the north, his evidence is rejected'? - There is no contradiction; one statement speaks of the dry season, the other of the rainy season. The new moon always appears due west. Hence in the summer months when the sun sets in the north-west it is south of the sun, and similarly in the winter months north of the sun.

² Babylonian Talmud - Rosh Hashanah 23B R. Johanan has said: What is meant by the verse, *Dominion and fear are with him, He maketh peace in his high places?* [Job 25:2] Never did the sun behold the concavity of the new moon nor the concavity of the rainbow. It never sees the concavity of the moon, so that she should not feel humiliated. It never sees the concavity of the rainbow so that the worshippers of the sun should not say, He is shooting arrows [at those who do not worship him]. And in this way God keeps peace between the sun and the moon.

³ Babylonian Talmud - Rosh Hashanah 24A R. GAMALIEL USED TO HAVE A DIAGRAM OF PHASES OF THE MOON ON A TABLET [HUNG] ON THE WALL OF HIS UPPER CHAMBER, AND HE USED TO SHOW THEM TO THE UNLEARNED AND SAY, DID IT LOOK LIKE THIS OR THIS?

⁴ Babylonian Talmud - Rosh Hashanah 24A *And Moses declared the appointed seasons of the Lord; [Leviticus 23:44];* from this we learn that the head of the Beth din says, 'sanctified' And all the people respond after him, 'It is sanctified! It is sanctified!'

⁵ Mishna - Rosh Hashanah 2.2 - 2.4 Originally they accepted testimony about the new moon from anyone, [but] after the heretics did harm, they [the Sages] enacted that they [the *beis din*] should not accept [testimony] except from known people. Originally they used to light torches; [but] after the Cuthites did harm, they enacted that messengers should go forth. How did they light the torches? They would bring long poles of cedar-wood, reeds, balsam-wood, and fiber-chips of flax. Someone would tie them together with rope, climb to the mountaintop, set fire to them and wave [the torch] back and forth, up and down, until he saw his colleague doing likewise on top of the second mountain; and so, too, on top of the third mountain. And from where did they light the torches? From the Mount of Olives to Sarteve, from Sarteve to Grofina, from Grofina to Chavran, from Chavran to Beis Biltin. From Beis Biltin they did not move but [the signaler] would wave [the torch] back and forth, up and down until he saw the entire Diaspora before him as a mass of fire.

⁶ Yerushalmi Talmud - Rosh Hashanah 2.2 Originally they used to light torches; [but] after the Cuthites did harm, they enacted that messengers should go forth.

As these couriers could not reach the more distant places before the 31st day of the old month, the residents of those places used to celebrate two days for their holidays¹ - because they were not sure whether the first of the month was on the 30th or on the 31st day. In the case of New Year, two days were kept even in Jerusalem (and are still so kept) in case witnesses arrived late in the day.² These couriers were at first sent out only 6 times a year, viz., Nisan - on account of Passover; Av - on account of the Fast on the 9th; Iyyar - on account of a minor feast, Purim Katan; Elul on account of the New Year starting on the first of the following month - Tishri, in order to fix the order of the festivals; Kislev, on account of the feast of lights - Chanukah. Rabbi sent out couriers also in Adar - on account of Purim.³

¹ Babylonian Talmud - Pesachim 51B - 52A R. Safra said to R. Abba: For instance I, who know [the art] of fixing the New Moon, in inhabited places I do not work, because it is a change [which would lead to] strife. [But] how is it in the wilderness? - Said he to him, Thus did R. Ammi say: In inhabited regions it is forbidden; in the desert it is permitted. R. Nathan b. Asia went from Rab's academy [in Sura] to Pumbeditha on the second Festival day of Pentecost, [where-upon] R. Joseph put him under the ban.

² See Maimonides, Hilchoth Kiddush Hachodesh 5.7 - 5.8

³ Tosefta Rosh Hashanah, 1. Quoted by A. Schwarz, Der jud, Kalender. Breslau, 1872, p. 28.

The Two Adars Could have either 29 or 30 Days

Rosh Hashanah 19b 'R. Simai testified in the name of Haggai, Zechariah and Malachi concerning the two Adars that if they [the Beth din] desired they could make both of them full, and if they desired they could make both of them, defective, and if they desired they could make one full and the other defective; and such was their custom in the Diaspora.

Intercalation and the Rule of the Equinox

Adapted Excerpts from *Calendar and Community* by Sacha Stern

Published by Oxford University Press 2001

2.1.1 The procedure of intercalation

An essential feature of Jewish and other ancient lunar calendars is the intercalation of an additional month (a 13th month) every second or third year. This intercalation is necessary in order to remain in line with the solar year. Twelve lunar months, indeed, amount to approximately 354 ½ days (each month being on average slightly over 29 ½ days), whereas the solar (tropical) year is just under 365 ¼ days; hence a discrepancy of almost 11 days. In order for the lunar year to keep up with the solar year, i.e. for lunar months to recur in or around the same seasons, this discrepancy must be compensated every three (and sometimes two) years with the intercalation of an additional lunar month. Because of this solar element, the Jewish calendar is sometimes called ‘lunisolar’.

There are two ways of making intercalations. The first is purely *empirical*. An assessment is made every year – or at most, one or two years in advance – of the discrepancy that has accumulated between the lunar and the solar year. On that basis, the decision is taken whether to intercalate an additional month. In some cases, account is also taken of extraneous considerations, e.g. social, political or economic. The incidence of intercalated years is thus irregular and largely unpredictable. A procedure of this kind is prescribed, for instance, in early rabbinic sources.

The second way is to rely entirely on a *fixed cycle*, i.e. a sequence of intercalary years that permanently repeats itself. The length of the cycle can vary (cycles commonly found are of 3, 8, 19, 25, or 30 years). Once this ‘lunisolar’ cycle is in place, it becomes self-perpetuating and no further decisions need to be made. The incidence of intercalated years is thus regular and predetermined *ad infinitum*.

The disadvantage of the first procedure is its unpredictable, irregular nature, and its dependence on an authoritative person or body of people who are responsible for deciding, every year, whether or not to intercalate. The disadvantage of the second procedure is its unavoidable inaccuracy. No cycle, indeed, achieves an accurate synchronization of lunar and solar years. The second procedure, unlike the first, makes no provision for occasional adjustments or corrections.

2.2.2 The rule of the equinox

As to the ‘limits’ within which Passover would have occurred, evidence may be drawn from the work of Aristobulus of Alexandria (mid second century B.C.E.)³. Fragments of his work are cited by Anatolius bishop of Laodicia (Syria), whose treatise on the date of Easter, written in the 270s C.E., is itself preserved in fragmentary form in Eusebius’ *Ecclesiastical History*. There, Aristobulus and later Jewish authorities are credited with the ‘rule of the equinox’, which is that Passover should always occur on or after the vernal equinox:

And this [i.e. the rule of the equinox] is not our own reckoning, but it was known to the Judeans long ago even before the Messiah and it was carefully observed by them. One can learn it from what is said by Philo, Josephus, (and) Musaeus, and not only by these, but also by both of the Agathobuli, who are still more ancient and are surnamed the teachers. One can learn it also from what is said by the excellent Aristobulus...When these (writers) explain questions concerning the Exodus, they say that it is necessary that all alike sacrifice Passover after the vernal equinox, in the middle of the first month; and this occurs when the sun passes through the first sector of the solar, or as some of them call (it), the zodiacal cycle (Anatolius ap. Eusebius, *Ecclesiastical History*, 7. 32. 16-17).⁴

2.5.1 The rule of the equinox in the fourth century

A consensus emerges in Christian sources, from the beginning of the fourth century, that the Judeans in this period ignored the rule of the equinox and frequently celebrated Passover on the preceding full moon.

This notion is actually already implicit in the Canons of Anatolius, written at Laodicia (Syria) in the 270s C.E. As I have mentioned (section 2.2), Anatolius himself was among the first Christians to advocate the rule of the equinox. This rule he ascribed to the Judeans of earlier Antiquity:

Those [Christians] that place the first month in it [i.e. in the 12th segment of the zodiac, that precedes the equinox] and that fix the 14th of the month [i.e. Passover] by it, commit, as we think, no little and no common blunder. For this [i.e. the rule of the equinox] is not our own reckoning, but it was known to the Judeans long ago even before the Messiah and it was carefully observed by them. One can learn it from what is said by Philo, Josephus, (and) Musaeus, and not only by these, but also by both of the Agathobuli, who are still more ancient and are surnamed the teachers. One can learn it also from what is said by the excellent Aristobulus, who was enrolled among the seventy who translated the sacred Scriptures of the Hebrews for Ptolemy II Philadelphus (285-246) and his father...⁵⁹

His avoidance of any reference to contemporary Jewish practice, and his insistence, instead, on ascribing the rule of the equinox to the 'Judeans long ago even before the Messiah', to first-century authors such as Philo and Josephus, to the 'still more ancient' Agathobuli, and finally to Aristobulus of the early Ptolemaic period, suggests implicitly that the Judeans of his day did not subscribe to this rule.

It is not till the early fourth century, however, that we find explicit statements in Christian sources that contemporary Judeans ignored the rule of the equinox and celebrated Passover, 'in error', one month too early. The emphasis, there, has significantly shifted. Whereas Anatolius' main purpose was to legitimize the rule of the equinox by invoking the authority of Jewish sages of old, subsequent sources emphasize the error of contemporary Judeans as a polemical argument against those Christians who observed Easter at the same time as the Judeans.

The earliest source for us to consider is a letter on the date of Easter attributed to Peter, bishop of Alexandria in the first decade of the fourth century, addressed to an unknown Tricentius.⁶⁰ Both correspondents agreed, it seems, that 'the men (i.e. the Judeans) of the present day now celebrate it (Passover) before the equinox'.⁶¹ But Tricentius appears to have argued that Easter should be observed at the same time as the Jewish Passover, even if the latter was erroneous, because the crucifixion occurred at no other time but when the Judeans were celebrating this festival.⁶² Peter responded that the Judeans had only reckoned in error since the destruction of the Temple, but that in the days of the Messiah, the rule of the equinox was still observed; it was the date of Passover as reckoned in Messiah's period that Christians should follow.

2.5.2 From the first century to the fourth: a radical change

The observance of Passover before the equinox, widespread in the fourth century, contrasts with our findings for the first century, when Passover appears to have occurred considerably later, sometimes over a month after the equinox. This suggests, in Jewish calendrical practice, a rather radical change.

The theory that the Jewish calendar changed in this manner is of course not new. It lies at the forefront of the argument of Peter of Alexandria, which I have outlined above: namely, that in the times of the Messiah the Judeans observed the rule of the equinox, but that following the destruction of the Temple they 'fell into error' and began observing Passover at the wrong time. A similar idea is also implicit, as we have seen, in the *Canons* of Anatolius. Modern scholars such as Grumel have accepted this account at face value,⁷⁶ as we have seen, the evidence would appear to vindicate it.

The Rule of the Equinox and the Creation Calendar

The Torah stipulates that three times every year all the males of Israel were to appear before יהוה in Jerusalem.

Exodus 23:14-17 *Three times a year you are to keep a festival to Me. You shall keep the Festival of Unleavened Bread: (you shall eat unleavened bread seven days, as I commanded you, in the time appointed of the month Abib; for in it you came out from Egypt: and none shall appear before Me empty:) And the Festival of Harvest [Shavuot], the firstfruits of your labors which you have sown in the field: and the Festival of Ingathering [Sukkot], which is in the end of the year, when you have gathered in the labors out of the field. Three times in the year all your males appear before יהוה Elohim.*

Deuteronomy 16:16 *Three times in a year shall all your males appear before יהוה your Elohim in the place which He shall choose; in the Festival of Unleavened Bread, and in the Festival of Weeks [Shavuot], and in the Festival of Tabernacles [Sukkot]: and they shall not appear before יהוה empty:*

As all three festivals needed to take place within a year, and as the spring equinox was considered the demarcation point of a solar cycle among the ancients, it was decided long ago that the first day of Unleavened Bread always *needed to occur on or after* the spring equinox. The first day of Unleavened Bread *could not occur before* the spring equinox. This would ensure that all three festivals would take place within one year as the Torah required. This means that if at first crescent visibility in Jerusalem at the end of the twelfth month there are 15 days or less until the vernal equinox, then the first month is declared. If at first crescent visibility at the end of the twelfth month there are 16 days or more until the vernal equinox, then a thirteenth month is declared. The *rule of the equinox* can be stated this way: Day 15 of Month 1 in Jerusalem will always fall *on or after* the Hebrew Day of the spring equinox.

The Creation Calendar intercalates [inserts an extra month] based on *the rule of the equinox*. The Creation Calendar also only intercalates *at the end of the twelfth month*. The equinox is defined as right ascension 0 hours 0 minutes when the sun is crossing the celestial equator. The current rabbinic calendar in use today is *not* following the rule of the equinox or first crescent visibility from Jerusalem. In the Creation Calendar a year can begin around the time of the spring equinox *or* around the time of the autumnal equinox. New Year's Day in spring commemorates the creation of the *spiritual* universe. New Year's Day in fall commemorates the creation of the *physical* universe.

In the Creation Calendar, the reference point for sighting the new moon is the foundation stone on the Temple Mount in Jerusalem. This is the reason that the Temple Mount in Jerusalem is so intrinsically important. The physical laws governing the sighting of the first visible crescent will consistently predict, with a high degree of accuracy, when the new moon will be visible for any location on the earth's surface based on ideal conditions without clouds or haze. However, each location on earth will produce a different combination of lunar month lengths. The first visible crescent may be seen on one night in one location on the globe when it will not be seen that same night in another location. Different sets of data determining the beginning of months could be accurately produced for every location on earth. However, it is the visibility of the new moon from *Jerusalem* which is the reference standard for time keeping. All timekeeping may be calibrated by Jerusalem time.

The nations of Israel and Judah, the Babylonians, Assyrians, the Medes and Persians, as well as the Greeks observed the first visible crescent for their new moon. However, these nations did not always place **Day 15** of Month 1 *on or after* the day of the spring equinox. Sometimes they placed **Day 1** of Month 1 *after* the day of the spring equinox. After the Judeans were exiled from the land in the wake of the Bar Kochba revolt in **134 C.E.**, they were forced more and more to rely on calculation of the new moon, or local observation from their location outside the land of Israel.

At some point the rabbinic Judeans began to rely on the 19 year cycle of the Greek astronomer Meton to predict the day of the new moon. The 19 year cycle seems to have been adjusted periodically to the equinox, but it appears during the dark and middle ages this was neglected. Sometime between **359 C.E.** and the *eleventh century*, the rabbinic Judeans began to observe Yom Teruah on the day of the conjunction, called the "molad," rather than on the day of the visible crescent according to all previous tradition. In addition to this they formulated seven man made "*rules of postponement*" in *direct violation to the command of Moses*.

As an example, the first "rule of postponement" states that Yom Teruah may not fall on a Sunday, Wednesday or Friday. Yom Teruah were on a Sunday, then the seventh day of Sukkot called Hoshana Rabbah would be on a Sabbath. This was to be avoided so as not to prevent the proper celebration of the Festival of the Willows. If Yom Teruah were on a Wednesday, then Yom Kippur would be on a Friday and this would cause unusual hardship as there would be two days in a row with severe restrictions. If Yom Teruah were on a Friday, then Yom Kippur would be on a Sunday and there would again be two days in a row with severe restrictions. So the spiritual leaders of Israel in the past took it upon themselves to fabricate a false calendar and a false set of festival dates. Generally speaking there is worldwide uniformity to this rabbinic calendar among the Jewish people today.

The rabbinic calendar is in error in several ways. Firstly, it does *not* reckon the month from *first crescent visibility at Jerusalem*. Secondly, it does *not* intercalate based on the *rule of the equinox*. Thirdly, it *conforms around man made precepts* called "*the rules of postponement*." The restored Creation Calendar at <http://www.torahcalendar.com> does not have these errors.

The Gregorian Calendar

Elijah David ben Issachar The term C.E. is the abbreviation for “Common Era” or the “Current Era.” These are alternative terms for A.D., which is an abbreviation for “Anno Domini” in Latin or “the year of the Lord” in English. C.E. and A.D. are equivalent in value. The term E.V., an abbreviation for “Era Vulgaris” which is Latin for “Common Era”, is also the equivalent of C.E. and A.D. The term A.D. was intended to refer to the exact year in which **יהושע** of Nazareth was born. It was a system devised by the monk Dionysius Exiguus in the year **525 C.E.**

Dionysius Exiguus (Dennis the Little, meaning humble) (c.470- c.544) was a sixth century monk born in Scythia Minor, in what is now the territory of Dobruja, Romania, and member of the so called “Scythian monks” community. Dionysius is most well known as the inventor of the Anno Domini era, which used to number the years of both the Gregorian Calendar and the Julian calendar. He used it to identify the several Easters in his Easter tables, but did not use it to date any historical event. When he devised his tables, Julian calendar years were identified by naming the consuls who held office that year – he himself stated that the “present year” was “the consulship of Probus Junior [Flavius Probus]”, which he also stated was 525 years “since the incarnation of our Lord Jesus Christ.” **How he arrived at that number is unknown.** He invented a new system of numbering years to replace the Diocletian years that had been used in an old Easter table because he did not wish to continue the memory of a tyrant who persecuted Christians. The Anno Domini era became dominant in Western Europe only after it was used by the Venerable Bede to date the events in his *Ecclesiastical History of the English People*, completed in **731 C.E.** Wikipedia – The Free Encyclopedia <http://en.wikipedia.org/wiki/Dionysius_Exiguus>

With the use of the Christian era and the reckoning Anno Domini there arose the possibility of counting backward from this beginning point as well as forward. While this possibility now seems obvious, it actually remained a custom for a long time to designate dates prior to the Christian era in terms of some of the older eras. Although the Anglo-Saxon historian Bede used the Latin term “Ante Incarnationis Dominicæ” (roughly equivalent to the English term “Before Christ”) to identify years before the first year of this Era two centuries after Dionysius Exiguus, the practice was not customary until the eighteenth century. However, from the eighteenth century onward the use of a reckoning prior to the Christian epoch as well as following it became customary, and the designations Ante Christum (A.C.), Anno Ante Christum (A.A.C.), and “Before Christ” (B.C.) were employed. [Jack Finegan, *Handbook of Biblical Chronology*, 220.] The term B.C.E. stands for “Before the Common Era” or “Before the Current Era.” B.C.E. is the equivalent of B.C. In this system of reckoning there is no year zero, and so **1 C.E. is immediately preceded by 1 B.C.E.**

The exact nomenclature that is used to designate time in the modern world is a sensitive subject. Many academics use the terms B.C.E. and C.E., while the general public generally uses the terms B.C. and A.D. Some Christians are offended by the idea of using B.C.E. and C.E. They insist doing so is the result of secularization, anti-supernaturalism, religious pluralism, and political correctness. They believe the traditional method of dating is a reminder of the preeminence of the Messiah and His message in world history. Others believe that using B.C.E. and C.E. is preferable as it is less offensive to non-Christians, who are **compelled** to use this calendar out of necessity, as the Gregorian Calendar has become a global standard and is built into every computer’s hardware. The fact of the matter is that at this time in history every culture and every nation in the world, regardless of what religions are observed, employs a system of time reckoning which attempts to identify the epoch birth of **יהושע** the Messiah. The Creator of the universe has ensured this, just as He has ensured that every nation and culture is on a seven day week.

The terms B.C.E. and C.E. are used in this book **strictly** because they are **academically preferable**. They are more preferable as they **do not** designate by their usage **an incorrect date** for the **epoch event** of the year of the birth of **יהושע** of Nazareth. If the epoch event of the birth of **יהושע** of Nazareth occurred in **1 A.D.**, then it would be academically acceptable to use this system of reckoning, as it would accurately reflect the historical truth of the epoch event. However, as knowledge has increased, it is historically possible to determine that **יהושע** of Nazareth was born on **September 11, 3 B.C.E.**, several years before the system devised by Dionysius Exiguus determined the epoch event occurred.

Therefore, it is possible to determine that the **system** devised by Dionysius Exiguus is **historically inaccurate**. His system, which has become a universal standard for world history, **does not truthfully reflect the epoch event which it ascribes to**. For academic purposes in discussing history, it is preferable to **maintain the system** which Dionysius Exiguus devised, as it is prevalent in many history books in the world, but to **change the designation** from B.C. and A.D. to B.C.E. and C.E. so as **not** to be historically misleading. For these reasons, the terms B.C.E. and C.E. will be utilized in the discussion of history in this book.

The Julian Calendar Reform by Pope Gregory XIII

Adapted Excerpts: *From Sabbath to Sunday* by Carlyle B. Haynes

Published by Review and Herald® Publishing Association in 1928 C.E.

The Julian Calendar was used for fifteen centuries in much of the world. It was not, however, an accurate calendar. It assumed the length of the solar year to be **365 ¼ days**, whereas it is eleven minutes and a few seconds less than that. This does not seem to be a great error, but in the course of years it accumulated. As a result, under the Julian calendar a little time was lost each year; that is, it was not based exactly on the movements of the celestial bodies, and the result was that, year by year, the vernal equinox, which in Julius Caesar's (49-44) time occurred about **March 25**, gradually receded toward the beginning of March. By the beginning of the sixteenth century of the Common Era, it was occurring about **March 11**.

As long ago as the thirteenth century, astronomers began to write about the inaccuracy of the Julian calendar. Some of the countries of Europe desired to take action looking toward a reform of the calendar. But nothing was done for a long time, because leadership and agreement were necessary in order to establish a revision of the calendar that would bring about uniformity in all countries.

At last the sympathy and interest of the Papacy itself were enlisted. Under Pope Gregory XIII the calendar was changed, and a correction of ten days was made to bring back **March 21** to the vernal equinox, where it had stood at the time of the Council of Nicaea in **325 C.E.** Pope Gregory XIII published a bull, dated **March 1, 1582 C.E.**, annulling ten days, so that the day which would have been reckoned **October 5, 1582 C.E.**, was to be reckoned the **October 15, 1582 C.E.** The new calendar was given the name of the pope in whose pontificate the new calendar was established, Pope Gregory. It is therefore known as the Gregorian Calendar.

The Gregorian Calendar, according to which nearly all the world reckons time, was, as has been said, established by proclamation of the pope of Rome in **1582 C.E.** The change that put it into effect, a change of ten days between it and the old Julian calendar, was made on **Friday, October 5, 1582 C.E.** The way the ten days were made up was merely to call that day, which under the Julian calendar was the **5th of October**, the **15th of October**. This is all that was done. And this made the calendar year uniform with the vernal equinox.

The day was still Friday, but instead of being Friday the **5th**, it was Friday the **15th**. There was no difference in the month. It was still October. There was no difference in the week. There was no difference in the day of the week. It was still Friday. The difference was in the day of the month. It was the **15th** instead of the **5th**. That is all.

The next day was Saturday, just as it would have been if the calendar had not been changed. Only it was the sixteenth instead of the sixth. The change of the calendar made no change in the Sabbath of **שבת**, and creates no difficulty in locating the identical seventh day now. [On the Creation Calendar, **October 4, 1582 C.E.** equates to Day 16 of Month 7 [**16 Tishri = Thursday, October 4, 1582 C.E. (2299160) = Day 16, Month 7, Year 5568 = Day 2,033,344 since the creation**], and **October 15, 1582 C.E.** equates to Day 17 of Month 7 [**17 Tishri = Thursday, October 4, 1582 C.E. (2299161) = Day 17, Month 7, Year 5568 = Day 2,033,345 since the creation**].]

Spain, Portugal, and Italy adopted the new Gregorian Calendar at once. A little later in **1582 C.E.**, France adopted it, by calling the **10th of December** the **20th**. The Catholic states of Germany adopted the new calendar in the year **1583 C.E.**, but in the Protestant states of Germany the old style, or Julian calendar, was adhered to until the year **1700 C.E.** In that year the Low Countries, as they were called, or the Netherlands, adopted the new calendar. They were not friendly to the Papacy, and hence were slow to accept anything that they considered came from the pope. England did not adopt the new calendar until **1752 C.E.** Sweden and Denmark accepted it about the same time as the Protestant states of Germany.

During all this time when some of the countries were reckoning time under one calendar and some another, the days of the week were identically the same in all countries. When it was Saturday in Spain and Portugal and Italy, it was also Saturday in England, although until the year **1700 C.E.** they were ten days apart in their dates, and after **1700 C.E.** they were eleven days apart.

England had refused to accept the new calendar because at that time she was passing through the experience of establishing what has later come to be known as the Church of England, and wanted nothing whatever to do with the Papacy. The difference in the reckoning of dates, however, resulted in confusion and difficulty in the transaction of business between England and the Continent. Finally the businessmen of England made such an agitation over the matter that England was obliged to adopt the new calendar, which by that time was known to be accurate and precise. In the study of history one will often observe, when dates of certain events are referred to, the letters "O.S." or "N.S." They are for the purpose of indicating whether the old style or new style calendar is referred to.

It was on **September 2, 1752 C.E.** that the new style calendar, the Gregorian, was adopted by the British Parliament. The act of Parliament reads merely that the day following **September 2** should be called **September 14**. The day was **Thursday**. Under the old style, or Julian calendar, it would have been **Thursday, September 3**. The act of Parliament adopting the Gregorian Calendar made it **Thursday, September 14**. The difference between the old style and the new style by that time amounted to 11 days. The second of September was followed by the 14th of September. The day of the month was changed but not the day of the week. The second was Wednesday. The next day, the 14th, was Thursday. It would have been Thursday if the change had not been made. But it would have been Thursday the third; now it was Thursday the 14th. Following this was Friday the 15th, then Saturday the 16th. If the change had not

been made, this Saturday would have been the fifth of September. But it would still have been Saturday. It was the seventh day of the week on the Continent; it was the seventh day in England; it was the seventh day everywhere. The dates attached to that day had been different on the Continent and in England. Now they were made the same. But the day was not changed. The day was not lost. There was no confusion in the matter. The change made did not affect the days of the week at all. They continued and remained just the same. [On the Creation Calendar, **September 2, 1752 C.E.** on the old British Calendar equates to the Day 5 of Month 7 [**5 Tishri = Thursday, September 14, 1752 C.E. (2361222) = Day 5, Month 7, Year 5738 = Day 2,095,406 since the creation**].]

From **1582 C.E.**, when the new style calendar had been adopted in Italy, to **1752 C.E.**, when it was adopted in Great Britain, is 170 years. During all these 170 years, when countries of the Continent of Europe were using the new style calendar, England had been using the old style calendar. At one time they were ten days apart in their reckoning, at a later time eleven days. But during all this time the days of the week were just the same on the Continent as they were in England. There was no confusion at all concerning them. Certainly this is conclusive evidence that the change in the calendar made no difference in the days of the week.

Russia and Greece continued using the old style calendar. They were under the influence of the Greek Church, which was not in communion with the see of Rome; hence they would not adopt the new calendar. Rumania, Serbia, and Turkey, however, finally adopted the Gregorian Calendar in **1919 C.E.**, and Soviet Russia made the change soon after the revolution. In none of these changes were the days of the week affected. By that time the difference between the two calendars amounted to fourteen days.

While the *dates* in Germany were not the same as the dates in Russia, the *days* were just the same. When it was Monday in Russia it was Monday in Germany, though they were under different calendars. When the Sabbath came in Germany, the seventh day of the week, it was Sabbath in Russia as well, though the dates on the calendar were fourteen days apart. What the *Encyclopedia Britannica* called the "unalterable uniformity" of the week, has never been affected by calendar changes. Hence the day of the Sabbath has not been changed or altered or affected in the slightest degree by such changes. Carlyle B. Haynes, [From Sabbath to Sunday](#), 1928, pgs. 66-72.