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A table of contents for *Journal of the Transactions of the Victoria Institute* can be found here:

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1929

716TH ORDINARY GENERAL MEETING,

HELD IN COMMITTEE ROOM B, THE CENTRAL HALL,
WESTMINSTER, S.W.1, ON MONDAY, JANUARY 7TH, 1929,

AT 4.30 P.M.

THE REV. A. H. FINN IN THE CHAIR.

[The Minutes of the previous Meeting were read, confirmed, and signed, and the HON. SECRETARY announced the following elections:—As a Life Member, the Rev. William Davey, and as an Associate, Alfred George Secrett, Esq.

The CHAIRMAN explained that in the unavoidable absence in Canada of the author of the paper, Dr. W. Bell Dawson, he would himself read the paper on “The Hebrew Calendar, and Time Periods.”

THE HEBREW CALENDAR, AND TIME PERIODS.

By W. BELL DAWSON, Esq., M.A., D.Sc., M.Inst.C.E.

IN the various calendars used by ancient and modern nations, the main object is to bring the reckoning of time into some relation with the sun and moon, so that the seasons of the year may be known, as well as the months, which depend primarily upon the moon. The peoples of Western Asia have given preference in their calendar system to the period of the moon's phases—that is, the lunar month; whereas, in ancient Egypt and in modern Europe, the chief place has been given to the sun in its relation to the seasons, and the moon has been very largely ignored. Our present object is to point out the way in which the practical advantages of both these systems have been obtained in the Hebrew calendar.

The very early development of calendar systems in the history of the human race is explained, by its real importance to any people who live a natural life and depend upon agriculture and fishing. At the present day, even the most unintelligent tribes find some means of knowing the return of the seasons from the heavenly bodies. From the earliest times men have needed to know when it is best to sow their seed, or when the rainy season would begin. The question of moonlight is of consequence also, for the full moon rises at sunset, and thus practically prolongs the day for any out-door work such as harvesting, for which moonlight may be sufficient. This may be of real service in the urgency of harvest-time; and moonlight may also be helpful for night travel at the hottest seasons of the year. For people on an ocean shore, who depend upon sea-food such as shell-fish and crabs, their best opportunity for collecting these occurs at the lowest tides, which are related to the moon's position. This would concern those who lived on the outer shores beyond the Mediterranean, for in it there is practically no tide.

A well arranged calendar of the year and the months is therefore no merely abstract or technical method of measuring time, and it is specially serviceable to a primitive people leading a natural life. Yet it is essential to secure accuracy in the calendar adopted, so that it may not become disarranged in the course of years and centuries. We now know that astronomy was one of the earliest pursuits, almost at the outset in the career of mankind. There is reason to believe that very early in the history of the world men arrived at true values for the length of the year and the month, chiefly by means of averages deduced from a long series of observations, and undoubtedly the long lives of early men helped them much in their endeavours.

THE MONTH AND THE YEAR.

At the Creation, the two conspicuous luminaries, the sun and the moon, were appointed to "be for signs, and for seasons, and for days, and years" (Genesis 1; 14). The day is the primary measure of time; but the month, from new moon to new moon, is not a complete number of days without a fraction over, nor is the year; and there are not a complete number of natural lunar months in the solar year. It is evident enough, therefore, that the starting-point in the whole matter is to determine correctly the length of the month in days, and the length

of the year in days, so that they may be compared with each other.

Few people may realize how very accurately this can be done by careful observation, without scientific instruments, by simply counting the days. When the moon is actually new, it is close to the sun and cannot be seen; and at full moon it is difficult to estimate just when the moon is truly full. But the ancients found that the moon's quarters could be well observed, that is, the day and hour when the moon is exactly half-bright. The length of the month could thus be measured between the corresponding quarters. It would be found, however, that the length of successive months was not equal, because the speed of the moon's motion varies in a way that does not correspond with its phases. Any observant person can see for himself that the distance which the moon moves on the face of the sky, from one evening to the next, is appreciably different at different times. The ancients termed this the "anomaly" of the moon; but they found the true average value of the lunar month with a remarkable degree of accuracy, as their lunar calendar shows.*

The simplest way to determine the length of the year, is by noticing the point on the horizon where the sun rises or sets, and counting the days till this occurs at the same point in the following year. Anyone who has been in the country or at the seaside where there is a good horizon, must have noticed that the point at which the sun sets shifts in position on the edge of the sky. Some notch in a line of distant hills will readily serve as a reference mark. The Egyptians used specially constructed temples for this purpose, which were in reality masonry telescopes, directed to the Equinoxial point on the horizon. On the same day of each year, a beam of light at sunrise shone directly along the axis-line of the temple. By counting the number of days, a very accurate length for the year, to a close fraction of a day, could thus be determined in course of time. The Chaldeans appear to have preferred the method of marking the length of the sun's shadow at noon, as given by the highest point on a tower or temple; and in this way

* It may be supposed that the true length of the lunar month could be deduced from eclipses of the sun and moon. But to give a correct result, the interval between the eclipses used would need to correspond with the "anomalistic month." The observations from month to month, as here described, would furnish a more trustworthy average value in the long run.

the corresponding day in each year could be determined, and the length of the year ascertained.

It may be well to note just what these observations of the point of sunrise or sunset on the horizon would reveal. Any day in the spring or autumn could be chosen as a starting-point for the observations, when the point of sunset is changing most rapidly.* After the lapse of one year it would be found that the nearest sunsets were slightly off the point chosen, because of the odd quarter-day in the length of the year ($365\frac{1}{4}$). But on the fourth year the sun would set very precisely at the same spot, giving a count of 1461 days for the four years. In so short a period as this, it could therefore be found that the year contained $365\frac{1}{4}$ days, and in 40 or 60 years a still more accurate value for the fraction beyond 365 days could be determined. It is futile therefore for critics to maintain that the true length of the year was not known in very ancient times, for the earliest records discovered prove the attention given to astronomy.

A year of 360 days, made up of twelve months of 30 days, may have been used for convenience; just as astronomers at the present day base their reckoning on the Julian year of 365.25 days, to avoid the inconvenience of leap years in their calculations, although they are quite aware that it is not correct.† This year of 360 days is also the mean value between the solar year and the lunar year of twelve lunar months; a compromise which may indicate a desire to harmonize these, and which thus points to a knowledge of the length of both year and month. It was in use as early as the Flood (compare Genesis 7; 11; and 8; 3-4); and the Egyptians continued to use it, although they knew the true length of the year with accuracy.

We cannot suppose that ancient astronomers did not know just where the heavenly bodies were, while they were invisible. For example, they named the Signs of the Zodiac after the seasons of the year when the sun was in its various constellations. They thus knew which stars the sun was amongst, although they could not see them at the time. The "dog-days" of summer heat occur when the sun is nearest to Sirius, the dog-star.

* The summer Solstice is the least suitable time; and the orientation of some Egyptian temples to the Solstice, as well as Stonehenge, had no doubt a different motive; probably in relation to sun-worship.

† See the clear explanation of this usage by Simon Newcomb, Superintendent of the American Nautical Almanac, in his work: *The Recurrence of Solar Eclipses, with Tables.*

They must also have been quite aware of the moment when the moon was new, although it was then invisible; for the ancient Chaldeans were able to predict eclipses. It is only by holding to the Scriptural account, which shows that early man was highly endowed with natural intelligence, that we can understand aright. The theory of the evolution of man, by gradual development from the level of a degraded savage, is thoroughly misleading in any investigation of the achievements of early men.

CALENDAR SYSTEMS.

It would appear that a keen endeavour of the wise men of old was to reconcile the lunar month with the year. Their ambition was to discover a cycle of years which contained some complete number of lunar months, with less than a day of error, over or under, at the end of the cycle. Some very ancient cycles of this kind are known, one of them being even attributed to Enoch. As far on as the Greek times, lunar months were used in the calendar devised by means of a cycle that bears the name of the Greek astronomer Meton (432 B.C.) although the cycle is believed to be of much earlier origin. The system Meton devised was further improved a century later by Callippus. The Romans also, at the beginning of their career, made trials to reconcile the lunar month with the year; but they had quite lost the accuracy of the more ancient nations. Their calendar went through one phase of confusion after another for six centuries, from the days of Numa Pompilius to Julius Caesar (46 B.C.). He gave up the lunar months altogether, and the Julian calendar, which he devised, accords with the sun only, the months being merely an arbitrary division of the year into twelve parts that are neither equal nor orderly in their arrangement. In contrast with these attempts, the Hebrew calendar, a dozen centuries previously had accomplished the reconciliation of the movements of the sun and moon in a very admirable way, and without any necessary dependence upon a cycle.

We must pass over the calendar systems of the various nations with a mere mention of the means used to maintain their accuracy, for comparison with the Hebrew system of reckoning. The solar calendar which we inherit from the Romans, is kept true to the seasons of the year by making every fourth year a leap year of 366 days. The years ending the centuries (1800, 1900, etc.), are not leap years, except at the

end of every fourth century. It thus requires a period of 400 years to complete the adjustments of intercalary days.

The use of the lunar calendar was widely extended by the Mohammedan conquests which began in the seventh century; and it has been the calendar of all the Bible lands of the East until quite recently. Its year consists of twelve lunar months, making up 354 days and a fraction. The months have 29 and 30 days which alternate evenly, and all the adjustments are made in a cycle of 30 years, during which there are 11 intercalary days. The accuracy of this calendar is very remarkable, in view of its being based on the length of the lunar month. Its error is only one day in 2439 years; whereas the Julian calendar, which was in use in Europe until the reform of 1582 A.D., has an error of one day in 128 years. The great disadvantage of this Mohammedan calendar is that the beginning of the year falls back continually to an earlier season.

The nations of Europe and Western Asia settled down to the use of these calendars during the Christian era; and thus abandoned the nobler endeavour of the earlier peoples to maintain a truly natural calendar, in which the sun and the moon are equally recognized.

THE HEBREW CALENDAR.

In this calendar the months conform to the moon and the year to the sun. In counting by lunar months, the first day of the month is at the New moon, and the Full moon is on the 15th day of each month. It was ordained at the Exodus that the year was to begin in the spring, and that the Passover was to be held on the 14th day of the First month. This change in the calendar was no doubt one of the divine ordinances which were intended to keep the Hebrews a separate people. Yet, according to Josephus the year of the other nations which began in autumn was retained for commercial purposes; and it is still used by the Jews of the present day. In the year of the seasons, the reference mark for the spring is the Equinox, when the sun crosses the Equator going northward. It is evident that there must always be a New moon within 15 days of the Equinox, either before or after, because the length of the lunar month is $29\frac{1}{2}$ days. If then the beginning of the First month is counted from this New moon, the Passover will always remain at the spring season. The twelve lunar months of the year, when counted forward from this, will fall short of a full year by 11 days; and

whenever this shortage amounts to a month a thirteenth month must be added at the end of the year. This will usually be required every third year. In this way the months will be kept in accord with the seasons.*

The Hebrew system can thus be reduced to a very simple rule: The first day of the First month is to be at the New moon, which is within 15 days before or after the Equinox in spring. Whenever there is the space of a month between this New Moon and the one at the end of the Twelfth month preceding it is to be made a Thirteenth month at the end of the year.

This is a most natural way, and a beautifully simple one; because it enables the true months of the moon to be used, while at the same time the seasons are kept in their right place in the year. It is strange that many Bible Dictionaries, and other compendiums of Scripture information, seem to look upon the Hebrew calendar as primitive and crude. This can only be because they do not understand the complexity of the problem of reconciling the natural month with the year, by any method of astronomical calculation, or by means of some soli-lunar cycle; and they fail to appreciate a system which affords a solution that can go on for all time without accumulating any error. Practically all the modern nations have abandoned the attempt to maintain a natural calendar; but the Chinese still adhere to it by means of a highly astronomical method which contrasts with the simplicity of the Hebrew system.

The Chinese regard the Zodiac as divided into twelve spaces or "Signs" of exactly 30 degrees each, which thus make up the complete circle of 360 degrees through which the sun moves in the course of the year. Their calendar rule is then as follows: Whenever two New moons occur during the time that the sun takes to travel through any one Sign of the Zodiac, an extra lunar month is to be put in the calendar. To carry out such a rule, it is evident that great precision is required (either by calculation

* In accordance with the position of the First month as here defined, the Full moon of the Passover would be at the Equinox or after it up to the limit of a month later. This corresponds with the decision of the Council of Nicaea (in 325 A.D.) in regard to the position of Easter; that it is to be "on the Sunday following the Full moon which occurs on or next after the day of the vernal Equinox." If it were maintained, however, that the Passover should rightly be kept at the Full moon which is nearest to the Equinox, whether before or after it, the months would be set back 15 days earlier in the solar year than as here defined. But this would in no way alter the bearing of the present discussion.

or careful observation) to determine just when the sun crosses each of the 30-degree lines on the face of the sky, which divide the Signs of the Zodiac ; as well as to correlate these crossings with the time of New moon. Also, the speed of the sun's motion on the face of the sky is slightly lower in summer than in winter ; and the two New moons looked for are therefore more probable in the summer-time. The extra month has thus usually to be put in about the middle of the year, which is a practical inconvenience.

The advantages of the Hebrew calendar may be summarized as follows :—

(1) The months of the year are natural lunar months, so that the New moon is always at the beginning of the month, and the Full moon on the 15th day. This is of much practical service to agriculturalists and fishermen.

(2) The number of days in the month are 30 and 29 alternately, during the twelve months, making up the 354 days of the lunar year. This regularity is in marked contrast with the months that we use.

(3) The additional month, when required, is always at the end of the year, and does not break the sequence of the usual months. This extra or intercalary month is required after 3 years, or sometimes after 2 years ; and it comes in automatically according to the position of the New moon in relation to the Equinox in spring, when the year begins. (In a period of 19 years, according to the Metonic cycle, seven intercalary months are required.)

(4) The first day of the year is always within 15 days of the spring Equinox, before or after it ; and accordingly the seasons can never be more than half a month early or late, as an extreme limit, in relation to the calendar.

We may not know definitely that this calendar was of divine origin, although this may almost be inferred ; because at the Exodus the Lord commanded the Israelites to make the Passover month the First month of the year, and thus to begin their year in the spring, instead of the autumn, which was the custom amongst other nations. (See Exodus 12 ; 1-2.) We readily recognize also how well adapted this calendar is to the sacred feasts which the Lord appointed, and it may even be that

this was a dominating purpose in the arrangement of the calendar. All the feasts were in the first seven months, and the intercalary month was so placed that it did not disturb them. The prominent days in the principal feasts were on the 14th or 15th of the month, when the moon was always full. (See Leviticus 23 ; 5, 6, 34 and 39.) From the beginning of their national career, at the Exodus from Egypt, this calendar was in use, and all the months mentioned in Scripture, and the dates given in the Prophets and other books, are in conformity with it.

RELATION OF THE CALENDAR TO CYCLES.

The typical year for the Hebrew calendar is one in which the first day of the First month falls on the vernal Equinox ; for the seasons, which are governed by the sun, then have their truly correct positions in relation to the months, which are lunar. A question accordingly, that leads to most interesting results, is this : If we begin with this typical year, in which the New moon occurs exactly at the vernal Equinox, how many years will elapse until this happens again ? To answer this question we must discover a cycle of solar years that contains some number of complete lunar months within some very small fraction over or under ; that is, a soli-lunar cycle correlating the month and year ; which is one of the four types of astronomical cycles that there are. The cycle required would begin with a New moon at the vernal Equinox, and this would occur again at the end of the cycle, and the lunar months would thus again have precisely the same position in the solar year.

The relation of such a cycle to the Hebrew calendar is very evident. For if a period of years contains any complete number of lunar months, this will show just how many intercalary months are required in the period. To illustrate this we may take the Metonic cycle of 19 years, which contains 235 lunar months or lunations almost exactly. Twelve lunar months in each of these 19 years make only 228 months, leaving seven over ; which shows that seven intercalary months are required in the course of the 19 years. In the Hebrew calendar system these months will fall into their places every three or two years, in accordance with their relation to the Equinox, as already explained. Yet the cycle makes clear what is required, while, on the other hand, the Hebrew calendar will always accord automatically with any cycle that may exist.

It is very remarkable that the most accurate cycles ever found have been deduced from the prophetic numbers 1260 and 2300 in the book of Daniel. This was first pointed out by M. de Cheseaux in a publication issued in 1754, and he termed them the "Daniel Cycles." They were discovered by accepting the view that the days in Daniel represent years. One of these cycles (now known as the Cheseaux cycle) is so exact that its error is less than one day in 12,000 years. The most comprehensive of all was announced by the writer in 1905; being based on the same two numbers in Daniel, but in another way. It brings the complete lunar year of twelve months into accord with the solar year, with such exactitude that the error would be less than a day in 16,000 years. If such results were better understood, they would convince anyone that the book of Daniel is entitled to reverent consideration instead of hostile criticism.

We may here give a comparative summary of a few of the best soli-lunar cycles. The New moon at the beginning of the cycle is assumed to occur with precision at the moment of the vernal Equinox, when the sun's centre crosses the Equator; and the error at the end of the cycle is indicated by the interval between the Equinox and the last New moon of the cycle.

Metonic Cycle.—19 years = 235 lunations. New moon at end of the cycle, 2 hours $4\frac{1}{2}$ minutes after the Equinox.

Jubilee Cycle.—49 years = 606 lunations. New moon at end of the cycle, one day, 7 hours and 55 minutes before the Equinox.

Cycle of 315 years = 3896 lunations; this period being one-fourth of 1260 years. New moon at end of the cycle, 2 hours and 50 minutes before the Equinox.

Ancient Cycle of 600 years = 7421 lunations. The error in this long cycle of six centuries is only a little over 1 day.

Cheseaux Cycle.—1040 years = 12,863 lunations. This period is the difference between two of the numbers in Daniel taken as years, namely, 2300 less 1260 = 1040. New moon at end of the cycle, 1 hour and 53 minutes after the Equinox.

As the period of 315 years is a cycle, it follows that 1260 years and its double 2520 years are also soli-lunar cycles. At the end of the long period of 2520 years which constitute the whole "Seven times" or Times of the Gentiles, the moon has the same position relatively to the sun, within one day. The

Hebrew calendar would thus maintain the months of the year in their true relation to the seasons, within a day in this age-long period.

We may thus appreciate one aspect of the training of the people of God under divine supervision. They were kept in touch, in their daily lives, with the two great "lights in heaven" which the Creator had appointed to afford a measure for time. The count ran on to the Jubilee, which was a type of the final fulfilment of the purposes of God. The minds of the Hebrew people were thus prepared for the numbers revealed to the Prophets, by which the correlated movements of the sun and moon measure out great cycles of time. By these, in the providence of God, a limit has been placed upon the dominance of evil and injustice in the world. The final jubilee would at length arrive when this "mystery of God" would be finished. A King will then reign in righteousness who shall not fail nor be discouraged till He has set judgment in the earth, and His dominion shall continue as long as the sun and moon endure.

REFERENCES TO CYCLES.

The Cyclical Character of the Prophetic times.—Full explanation of a series of soli-lunar cycles, and relation to cycles corresponding to the numbers in Daniel: 1260, 1290, 1335 and 2300. (*First Elements of Sacred Prophecy*, Chap. XIII, Sect. X, pages 367-372, by Rev. Prof. T. R. Birks, 1843.)

Cycle of Cheseaux.—Explained in *The Approaching End of the Age*, 13th edition, Part IV, Sect. III, Chap. III, pages 399-406, by Dr. H. Grattan Guinness, 1897.

Cycles: general summary.—Description of the four types of astronomical cycles, and their relative accuracy on a comparative basis, with announcement of a cycle of the highest type. ("Solar and Lunar Cycles implied in the Prophetic numbers in the book of Daniel," *Trans. Royal Soc. of Canada*, Vol. XI, Sect. III, pages 33-52, by Dr. W. Bell Dawson, 1905.)

DISCUSSION.

The CHAIRMAN (Rev. A. H. Finn) said: I must confess I find it difficult to follow some of Dr. Bell Dawson's arguments. The paper deals largely with the difficulty of adjusting a year of

lunar months with the solar year, and suggests (p. 48) the desirability of finding "a soli-lunar cycle correlating the month and year." Five of the "best soli-lunar cycles" are mentioned (p. 49), but none of these absolutely dispose of the difficulty. In each case, at the end of the cycle, there is some small difference (here called "error") between the solar and lunar reckonings left over. It is curious that the shortest cycle quoted (the Metonic of 19 years) only differs from the longest (that of Cheseaux, 1040 years) by $11\frac{1}{2}$ minutes.

That cycle, 1040, is obtained from "two of the numbers in Daniel" (p. 49), and those numbers are given as "1260, 1290, 1335 and 2300." So far as I can ascertain, the actual number 1260 does not occur in Daniel. The phrase "a time, times, and a half" occurs in two passages of Daniel—7 ; 25, the duration of the power of the blaspheming king, and 12 ; 7, the time of "the end of these wonders." In Revelation 12 ; 6, 14, the same phrase is equated to 1260 days as the time spent in the wilderness by the "woman clothed with the sun." It is doubtful whether these three passages can refer to the same period, but it is quite likely that the passage in Revelation shows the meaning of the phrase in Daniel. Yet even allowing that the number 1260 is indicated (though not stated), why should this be associated with 2300, which only occurs in Daniel 8 ; 14, as the time when the sanctuary shall be cleansed ? why should the other two numbers be disregarded ? and why should the one number be deducted from the other ?

It is said that this cycle was "discovered by accepting the view that the days in Daniel represent years" (p. 49), but that view is open to serious question. If it is urged that it is generally allowed in dealing with the prophecy of the "Seventy Weeks" (Daniel 9 ; 24), it is to be noted that in that passage the word "day" does not occur, and the word translated "week" simply means "a group of seven." That is no authority for understanding "years" where the text explicitly states "days." Revelation 11 ; 2, mentions a period of 42 months, and the next verse has 1260 days, which looks very much like literal months of 30 days. In Daniel 8 ; 14 (where 2300 is found) the unusual expression "evening-morning" occurs, which again looks like a literal day, not a year. The two numbers 1290, 1335 (Daniel 12 ; 11, 12) come close after the "time, times, and a half" of v. 7. If that means $3\frac{1}{2}$ years (of 360 days = 1260,) then

the next number (1290) is one month later, and 1335 is $1\frac{1}{2}$ months later still.

In the Hebrew calendar, it is said (p. 47) "The number of days in the month are 30 and 29 alternately . . . making up the 354 days of the lunar year." That may be true of the present Hebrew calendar, but there is no trace of it in Scripture. Genesis 7 ; 11, and 8 ; 3, 4, make 5 months equal 150 days, which means a month of 30 days and a year of 360, which also fits with the sequence of numbers in Daniel 12 ; 7, 11, 12. Nor am I aware of any mention in Scripture of the additional month, Ve-Adar, which has to be occasionally introduced. On p. 49 it is said that 2520 years "constitute the whole 'seven times' or Times of the Gentiles." The only period of "Seven times" in Scripture refer to the 7 years of Nebuchadnezzar's insanity. The "Times of the Gentiles" (St. Luke 21 ; 24, probably referred to in Romans 11 ; 25, "the fulness of the Gentiles") is nowhere referred to as a period of "Seven times."

There is a much simpler cycle of years for adjusting the lunar months to the solar year than any propounded by Dr. Bell Dawson. Taking first the lunar year of 354 days, a cycle of 8 years is sufficient if an intercalary month of 30 days is inserted at the end of the 3rd, 6th, and 8th years, respectively. Thus—

8 lunar years of 354 days	...	...	=	2832 days.
3 intercalary months	...	...	=	90 "
Total	...	...		<u>2922</u> "

Equally, 8 solar years of $365\frac{1}{4}$ days ... = 2922 "

There is reason, however, to think that the Scriptural year was one of 360 days, a mean between the lunar and solar years. A cycle of 40 years would satisfy this if intercalary months were inserted at the 6th, 12th, 17th, 23rd, 29th, 35th, and 40th years (sequence 6, 6, 5, 6, 6, 6, 5 = 40). Thus—

40 luni-solar years of 360 days...	...	...	=	14,400 days.
7 intercalary months of 30 days	...	...	=	210 "
Total	...	...		<u>14,610</u> "

Equally, 40 solar years of $365\frac{1}{4}$ days ... = 14,610 "

Since 40 is a multiple of 8, the end of this cycle would coincide with that of the lunar years.

40 is an important Scriptural number (40 years in Wilderness; 480 from Exodus to Solomon's Temple). The Cheseaux cycle, $1040 = 40 \times 26$ ($\frac{1}{2}$ the number of weeks in a year).

Lieut.-Col. KENNEY-HERBERT said: The data contained in this paper will be valuable to those who are interested in the statements of time to be found in the Bible, especially to those who, like myself, are ill-equipped to grapple with the problems which calendars present.

Re the first paragraph on p. 46, I submit that the Hebrew calendar, unlike those of all other nations, was designed to render those who were to use it entirely independent of all formulæ and cycles which a human knowledge of astronomy could suggest. Any observant agriculturalist could tell the day of visible New Moon without any scientific knowledge. He could see for himself whether or no, on any given New Moon, the barley was showing above ground: if so, that New Moon was the first New Moon of the year. All the Feasts of the Lord would fall into their designed place, when once this fact had been noted.

In such a calendar there is no need for exact Full Moons or Equinoxes. In fact, they cloud the issue, and are pitfalls into which many a chronologist has fallen. The endeavour to combine human science with the Law of Jehovah is, I believe, contrary to the spirit of Scripture. If we, however, want to reconstruct the facts as they were, a simple formula, such as that given in *Creation Centred in Christ*, by H. Grattan Guinness, will enable us to fix an astronomic New Moon within the probable margin of two hours, and the 1st day of the month with reasonable certainty. Calculation must do for us what eyesight did for those who lived in Bible times.

I presume that we are interested in calendars merely because, without their aid, we could never understand the exact meaning of the Bible statements of time. There is another snare into which we may fall, that is, the endeavour to harmonize Bible and secular history. It is impossible to do so. The latter is hearsay evidence at best, and not always disinterested evidence: the former we believe to be the accurate statements of the Spirit of God.

If it be correct that "cycles" are unnecessary in God's Calendar, yet He may have used them in His plan of the ages. For it is interesting to note that the space of time from the day of sin at Kadesh-Barnea to the forward movement begun on the day of the passage of the brook Zered, was exactly two Metonic Cycles. Again, if I have rightly understood the time statements of the Bible, and added them together correctly, there were 102 Metonic Cycles from the Covenant with Abraham (Genesis 15) to the Ascension and to Pentecost. The Solar Years of this period would run out at Ascension, and the Lunar Years at Pentecost, as the 2 hours $4\frac{1}{2}$ minutes difference of each cycle amount to over 9 days in the period in question.

In conclusion, I would add that the units of time given to Israel by Jehovah in Numbers 28 were all associated with prayer and worship, and that the calendar was made dependent on the visible New Moon in order to inculcate watchfulness. The lesson, therefore, is "Watch and Pray."

REV. HAROLD C. MORTON, Ph.D., said : Dr. Dawson has argued how simple and effective the Hebrew calendar was, the months conforming to the Moon and the years to the Sun : the New Year beginning at first 15 days after the autumnal equinox (say, October 7th), when the New Moon is due, and each month beginning with the New Moon, although at the Exodus the year's beginning was altered from the Autumn to the Spring. The special value of Dr. Dawson's paper seems to me to be the harmony sought (and so nearly reached) in his own soli-lunar cycle between the years and the months.

So far as the length of the *year* is concerned, I want, however, to call attention to Mr. Norman Denham's contention that the Hebrew year was not solar, but sidereal. It is worth while pointing out that the passage in Genesis 1, which says that God made the sun and the moon for days and months and years, adds the words, "He made the stars also." In his small work (small in size, but not small in any other sense), *The Hebrew Calendar Cycle*, Mr. Denham finds the first calendar clue in Exodus 12 ; 41 and 51, where it is twice repeated that "the sojourning of the children of Israel, who dwelt in Egypt, was 430 years. And it came to pass at the

end of the 430 years, *even the selfsame day*, it came to pass that all the hosts of the Lord went out from the land of Egypt." On the Hebrew system of inclusive reckoning, his formula "at the end of 430 years" means "after an interval of 429 years." This (Exodus 12 ; 41) is an immensely significant statement, and shows that Hebrew reckonings must have been such that, without losing or gaining even so much as *one day*, the datings of the Hebrew year repeated themselves after an interval of 429 years (*i.e.* from Abraham's departure from Haran, *see* Galatians 3 ; 17, to the day of the Exodus).

Mr. Denham's studies have led him to the conclusion that the cycle indicated is one of 39 years, 429 being an exact multiple of 39. That period, 39 sidereal years, falls short only by a very small fraction of 14,245 days. The difference between the solar and the sidereal year is only 20 minutes, 23 seconds, but this is sufficient to make all the difference between exactitude and inexactitude in the statement "the selfsame day" (Exodus 12 ; 41): for 39 solar years are more than half a day short of 14,245 days in length, and in 72 years solar time would fall behind sidereal time by one day. Solar time, then, does not accord with the statement in Exodus 12 ; 41. There is some variation, also, in solar time, which is getting gradually shorter ; but sidereal time is the one time which may be called fixed and without variation. Mr. Denham's investigations of Bible chronology have shown that the sidereal year and the cycle of 39 sometimes multiplied by 11, *i.e.* 429 years, fit with wonderful exactitude into the system of Bible datings. Time could stretch over a period of 17,775 sidereal years before one day was gained, and every 39 years the same series of datings would recur. To quote a phrase of Rev. David Nield, who is trying to reform the calendar of New Zealand, there is in the world to-day a great deal of "tangled time." But the Bible seems to offer material that should help to untangle our calculations.

Dr. Dawson speaks of the soli-lunar cycle, announced by himself in 1905, and based on the numbers 1260 and 2300 in the book of Daniel, which brings the complete lunar year of 12 months into accordance with the solar year with such exactitude that the error would be less than a day in 16,000 years. When one puts side by side with this the fact that 17,775 sidereal years gain only one day,

is it not possible that Dr. Dawson would find, reckoning with the sidereal year instead of the solar year, that there would be, apart from negligible fractions, perfect harmony between the sidereal and lunar years ?

Mr. WILLIAM C. EDWARDS said : The Jewish year 5688, which began on Tuesday, September 27th, 1927, was a so-called *ordinary* year of 354 days, and was the seventh in the 300th cycle of 19 years each—1921–39. This present Jewish year, 5689, began September 15th, 1928, and is an *embolismic* year of 385 days. The year to begin October 5th, 1929, will be a year of 353 days. Each year is regarded by Jews as *annus mundi*.

Now the Jewish year is what we may call a natural year, running apparently from harvest to harvest. It is worth while inquiring whether this was not the world's *original* calendar, and whether the new year which, by divine ordering, was made to begin at Passover (*see* Exodus 12 ; 2), was an alteration of this calendar. If Adam was created about harvest-time, coming into a world *blessed* by God, and uncursed by weeds, or blights, or pests of any kind, such a calendar would be just the calendar which we should expect. Is it impossible to conceive that, in the Jewish calendar, we have the original of all calendars ?

Mr. Edwards proceeded to point out the intimate relations subsisting between passages read in synagogue worship, first, of sections of the Law of Moses and then of excerpts from the writings of the Prophets, as these are set out and ordained in the Hebrew lectionary. Thus to the Jew the lectionary became a sort of calendar.

Dr. LOUIS E. WOOD, referring to statements on p. 49 intimated that in Daniel 8 ; 14, the Septuagint represents a reading, not of 2300 evenings and mornings, but rather of 2400 days, an addition of 100 being thus made to the period in which the sanctuary and the host would be trodden under foot.

In the absence of the Author, immediate reply was made by Dr. THIRTLE, as the result of investigations conducted many years ago. In short, he declared the reading 2400 to be an error, confined to printed editions of the Septuagint, in what is known as Codex B

(Vaticanus), as distinguished from Codex A (Alexandrinus), which reads 2300. He added that the Greek version of Daniel, as given in common editions of the Septuagint, was in reality not part of the original Septuagint at all, but was a revision made by Theodotion in the second century A.D. The true Septuagint of Daniel, which was lost for many centuries, was discovered in Rome, in the eighteenth century, by Prince Chigi, and is known by the name Codex Chisianus, and its readings have been carefully collated for modern, and more reliable, editions of the Septuagint. In this place, that Codex, the true Septuagint, reads 2300 days, and thus corresponds with the Massoretic text of the Hebrew original, the Latin Vulgate and the Peshito Syriac. Hence it is placed beyond question that 2300 is a stable reading of Daniel 8 ; 14, and not brought under any qualification from early texts or versions.

WRITTEN COMMUNICATION.

Mr. NORMAN S. DENHAM wrote : Authorities are not agreed that the calendar rules were as outlined by Dr. Bell Dawson, particularly as regards the commencement of the year, for Fynes Clinton says : "We have seen from preceding testimonies that a Jewish Passover was sometimes celebrated before the equinox, and, as Mr. Benson properly remarks, in the Mosaic law there is no injunction which refers to the equinox at all." Again, it is maintained by several that a month was not deemed to commence till the second day of New Moon, whereas Dr. Dawson observes that the day of actual New Moon must have been known in ancient times because the Chaldeans were able to forecast eclipses.

If Meton's cycle with its seven intercalary months in 19 years were known, as it is deemed to be, then the day of *actual New Moon* must have been known to the Hebrews with or without "observation" for the New Moon's disc. But as is well known to students, and admitted, for example, by Sir Robert Anderson in *The Coming Prince*, full moon did not fall on Thursday or Friday in any year from A.D. 27 to A.D. 32, on a date suited to the orthodox ideas upon the beginning of the year, and the week-day of the Crucifixion. The 39-year cycle harmonizing the day, the week, and the sidereal year—which I deem to be the basis of the *fixed calendar* of the

Scriptures from Adam's first day—is unique in the sense that the calendar could have continued close on 18,000 years, unaltered by a day.

With reference to the chronology advanced, I beg consideration of the following facts: In 480 B.C., prior to Xerxes setting out on his famous Grecian Expedition, there was a total eclipse of the sun, as recorded by Herodotus (VII, 37). There is no such eclipse recorded in Oppolzer's Canon. I drew the attention of Sir Frank Dyson, Astronomer-Royal, to this fact, and suggested that an eclipse satisfying the conditions would be found in 401 B.C. according to the telescoping of time deemed necessary from examination of sacred and secular history. In his courteous reply, he showed that of the four total eclipses visible to Xerxes at Sardis, that of January 18th, 401 B.C. (Julian)—in the period 300–500 B.C.—*is the only one tenable*. This would solve a long-known problem, and accord exactly with sacred chronology. If so, then the 2520 and 1260-year periods specified by Dr. Dawson are *necessarily lessened by 79 years*, and the theories of *The Times of the Gentiles* will need to be modified or abandoned.

THE LECTURER'S REPLY.

Writing from hospital (February 12th) after a major operation, the Author is unable to reply at length to the various criticisms of his paper. Some of these are suggestive; and he will be content to let the readers of the paper weigh the different points of view against each other.

The question of the beginning of the "Times of the Gentiles" deserves a note, however. This great period has its beginning in the era of the Captivity in Babylon, in the days of Daniel. Now, there is an interval of about two centuries at that time (say, 740 to 530 B.C.), in which the chronology is more definitely fixed than anywhere else in ancient history. It subsequently becomes less certain until we get well into the Christian era.

In the two centuries referred to, the dates of the kings in the region of Chaldea are fixed with reference to a series of *seven* eclipses of the sun and moon. These eclipses are recorded with all their details; the amount of the eclipse when not total, the hour of the day or night at which they occurred, as well as the month and day,

and the locality where they were observed. They are perfectly definite and unmistakable; and the years of the reigning kings are correlated with them. All this is in strong contrast with the vague accounts of eclipses in later centuries, as seen by armies on the march, with wide uncertainty as to their location at the time.

The interval of two centuries referred to, stands therefore as an island of rock in the midst of the ocean of time, which cannot be displaced by any uncertainties in subsequent history. For the chronology of this interval is correlated directly with the sun and moon. This can only be regarded as providential; as it is here that the Four Great Empires of prophecy have their beginning. The first of these Empires thus records its own starting-point, by means of a scientific (astronomical) method of its own devising. This ideal method places the chronology of the Babylonian and early Persian empires, in the days of Daniel, above the reach of any criticism. It would be well if this were more generally recognized and accepted.