names [1]. Thus arises the division of the month into three decades, in which however the last decade may vary between 9 and 10 days.

The division into decades is not so common as the halving of the month. The Zuñi of Arizona divide the month into three decades, each of which is called a 'ten' [2]. The Ahanta of the western Gold Coast divide the moon-month into three periods, two of ten days each, the third — which lasts until the new moon appears — of about 9 1/2 days (more correctly, no doubt, varying between 9 and 10 days.) The Sofalese of East Africa must have done the same, since de Faria says that they divided the month into 3 decades and that the first day of the first decade was the feast of the new moon [3]. The Masai, who number either the days of the whole month consecutively or the days of its two halves, nevertheless give special prominence to the initial days of the decades (alongside of other notable days), and call them *negera* [4].

Among the Greeks the division into decades displaced the older bisection. Of the names of the decades the first and third refer to the concrete form of the moon: *μὴν ἱστάμενος*, older *ἀεξόμενος* [5], literally 'the appearing, waxing moon', and *μὴν φθίνων*, 'the waning moon'. For originally *μήν* must here have had the sense of 'moon' which the etymology suggests. The second decade was called *μὴν μεσῶν*, 'the month at the middle': the epithet shews that *μήν* here means 'month', and not 'moon'. This name is therefore younger than the two others, which must once have been used to describe the two halves of the month, and do so still in Homer [6].

The custom of reckoning on the fingers or on a notched stick has doubtless lent assistance to the counting of the days of the month. The Wa-Sania make a notch in a stick for every day, and when the month is ended they put this stick aside and begin a new one [7]. At the southern corner of Lake Nyassa the days are counted by means of pieces of wood threaded on a string [8]. A complete enumeration of the days however

[1] Below, pp. 188 and 206 f. [2] Stevenson, p. 108. [3] Ellis, *Yoruba*, p. 144. [4] Merker, pp. 154 ff. [5] Hesiod, *Op.*, v. 773. [6] See my remarks in *Arch. f. Religionswiss., 14*, p. 432. [7] Barrett, p. 35. [8] Stannus, p. 288.

only exists among highly developed peoples who have discarded a more concrete time-reckoning in favour of an abstract system, just as the civilised peoples of modern Europe abandoned the Roman system of time-reckoning, which was still often used in the Middle Ages (though indeed it had long since departed from its concrete basis), in favour of a simple enumeration of the days of the month.

Finally a couple of curious East African reckonings of the days of the month are to be mentioned, although they are not primitive but have a lengthy development behind them. A common feature of both is that the day of the new moon is already the fourth day, so that the counting of the days begins with the moon's invisibility, which can hardly have been the original practice. The Wadschagga divide the month into four parts the days of which are numbered, the first and third parts consisting of ten days each, and the second and fourth of five days each. Accordingly they begin to count the new moon at 'the fourth day, which brings the moon', the day on which the slender delicate crescent of the moon first reappears after sunset: for the rites of this day see above, p. 153. On the fourth day of the second division (the eleventh after new moon) they say that 'the moon turns to the back of the house': when twilight falls it is already seen beyond the culmination-point. The fourth day of the third division (the 16th after new moon) is called 'the day that brings the moon up from below' (i. e. from the eastern horizon), where 'it appears like a pot'; the fourth day of the last division is called 'the four, which dismisses the moon', and the first of the first division, when the moon vanishes, 'the one, which floats away the moon so that it is no longer visible': it 'tramples into pieces the days of the God' [1]. The natural phases of the moon therefore make themselves felt in spite of the counting. With this, as is so often the case, is connected a fully developed superstition concerning the days of the month. The Masai in ordinary life reckon their moon-months as consisting of 30 days, and number the days from 1 to 30 or

[1] Gutmann, pp. 238 ff.

CHAPTER VIII.

OLD SEMITIC MONTHS.

1. BABYLONIA.

In the much disputed questions of the ancient Babylonian astronomy and calendar the non-expert is in a situation of despair: for whoever cannot himself make use of the sources is referred to the often directly contradictory statements of the experts. I cannot however shirk the task of investigating whether in Babylonian calendric systems traces of the primitive time-reckoning are not also to be found. Unfortunately I cannot limit myself to matters upon which a certain unity of opinion prevails, but must also touch upon burning questions, such as the intercalation. What is here offered is in the nature of things only an attempt: but I may perhaps be allowed to express the hope that competent specialists, not led astray by chronological hypotheses, may afterwards observe how far the few but obvious characteristics of the primitive time-reckoning recur also in the Babylonian system.

The multiplicity and variability of the names of the months are found once more in ancient Sumer. In so comparatively late a period as the kingdom of Ur (in the middle of the second half of the third millenium B. C.) each minor state had its own list of months, which I here reproduce, together with the suggested explanations, chiefly from the latest work of Landsberger [1]. At this time there was in use in Nippur a list of months the terms of which later served as general ideograms for the months. The names are: — 1, *bar-zag-gar(-ra)*, month

[1] The explanations given by Muss-Arnolt are known to me only through Ginzel, I, 117 ff.

of habitation or inhabitants of the sanctuary; 2, *gu(d)-si-sa*, the name is derived by the Babylonians themselves from an agricultural occupation, the driving of the irrigating-machine drawn by oxen: the moderns connect this name with the *gu(d)-si-su* festival celebrated in this month at Nippur; 3, *šeg-ga*, shortened from *šeg-u-šub-ba-gar-ra*, 'month in which the brick is laid in the mould'; 4, *šu-kul-na*, probably 'sowing-month', although the time does not fit: for displacements see below p. 261; 5, *ne-ne-gar(-ra)*, named from a festival; 6, *kin-^{d}Inanna*, named from an Istar festival; 7, *du(l)-azag(-ga)*, from a festival; 8, *apin-du-a*, 'month of the opening of the irrigation-pipes', which fits very well with the time of year; 9, *kan-kan-na*, probably 'ploughing-month', which also agrees very well with the season; 10, *ab(-ba)-e(-a)*, from a festival; 11, *aš-a(-an)*, 'month of the spelt'; 12, *še-kin-kud-(du)*, 'month of the corn-harvest'. There are therefore some names of the familiar kind, taken from agricultural occupations, but more are borrowed from festivals. It is very natural that the list of months should be regulated by ecclesiastical points of view, since Nippur was a great and very ancient centre of the religious cult.

Most interesting are the months from Girsu (Lagash). From the pre-Sargonic period about 25 names of months have hitherto been found, of which only 8 or 9 persisted up to the second and third periods. These 25 names of months are divided by Landsberger into the following groups: — (1) occasional names of months, under which he includes those which are consciously named after the object or employment mentioned in the document itself, or even improvised from the domestic occupation in question. Four names are given but are not translated. (2) isolated and foreign names of months: 'month in which the shining (or white) star sinks down from the culmination-point', a type familiar to us; 'month in which the third people came from Uruk', doubtless an accidental description. Further, two months named from festivals at Lagash. (3) agricultural by-names: *itu še-kin-kud-du*, see above; *itu gur-dub-ba-a*, 'month in which the granary is covered with grain'; further a name not explained, perhaps identical with the foregoing. (4) terms belonging to the religious cult.

Of these no fewer than 17 exist, not counting those already mentioned: they are nearly all named after festivals. Great pains have been taken to arrange the months in their position in the calendar, and the superfluous names have been set down merely as doublets, since they have been judged by the lists of months current among ourselves. When we compare the terms with those of the primitive time-reckoning, it becomes clear that the naming of the months is here in the same fluctuating state as e. g. among the Melanesians. According to circumstances, an agricultural occupation, the rising of a star, a festival, etc. is seized upon in order to describe the month. Certainly the months can be chronologically arranged, but to draw up a fixed series from these 25 names is impossible, even if tendencies towards the formation of such a series already exist. The development tends in this direction in order to facilitate a general understanding, and in the second period, at the time of the kingdom of Akkad in the 28th to 26th centuries, a list of this nature occurs [1]: — 1, *itu ezen ganmaš,* perhaps 'month of the reckoning', i. e. of the profits of the agriculture, or *'mois où la campagne resplendit'; 2, itu ezen har-ra-ne-sar-sar,* 'month in which the oxen work'; 3, *itu ezen dingir ne-šu,* of uncertain meaning but connected with the cult; 4, *itu šu-kul,* see above; 5, *itu ezen dim-ku,* month of the feast in which the *dim* consecrated to the deity was eaten; 6, *itu ezen* ^{dingir} *Dumu-zi,* month of the Tammuz feast; 7, *itu ur;* 8, *itu ezen* ^{dingir} *Bau,* month of the feast of the goddess Bau; 9, *itu mu-šu-gab,* meaning uncertain; 10, *itu mes-en-du-še-a-na* (?); 11, *itu ezen amar-a(-a)-si, amar* = 'young brood', *a* = 'water', *si* = *malu* = 'to be full', and therefore probably 'spawning month'; 12, *itu še-še-kin-a,* another form for *še-kin-kud;* 13, *itu ezen še-illa, 'mois où le blé monte',* according to Radau 'grain grow(n)', according to de Genouillac, whom Kugler follows, *'mois où on lève le blé pour les moutons':* i. e. after the corn has been trodden out on the threshing-floor by the oxen, the stalks are taken up for the cattle. The list has therefore thirteen months. Further, two points are to be noted.

[1] The respective explanations are from Kugler, II: 1, pp. 176 ff., and Thureau-Dangin.

In the first place only eight months (nos. 1, 2, 3, 5, 8, 11, 12, and 13), or perhaps nine — if *itu ur* is to be regarded as an abbreviation of *itu ga-udu-ur-(ra-)ka* — are taken over from the preceding period. The multiplicity and instability of the names of months were therefore at an earlier period still greater than the known names indicate. In the second place the word *ezen,* 'feast', is a secondary addition to the names of the 2nd, 3rd, 13th, and probably the 4th months, that is to say, the ecclesiastical point of view has penetrated into the nomenclature of the months to such an extent that even months with names borrowed from agricultural occupations are explained anew by festivals. The third period is the time of Dungi and his successors. The list of months differs only in that 7, *itu ur,* was re-named as *itu ezen* ^{dingir} *Dungi,* and the tenth month of the above list is missing, so that we have 10, *itu amar-a-asi;* 11, *itu še-kin-kud;* 12, *itu se-illa;* in the intercalation 11 is doubled, *itu dir še-kin-kud.* The seventh month takes its name from a festival celebrated in honour of the deified king Dungi; it is therefore the oldest example of a naming of a month from deified rulers which originates in the festivals bound up with the cult; such names are familiar from the Graeco-Roman period and examples still survive in the words 'July' and 'August'. Still another version of this list exists in the so-called syllabar of months, in which six series of names of months are enumerated. This list is not completely preserved. The most considerable deviation is that only two months instead of three intervene between the months *šu-kul-ua* and *ezen* ^{d} *Bau*: the order of succession is therefore broken. Landsberger conjectures that we have to do either with a later form of the calendar from Lagash, at the time of the kings of Larsa and Isin — afterwards the Nippur list was used, this being employed everywhere, at least ideographically — or else with a local offshoot. In any case the list affords valuable evidence of the instability of the months.

In modern Drehem there is found a list of months in which each month is allotted to an official of the cult, so that the result is a monthly regulation of the cult. The list is assigned to the town of Ur. 1, *maš-da-ku,* 'month of the gazelle eating',

from a festival ceremony; 2, *šeš-da-ku*, and 3, *u-bi-ku*, borrowed from religious festivals; 4, *ki-sig* ^{d} *Nin-a-zu*, month of the mourning festival of Ninazu; 5, *ezen* ^{d} *Nin-a-zu*, month of the (joyful) festival of Ninazu; 6, *a-ki-ti*, named from a feast; 7, *ezen* ^{d} *Dungi*, see above; 8, *šu-eš-ša*, unexplained, later ousted by ^{itu} *ezen* ^{d} *Su-* ^{d} *Sin*; 9, *ezen-mah*, 'month of the high feast'; 10, *ezen-an-na*, month of the Anu feast; 11, *ezen Me-ki-gal*, doubled in intercalation; 12, *še-kin-kud*. There are also many variants. The names, with the exception of that of the old harvest month, are all taken from feasts: the ecclesiastical nomenclature has therefore been carried out very fully.

The list of months from Umma: — The months 1, 2, and 6 are borrowed from the Nippur list. Of undoubted religious origin are: — 9, ^{d} *Ne-gun*; 10, *ezen* ^{d} *Dungi*; 12, ^{d} *Dumu-zi*. 11 has the variant ^{itu} ^{d} *Pap-u-e*. To none of the four local systems can ^{itu} *azag-šim* be allotted.

A fifth list is known only from the above-mentioned syllabar, and is not certainly localised. The names of months refer to festivals and religious ceremonies, and have not all been completely preserved.

We have seen what a multiplicity prevails among the Sumerian names of months. At the time of the dynasty of Hammurabi the signs of the Nippur list are used as ideographic signs of the months. The phonetic readings are known. The names are the common ones which were also adopted by the Jews in exile. The explanations are, according to Muss-Arnolt: — 1, *nisanu*, from *nesu* = 'to stir, to move on, to leap'; 2, *airu*, from *aru*, 'bright', or *'ir*, 'to send out, to sprout', and therefore the month of blossoming and sprouting; 3, *sivanu*; 4, *duzu*, 'son of life'; 5, *abu*, 'hostile' (on account of the heat); 6, *ululu*; 7, *tašritu*, 'origin, beginning'; 8, *arah-samna*, 'the eighth month'; 9, *kislivu*; 10, *dhabitu*, 'the gloomy month'; 11, *sabadhu*, 'the destroyer'; 12, *addaru*, 'the dark (month)'. The names are therefore borrowed throughout from natural phenomena. Numerous phonetic writings in legal documents are alone sufficient to shew that, at least for Sippar, our common pronunciations of the month-ideograms of this time were not the only ones in use. Landsberger gives 12 other names, of which only

a few can be explained. *Sibutim, sibutu* is the name for the 7th day and its festival, as the name of a month therefore, carrying over the idea to the year, it is the *sibutu* of the year; *ki-nu-ni*, 'oven month', because the oven must then be heated; *arah ka-ti-ir-si-tim*, 'hand of the underworld', probably something like 'month of epidemics'. One or two are named from gods. Therefore among the Semites of Babylonia also a fixed series of months was formed only gradually, by selection, and indeed under the influence of the Sumerian calendar from which the ideograms were borrowed.

The Elamite calendar is known partly from the so-called syllabar of months, and partly from documents[1]: the latter offer 13 names of which Hrozný tries to explain away the last by identifying it with another. The names in the two sources sometimes vary considerably, but are chiefly of Babylonian origin. Several, according to Hrozný's interpretations, refer to the seasons: *še-ir(-i)-eburi*, (month of the) prospering of the harvest; *tam-ti-ru-um*, month of rain; *tar-bi-tum* (month of the) growth (of plants). *Pi-te-bâbi* means 'opening of the gate', and probably refers to a religious ceremony.

The ancient Assyrian list of months is partly preserved in the syllabar of months, and also occurs in the inscriptions of the early Assyrian kings and in the so-called Cappadocian tablets, which come from an Assyrian colony of the third millenium at Kara Eyjuk in Asia Minor. We find: — 2, perhaps month of the moon-god; 3, *ku-zal-li*, shepherd's month; 4, *al-la-na-a-ti*, also shepherd's month; 6, *ša sa-ra-te*, perhaps the name of some employment; 12, *qar-ra-a-tu*, name of an occupation (?). The other names are missing or are uncertain. In regard to the interpretation of the names from occupations a certain caution should be exercised, since in accordance with all the examples hitherto given a name like 'shepherd's month' ought to refer not to the occupation as such but to the pasture season. All other explanations are quite problematical.

In the above I have only been able to reproduce the material collected by Assyriologists and the explanations given by them: but from this it clearly appears that the development

[1] Hrozný, pp. 85 ff.

of the series of months has proceeded in the same fashion here as elsewhere. At the beginning we find an indefinite number of names of months borrowed principally from natural phenomena. Among these a selection takes place, the result of which, however, is different in each city. At first it seems as though series of 13 months arose. But these series, as the examples from Lagash shew, were not fixed throughout. New names penetrate into them, even the position of the month can be altered. Finally the series becomes quite fixed, and with this seems to be connected the falling away of the thirteenth month: in the series of months now fixed at twelve the leapmonth becomes a doubling of the preceding month. While this development continues, the calendar takes on more and more an ecclesiastical stamp, since months named from festivals are constantly ousting those named from natural phenomena, and finally attain to almost exclusive predominance. This is easily to be understood in the case of ancient Sumer, since not only were the priests alone — here as elsewhere — in possession of the art of writing and the other higher branches of knowledge of the people, but the temples also had the largest landed property, with an extensive administration. Occupations and religious ceremonies, festival seasons and time-reckoning for practical purposes were more closely connected at that time than at any other. The Semitic calendars all present the same characteristics as the ancient Sumerian, a resemblance which is only slightly disguised by the fact that the signs of the now fixed Sumerian series of months are used as ideograms of the months. Everyone read the ideograms in accordance with his custom, so that a variety in the names of months still existed, as the phonetic writings testify. But the fixed writing naturally contributed to bring about fixed readings, i. e. a fixed series of months.

2. THE ISRAELITES.

The Israelites, like all Semitic races, reckoned in lunar months. I need not discuss the views which ascribe to them a solar year, or would make the old Canaanitish months divi-

sions of the solar year. From early times the day of the new moon was celebrated with general festivities and rest from labour, and the old feasts of the agricultural year seem to have been postponed till the time of full moon. Like the Homeric Greeks, the Jews at their immigration had no names of months. Hence they took over the old Canaanitish names. The latter appear in the oldest portions of the law, in the regulations for the feast of the Passover, which is to be celebrated in *chodesh ha-abib*, the month of ears of corn, and in the history of the building of Solomon's temple [1], where three others — *chodesh* or *yerash ziv*, *yerash bul*, *yerash ha-etanim* — are mentioned and compared with the numerical months by which their position is fixed. Of these *y. bul* and *y. etanim* recur among the eleven Phoenician names of months known from inscriptions. The above-mentioned series of months, which we possess only in fragments, was therefore at least in part identical with the Phoenician: hence the term 'old Canaanitish' is justified. The explanations are also clear, having regard to the position of the months in the year. *Chodesh ha-abib*, corresponding to the first month, about April, is the month of the ripening ears. *Yerash ziv*, the second, about May, the month of brightness (though certainly the etymology is not certain), is referred to the splendour of the blossoming season, though this falls earlier. But in May the dry season begins, and so one would think rather of the splendour of the sun. *Yerash ha-etanim*, corresponding to the seventh, about September, means month of the flowing, i. e. of the perennial streams, which now at the end of the dry season are the only ones that have water. *Yerash bul*, the eighth, cannot be referred to the gathering of the fruit *(bul)*, which has already taken place, but probably means the rainy month, since the autumn rains now begin [2]. The descriptions are therefore of the kind already sufficiently familiar.

But in the writings of the Old Testament the numbering of the months, beginning at the Feast of the Passover, is the common method of description, which is only replaced by the

[1] I Kings, Chap. VI and VIII. [2] Dillman, p. 926, König, p. 612 ff., and elsewhere.

THE CHRONOLOGY

OF

ANCIENT NATIONS

AN ENGLISH VERSION OF THE

ARABIC TEXT OF THE ATHÁR-UL-BÁKIYA OF ALBÍRÚNÍ,

OR

"VESTIGES OF THE PAST,"

COLLECTED AND REDUCED TO WRITING BY THE AUTHOR
IN A.H. 390—1, A.D. 1000.

TRANSLATED AND EDITED, WITH NOTES AND INDEX, BY

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PREFACE.

It was Sir Henry Rawlinson who first directed public attention to this work of Albîrûnî, in his celebrated article on Central Asia in the "Quarterly Review" for 1866, in which he gave some valuable information derived from his own manuscript copy, now the property of the British Museum. In offering the book, both in text and translation, to the learned world, I feel bound to premise that it is scarcely of a nature to attract the interest of the general reader. It appeals to minds trained in the schools of various sciences. Even competent scholars will find it no easy matter to follow our author through all the mazes of his elaborate scientific calculations. Containing, as it does, all the technical and historical details of the various systems for the computation of time, invented and used by the Persians, Sogdians, Chorasmians, Jews, Syrians, Ḥarránians, and Arabs, together with Greek traditions, it offers an equal interest to all those who study the antiquity and history of the Zoroastrian and Jewish, Christian and Muhammadan religions.*

The work of Albîrûnî has the character of a primary source. Oriental philologists are accustomed to see one book soon superseded by another, Barhebraeus by Ibn-al'athîr, Ibn-al'athîr by Al-Ṭabarî. Although it is likely enough

* By Christians, I understand the Melkite and Nestorian Churches, whilst the author does not seem to have known much more of the Jacobites than the name.

that on many subjects in this book we shall one day find better authenticated and more ancient information, I venture to say, that, as a whole, it will scarcely ever be superseded. It is a standard work in Oriental literature, and has been recognised as such by the East itself, representing in its peculiar line the highest development of Oriental scholarship. Perhaps we shall one day find the literary sources themselves from which Albîrûnî derived his information, and shall be enabled to dispense with his extracts from them. But there are other chapters, *e.g.* those on the calendars of the ancient inhabitants of Central Asia, regarding which we shall, in all likelihood, never find any more ancient information, because the author had learned the subject from hearsay among a population which was then on the eve of dying out. As the first editor and translator of a book of this kind, I venture to claim the indulgence of the reader. Generations of scholars have toiled to carry the understanding of Herodotus to that point where it is now, and how much is wanting still! The work of generations will be required to do full justice to Albîrûnî. A classical philologist can edit a Greek text in a correct form, even though he may have no complete understanding of the subject-matter in all possible relations. Not so an Arabic philologist. The ambiguity of the Arabic writing—*proh dolor!*—is the reason why a manuscript expresses only three-quarters of the author's meaning, whilst the editor is compelled to supply the fourth quarter from his own knowledge and discernment. No number in any chronological table can be considered correct, as long as it is not proved by computation to be so, and even in the simplest historical narrative the editor and translator may most lamentably go astray in his interpretation, if there is something wrong with the method of his research.

I have boldly attacked the sometimes rather enigmatic style of the author, and if I have missed the mark, if the bewildering variety and multiplicity of the subject-matter have prevented me reaching the very bottom of every question, I must do what more or less every Oriental author does at the end of his work,—humbly ask the gentle reader to pardon my error and to correct it.

I. *The Author.*

The full name of the author is *Abû-Raiḥân Muḥammad b. 'Ahmad Albîrûnî*. He quotes himself as *Abû-Raiḥân* (*vide* p. 134, l. 29), and so he is generally called in Eastern literature, more rarely *Albîrûnî*.

The latter name means, literally, *extraneous*, being a derivative from the Persian بیرون which means *the outside* as a noun, and *outside* as a preposition. In our time the word is pronounced *Bîrûn* (or *Beeroon*), *e.g.* in Teheran, but the vowel of the first syllable is a *yâi-majhûl*, which means that in more ancient times it was pronounced *Bêrûn* (or *Bayroon*). This statement rests on the authority of the Persian lexicographers. That the name was pronounced in this way in Central Asia about the author's time, we learn from an indisputable statement regarding our author from the pen of Alsam'ânî, a philologist and biographer of high repute, who wrote only one hundred years after the author's death (*vide* Introduction to my edition of the text, p. xviii.).

He was a native of Khwârizm, or Chorasmia, the modern Khiva; to speak more accurately, a native either of a *suburb* (*Bêrûn*) of the capital of the country, both of which bore the same name *Khwârizm*, or of the *country-district* (also called *Bêrûn*) belonging to the capital.

Albîrûnî was born A.H. 362, 3. Dhû-alḥijja (A.D. 973,

The matter standing thus, it is our duty to proceed from what is near to the more distant, from what is known to that which is less known, to gather the traditions from those who have reported them, to correct them as much as possible, and to leave the rest as it is, in order to make our work help him, who seeks truth and loves wisdom, in making independent researches on other subjects, and guide him to find out that which was denied to us, whilst we were working at this subject, by the will of God, and with his help.

In conformity with our plan, we must proceed to explain the nature of day and night, of their totality, *i.e.* the astronomical day, and assumed beginning. For day and night are to the months, years, and eras, what one is for the numerals, of which they are composed, and into which they are resolved. By an accurate knowledge of day and night, the progress towards learning that which is composed of them and built upon them, becomes easy.

CHAPTER I.

ON THE NATURE OF DAY AND NIGHT, OF THEIR TOTALITY AND OF THEIR BEGINNINGS.

I SAY: Day and night (*i.e.* *νυχθήμερον*) are one revolution of the sun in the rotation of the universe, starting from and returning to a circle, which has been assumed as the beginning of this same Nychthemeron, whichsoever circle it may be, it being determined by general consent. This *circle* is a "great" circle; for each great circle is dynamically an horizon. By "*dynamically*" (*τῇ δυνάμει*), I mean that it (this circle) may be the horizon of any place on the earth. By the "*rotation of the universe*," I mean the motion of the celestial sphere, and of all that is in it, which we observe going round on its two poles from east to west.

The Setting of the Sun as the beginning of the Day.—Now, the Arabs assumed as the beginning of their Nychthemeron the point where the setting sun intersects the circle of the horizon. Therefore their Nychthemeron extends from the moment when the sun disappears from the horizon till his disappearance on the following day. They were induced to adopt this system by the fact that their months are based upon the course of the moon, derived from her various motions, and that the beginnings of the months were fixed, not by calculation, but by the appearance of the new moons. Now, full moon, the appearance of which is, with them, the beginning of the month, becomes visible towards sunset. Therefore their night preceded their day; and, therefore, it is their custom to let the nights precede the days, when they mention them in connection with the names of the seven days of the week. p. 6.

Those who herein agree with them plead for this system, saying that darkness in the order (of the creation) precedes light, and that light suddenly came forth when darkness existed already; that, therefore, that which was anterior in existence is the most suitable to be adopted

Chronology of Anc. Nations.

as the beginning. And, therefore, they considered absence of motion as superior to motion, comparing rest and tranquillity with darkness, and because of the fact that motion is always produced by some want and necessity; that weariness follows upon the necessity; that, therefore, weariness is the consequence of motion. Lastly, because rest (the absence of motion), when remaining in the elements for a time, does not produce decay; whilst motion, when remaining in the elements and taking hold of them, produces corruption. As instances of this they adduce earthquakes, storms, waves, &c.

The Rising of the Sun as the beginning of the Day.—As to the other nations, the Greeks and Romans, and those who follow with them the like theory, they have agreed among themselves that the Nychthemeron should be reckoned from the moment when the sun rises above the eastern horizon till the same moment of the following day, as their months are derived by calculation, and do not depend upon the phases of the moon or any other star, and as the months begin with the beginning of the day. Therefore, with them, the day precedes the night; and, in favour of this view, they argue that light is an *Ens*, whilst darkness is a *Non-ens*. Those who think that light was anterior in existence to darkness consider motion as superior to rest (the absence of motion), because motion is an *Ens*, not a *Non-ens*—is life, not death. They meet the arguments of their opponents with similar ones, saying, *e.g.* that heaven is something more excellent than the earth; that a working man and a young man are the healthiest; that running water does not, like standing water, become putrid.

Noon or Midnight as the beginning of the Day.—The greater part and the most eminent of the learned men among astronomers reckon the Nychthemeron from the moment when the sun arrives on the plane of the meridian till the same moment of the following day. This is an intermediate view. Therefore their Nychthemera begin from the visible half of the plane of the meridian. Upon this system they have built their calculation in the astronomical tables (the Canons), and have thereby derived the places of the stars, along with their equal motions and their corrected places, in the almanacks (*lit.* year-books). Other astronomers prefer the invisible half of the plane of the meridian, and begin, therefore, their day at midnight, as *e.g.* the author of the Canon (Zîj) of Shahriyârân Shâh. This does not alter the case, as both methods are based upon the same principle.

People were induced to prefer the meridian to the horizon by many circumstances. One was, that they had discovered that the Nychthemera vary, and are not always of the same length; a variation which, during the eclipses, is clearly apparent even to the senses.

The reason of this variation is the fact that the course of the sun in the ecliptic varies, it being accelerated one time and retarded another; and that the single sections of the ecliptic cross the circles (the horizons)

at a different rate of velocity. Therefore, in order to remove that variation which attaches to the Nychthemera, they wanted some kind of equation; and the equation of the Nychthemera by means of the rising of the ecliptic above the meridian is constant and regular everywhere on the earth, because this circle is one of the horizons of the p. 7. globe which form a right angle (with the meridian); and because its conditions and qualities remain the same in every part of the earth. This quality they did not find in the horizontal circles, for they vary for each place; and every latitude has a particular horizon of its own, different from that of any other place, and because the single sections of the ecliptic cross the horizons at a different rate of velocity. To use the horizons (for the equation of the Nychthemera) is a proceeding both imperfect and intricate.

Another reason why they preferred the meridian to the horizon is this, that the distances between the meridians of different places correspond to the distances of their meridians on the equator and the parallel circles; whilst the distances between the horizontal circles are the same with the addition of their northern and southern declination. An accurate description of everything connected with stars and their places is not possible, except by means of that direction which depends upon the meridian. This direction is called "longitude," which has nothing in common with the other direction, which depends upon the horizon, and is called "latitude."

Therefore they have chosen that circle which might serve as a regular and constant basis of their calculations, and have not used others; although, if they had wished to use the horizons, it would have been possible, and would have led them to the same results as the meridian, but only after a long and roundabout process. And it is the greatest mistake possible purposely to deviate from the direct route in order to go by a long roundabout.

Day, Night, and the Duration of the Day of Fast.—This is the general definition of the day which we give, the night being included. Now, if we proceed to divide and to distinguish, we have to state that the words "*Yaum*" (day) in its restricted signification, and "*Nahâr*" (day), mean the same, viz., the time from the rising of the body of the sun till its setting. On the other hand, *night* means the time from the setting of the body of the sun till its rising. Thus these two terms are used among all nations by general consent, nobody disputing their meanings, except one Muslim lawyer, who has defined the beginning of the day to be the rise of dawn, and its end to be the setting of the sun, because he presumed that the day and the duration of fasting were identical. For this view of his he argues from the following word of God (Sûra ii. 183): "Eat and drink till you can distinguish a white thread from a black thread at the light of *dawn*. Thereupon fast the entire day till the *night*." Now, he has maintained that these two terms

(*dawn* and *night*) are the two limits of the day (*beginning* and *end*). Between this view, however, and this verse of the Coran there is not the slightest connection whatsoever. For if the beginning of fasting was identical with the beginning of the day, his (God's) definition of something that is quite evident and well known to everybody, in such terms, would be like a pains-taking attempt to explain something void of sense. Likewise he has not defined the end of day and the beginning of night in similar terms, because this is generally known among all mankind. God orders that fasting should commence *at the rise of dawn*; but the end of fasting he does not describe in a similar way, but simply says that it should end at "*night*," because everybody knows that this means the time when the globe of the sun disappears. Hence it is evident that God, by the words of the first sentence (*i.e.* eat and drink till you can distinguish a white thread from a black thread at the light of dawn), does not mean the beginning of day.

A further proof of the correctness of our interpretation is the word of God (Sûra ii. 183): "It has been declared as lawful to you during the
p. 8. night of fasting to have intercourse (*lit.* to speak obscene things) with your wives," &c., to the passage, "Thereupon fast the entire day till the night." Thereby he extends the right of having intercourse with one's wife, and of eating and drinking, over a certain limited time, not over the entire night. Likewise it had been forbidden to Muslims, before this verse had been revealed, to eat and drink after night-prayer (the time when the darkness of night commences). And still people did not reckon their fasting by days and parts of the night, but simply by days (although the time of fasting was much longer than the day).

Now, if people say that God, in this verse (Sûra ii. 183), wanted to teach mankind the beginning of the day, it would necessarily follow that before that moment they were ignorant of the beginning of day and night, which is simply absurd.

Now, if people say the *legal* day is different from the *natural* day, this is nothing but a difference in words, and the calling something by a name, which, according to the usage of the language, means something else. And, besides, it must be considered that there is not the slightest mention in the verse of the day and of its beginning. We keep, however, aloof from pertinacious disputation on this subject, and we are willing to agree with our opponents as to the expressions if they will agree with us regarding the subject-matter.

And how could we believe a thing the contrary of which is evident to our senses? For evening-twilight in the west corresponds to morning-dawn in the east; both arise from the same cause, and are of the same nature. If, therefore, the rise of morning-dawn were the beginning of the day, the disappearance of evening-twilight would be its end. And actually some Shiites have been compelled to adopt such a doctrine.

Let us take it for granted that those who do not agree with us

regarding that which we have previously explained, agree with us as to the fact that twice a year night and day are equal—once in spring and once in autumn. Further, that he thinks, like us, that we have the longest day when the sun stands nearest to the north pole; the shortest day when the sun is at the greatest distance from the north pole; that the shortest summer night is equal to the shortest winter day; and that the same meaning is expressed by the two verses of the Coran: "God makes night enter into day, and he makes day enter into night" (Sûra xxxv. 14), and "He wraps night around day, and he wraps day around night" (Sûra xxxix. 7). Now, if they do not know this, or pretend not to know it, at all events they cannot help admitting that the first half of the day is six hours long, and likewise the latter half. Against this they cannot pretend to be blind, because of the well known and well authenticated tradition which relates to the prerogatives of those who hasten to the mosque on a Friday, and which shows that their wages are the highest, although their time of work in the six hours from the beginning of the day till the time of the decline of the sun is the shortest. This is to be understood of the *Horæ temporales obliquæ* (*ὧραι καιρικαί*), not of the *Horæ rectæ*, which are also called *æquinoctiales* (*ὧραι ἰσημεριναί*).

Now, if we should comply with their wish, and acknowledge their assertions as truth, we should have to believe that an equinox takes place when the sun moves on either side of the winter solstice (*i.e.* near to the point of the winter-solstice either arriving there or leaving it); that this takes place only in some parts of the earth to the exclusion of others; that the winter night is not equal to the summer day, and that noon is not then when the sun reaches the midst between his rising and p. 9.
setting points. Whilst just the contrary of these necessary inferences from their theory is the conclusion generally accepted even by those who have only a slight insight into the matter. That, however, similar absurdities must follow out of their reasoning he only will thoroughly comprehend who is to some degree acquainted with the motions of the (celestial) globes.

If somebody will stick to what people say at dawn-rise, "*morning has come, night has gone;*" what is he to think of what they say when the sun is near setting, and becomes yellow—"evening has come, day has gone, night has come?" Such expressions merely indicate the approaching, the advancing, and the receding of the precise time in which people just happen to be. These phrases are to be explained as metaphors and metonymics. They are allowed in the usage of the language, *cf. e.g.* the word of God (Sûra xvi. 1): "The order of God has come; therefore do not *hurry* it."

Another argument in favour of our view is the following saying, which is attributed to the Prophet, to whom and to whose family may God be merciful: "The prayer of the day is silent." And the fact that

this persuasion is established, that he had received divine inspiration and help.

p. 26. For it is quite possible that these (celestial) bodies were scattered, not united at the time when the Creator designed and created them, they having these motions, by which—as calculation shows—they must meet each other in *one* point in such a time (as above mentioned). It would be the same, as if we, *e.g.* supposed a circle, in different separate places of which we put living beings, of whom some move fast, others slowly, each of them, however, being carried on in equal motions—of its peculiar sort of motion—in equal times; further, suppose that we knew their distances and places at a certain time, and the measure of the distance over which each of them travels in one Nychthemeron. If you then ask the mathematician as to the length of time, *after* which they would meet each other in a certain point, or *before* which they had met each other in that identical point, no blame attaches to him, if he speaks of billions of years. Nor does it follow from his account that those beings *existed* at that (past) time (when they met each other), or that they would *still exist* at that (future) time (when they are to meet again); but this only follows from his account, if it is properly explained, that, *if* these beings really existed (in the past), or would still exist (in future) in that same condition, the result (as to their conjunctions) could be no other but that one at which he had arrived by calculation. But then the verification of this subject is the task of a science which was not the science of 'Abû-Ma'shar.

If, now, the man who uses the cycles (the star-cycles), would conclude that they, viz. the stars, if they stood in conjunction in the first part of Aries, would again and again pass through the same cycles, because, according to his opinion, everything connected with the celestial globe is exempt from growth and decay, and that the condition of the stars in the past was exactly the same, his conclusion would be a mere assumption by which he quiets his mind, and which is not supported by any argument. For a proof does not equally apply to the two sides of a contradiction; it applies only to the one, and excludes the other. Besides it is well known among philosophers and others, that there is no such thing as an *infinite* evolution of power (δύναμις) into action (πρᾶξις), until the latter comes into real existence. The motions, the cycles, and the periods of the past were computed whilst they in reality existed; they have decreased, whilst at the same time increasing in number; therefore, they are not *infinite*.

This exposition will be sufficient for a veracious and fair-minded student. But if he remains obstinate, and inclines to the tricks of overbearing people, more explanations will be wanted, which exceed the compass of this book, in order to remove these ideas from his mind, to heal what is feeble in his thoughts, and to plant the truth in his soul. However, there are other chapters of this book where it will be more

suitable to speak of this subject than here. The discrepancy of the cycles, not the discrepancy of the observations, is a sufficient argument for—and a powerful help towards—repudiating the follies committed by 'Abû-Ma'shar, and relied upon by foolish people, who abuse all religions, who make the cycles of Sindhind, and others, the means by which to revile those who warn them that the hour of judgment is coming, and who tell them, that on the day of resurrection there will be reward and punishment in yonder world. It is the same set of people who excite suspicions against—and bring discredit upon—astronomers and mathe-
10 maticians, by counting themselves among their ranks, and by representing themselves as professors of their art, although they cannot even impose p. 27. upon anybody who has only the slightest degree of scientific training.

Era of Nabonassar.—The next following era is the Era of the first Nebukadnezar (Nabonassar). The Persian form of this word (*Bukhtanaṣṣar*) is *Bukht-narsi*, and people say that it means "one who weeps and laments much"; in Hebrew, "Nebukadnezar," which is said to mean "Mercury speaking," this being combined with the notion that he cherished science and favoured scholars. Then when the word was Arabized, and its form was simplified, people said "*Bukhtanaṣṣar*."
20 This is not the same king who devastated Jerusalem, for between these two there is an interval of about 143 years, as the following chronological tables will indicate.

The era of this king is based upon the Egyptian years. It is employed in the Almagest for the computation of the places of the planets, because Ptolemy preferred this era to others, and fixed thereby the mean places of the stars. Besides he uses the cycles of Callippus, the beginning of which is in the year 418 after Bukhtanaṣṣar, and each of which consists of seventy-six solar years. Those who do not know them (these cycles), try to prove by what they find mentioned in Almagest, that they are of
30 Egyptian origin; for Hipparchus and Ptolemy fix the times of their observations by Egyptian days and months, and then refer them to the corresponding cycles of Callippus. Such, however, is not the case. The first cycle, employed by those who compute the months by the revolution of the moon and the years by the revolution of the sun, was the cycle of eight years, and the second that of nineteen years. Callippus was of the number of the mathematicians, and one who himself—or whose people—considered the use of this latter cycle as part of their laws. Thereupon, he computed this cycle (of seventy-six years), uniting for that purpose four cycles of nineteen years.

40 Some people think that in these cycles the beginning of the months was fixed by the appearance of new moon, not by calculation, as people at that (remote) age did not yet know the calculation of the eclipses, by which alone the length of the lunar month is to be determined, and these calculations are rendered perfect; and that the first who knew the theory of the eclipses was Thales of Miletus. For after having frequently

attended the lectures of the mathematicians, and having learned from them the science of form and motions (astronomy), he proceeded to discover the calculation of the eclipses. Then he happened to come to Egypt, where he warned people of an impending eclipse. When, then, his prediction had been fulfilled, people honoured him highly.

The matter, as thus reported, does not belong to the impossible. For each art goes back to certain original sources, and the nearer it is to its origin, the more simple it is, till you at last arrive at the very origin itself. However, this account, that eclipses were not known before Thales, must not be understood in this generality, but with certain local restrictions. For some people refer this scholar (Thales) to the time of Ardashîr ben Bâbak, others to that of Kaiḳubâdh. Now, if he lived at
p. 28. the time of Ardashîr, he was preceded by Ptolemy and Hipparchus; and these two among the astronomers of that age knew the subject quite sufficiently. If, on the other hand, he lived at the time of Kaiḳubâdh, he stands near to Zoroaster, who belonged to the sect of the Ḥarrânians, and to those who already before him (Zoroaster) excelled in science, and had carried it to such a height as that they could not be ignorant of the theory of the eclipses. If, therefore, their report (regarding the discovery of the theory of the eclipses by Thales) be true, it is not to be understood in this generality, but with certain restrictions.

Era of Philippus Aridæus.—The era of Philip, the father of Alexander, is based upon Egyptian years. But this era is also frequently dated from the death of Alexander, the Macedonian, the Founder. In both cases the matter is the same, and there is only a difference in the expression. Because Alexander, the Founder, was succeeded by Philip, therefore, it is the same, whether you date from the death of the former, or the accession of the latter, the epoch being a connecting link common to both of them. Those who employ this era are called *Alexandrines*. On this era Theon Alexandrinus has based his so-called "Canon."

Era of Alexander.—Then follows the era of Alexander the Greek, to whom some people give the surname *Bicornutus*. On the difference of opinions regarding this personage, I shall enlarge in the next following chapter. This era is based upon Greek years. It is in use among most nations. When Alexander had left Greece at the age of twenty-six years, prepared to fight with Darius, the king of the Persians, and marching upon his capital, he went down to Jerusalem, which was inhabited by the Jews; then he ordered the Jews to give up the era of Moses and David, and to use his era instead, and to adopt that very year, the twenty-seventh of his life, as the epoch of this era. The Jews obeyed his command, and accepted what he ordered; for the Rabbis allowed them such a change at the end of each millennium after Moses. And at that time just a millennium had become complete, and their offerings and sacrifices had ceased to be practised, as they relate. So they adopted his era, and used it for fixing all the occurrences of their months and days,

as they had already done in the twenty-sixth year of his life, when he first started from home, with the view of finishing the millennium (*i.e.* so as not to enter upon a new one). When, then, the first thousand years of the Æra Alexandri had passed, the end of which did not coincide with any striking event which people are accustomed to make the epoch of an era, they kept the Æra Alexandri, and continued to use it. The Greeks also use it. But according to the report of a book, which Ḥabîb ben Bihrîz, the metropolitan of Mosul, has translated, the Greeks used to date—before they adopted the Æra Alexandri—from the migration of Yûnân ben Paris from Babel towards the west.

Era of Augustus.—Next follows the era of the king Augustus, the first of the Roman emperors (*Cæsares*). The word "*Cæsar*" means in Frankish (*i.e.* Latin) "he has been drawn forth, after a cutting has been made." The explanation is this, that his mother died in labour-pains, whilst she was pregnant with him; then her womb was opened by the "Cæsarean operation," and he was drawn forth, and got the surname "*Cæsar*." He used to boast before the kings, that he had not come out of the *pudendum muliebre* of a woman, as also 'Aḥmad ben Sahl ben Hâshim ben Alwalîd ben Ḥamla ben Kâmkâr ben Yazdajird ben Shahryâr used to boast, that the same had happened to him. And he (Augustus) used to revile people calling them "*son of the pudendum muliebre*." p. 29.

The historians relate, that Jesus, the son of Mary, was born in the forty-third year of his reign. This, however, does not agree with the order of the years. The chronological tables, in which we shall give a corrected sequence of events, necessitate that his birth should have taken place in the seventeenth year of his reign.

It was Augustus who caused the people of Alexandria to give up their system of reckoning by non-intercalated Egyptian years, and to adopt the system of the Chaldæans, which in our time is used in Egypt. This he did in the sixth year of his reign; therefore, they took this year as the epoch of this era.

Era of Antoninus.—The era of Antoninus, one of the Roman kings, was based upon Greek years. Ptolemy corrected the places of the fixed stars, dating from the beginning of his reign, and noted them in the Almagest, directing that their positions should be advanced one degree every year.

Era of Diocletianus.—Then follows the era of Diocletian, the last of the Roman kings who worshipped the idols. After the sovereign power had been transferred to him, it remained among his descendants. After him reigned Constantine, who was the first Roman king who became a Christian. The years of this era are Greek. Several authors of Canons have used this era, and have fixed thereby the necessary paradigms of the prognostics, the *Tempora natalicia*, and the conjunctions.

Era of the Flight.—Then follows the era of the Flight of the

the end of the month Ispandârmajî, with the same name by which they begin the days of the month; the second day they call Azmîn, the third Ardawasht, and so on till the fifth day Ispandârmajî. Then they return and commence anew with the first day زیمرد, the 1st of the month Nâwasârjî. They do not use or even know special names for the Epagomenæ, but I believe that this fact simply arises from the same confusion, regarding these names, which prevails among the Persians and Sughdians. For after Ḳutaiba ben Muslim Albâhilî had killed their learned men and priests, and had burned their books and writings, they became entirely illiterate (forgot writing and reading), and relied in every knowledge or science which they required solely upon memory. In the long course of time they forgot that on which there had been a divergence of opinion, and kept by memory only that which had been generally agreed upon. But Allâh knows best!

As to the three identical names of days (the 8th, 15th, and 23rd,—*Dai* in Persian, *Dast* in Sughdian, *Dadhû* in Khwârizmian), the Persians refer them to the following, and compound them with these, saying *Dai-ba-Ádar*, and *Dai-ba-Mihr*, and *Dai-ba-Dîn*. Of the Sughdians and Khwârizmians some do the same, and others connect the words in their language for "the first, the second, the third," with each of them.

In the early times of their empire the Persians did not use the week. For, first, it was in use among the nations of the west, and more particularly among the people of Syria and the neighbouring countries, because there the prophets appeared and made people acquainted with the first week, and that in it the world had been created, in conformity with the beginning of the Thora. From these the use of the week spread to the other nations. The pure Arabians adopted the week in consequence of
p. 49. the vicinity of their country to that of the Syrians.

We have not heard that anybody has imitated the example of the Persians, Sughdians, and Khwârizmians, and has adopted their usage (of giving special names to the thirty days of the month, instead of dividing them into weeks), except the Copts, *i.e.* the ancient inhabitants of Egypt. For they, as we have mentioned, used the names of the thirty days till the time when Augustus, the son of Gajus, ruled over them. He wanted to induce them to intercalate the years, that they might always agree with the Greeks and the people of Alexandria. Into this subject, however, it would be necessary to inquire more closely. At that time precisely five years were wanting till the end of the great intercalation period. Therefore, he waited till five years of his rule had elapsed, and then he ordered people to intercalate one day in the months in every fourth year, in the same way as the Greeks do. Thereupon they dropped the use of the names of the single days, because, as people say, those who used and knew them would have required to invent a name for the intercalary day. They (the names of the days of the month) have not been handed down to posterity.

Months of the Egyptians.—The following are the names of their months:—

I.	Thot	30 days.	VII.	Phamenoth	30 days.
	Paophi	30 „		Pharmuthi	30 „
	Athyr	30 „		Pachon	30 „
	Choiak	30 „		Payni	30 „
	Tybi	30 „		Epiphi	30 „
	Mechir	30 „		ابيقا	30 „

These are the ancient names of the months. In the following we give the names which were modernized by one of their princes, after intercalation had been adopted:—

I. توت	VII. برمهات
بابة	برمودة
هتور	بشنس
كيهك	بونة
طوبة	ابيب
امشير	مسرى

Some people call the months كيهك, برمهات, بشنس, and مسرى by the names كياك, برمهوط, بشانس and ماسورى. These are the forms on which people agree; in some books, however, these names are found in forms somewhat different from those we have mentioned.

The five additional days they call, Ἐπαγομέναι, which means "*the small month*;" they are appended at the end of Mesori, and at the same place the intercalary day is added, in which case the Epagomenæ are six days. The leap-year they call النقط, which means "*the sign*." p. 50.

Months of the People of the West.—'Abû-al'abbâs Alâmulî relates in his *Kitâb-dalâ'il-alḳibla*, that the *Western people* (of Spain?) use months, the beginnings of which agree with those of the Coptic months. They call them by the following names:—

I.	May	30 days.	VII.	November	30 days.
	June	30 „		December	30 „
	July	30 „		January	30 „
	August	30 „		February	30 „
	September	30 „		March	30 „
	October	30 „		April	30 „

Then follow the five Epagomenæ at the end of the year.

Months of the Greeks.—The months of the Greeks are always twelve in number. Their names are these:—

I.	Ἰανουάριος	31 days.	IV.	Ἀπρίλις	30 days.
	Φεβρουάριος	28 „		Μαῖος	31 „
	Μάρτιος	31 „		Ἰούνιος	30 „

was a *protégé* of those people, entirely mixed up with them, and because it was he who polished for them their scientific work. He had collected the materials of this book with the object of explaining the fact of the solar years not being always equal to each other, on account of the motion of the apogee. With all this he was compelled to assume equal circles, and equal motions along with their times, in order to derive thereby the mean motion of the sun. But he did not find equal circles, except those which move in an excentric plane, described (*viz.* the circles) round a point within it, which point is assumed exclusively for these circles. And this circle, which was sought for, extends the six hours by additional fractions (*i.e.* its time of revolution is 365 days 6 hours + *a fraction*), as Ḥamza has related. However, such a circle is not called a solar year, for the solar year is, as we have defined already, that one, in which all natural occurrences which are liable to growth and to decay return to their original condition.

Jewish Months.—The Hebrews and all the Jews, who claim to be related to Moses, have the following twelve months:—

I. Nîsân	of 30 days.	VI. Tishrî	of 30 days.
Jyâr	of 29 „	Marḥeshwân	of 29 „
Sîwân	of 30 „	Kislew	of 30 „
Tammûz	of 29 „	Ṭêbeth	of 29 „
Âbh	of 30 „	Shefaṭ (Shebhaṭ)	of 30 „
Elûl	of 29 „	Adhâr	of 29 „

p. 53. The sum total of their days is 354, being identical with the number of days of the lunar year. If they simply used the lunar year as it is, the sum of the days of their year and the number of their months would be identical. However, after having left Egypt for the desert Al-tîh, after having ceased to be the slaves of the Egyptians, having been delivered from their oppression, and altogether separated from them, the Israelites received the ordinances and the laws of God, described in the second book of the Thora. And this event took place in the night of the 15th Nîsân *at full moon* and *spring time*. They were ordered to observe this day, as it is said in the second book of the Thora (Exodus xii. 17, 18): "Ye shall observe this day as an ordinance to your generations for ever on the fourteenth of the first month." By the "*first month*" the Lord does not mean Tishrî, but Nîsân; because in the same book he commands Moses and Aaron, that the month of passover should be the first of their months, and the beginning of the year (Exodus xii. 2).

Further, Moses spake unto the people: "Remember the day when ye came out from bondage. Therefore ye shall not eat leavened bread on this day in that month when the trees blossom." In consequence, they were compelled to use the solar year and the lunar months; the solar year in order that the 14th Nîsân should fall in the beginning of spring,

when the leaves of the trees and the blossoms of the fruit trees come forth'; the lunar months in order that, on the same day, the body of the moon should be lit up completely, standing in the sign of Libra. And as the time in question would naturally advance for a certain number of days (the sum of the days of twelve lunar months not being a complete year), it was necessary for the same reason to append to the other months those days, as soon as they made up one complete month. They added these days as a complete month, which they called the *First Adhâr*, whilst they called the original month of this name the *Second Adhâr*, because of its following immediately behind its namesake. The leap-year they called *'Ibbûr* (עִבּוּר), which is to be derived from *Me'ubbereth* (מְעֻבֶּרֶת), meaning in Hebrew, "*a pregnant woman.*" For they compared the insertion of the supernumerary month into the year, to a woman's bearing in her womb a foreign organism.

According to another opinion, the First Adhâr is the original month, the name of which without any addition was used in the common year, and the Second Adhâr is to be the leap-month, in order that it should have its place at the end of the year, for this reason, that according to the command of the Thôrâ, Nîsân was to be the first of their months. This, however, is not the case. That the Second Adhâr is the original month, is evident from the fact, that its place and length, the number of its days, the feast- and fast-days which occur in it, are not liable to any changes. And of all these days nothing whatsoever occurs in the First Adhâr of a leap-year. Further, they make it a rule that, during the Second Adhâr, the sun should always stand in the sign of Pisces, whilst in the First Adhâr of a leap-year he must be in the sign of Amphora.

Five Cycles.—Now for the leap-years they wanted a certain principle of arrangement as a help to facilitate their practical use. Therefore they looked out for cycles which were based upon solar years, consisting of lunar months. Of those cycles they found the following five:— p. 54.

I. The cycle of 8 years consisting of 99 months, of which there are 3 leap-months.

II. The cycle of 19 years, called the *Minor Cycle*, consisting of 235 months, of which there are 7 leap-months.

III. The cycle of 76 years, consisting of 940 months, of which there are 28 leap-months.

IV. The cycle of 95 years, called the *Middle Cycle*, consisting of 1,176 months, of which there are 35 leap-months.

V. The cycle of 532 years, called the *Major Cycle*, consisting of 6,580 months, of which there are 196 leap-months.

Of these cycles they choose that one, the observation of which would be the easiest and simplest. This quality is peculiar to the cycles of 8 and of 19 years, with this difference, however, that the latter one agrees

The first (outer) circle indicates the quality of the year, whether it is a common year or a leap-year. The three other circles contain the three *formulæ*, indicating the order of the leap-years in the Maḥzôrs; the
p. 56. second circle, the formula בהזיגוח; the third circle, the formula אדוטבהז; and the inner circle, the formula גבטבג.

The cycles which we have mentioned hitherto, are derived from the moon, though not exclusively. The solar cycle consists of 28 years, and serves to indicate on what days of the week the solar years commence. For if the Jewish year had simply 365 days without the quarter-day, the beginning of the year would in every seven years return to the same week-day. Since, however, they are intercalated once in four years, the beginning does not return to the same day, except in 28 years, *i.e.* 4 × 7 years. Likewise the other cycles, heretofore mentioned, do not, on being completed, return to the same week-day, except the largest cycle, on account of its arising from a duplication of the cycle of 19 years with the solar cycle.

The three kinds of the Jewish Year.—I say further: If the Jewish years had simply the first two qualities, *i.e.* were either common years or leap-years, it would be easy to learn their beginnings, and to distinguish between the two qualities which are proper to them, provided the above-mentioned formula of computation for the years of the Maḥzôr be known. The Jewish year, however, is a threefold one. For they have made an arrangement among themselves, that New Year shall not fall on a Sunday, Wednesday, or Friday, *i.e.* on the days of the sun and his two stars (Mercury and Venus); and that Passover, by which the beginning of Nîsân is regulated, shall not fall on the days of the inferior stars, *i.e.* on Monday, Wednesday, and Friday, for reasons on which we shall hereafter enlarge as much as possible. Thereby they were compelled either to postpone or to advance New Year and Passover, when they happened to fall on one of the days mentioned.

For this reason their year consists of the following three species:—

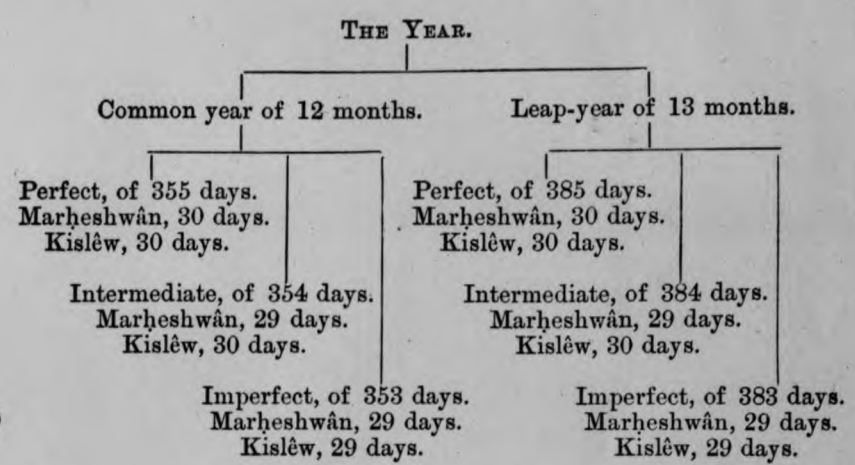
I. The year called حسارين, *i.e.* the imperfect one (חֲסֵרָה), in which the months Marḥeshwân and Kislêw have only 29 days.

II. The year called كسدران, *i.e.* the intermediate (כְּסִדְרָן), lit. *secundum ordinem suum*, in which Marḥeshwân has 29 days, and Kislêw 30 days.

III. The year called هلاميم, *i.e.* the perfect one (שְׁלֵימָא), in which both Marḥeshwân and Kislêw have 30 days.

Each of these three species of years may be either a common year or a leap-year. So we get a combination of six species of years, as we have here illustrated in the form of a genealogical diagram, and distributed in the following representation.

p. 57.



For the deduction of these differences they have many modes of computation as well as tables, which we shall not fail to explain hereafter.

Determination of New Moon.—Regarding their knowledge of the beginning of the month, and the mode in which it is computed and used, the Jews are divided into two sects, one of which are the Rabbanites. They derive the beginning of the month by means of calculation from the mean motions of the two luminaries (sun and moon), no regard being had as to whether new moon is visible already or not. For it was their object to have a conventional time, that was to begin from the conjunction of sun and moon. By the following accident they were, as they relate themselves, induced to adopt this system: at the time when they returned to Jerusalem, they posted guards upon the tops of the mountains to observe new moon, and they ordered them to light a fire and to make a smoke, which was to be a signal for them that new moon in fact had been seen. Now, on account of the enmity which existed between them and the Samaritans, these latter went and sent up the smoke from the mountain one day before new moon was seen. This practice they continued during several months, at the beginnings of which heaven always happened to be clouded. Finally, people in Jerusalem found out this, observing that new moon, on the 3rd and 4th of the month, rose above the horizon from the east. Hence it was evident that the Samaritans had deceived them. Therefore they had recourse to the scholars of their time, in order to be protected by a system of calculation against the deceitful practices of their enemies, to which they were exposed by their present method.

In order to prove that it was legally permitted to fix the beginning of the month by calculation instead of observation, they referred to the duration of the deluge. For they assert that Noah computed and fixed the beginnings of the months by calculation, because heaven was covered p. 58.

and clouded for so long as six months, during which time neither new moon nor any other phase of the moon could be observed.

The mathematicians, therefore, computed for them the cycles, and taught them how to find, by calculation, the conjunctions and the appearance of new moon, viz. that between new moon and the conjunction the time of 24 hours must elapse. And this comes near the truth. For if it was the corrected conjunction, not the mean one, the moon would in these hours move forward about 13 degrees, and her elongation from the sun would be about 12 degrees.

This reform was brought about nearly 200 years after Alexander. Before that time they used to observe the *Teḳûfôth* (תְּקוּפוֹת), *i.e.* the year-quarters, on the computation of which we shall enlarge hereafter, and to compare them with the conjunction of that month, to which the Teḳûfâ in question was to be referred. If they found that the conjunction preceded the Teḳûfâ by about 30 days, they intercalated a month in this year, *e.g.* if they found that the conjunction of Tammûz preceded the Teḳûfâ of Tammûz, *i.e.* the summer-solstice by about 30 days, they intercalated in that year a month Tammûz, so that it had one Tammûz and a second Tammûz (תַּמּוּז וְתַמּוּז). In the same way they acted with the other Teḳûfôth.

Some Rabbanites, however, deny that such guards were posted, and that they made a smoke as a signal. According to their opinion, the cause of the deduction of this system of calculation was the following: the scholars and the priests of the Israelites, feeling convinced that their people would be scattered and dispersed in consequence of the last destruction of Jerusalem, as they thought, were afraid that their compatriots, being scattered all over the world, and solely relying upon the appearance of new moon, which of course in different countries would be different for them, might, on account of this, fall into dissensions, and a schism in their doctrine might take place. Therefore they invented these calculations,—a work which was particularly attended to by Elîezer ben Pârûaḥ, and ordered people to adhere to them, to use them, to return to them, wherever and under whatever circumstances they lived, so that a schism among them might be avoided.

The second sect are the *Milâdites*, who derive the beginning of the month from the conjunction; they are also called *Alḳurrâ* and *Al'ishma'iyya*, because they demand that people shall only follow the wording of the text, no regard being had to considerations and analogies, etc., even if it may be illogical and impracticable.

One party of them is called the *'Ananites*, who derived their name from 'Ânân, the head of the emigration (ראשׁ גלותא), who lived between 100 and 110 years ago. A head of the emigration must of necessity be one of the descendants of David; an offspring of another family would not be fit for this office. Their common people relate, that only he is qualified who, standing upright, can reach his knees with the tops of his

fingers; just as people relate such things of the prince of the true believers, 'Alî beñ 'Abî Ṭâlib, and of those of his descendants who are qualified for the Imâma and the rule of the community (the Muḥammadan world).

The genealogy of this 'Ânân is the following:—

I. ענן בן דניאל ב' שאול ב' ענן ב' דוד
VI. ב' חסדאי ב' כפנאי ב' בסתנאי ב' הנומר ב' זוטרא
XI. ב' רב הונא ב' שפטיה ב' הונא ב' נתן ב' אבא מר
XVI. ב' רבנא עקיבא ב' שבניא ב' זכאי ב' חזקיא ב' שמעיא
XXI. ב' שפתיא ב' יוחנן ב' רצוציתא ב' ענן ב' ישעיא
XXVI. ב' זכריא ב' ברכיא ב' עקוב ב' חנניא ב' בסדיא
XXXI. ב' מעשיא ב' פדיה ב' זרבבל ב' שאלתיאל ב' יהויכין
XXXVI. ב' יהויקים ב' יהואחז ב' יאשיה ב' אחזיא ב' יהורם
XLI. ב' יהושפט ב' אסה ב' אביה ב' רחבעם ב' שלמה
XLVI. ב דוד

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He opposed a community of Rabbanites in many of their observances. He fixed the beginning of the month by the appearance of the new moon in a similar way, as is prescribed in Islâm, not caring on what day of the week the beginning of the month happened to fall. He gave up the system of computation of the Rabbanites, and made the intercalation of a month depend upon the observation of barley-seed in 'Irâk and Syria between the 1st and the 14th Nîsân. If he found a first-fruit fit for friction and reaping, he left the year as a common year; if he did not find that, he intercalated the year. The mode of prognosticating the state of the corn was practically this, that one of his followers went out on the 23rd Shebâṭ, to examine—in Syria and the countries of a similar climate—the state of the barley-seed. If he found that the Safâ, *i.e.* the prickles of the beard of the ear of corn, had already come out, he counted from that day till Passover 50 days; if he found that it had not yet come out, he intercalated a month into the year. And some added the intercalary month to Shefaṭ, so that there was a *Shefaṭ* and an *U-Shefaṭ*; whilst others added it to Adhâr, so that there was an *Adhâr* and a *We-Adhâr*. The Ânânites mostly use Shefaṭ, not Adhâr, whilst the Rabbanites use exclusively Adhâr.

This system of prognosticating the state of the corn is a different one according to the difference of the air and the climate of the countries. Therefore it would be necessary to make a special rule for every place, and not to rely upon the rule made for one certain place, because this would not be applicable elsewhere.

Syrian Months.—The Christians in Syria, 'Irâḳ, and Khurâsân have combined Greek and Jewish months. For they use the months of the Greeks, but have adopted the 1st of the Greek October as the beginning

Nâjir is derived from *najr*, which means "intense heat," as it is used in the following verse:—

"A stinking water, on account of which a man turns his face aside,
Even he who is tortured by thirst, if he tasted it in a '*boiling hot*' month."

Khawwân is the form فَعّال of the verb "*to deceive*," and *Ṣuwân* is the form فُعال of the verb "*to preserve, to take care*." And these significations agreed with the natures of the months at the time when they were first employed as names for them.

Zabbâ means a "*great and frequently occurring calamity*." The month was called so, because in it there was much and frequent fighting.

Bâ'id, too, received its name from the fighting in it, for many people used to "*perish*" in it. This circumstance is expressed in the following proverb: "*All that is portentous happens between Jumâdâ and Rajab.*" For in this month people were in great haste and eagerness to carry out whatever blood revenge or warlike expeditions they were upon, before the month Rajab came in.

'Aṣamm was called so, because in it people abstained from fighting, so that the clash of weapons was not heard.

Wâghil means "*one who comes to a drinking-party without having been invited.*" This month was called so, because it suddenly comes in after Ramaḍân, and because in Ramaḍân there was much wine-drinking, on account of the next following months being the months of pilgrimage.

Nâṭil means "*a measure, a pot of wine.*" The month was called so, because in it people indulged in drinking debauches, and frequently used that pot.

'Âdil is derived from "*'adl*" (which means either "to be just" or "to turn aside"). The month was called so, because it was one of the months of pilgrimage, when they used to abstain from the use of the Ṇâṭil, *i.e.* the wine-pot.

Ranna was called so, because the sheep were "*crying*" on account of the drawing near of the time when they were to be killed.

Burak was called so, because of the kneeling down of the camels on being led to the slaughtering-place.

A better versification of these names than the above-mentioned one is that by the Wazîr 'Ismâ'îl ben 'Abbâd:—

"You wanted to know the months of the pagan Arabs. Take them according to the order of Muḥarram (Ṣafar, etc.), of which they partake.

p. 62. First comes *Mu'tamir*, then *Nâjir;* and *Khawwân* and *Ṣuwân* are connected by one tie.

Ḥanîn, Zabbâ, 'Aṣamm, 'Âdil, Nâfiḳ with *Waghl*, and *Ranna* with *Burak.*"

If the etymologies of these two classes of names of the months are such as we have related, we must suppose that between the two periods of giving the names there was a great interval of time. Or else our explanations and etymologies would not be correct. For in one class of the months the highest pitch of the heat is Ṣafar, whilst in the other it is Ramaḍân; and this (that the greatest heat should be either in Ṣafar or in Ramaḍân) is not possible at one and the same period, or at two periods which are not very far distant from each other.

Intercalation of the Ancient Arabs.—At the time of paganism the Arabs used their months in a similar way to the Muslims; their pilgrimage went wandering around through the four seasons of the year. But then they desired to perform the pilgrimage at such time as their merchandise (hides, skins, fruit, etc.) was ready for the market, and to fix it according to an invariable rule, so that it should occur in the most agreeable and abundant season of the year. Therefore they learned the system of intercalation from the Jews of their neighbourhood, about 200 years before the Hijra. And they used intercalation in a similar way to the Jews, adding the difference between their year and the solar year, when it had summed up to one complete month, to the months of their year. Then their intercalators themselves, the so-called *Ḳalâmis* of the tribe Kinâna, rose, after pilgrimage had been finished, delivered a speech to the people at the fair, and intercalated the month, calling the next following month by the name of that month in which they were. The Arabs consented to this arrangement and adopted the decision of the *Ḳalammas*. This proceeding they called "*Nasî'*," *i.e. postponement*, because in every second or third year they *postponed* the beginning of the year for a month, as it was required by the progression of the year. One of their poets has said:—

> "We have an intercalator, under whose banner we march;
> He declares the months profane or sacred, as he likes."

The first intercalation applied to Muḥarram; in consequence Ṣafar was called Muḥarram, Rabî' I. was called Ṣafar, and so on; and in this way all the names of all the months were changed. The second intercalation applied to Ṣafar; in consequence the next following month (Rabî' I.) was called Ṣafar. And this went on till intercalation had passed through all twelve months of the year and returned to Muḥarram. Then they commenced anew what they had done the first time.

The Arabs counted the cycles of intercalation and fixed thereby their dates. They said for instance: "From the time x till the time y the years have turned round one cycle."

But now, if notwithstanding intercalation it became evident that a month progressed beyond its proper place in the four seasons of the year, in consequence of the accumulation of the fractions of the solar year, and of the remainder of the *plus-difference* between the solar year

and the lunar year, to which latter they had added this plus-difference, they made a second intercalation. Such a progression they were able to recognize from the rising and setting of the Lunar Mansions. This went on till the time when the Prophet fled from Makka to Madîna, when the turn of intercalation, as we have mentioned, had come to Sha'bân.

p. 63. Now, this month was called Muḥarram, and Ramaḍân was called Ṣafar. Then the Prophet waited till the "*farewell pilgrimage*," on which occasion he addressed the people, and said: "The season, the time has gone round as it was on the day of God's creating the heavens and the earth." (Sûra ix. 38.) By which he meant that the months had returned to their original places, and that they had been freed from what the Arabs used to do with them. Therefore, the "*farewell pilgrimage*," was also called "*the correct pilgrimage*." Thereupon intercalation was prohibited and altogether neglected.

Months of the Themudeni.—'Abû-Bakr Muḥammad ben Duraid Al'azdî relates in his *Kitâb-alwishâḥ*, that the people Thamûd called the months by the following names:—

I. Mûjib *i.e.* Muḥarram.	VII. Haubal.
Mûjir.	Mauhâ.
Mûrid.	Daimur.
Mulzim.	Dâbir.
Muṣdir.	Ḥaifal.
Haubar.	Musbil.

He says that they commenced their year with the month Daimur, *i.e.* Ramaḍân. The following is a versification of these names by 'Abû-Sahl 'Îsâ ben Yaḥyâ Almasîḥî:—

"The months of Thamûd are *Mûjib*, *Mûjir*, *Mûrid*; then follow *Mulzim* and *Muṣdir*.
Then come *Haubar* and *Haubal*, followed by *Mauhâ* and *Daimur*.
Then come *Dâbir*, and *Ḥaifal*, and *Musbil*, till it is finished, the most celebrated among them."

Arabic Names of Days.—The Arabs did not, like the Persians, give special names to the single days of the month, but they had special names for each three nights of every month, which were derived from the state of the moon and her light during them. Beginning with the first of the month, they called—

The first three nights (1st–3rd) *ghurar*, which is the plural of *ghurra*, and means *the first of everything*. According to others they were called so, because during them the new moon appeared like *a blaze on the forehead of a horse*.

The second three nights (4th–6th) *nufal*, from *tanaffala*, which means, "*beginning to make a present without any necessity*." Others call them *shuhb*, *i.e.* the white nights.

"Sed neomenia Judaica, Arabica, & Samaritana excedit modum φάσεως ut plurimũ. ita civiles neomenie mensium Lunariũ sint triplicis generis: Atticae ἀπὸ τῆς συνόδου: Calippicae ἀπὸ τῆς αποκρύσεως: Judaicae, Samaritanae, & Arabicae, ἀπὸ τῆς μηνοειδοῦς χήματος, a tertia, inquam, die."-- Scaliger, Joseph, "De Emendatione Temporum," p. 6.

Translation: But the Jewish, Arabic, and Samaritan new moon commonly exceeds the size of the phasis [moon's first appearance], so that the civil new moons of lunar months are a triple kind: the Attic, from the conjunction; the Calippic, from the waxing; the Jewish, Arabic, and Samaritan, from the shape of the moon from the third day, I say.

[Roman months seem to copy Greek moons]
The Ides correspond to the 15th of March, May, July and October, and to the 13th of the other months. Webster.

"Nonnullis placet, Idus dictas vocabulo Graeco, à specie, quae apud illos εἰδέα vocatur, quod ea die plenam speciem luna demonstret."-- Venerabilis Bedae, "Opera Quae Supersunt Omnia," Edited, G.A. Giles, Vol. VI, Londini, 1843, p. 176.

Translation: Some hold that in the Greek language, Ides was called from "specie," which with them is called "εἰδέα," because on that day the moon shows a full face.
Ἰδέω corresponds to Latin "video."

"In the beginnings of the Church, both the Apostles and and those who followed after them for a hundred years, always celebrated the Jewish passover, as testifies Eusebius and his ancient ecclesiastical history, and after all, Nicephorus Callistus. But under Commodus, those who were observing the Jewish passover, were condemned of heresy by Victor, bishop of Rome, and by others whom he himself had called into the synod. But the difference in this celebration is twofold, in fact, either in the calculation of the moon or in the rite. In like manner, the difference is twofold in reference to the calculation of the moon. For either in the new moon, to the extent the new moons were triply employed by the ancients, as we have discussed in the Greek year; or in the embolism. For the new moons are reckoned either according to the conjunction, as of the ancient Ateliotics; or according to the waxing, as the Calippics; or according to the shape of the moon, such as of the Jews, Arabs, Arabs, ancient Chaldeans, and Damascenes. ['In the first it was quite dark; in the second it did open itself to receive the sun-beams; in the last it did appear, corniculata, horned.'-- Godwyn, Thomas, "Moses and Aaron," London, 1685, p. 122.] The embolisms differ as to the calculation of the beginning of the cycles, since indeed some begin their cycles one way, and some another, so that the first year of the Jewish cycle is fourth in that of our Tisri, and fifth in Nisan. In this manner the Paschal month of the Christians often runs in Adar of the Jews. But the rite of the "fourteenth day" was differing from the rite of the Europeans in time alone, because the Europeans decree that the passover of the resurrection must be celebrated on the Lord's day, but the "fourteenth day" people were celebrating the passover of the crucifixion on the 14th of the moon. I earnestly desire to weigh diligently these differences. For in ignorance of them, they who condemned the quartadecimans have followed this, so that not only do they themselves not know the day of the passion of the Lord, but they have even left it hidden to posterity in great shadows of ignorance. But what, or of what kind the cycle of the quartadecimans was, even if I keep silent, they who read Eusebius and the ecclesiastical writers of history know. For it is not hidden that the cycle of those who imitated in every way the Apostles in this thing -- and very many of them had crossed over from Judaism to Christianity -- was pure Jewish and Chaldaic, whose earliest Nisan in the times of Dionysius was March 24, in the first Dionysian cycle of the moon. But

the latest, was April 20, by the twelfth Dionysian cycle. Would that those enemies of the quartadecimans had carefully taken note of this fact. . . Page 105.

"Although we have touched somewhat in the foregoing chapter concerning the ancient rite of the Passover by the Christians, yet this place demands that we speak more fully concerning this. All the ancient Christians were regulating the Passover according to the lunar year, using the canon only for it, and thereby thinking that they trod in the footsteps of Moses and the Jews. But there was a twofold difference. One is, that some sooner, others later, were intercalating the months. For the Asians, who were following the footsteps of John the Evangelist, and of others who were the equal of the Apostles, were using the pure Jewish year. But the Europeans were placing their cycle at the equinox, and were celebrating the Passover on the full moon next after the equinox. This was the difference in the months. Another difference was in the day: because indeed some were appointing the paschal festival on the Jewish 14th of Nisan, others, on the next Lord's day after the 14th of the moon. . . p. 106.

"But those ancients [early Church], when they used this cycle, were thinking that they celebrated the Passover in the Jewish Nisan, which was Adar in the years 2, 4, 5, 7, 10, 12, 13, 15, 16, 18, as the Table [page 107] indicates, which now will first teach our men how much those ancients erred in ignorance of a thing of no little moment, since from which the computation of the times of the preaching of Christ and of His passion was pending. We certainly know this from no Christian man, but of those who have either published the Jewish year, or have written concerning the day of the Lord's passion that thus far have perceived the position and place of the Jewish new moons and their embolisms."-- Scaliger, Joseph, "De Emendatione Temporum," p. 107.

The third three nights (7th–9th) *tusa'*, because the *ninth* night is the last of them. Others call them *buhr*, because in them the darkness of the night is particularly *thick*.

The fourth three nights (10th–12th) *'ushar*, because the *tenth* night is the first of them.

The fifth three nights (13th–15th) *bîḍ*, because they are *white* by the shining of the moon from the beginning of the night till the end.

The sixth three nights (16th–18th) *dura'*, because they are black at the beginning like the sheep *with a black head and a white body*. p. 64.
Originally the comparison was taken from a coat of mail in which people are clad, because the colour of the head of him who is dressed in it, differs from the colour of the rest of his body.

The seventh three nights (19th–21st) *ẓulam*, because in most cases they were *dark*.

The eighth three nights (22nd–24th) *ḥanâdis* (from *ḥindis*=extremely dark). Others call them *duhm*, on account of their being dark.

The ninth three nights (25th–27th) *da'âdi'*, because they are remainders (or last parts). Others derive it from the mode of walking of the camels, *viz.*, *stretching forth the one foot, to which the other is quickly following*.

The tenth three nights (28th–30th) *miḥâḳ*, on account of the *waning* of the moon and the month.

Besides, they distinguished certain nights of the month by special names, *e.g.* the last night of the month was called *sirâr*, because in it the moon *hides herself*; it was also called *faḥama* on account of there being no light in it, and *barâ'*, because the sun has nothing to do with it. Likewise the last day of the month was called *naḥîr*, because it is in the *naḥr* (throat) of the month. The 13th night is called *sawâ'*, the 14th the night of "*badr*," because in it the moon is *full*, and her light complete. For of everything that has become complete you say *baḍara*; *e.g.* 10,000 dirhams are called one *badra*, because that is supposed to be the most complete and the last number, although it is not so in reality.

Night precedes the day p. 5

The Arabs used in their months also the seven days of the week, the ancient names of which are the following:—

1. 'Awwal, *i.e.* Sunday.
2. 'Ahwan.
3. Jubâr.
4. Dubâr.
5. Mu'nis.
6. 'Arûba.
7. Shiyâr.

They are mentioned by one of their poets in the following verse:—

"I strongly hope that I shall remain alive, and that my day (of death) will be either *'Awwal*, or *'Ahwan*, or *Jubâr*,

But, when they tried to fix thereby the beginning and end of fasting, their calculation, in most cases, preceded the legitimate time by one day. Whereupon they set about eliciting curious things from the following word of the Prophet: "Fast, when she (new-moon) appears, and cease fasting when she re-appears." For they asserted, that the words "fast, *when* she appears" (صوموا لرؤيته), mean the fasting of *that* day, in the afternoon of which new-moon becomes visible, as people say, "*prepare yourselves to meet him*" (تهيّؤا لاستقباله), in which case the act of preparing precedes that of meeting.

Besides, they assert that the month of Ramaḍân has never less than thirty days. However, astronomers and all those who consider the subject attentively, are well aware that the appearance of new-moon does not proceed regularly according to one and the same rule for several reasons: the motion of the moon varies, being sometimes slower, sometimes faster; she is sometimes near the earth, sometimes far distant; she ascends in north and south, and descends in them; and each single one of these occurrences may take place on every point of the ecliptic. And besides, some sections of the ecliptic sink faster, others slower. All this varies according to the different latitudes of the countries, and according to the difference of the atmosphere. This refers either to different places where the air is either naturally clear or dark, being always mixed up with vapours, and mostly dusty, or it refers to different times, the air being dense at one time, and clear at another. Besides, the power of the sight of the observers varies, some being sharp-sighted, others dim-sighted. And all these circumstances, however different they are, are liable to various kinds of coincidences, which may happen at each beginning of the two months of Ramaḍân and Shawwâl under innumerable forms and varieties. For these reasons the month Ramaḍân is sometimes incomplete, sometimes complete, and all this varies according to the greater or less latitude of the countries, so that, *e.g.* in northern countries the month may be complete, whilst the same month is incomplete in southern countries, and *vice versâ*. Further, also, these differences in the various countries do not follow one and the same rule; on the contrary, one identical circumstance may happen to one month several consecutive times or with interruptions.

But even supposing that the use which they make of those tables and calculations were correct, and their computation agreed with the appearance of new-moon, or preceded it by one day, which they have made a fundamental principle, they would require special computations for each degree of longitude, because the variation in the appearance of new-moon does not depend alone upon the latitudes, but to a great extent p. 66. also upon the longitudes of the countries. For, frequently, new-moon is not seen in some place, whilst she *is* seen in another place not far to the west; and frequently she is seen in both places at once. This is one of the reasons for which it would be necessary to have special calculations

and tables for every single degree of longitude. Therefore, now, their theory is quite utopian, viz. that the month of Ramaḍân should always be complete, and that both its beginning and end should be identical in the whole inhabited world, as would follow from that table which they use.

. . . Compare with this the following saying of the Prophet: "We are illiterate people, we do not write nor do we reckon the month thus and thus and thus," each time showing his ten fingers, meaning a complete month or thirty days. Then he repeated his words, saying, "and thus and thus and thus," and at the third time he held back one thumb, meaning an incomplete month or twenty-nine days. By this generally known sentence, the Prophet ordained that the month should be one time complete, and incomplete another time, and that this is to be regulated by the appearance of the new moon, not by calculation, as he says, "we do not write, nor do we reckon (calculate)."

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For the same reason, three months which are perfect according to the appearance of new moon, can follow each other, whilst of the imperfect months not more than two can follow each other. And their following each other is possible only in consequence of the variation of the motions of the two great luminaries (sun and moon), and of the variation of the setting of the zodiacal signs (i.e. the varying velocity with which the sun moves through the various signs of the Ecliptic).

In what Period the beginning of the Jewish Year returns to the same Date.--If the conjunctions at the beginnings of two consecutive great cycles (of 532 years) coincided with each other (i.e. if they were cyclical in such a way as to begin always at the same time of the week), we should be able to compute the qualities of the Jewish years by means of tables, comprising the years of a great cycle, similar to the Chronicon of the Christians. However, the moleds of these cycles do not return to the same time of the week except in 689,472 years, for the following reason:

The Character of the small cycle, i.e. the remainder which you get by dividing its number of days by 7, is 2d. 16h. 595Ḥ. This fraction is not raised to one whole, except in a number of cycles, which is equal to the number of Ḥalâḳîm of one Nychthemeron, i.e. 25,920. Because fractions are not raised to wholes, except when multiplied by a number which is equal to the complete number of the same kind of fractions of one whole (i.e. by the denominator).

But as both the number of the Ḥalâḳîm of the Nychthemeron

Or the following day, *Dubâr*, or if I get beyond that, either *Mu'nis* or *'Arûba* or *Shiyâr*."

Afterwards the Arabs gave them the following new names:—

Al-'aḥad,	*i.e.*	one.
Al-ithnân,	„	two.
Al-thulathâ,	„	three.
Al-'arbi'â,	„	four.
Al-khamîs	„	five.
Al-jum'â,	„	gathering.
Al-sabt,	„	sabbath.

The Arabs fixed the beginning of the month by the appearance of new moon, and the same has been established as a law in Islâm, as the Lord has said (Sûra ii. 185): "They will ask thee regarding the new moons. Speak: they are certain moments of time for the use of mankind (in general) and for pilgrimage."

Determination of the length of Ramadan, the Month of Fasting.—Some years ago, however, a pagan sect started into existence somehow or other. They considered how best to employ the interpretation (of the Koran), and to attach themselves to the system of the exoteric school of interpreters who, as they maintain, are the Jews and Christians. For these latter have astronomical tables and calculations, by means of which they compute their months, and derive the knowledge of their fast days, whilst Muslims are compelled to observe new moon, and to inquire into the different phases of the light of the moon, and into that which is common to both her visible and invisible halves. But then they found that Jews and Christians have no certainty on this subject, that they differ, and that one of them blindly follows the other, although they had done their utmost in the study of the places of the moon, and in the researches regarding her motions (*lit.* expeditions) and stations.

Thereupon they had recourse to the astronomers, and composed their *Canons* and books, beginning them with dissertations on the elements of the knowledge of the Arabian months, adding various kinds of computations and chronological tables. Now, people, thinking that these p. 65. calculations were based upon the observation of the new-moons, adopted some of them, attributed their authorships to Ja'far Al-ṣâdiḳ, and believed that they were one of the mysteries of prophecy. However, these calculations are based not upon the apparent, but upon the mean, *i.e.* the corrected, motions of sun and moon, upon a lunar year of $354\frac{1}{8}$ days, and upon the supposition that six months of the year are complete, six incomplete, and that each complete month is followed by an incomplete one. So we judge from the nature of their *Canons*, and from the books which are intended to establish the bases on which the *Canons* rest.

IV. They determine this space of time (between the conjunction and the appearance of new moon) by ὧραι καιρικαί. Whilst it is well known that it is not allowed to use them for the computation of conjunction, except on the equator.

V. They compute the conjunctions by the mean, not the apparent motion. Therefore passover frequently falls two complete days later than the real opposition—one day in consequence of the *Equations*, another day in consequence of their postponing passover from a *Dies illicita* to a *Dies licita*.

Computation of the Moled of a Year according to the Jewish System.—If we, now, want to find the *Môlêd* of a year, which term the Jews apply to the conjunction at the beginning of each month as well as the conjunction at the beginning of every cycle, we take the complete years of the *Æra Adami*, *i.e.* till the end of the year which is preceded by the month *Tishrî* in question. We convert the number of years into *Minor Cycles*, and multiply the number of cycles by 2d. 16h. 595^{H}, which you get as a remainder if you convert the days of the minor cycle into weeks. The product which arises we keep in mind.

Thereupon, we consider the remainder of years that do not fill up one complete minor cycle. How many of them are common years, how many leap years, we learn by the *Ordo intercalationis*,

בהזיגוחט

(*i.e.* the 2nd, 5th, 7th, 10th, 13th, 16th, and 18th years of the cycle are leap years).

The number of common years we multiply by 4d. 8h. 876^{H}, the number of leap years by 5d. 21h. 589 . The product of these two multiplications we add to the sum we have kept in mind.

To the sum we always add

5d. 14h.,

which represents the interval between the time of the conjunction and the beginning of the night of Sunday that was the commencement of the first year of the *Æra Adami*.

Then we raise each 1,080 Ḥalaḳs to 1 hour, and add it to the other hours; each 24 hours we convert into 1 day, and add it to the other days. The sum of days that arises we convert into weeks, and the remainder of days that are less than a week is the distance of the *Môlêd* from the beginning of the night of Sunday. Now, that time to which in the last instance our calculation leads us, is the time of the conjunc-
p.147. tion at the beginning of *Tishrî*.

We have made such a computation for a year of the *Æra Alexandri*, in order to facilitate the process and to simplify the apparatus.

If you want to find the conjunction at the beginning of Tishrî, take the years of the *Æra Alexandri*, and subtract therefrom always 12 years, which are the remainder of the minor cycle at the epoch of the Æra

Alexandri, according to the *Ordo intercalationis* גבטבג. The remainder of years divide by 19; the quotient you get is the number of minor cycles.

Convert these minor cycles into great cycles, if they are of a sufficient number to give complete great cycles, and keep in mind what remainder of years you have got. They are the current years of the cycle in question, according to the *Ordo intercalationis* גבטבג.

The great cycles, if you get such, compare with the table of the great cycles, and take the number of days, hours, and Ḥalâḳîm which you find opposite them.

The small cycles compare with the table of the small cycles, and the number of days, hours, and Ḥalâḳîm which you find opposite them.

These two numbers add together, days to days, hours to hours, and Ḥalâḳîm to Ḥalâḳîm.

This sum add to the *Basis*, which is written in the table uppermost, and which is the Môlêd of the 12th year of the *Æra Alexandri*. Convert each 1,080 Ḥalâḳîm into an hour, each 24 hours into a day, and the days into weeks. The remainder of days you get is the distance between the beginning of the night of Sunday and the time of the conjunction. This is according to Jewish calculation.

We have used as the starting-point in this our calculation the beginning of the night for no other reason but this, that they commence the *Nychthemeron* with sunset, as we have mentioned in the first part of this book.

Here follows the table, computed by that method of calculation which we have explained in the preceding pages:— p.148.

The Numbers of the Small Cycles.	The Years of the Small Cycles.	Days.	Hours.	Ḥalâḳîm.
1	19	2	16	595
2	38	5	9	110
3	57	1	1	705
4	76	3	18	220
5	95	6	10	815
6	114	2	3	330
7	133	4	19	925
8	152	0	12	440
9	171	3	4	1,035
10	190	5	21	550
11	209	1	14	65
12	228	4	6	660
13	247	6	23	175
14	266	2	15	770
15	285	5	8	285

(25,920) and the number of the remainder of the Halakim of the cycles (595) may be divided by 5, the fractions will be raised to wholes if multiplied by a number of cycles, which is equal to 1/5 of the Ḥalâḳîm of the Nychthemeron, i.e. 5184.

Now, the conjunction (at the beginning of the year) does not return to the same time of the week except in a number of cycles which is the sevenfold of this number (5184), i.e. 36,288. And this is the number of cycles which represent the above-mentioned number of years (viz. 689,472).

In general, conjunction and opposition return to the same place (i.e. happen again at the same time of the week) in each 181,440 months, which is the product of the multiplication of the number of Ḥâlaḳîm of one Nychthemeron (25,920) by 7.

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Likewise there is a difference between Jews and Christians regarding the leap year, as we shall explain in the chapter on the Christian Fast, if God permits. If, now, there is a difference between them, and they are willing to accept our decision, we shall consider the two oppositions of their two passovers, and shall say, that that opposition at which the moon moves in the middle part of Spica or of Cancer, or the sun is about to leave Aries, is to be rejected according to both systems, whilst the contrary is to be adopted. To the lover of truth, the correctness of these two assertions will be apparent, if the conditions we have mentioned are observed.

' = Virgo's "ear of corn"

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Adhâr II

This is the original Adhâr, which is called so in general (without the addition of I. or II.) in common years. There cannot be any ambiguity about what we just mentioned, speaking of another Adhâr preceding this one (because this only relates to leap-years). It has two Rosh-Ḥôdesh and 29 days.

302

The followers of Jesus wanted to know beforehand the Passover of the Jews, in order to derive thence the beginning of their Lent. So they consulted the Jews, and asked them regarding this subject, but the Jews, guided by the enmity which exists between the two parties, told them lies* in order to lead them astray. And besides, the eras of both parties differed.

* Cf translated excerpt from Scaliger on p. 75a of Albîrûnî

Finally, many of the Christian mathematicians took the work in hand and made calculations with the various cycles and different methods. Now, that method which they at least agreed to adopt, is the table called Χρονικόν, of which they maintain that it was calculated by Eusebius, Bishop of Caesarea, and the 318 bishops of the Synod of Nicaea.

314-315

As regards the Sabians, we have already explained that this name applies to the real Sabians, i.e. to the remnant of the captive Jews in Babylonia, whom Nebukadnezar had transferred from Jerusalem to that country. After having freely moved about in Babylonia, and having acclimatized themselves to the country, they found it inconvenient to return to Syria; therefore they preferred to stay in Babylonia. Their religion wanted a certain solid foundation, in consequence of which they listened to the doctrines of the Magians, and inclined towards some of them. So their religion became a mixture of Magian and Jewish elements like that of the so-called Samaritans who were transferred from Babylonia to Syria.

Their day begins with sunrise, whilst all others, who use lunar months, make it begin with sunset. [This statement refers to the Ḥarrânians].

Their lunar month begins with the second day after conjunction (new moon). If, now, conjunction precedes sunrise only by one minute, the third following day is the beginning of the month. But if conjunction coincides with sunrise or falls only a little later, the second day after conjunction is the beginning of the month.

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(The author tries to form his information regarding the Harranian calendar into a system.)--Because their great fasting falls into the first phase (quadrature) of Hilal [new moon] Adhar, whilst sun and moon stand in two double-bodied signs (Pisces and Gemini?), and because the end of the fasting falls into the first phase of Hilâl Nisân, whilst the sun and moon stand in certain two inclining signs (Aries and Cancer), their months must of necessity revolve in the solar year in a similar way to the Jewish months, that is to say: on an average. And between the causes of each of these two things there is a connection. For the Jewish Passover demands that the sun and moon should stand in the first opposition in two signs of the equinoxes--for they may stand in opposition, and not only once, but twice--and the Ḥarrânian fast-breaking demands that which we have men-

tioned (in Hilâl Adhâr). Hence follows that the phase (quadrature) next preceding the Jewish Passover is the fast-breaking of the Ḥarrânians, and that the conjunction which falls next to the autumnal equinox is the beginning of their year, never falling beyond Îlûl.

If we compute these elements for a cycle of 19 years, we get a rough sort of computation, but only a rough one, for they themselves try to correct it by means of the time of the conjunction, as we have mentioned.

The methods of both Jews and Christians for the computation of Passover are based upon such motions of the luminaries, of which we have found out that they remain back behind real time, especially as regards the sun (the precession of the equinoxes having been neglected). If we examine the oppositions according to the motions that have been found by recent observations, we find that some of them precede the Easter-limit according to both Jewish and Christian systems; they, however, disregard this precession, whilst it is really the case, and we find that others of them (the oppositions) fall near the end of the Easter-limit; these latter oppositions they adopt and rely upon them, whilst they are utterly wrong; for the real time (or opposition) precedes that time already by one month.

386

p. 63, l. 15. This view, that Adhâr II. is the leap-month, was held by the Karaeans, according to Eliah ben Mose in Selden, "Dissertatio de civili anno Judaico," cap. v. p. 166.

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II. Enneadecateris

Meton discovered that 235 synodical months pretty nearly correspond to 19 solar years. In constructing his cycle of 19 years, he reckoned the solar year at 365 and 5/19 d., i.e. by 1/76 d. longer than it had been reckoned in the Octaeteris (a mistake which afterwards Callippus strove to retrieve). More correct was the following Jewish calculation with Hipparchic measures:

235 lunations, each = 29d. 12h. 793 Ḥ., give the sum of--
6,939 d. $16\frac{595}{1080}$ h. = 179,876,755 Ḥ.

If we divide this sum of Ḥalaḳs by the length of the solar year of --
365 d. $5\frac{3791}{4104}$ h. = 9,467,190 Ḥ.,
we get as quotient 19 (years), and a remainder of only 145 Ḥ.

According to this computation, the difference between the rotations of sun and moon at the end of the first Enneadecateris

would not be more than 145 H., or $\frac{29}{216}$ h., i.e. a little more than 1/7 h., or than 1/168 d., whilst, according to Callippus, this difference was greater, viz. 19/76 d. = 1/4 d.

This reform of the Metonic Enneadecateris enabled the Jews to dispense with the 76 years cycle of Callippus, which he constructed of four-times the Enneadecateris with the omission of one day. The Jewish calculation is more correct than that of Callippus, who reckoned the solar year too long.

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p. 66, l. 23. The words that Passover by which the beginning of Nîsân is regulated I understand in this way, that Passover, i.e. the 15th Nîsân, and the 1st Nîsân always fall on the same week-day.

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p. 68, l. 35. If the Mîlâdîtes commenced the month with the moment of the conjunction, they differed from the Rabbanites in this, that the latter made the beginning of the month (e.g. the beginning of the first month or New-year's-day) depend not alone upon conjunction, but also upon certain other conditions, for example, the condition לוח (Lazarus Bendavid, section 36). The Rabbanites tried in everything to assimilate their calendar, based upon the astronomical determination of conjunction, to the more ancient calendar which had been based upon the observation of New Moon. The conservative tendency of this reform of the Jewish calendar is pointed out by A. Schwarz, "Der Jüdische Kalendar," pp. 59-61.

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p. 300, l. 4. The Jews count 3,448 years between Adam and Alexander. If you divide this sum by 19, you get 9 as a remainder, i.e. the first year of the Aera Alexandri is the 10th year of the cycle.

The division of 5180 by 19 gives a remainder of 12, i.e. the first year of the Aera Alexandri is, according to the Christians, the 13th year of the cycle.