[From Chambers' Edinburgh Journal.]

Boyd's History of Literature—Origin of Time Reckonings.

Two volumes out of four have appeared, of a 'History of Literature, or the Progress of Language, Writing, and Letters, from the Earliest ages of Antiquity to the Present Time; with a View of the State of Science and the Fine Arts;' the author being Sir William Boyd, M.D. The second volume terminates with the Augustan age of Rome.

Without pretension to any brilliant originality, this work appears to us to present a very fair and judicious view of the progress of letters amongst mankind; the biographies of writers, and criticisms on their writings, are generally spirited, and the specimens of classic productions of celebrity are for the most part ably translated. For youthful study, we do not know a book upon the same subject calculated to be equally useful.

On a perusal of the work, it has appeared to us that none of the purely literary notices could be so appropriate for quotation in this place as the brief view which the author gives of the origin of time reckonings, a subject which comes under his attention in treating of the history of astronomy among the ancients.

'Days, years, months, the sky, the constellations, &c., are,' he says, 'ideas which common and uncultivated minds possess; nevertheless these are the elements of astronomy.

The notion of a day is obviously and constantly impressed upon man in every condition in which he is placed. The recurrence of light and darkness, of warmth and cold, of noise and silence, of activity and repose, makes the notion of a day necessarily occur.

A year is a notion formed in a similar manner, implying the idea of recurring facts, with the faculty of arranging them in time, and of appreciating their recurrence. The notion, however, of a year, though obvious, is, on many accounts, less so than that of a day.

The repetition of similar circumstances at equal intervals is far less manifest, and the intervals being much longer, an exertion of memory becomes requisite in order that the recurrence may be perceived.

Nations generally have marked this portion of time by some word having a reference to the returning circle of the seasons. The Latin *annus* signifies a ring, and the Greek term *eniautos*, means something which returns into itself. To make the term year imply a fixed number of days, it is necessary to know how many days the cycle of the seasons occupies, a degree of knowledge beyond what has been already alluded to; and men cannot reckon as far as any number approaching that of days in a year, without possessing a system of numerical terms, and methods of practical numeration, on which such a system is founded. Among the Greeks the seasons were at first only summer and winter; the latter included the wet and cold portion of the year.

The sun goes through his cycle of positions in the same period that the stars go through a cycle of appearances belonging to them: and it appears that the latter were also carefully observed to determine the exact length of the year.

Several of the groups of fixed stars are readily recognised, as exhibiting always the same configuration, and stars particularly bright become more prominently objects of attention.

These are observed at particular seasons to appear in the west after sunset: it is remarked, however, that when they do this, they are found nearer and nearer to the sun every successive evening, till they become invisible by his light; it is also observed, that at certain intervals after this, they rise before the dawn of day renders them imperceptible, and afterwards they rise at a longer interval before the sun.

The risings and settings of the stars under the above circumstances were, in countries where the sky is usually clear, a great help in marking the various seasons. Thus, the rising of the Pleiades in the evening was an emblem of the approach of winter; the rising of the waters of the Nile coincided with the heliacal rising of Sirius: even without an artificial division of time, it was not impossible to carry observations of this kind to such a degree of accuracy, as to learn from them the number of days which compose a year, and to fix the season from the appearance of the stars.

By such means it is said to have been determined that the year consisted at least of nearly 365 days. We are told by Herodotus that the Egyptians claimed the honor of this discovery; and the priests informed him that they were the first who divided it into twelve equal parts, or months, consisting of thirty days each, and that they added five days more* at the end of the year, and thus the circle of the seasons came round.

It appears that the Jews at an early period had a similar method of reckoning time; for the deluge is stated to have continued 150 days,† from the 17th day of the second‡ month, to the 17th day of the seventh§ month; that is, five months of thirty days.

A year thus settled as a period of a certain number of days, is called a civil year, and is one of the institutions of states possessing any degree of civilisation; and one of the earliest portions of systematical knowledge is the finding out the length of the civil year, so that it may agree with the natural year of the seasons.

By such a mode of reckoning, however, the circle of the seasons would not come round exactly; the actual length of the year is very nearly 365 days and a quarter; so that if a year of 365 days were used, in four years the year would commence a day too soon, when considered with reference to the sun and stars; and in sixty years it would begin fifteen days too soon, a number perceptible to even a loose share of attention.

Various contrivances were used to keep the year correct. The method which we employ, consisting in counting an additional day at the end of February every fourth, or leap year, is an example of the principle of intercalation, by which the correction was more usually made.

Methods of intercalation for the above purpose were found to exist in the new world; the Mexicans added thirteen days at the end of fifty-two years. The plan of the Greeks was more complex, by means of a cycle of eight years, which had the additional object of accommodating itself to the motions of the moon.

The Egyptians, on the other hand, knowingly permitted their civil year to deviate at least so far as their religious ceremonies were concerned. According to Geminus, they did not wish the same sacrifices to be made always at the same time, but that they should go through the various seasons, in order that the same feast might happen in summer and winter, in spring and autumn.

There were other nations that did not regulate their civil year by intercalation at short intervals, but rectified it at long periods when considered necessary.

The Persians are said to have added a month of thirty days every 120 years. The Roman calendar, at first rude in its structure, was reformed by Numa, and was directed to be kept in order by the constant interposition of the augurs.

This, however, was from various causes neglected, and the reckoning fell into complete disorder, in which state it was found by Julius Cæsar. By the advice of Sosigenes the astronomer, who came from Alexandria to correct the calendar, he adopted the mode of intercalation of one day in four years, which we still retain; and to amend the derangement which had been produced, he added ninety days to a year of the usual length, which consequently became what was called the year of confusion. The Julian calendar thus corrected came into use January 1, 45 B. C.

The circle of changes through which the moon passes in about thirty days, was marked in the earliest stages of languages by the word month, as the circle of changes of the seasons was designated by that of year.

The lunar changes are much more obvious to the senses than the annual. When the sun has set, the moon is the great natural object which attracts our notice. Her changes of form and place are marked and definite to all; and the duration of her cycle is so short, as to require little effort of memory to embrace it. It was therefore more easy, and, in the earlier stages of civilisation, more common to reckon time by moons than by years.

The month is not an exact number of days, being more than twenty-nine, and less than thirty; the latter was first tried as possessing the advantage of regularity; it existed for a long period in many countries.

A few months of thirty days, however, would suffice to derange the agreement between the days of the month and the moon's appearance; but a further trial of twenty-nine and thirty days alternately, would preserve for a considerable period the agreement.

The Greeks adopted this calendar, and considered the days of their month as representing the changes of the moon; the last day of the month was styled the old and new, as belonging to both the waning and reappearing moon; and their festivals and sacrifices, as determined by this mode of reckoning, were considered to be connected with the same periods of the cycles of the sun and moon.

According to Geminus, 'Their laws and oracle directed that they should in sacrifices observe three things: and months, days, and years were so understood.' With such a persuasion, a correct system became a religious duty.

The rule of alternate months of twenty-nine and thirty days, supposes the length of the lunar month to be twenty-nine days and a half, which is not exact.

Accordingly, the months and the moon became at variance; the correction of this inaccuracy, however, was not pursued singly; it was combined with another object, that of securing an exact correspondence between the lunar and solar years, the chief purpose of the early cycles.

According to the above rule, 12 lunations in a year would make 354 days, leaving about 11¼ days of difference between such a lunar and a solar. The first cycle, which produced a near correspondence between the reckoning of the moon and the sun, was the Greek octaeteris, or period of 8 years; 8 years of 354 days, together with 3 months of 30 days each, made up 2922 days, which is the amount of 8 years of 365¼ days each.

The usual method, it is said, was to add a month at the end of the third, fifth, and eighth year of the cycle. It is not known with certainty at what period, or by whom this method was introduced; probably about the sixth century before the Christian era.

This cycle was imperfect, and was corrected by others of 16 and 160 years, which were suggested when the length of the solar and lunar periods became known with accuracy.

At length a more exact cycle was introduced by Meton of Athens, 431 B.C. This cycle consisted of 19 years, and is so correct and convenient, that it continues in use among ourselves; the time occupied by 19 years, and by 235 lunations, is about the same; the former being less than 7940 days by 9½ hours, the latter by 7¼; hence, if the 19 years be divided into 235 months, so as to agree with the changes of the moon at the end of that period, the same succession may begin again with much exactness.

The coincidence of the solar and lunar period in this cycle was certainly an important discovery; indeed it is so exact, that it is still used in calculating the new moon for the time of Easter; and what is called the golden number of this cycle corresponding to the current year.

Meton's cycle was made still more exact by Calippus 100 years later, 330 B.C.; he discovered the error of it by observing an eclipse of the moon six years before the death of Alexander the Great; he calculated a period of four cycles of 19 years, and left out a day at the end of 76 years, to make an allowance for the hours by which, as already mentioned, 6940 days are greater than 19 years, and 235 lunations.

The same cycle of nineteen years has been used by the Chinese for a vast length of time; their civil year consisting, like that of the Greeks, of months of twenty-nine and thirty days. The Siamese also use the same period.

The planets doubtless attracted the notice of men while they were becoming acquainted with the fixed stars. Venus, owing to her brightness, and her accompany the sun at no great distance, and so appearing as the morning and evening star, was conspicuous; Pythagoras is said to have been the first who maintained that the evening and morning star are the same body.

Jupiter and Mars, sometimes brighter than Venus, were also very observable; Saturn and Mercury, less so, would, in a clear climate, still be detected, with their motions, by persons who studied the aspect of the heavens.

To reduce to rules the movements of these luminaries, must have taken time and thought; a remarkable evidence of their antiquity is to be found in the structure of one of our most familiar objects of time, the week, which comes down to us, according to the Jewish scriptures, from the commencement of the existence of mankind on earth.

The same usage is found all over the East; it existed among the Assyrians, Egyptians, and Arabians. The week is found in India among the Brahmins; it has there also its day marked by those of the heavenly bodies.

The idea which led to the usual designations of the days of the week is not easily discovered; the order in which the names are assigned, beginning with Saturday, is, Saturn, the Sun, the Moon, Mars, Mercury, Jupiter, and Venus.

Various accounts are given of the manner in which the above order was derived from a previous one; all the methods proceeded on arithmetical processes connected with astrological views.

Laplace considers the week as the most ancient monument of astronomical knowledge. This period has gone on without interruption from the earliest recorded times to our own days, surviving the extent of ages and the revolutions of empires.'

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*Syncellus say that, according to the legend, it was King Aseth who first added the five additional days to 360 for the year, about 1800 B. C.'

†Genesis, c. vii, v. 24. ‡Genesis, c. vii, v. 11.

§Genesis, c. viii, v. 4.

[From Chambers' Edinburgh Journal.]

Reproduction of Plants.

The main object of a plant during growth seems to be the reproduction of its kind. Whether the term of its existence be limited by a day, by a year, or by centuries, its sole effort—as it proceeds from leaf to stem, from stem to branch, and from branch to flower and fruit—is the multiplication of itself. This is effected variously: by seeds, by spores or germs, by tubers, by runners, which put forth shoots as they elongate, by branches which send down roots, by slips or detached branches, or even by single leaves. We shall notice the more remarkable of these modes, as exhibiting at once the perfection of design, and the inexhaustible contrivances which nature has ever at her adoption for the accomplishment of the end in view.

Increase by seed is the most familiar mode of reproduction, being common to all flowering plants. Seeds are merely leaves preserved in peculiar cerements till the return of the season of growth. And here it may be remarked, that wherever we have a healthy growing leaf, or number of leaves, there is no difficulty in rearing an independent plant, since, according to the doctrines of morphology, the leaf is the primary organ from which all other parts take their form and development.

A numerous class of vegetables have their seeds composed of two leaves or lobes, as may be seen in the bean and apple; in another class, as the oat and cocoa nut, they consist of a single lobe. But whether they have one or two lobes, in all of them the function of reproduction is of the most perfect description. To produce a fertile seed, the pollen or dusty granules which tip the stigmas must be conveyed to the pistil, and through the pistil to the embryo in the ovary. For this purpose a thousand beautiful adaptations have been called into existence.

These precious granules, liable to be swept away by every breeze and shower, are protected by the sheltering calyx and corolla, which turn their backs to the wind, or droop like a pent house to ward off the rain. And even should the pollen be scattered by accident, the pistil is covered with a fine mucilage, which intercepts and retains it in spite of every antagonist force.

Some plants have the stamens and pistils in one and the same flower; in others the stamens are in one flower and the pistil in another; while in not a few the male and female flowers are produced on separate stems—yet in all, the means of fertilization are seldom rendered nugatory. If the male and female flowers are near, they are placed so as to be brought in contact by the slightest waving of a branch; or if distant, the passing breeze and the limbs of the wandering bee are made the agents by the pollen is carried to the destined receptacle.

When properly matured, a seed must be provided, first, with the means of dispersion and preservation, and secondly, with a sufficiency of internal nourishment for the embryo plant, till its roots have struck into the soil, and its leaves have expanded in the atmosphere. Accordingly, some seeds are farinaceous, others albuminous, and many oleaginous—all of those products being converted, during germination, into those elements which enter into the structure of a growing plant.

For the conversion of these products, a certain amount of heat and moisture is necessary; but too much heat would parch them, and too much cold or moisture would destroy their vitality. To provide against such contingencies, natured has conferred on the seeds of plants the most ingenious and perfect covering.

The cocoa has a tough fibrous coir and woody nut, impervious alike to drouth and rain; the chestnut has a compact leathery envelope; the plum a hard stony drupe; the apple a fleshy pome, enclosing leathery cells; the rose a fleshy hip, packed with down; the pea and bean a pod of parchment; and seeds apparently naked have either a coriaceous membrane, or have the exterior tissue so condensed, that they look as if they had come from the hand of the japanner.

Thus, the protection against cold, drouth, moisture, and other destructive agencies is so complete, that seeds which have been buried for centuries have, on being brought to the surface, sprung up into healthy plants; even a crop of wheat has been reared from grain found in the case of an Egyptian mummy more than three thousand years old.

Equally perfect with this projection is the means for their dispersion over the surface of the globe. What could be better adapted for floating from island to island than the cocoa nut, with its light, waterproof, fibrous coir and woody shell? What more easily caught up by the slightest breath of air than the seeds of the thistle or dandelion, with their little parachutes of down? Or what more aptly fitted for attachment to the coats of wandering animals than the hooked heads of the teasel and burdock?

Nor does contrivance end here. Many, when ripe, are ejected from the vessels which contain them with considerable force by means of elastic valves and springs. The cardamine impatiens throws its ripe seed to considerable distance on being touched; so does the squirting cucumber, the geranium, the common broom, and others, as if they were endowed with vitality, and had a care for their embryo progeny. Some do not even part with their seeds till these have struck root as independent plants. Thus the mangrove, which flourishes amid the mud of tropical deltas and creeks, retains its berries till they have sent down long thread-like radicles into the silt below, as if it felt that the water and slime by which it was surrounded were elements too unstable to be intrusted with its offspring.

Plants that reproduce themselves by spores or germs belong to the cryptogamic or flowerless class of vegetation, as the ferns, sea weeds, mosses and mushrooms. In many of these the reproductive spores are so minute that they float in the air unseen; and not a dried mushroom or puff-ball that is struck by the wandering foot, but disperses thousands of its kind around it.

The little brown specks on the leaf of the fern, the snuff-like powder of the puff-ball, or the dust arising from the mould of a decayed cheese, are all alike the germs of future plants; and when we consider how minute each individual is, how liable to be borne about by winds, by water, and by the coverings of animals, to which they may adhere, we shall cease to wonder at the fact, that there is not a portion of surface, organic or inorganic, that may not be covered with their growth.

The spores of the fuci or sea weeds, which are always surrounded by water, are covered with a mucilage that enables them to adhere to whatever solid body they touch; and, what is peculiar in this adhesive substance, it is insoluble in water. 'Let chemistry,' says Macculloch, in his Illustrations of the Attributes of a God, 'name another mucilage, another substance, which water cannot dissolve, though apparently already in solution with water, and then ask if this extraordinary secretion was not designed for the special end attained? and whether, also, it does not afford an example of that Power which has only to will that it may produce what it desires, even by means the most improbable?'

Many plants, as the potato, reproduce themselves both by seeds and tubers. Both modes, however, do not take place with equal exuberance at one and the same time. In its native region of South America, where the climate is better adapted for blossom and maturation of seed, the potato flowers luxuriantly, but yields an insignificant crop of small acrid tubers; in our unstable climate, on the other hand, the underground progeny is the more abundant and prolific.

Acting upon the knowledge of this principle, the farmer in Europe cuts off the flower buds of the potato plant to increase his crop of tubers; just as the tulip or hyacinth fancier prevents his plants from flowering, in order to increase the stock of his bulbs, which throw out a number of offsets from their bases.

There is, it would seem, a certain amount of vital force in every plant, and if that force be expended on flowering, tubers will not be produced, and if on the production of an underground progeny, the seed will not be matured,