these four men during their stay in Timbuktu. The tablets bear simply the name of the explorer andthedateofhis visit.) In 1895 Felix Dubois made a stay of some duration in the town, investi­gating its history and that of the surrounding country. In 1904 Timbuktu became part of the colony of Upper Senegal and Niger.

The British connexion with Timbuktu may be briefly stated. Barth went to West Africa as the officially credited representa­tive of the British government, empowered to enter into relations with the native princes. At Timbuktu he stayed under the protection of the sheikh Sidi Mahommed El Backay (Bakhai), and took back to England letters from the sheikh professing friendship with the British. In reply Lord Clarendon, secretary of state for foreign affairs, wrote a letter dated the 15th of April 1859, to El Backay, stating that “ the friendship binding us shall not diminish through the centuries ” and “ as our govern­ment is very powerful we will protect your people who turn to us.” A nephew of the sheikh went to Tripoli where he received presents for his uncle and other chieftains from the British consul, who also wrote a letter to El Backay, saying, among other things, *“ The* English government has sent a steamer up the river which flows out of your country and has recommended those on board to make every effort to reach you.” The steamer did not ascend the Niger to Timbuktu, and no further efforts appear to have been made in England to maintain political relations with Timbuktu. Moreover the power of El Backay seems not to have been so great as was believed in England, or at least did not long continue after the departure of Barth.

Authorities.—The chief original authorities are the *Tarik es- Sudan* (trans. Houdas, Paris, 1901); and Ahmad Baba’s “ Chronicle” (trans. Barth) in *Zeitsch. der morgenländ. Gesellsch.* ix. 826. Among medieval writers, see especially lbn Batuta and Leo Africanus. Of early European records Barth’s *Travels* are the most important. The best popular account is F. Dubois, *Timbuctoo the Mysterious* (London, 1896). Consult also H. N. Frey, *Sénégal et" Soudan* (Paris, 1888); Lieut. Hourst, *The Exploration of the Niger* (London, 1898); O. Lenz, *Timbuktu* (Leipzig, 1884); W. D. Cooley, *Negroland of the Arabs* (London, 1841); A. Lebon, *Rapport de la mission au Senegal et au Soudan* (Paris, 1898); Commandant Toutée, *Dahomé, Niger, Touareg* (Paris, 1897), *Du Dahomé au Sahara* (Paris, 1899),· Lady Lugard, *A Tropical Dependency* (London, 1905). (F. R. C.)

**TIME** (0. Eng. *lima,* cf. Icel. *timi,* Swed. *limme,* hour, Dan. *time;* from the root also seen in “ tide,” properly the time of be­tween the flow and ebb of the sea, cf. 0. Eng. *gclidan,* to happen, “ even-tide,” &c.; it is not directly related to Lat. *tempus),* the general term for the experience of duration or succession, either in whole or in part. For time in its psychological sense see Space and Time; for time in music, see Rhythm; for the methods of reckoning time see Calendar; Day; Month; and the articles Time, Measurement or, and Time Standard, below. Gener­ally in English law, where any particular time is mentioned in acts of parliament or legal instruments, it is to be defined as meaning, in Great Britain, Greenwich mean time, and in Ireland, Dublin mean time. At common law, where parties enter into legal relations, and specify their intention of being bound by any particular arbitrary system, the courts will, as a rule, give effect to their intentions.

**TIME, MEASUREMENT OF.** Time is measured by successive phenomena recurring at regular intervals. The only astronom­ical phenomenon which rigorously fulfils this condition, and the most striking one—the apparent-daily revolution of the celestial sphere caused by the rotation of the earth—has from the remotest antiquity been employed as a measure of time. The interval between two successive returns of a fixed point on the sphere to the meridian is called the sidereal day; and sidereal time is reckoned from the moment when the “ first point of Aries ” (the vernal equinox) passes the meridian, the hours being counted from o to 24. Clocks and chronometers regulated to sidereal time are only used by astronomers, to whom they are indispensable, as the sidereal time at any moment is equal to the right ascension of any star just then passing the meridian. For ordinary purposes solar time is used. The solar day, as defined by the successive returns of the sun to the meridian, does not furnish a uniform measure of time, owing to the slightly variable velocity of the sun’s motion and the inclination of its orbit to the equator, so that it becomes necessary to introduce an imaginary mean sun moving in the equator with uniform velocity. The equation of time is the difference between apparent (or true) solar time and mean solar time. The latter is that shown by clocks and watches used for ordinary purposes. Mean time is converted into apparent time by applying the equation of time with its proper sign, as given in the *Nautical Almanac* and other ephemerides for every day at noon. As the equation varies from day to day, it is necessary to take this into account, if the apparent time is required for any moment different from noon. The ephemerides also give the sidereal time at mean noon, from which it is easy to find the sidereal time at any moment, as 24 hours of mean solar time are equal to 24h 3m 56∙5554∙ of sidereal time. About the 21st of March of each year a sidereal clock agrees with a mean time clock, but it gains on the latter 3m 56∙5∙ everyday, so that in the course of a year it has gained a whole day. For a place not on the meridian of Greenwich the sidereal time at noon must be corrected by the addition or subtraction of 9-8565· for each hour of longitude, accoιding as the place is west or east of Greenwich.

While it has for obvious reasons become customary in all civilized countries to commence the ordinary or civil day at midnight, astronomers count the day from noon, being the transit of the mean sun across the meridian, in strict conformity with the rule as to the beginning of the sidereal day. The hours of the astronomical day are also counted from o to 24. An international conference which met in 1884 at Washington to consider the question of introducing a universal day (see below), recommended that the astronomical day should commence at midnight, to make it coincide with the civil day. The great majority of astronomers, however, expressed themselves very strongly against this proposal, and it has not been adopted.

*Determination of Time.—*The problem of determining the exact time at any moment is practically identical with that of determining the apparent position of any known point on the celestial sphere with regard to one of the fixed (imaginary) great circles appertaining to the observer’s station, the meridian or the horizon. The point selected is either the sun or one of the standard stars, the places of which are accurately determined and given for every tenth day in the modern ephemerides. The time thus determined furnishes the *error* of the clock, chrono- metèr or watch employed, and a second determination of time after an interval gives a new value of the error and thereby the *rate* of the timekeeper.

The ancient astronomers, although they have left us very ample information about their dials, water or sand clocks *{clepsydrae),* and similar timekeepers, are very reticent as to how these were controlled. Ptolemy, in his *Almagest,* states nothing whatever as to how the time was found when the numer­ous astronomical phenomena which he records took place; but Hipparchus, in the only book we possess from his hand, gives a list of 44 stars scattered over the sky at intervals of right ascension equal to exactly one hour, so that one or more of them would be on the meridian at the commencement of every sidereal hour. H. C. F. C. Schjellerup@@1 has shown that the right ascensions assumed by Hipparchus agree within about 15' or one minute of time with those calculated back to the year 140 B.c. from modern star-places and proper motions. The accuracy which, it thus appears, could be attained by the ancients in their determinations of time was far beyond what they seem to have considered necessary, as they only record astronomical phenomena *(e.g.* eclipses, occultations) as having occurred “ towards the middle of the third hour,” or “ about 8⅜ hours of the night,” without ever giving minutes.@@2 The Arabians had a

@@@1 “Recherches sur l’astronomie des Anciens: I. Sur le chrono­mètre céleste d’l·Iipparque,” in *Copernicus: An International Journal of Astronomy,* i. 25.

@@@2 For astronomical purposes the ancients made use of mean­time hours—*ωραι. lσημepιvat, horae equinoctiales—*into which they translated all indications expressed in civil hours of varying length— *&pai κaιpcκal, horae temporales.* Ptolemy counts the mean day from noon.