GREGORIAN *CALENDAR*

A reform of the Julian calendar (see CALENDAR, JULIAN) was promulgated by Pope Gregory XIII in his bull *Inter gravissimas* of 24 February 1582. The commission that he had named with this in mind ultimately adopted most of the details of the project drawn up by a Calabrian astronomer, Luigi Giglio Ghiraldi (Aloysius Lilius), who had died in 1576, and the final rules were worked out mainly by a German Jesuit, Christopher Clavius.

At the time of its introduction, ten days (5-14 October 1582) were dropped from the solar calendar, nine of them so that the mean vernal equinox would occur 20 March instead of 11 March, as it did at the time of the reform, and the tenth so that the calendar corrections necessary from year to year in a 400-year cycle could be diminished by one day. By placing the mean vernal equinox on 20 March, the reformers made sure that the true equinox would never occur later than 21 March, the fixed equinoctial date established in the fourth century, when Easter was defined as the Sunday after the fourteenth moon on or after (never before) the vernal equinox.

In the lunar calendar the epacts were reformed by adding three (days) to compensate for three of the five lunar equations (each necessitating new moons a day earlier thereafter) neglected in the preceding 1,400 years, and by subtracting ten to equal the ten days dropped from the solar calendar. The simultaneous addition of three and subtraction of ten amounted to an effective subtraction of seven from each epact of the series in use up to the time of the reform, and the result was a calendar date seven days later in most instances for each new and full moon in a thirty-year lunar cycle, including the paschal full moons. The beginning of the year was reaffirmed as 1 January.

In order to avoid the need for similar drastic calendar reforms in the future, the Gregorian reformers prescribed that in every century- year

except those perfectly divisible by 400, the intercalary day in February indicated by the Julian calendar in every year divisible by 4 should be omitted (century years like 1600 and 2000 thus remain leap years, while those like 1700, 1800, and 1900—divisible by 4 but not by 400—are reduced to common years).

In this way the reformers compensated for the accumulated overcorrection caused by the corrective intercalary days in February within the 400-year cycle. As a result, the discrepancy between the dates of the Julian calendar and those of the Gregorian calendar for one and the same solar day increases by one day in each century-year not divisible by 400.

Periodic correction of the lunar calendar was provided for by prescribing (1) the reduction of the number of each lunar epact by one at the beginning of every century-year not perfectly divisible by 400 (thereby adding one day to the new moon dates thereafter—the "solar equation" equating the advance of dates in the solar calendar caused by the omission of the February intercalary day in those years); and (2) the raising of the number of each lunar epact by one at the beginning of 1800 and of every third century-year thereafter (thereby moving new moon dates back one day—the "lunar equation" correcting the 300-year accumulation of excess of the lunar cycle over its correct value and thus keeping the maximum lag of calendar new moons behind their mean new moons from increasing beyond two days).

In century-years in which both the solar equation and the lunar equation occur, the simultaneous addition and subtraction neutralize one another, so that the epacts, and hence the new and full moon dates, remain unchanged. After 3,200 years the Gregorian solar calendar will have an accumulated need for further correction, which can be taken care of by restoring as a leap year a century-year divisible by 400 (with a corresponding solar equation in the lunar calendar), with provision for repeating that step every 3,200 years. The Gregorian lunar calendar can

run for 20,000 years before needing a day's further adjustment by means of an additional lunar equation.

The Gregorian calendar was accepted as the legal civil calendar on 5/15 October 1582 by the Italian states, Spain, and Portugal. Other Catholic lands accepted it from the final months of 1582 through 1584, but the Protestant regions of northern Europe retained the Julian calendar into the eighteenth century for the most part, and the reformed calendar was not accepted as the civil calendar of the non-Catholic nations of eastern Europe until the twentieth century (Bulgaria in 1917, Greece and Rumania in 1924, Russia in 1918, Serbia in 1919, Turkey in 1927). (For the divergence between the Gregorian calendar and the Alexandrian calendar used by Copts and Ethiopians, see CALENDAR, COPTIC.)

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