The Moon and the Maternity Ward

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The role of the moon as the principal raiser of tides on the earth has been known for many hundreds of years and was first explained in terms of gravitational theory by Isaac Newton in the seventeenth century. Actually the gravitational force of the sun on the earth is more than 100 times stronger than that of the moon; but because the moon is nearer, the difference between its gravitational pull on the side of the earth nearest it and the pull on the other side farthest from it is greater than the corresponding difference in the sun's pull by a factor of about 2.5. Consequently, while the sun also plays a role in raising tides, the moon's role is dominant.

The importance of the moon in producing solar eclipses has been known for thousands of years; and similarly, eclipses of the moon, which occur on those infrequent occasions when the full moon enters the shadow of the earth, have been known since antiquity. Indeed the correct explanation of eclipses is found in the writings of Aristotle and must have been known much earlier.

Sunlight reflected to the earth from the moon, especially when the moon is near full, has been an important influence on man's affairs since antiquity. The harvest moon, for example, which occurs in autumn, when the angle that the moon's rising path makes with the horizon is such that

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there can be bright moonlight in the early evenings for several days in a row, has been a longtime boon to farmers. Obviously, the bright light of full moon is an aid to certain nighttime activities, just as the time near new moon, when the sky is darkest at night, is optimum for other activities, such as astronomical observations of faint objects. Song and poetry are full of allusions to the moon as an aid to romance. Perhaps there are psychological effects of the moon upon man as well.

The few obvious effects, such as tides and eclipses, and other spectacular phenomena associated with the moon give rise to a vast amount of lunar folklore and superstition. It has been claimed, for example, that crops fare best when planted just after full moon. The full moon has been associated with fertility, with women's menstrual cycles, with violence, especially murder and suicide, with incidences of epilepsy, with evil spirits, with madness, and even with lycanthropy (the curse of the werewolf). For a sensational, if rather inaccurate, account, see *Moon Madness* (Abel, 1976).

Many of the alleged influences of the moon are often cited as evidence that celestial bodies (the moon, at least) can affect humans and their affairs, and thus as support for astrology.*

Full Moon and the Time of Birth

One of the most widely held beliefs about lunar effects is that there are many more human births at the time of full moon than at other times of the lunar cycle. The belief is even widespread among nurses in maternity wards and among some gynecologists as well. One of our colleagues recalls that his first child was born during full moon and that when he arrived at the hospital there were expectant women waiting in the halls for available rooms; the nurses all explained that "it always happens this way" at the time of full moon. Astrologer Sydney Omarr frequently refers to the incidence of crime and violence, as well as the higher birthrate, at the time of full moon and recommends that the moon be saved for romance.

There are some published studies that seem to support the idea that the full moon favors a higher than average rate of births. E. J. Andrews (1960), for example, reports that in the Tallahassee Memorial Hospital during the period 1956 to 1958 there were 401 babies born within two days of full moon, 375 within two days of new moon, and 320 within two days of first quarter. In a study of more than 510,000 births in New York City during the ten-year period beginning in 1948, Menaker and Menaker

*It must be noted, however, that these alleged lunar influences on humans are not, in general, the ones that would have been predicted from the appearance of the moon in the natal horoscope—the chart showing the positions in the heavens of the planets at the time and place of the birth of an individual.

(1959) claim that the birthrate was about one percent higher during the two weeks following full moon than before. However, one of those authors (Menaker, 1967) later studied another half-million births in New York during 37 lunar months from 1961 to 1963 and reported a one percent excess in the birthrate during the two-week period *centered* on full moon. Subsequently, Osley, Summerville, and Borst (1973) reported on a study of yet another half-million births in New York, during a later unspecified three-year period, showing a one percent excess in the birthrate during the two weeks *preceding* full moon. In contrast, Rippmann (1957) analyzed 9,551 natural births over a ten-year period in Danville, Pennsylvania, and found no correlation at all with the phase of the moon.

Again astrologers invoke the alleged influence of the full moon on the birthrate as evidence that celestial bodies can affect human affairs. It is not clear, however, how such a correlation would have anything to do with the interpretation of natal horoscopes according to the rules of Ptolemy (handed down from the second century) by which astrologers interpret the personalities and predict the futures for those individuals.

Still, if true, any correlation between the birthrate and the phase of the moon would be a very surprising result. Moreover, if properly interpreted, such a correlation would tell us something of the greatest importance to our understanding of the human reproductive cycle, to say nothing of influences over a distance of a quarter of a million miles that evidently have nothing to do with any of the known forces of nature. Thus we felt that the matter was worth a very careful check. Our analysis has been reported in the *New England Journal of Medicine* (Abell and Greenspan, 1979).

Data

We have tallied all births, live and dead, from the records of the UCLA Hospital maternity ward during the period March 17, 1974, to April 30, 1978. In some instances a birth would occur at home before the mother left for the hospital or en route to the hospital. To be consistent, we counted only births that actually took place in the hospital. During that interval there were 11,691 live births at the hospital. Of these, 3,549 were induced (by drugs or Caesarean section), leaving a total of 8,142 births that occurred naturally. To take account of the possibility that inducing a birth might have caused it to occur on a date earlier than normal, we treated total live and natural births separately. During the same interval there were 141 instances of multiple births, all of which were twins except for four sets of triplets and one set of quadruplets. In some of these multiple births, one of the infants was born before the mother reached the hospital. Finally, there were 168 stillbirths—amounting to 1.4 percent of the total.

The Lunar Phase

The average time that the moon requires to pass through a complete cycle of phases—that is, from new moon to new moon, or full moon to full moon, an interval known as the *synodic month*—is 29.530588 days. Because our birth data are recorded by calendar days (midnight to midnight) we had to divide our period of 1,506 days into synodic months of either 29 or 30 days. Our procedure was as follows.

The local date of each full moon during the interval was obtained

TABLE 1
Live Births at UCLA Hospital, March 17, 1974, to April 30, 1978

Phase Day	Total Live Births	Natural Live Births
1	406	273
2	390	273
3	425	291
4	412	287
5	391	270
6	396	282
7	399	293
8	398	276
9	383	260
10	380	271
11	364	243
12	398	292
13	372	261
14	411	279
15 (Full)	385	268
16	397	270
17	397	276
18	401	290
19	394	278
20	416	303
21	371	241
22	383	252
23	397	268
24	411	294
25	385	265
26	423	305
27	418	280
28	405	285
29	372	264
30	211	152
Totals	11,691	8,142

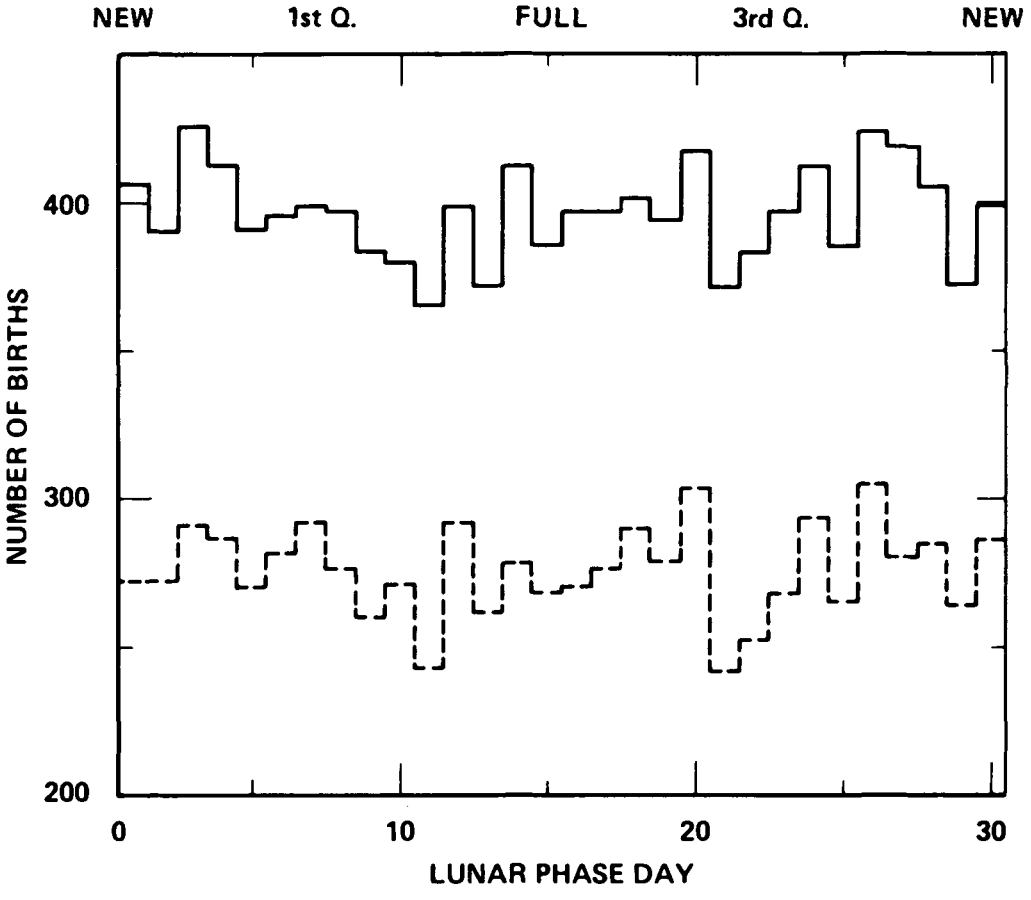

FIGURE 1. The numbers of total live births (solid line) during a four-year period at the UCLA Hospital plotted against lunar phase, and the numbers of natural live births (dashed line) during the same period.

from the U.S. Naval Observatory's annual publication *The American Ephemeris and Nautical Almanac*. In each case we took the local date in Los Angeles (between midnight and midnight, either Pacific Standard Time or Pacific Daylight Time, as appropriate). We defined the date of full moon as the fifteenth day in the lunar cycle. The previous day would then be lunar day number 14, and the day before that lunar day number 13, and so on. Thus by counting back 14 days from the date of full moon, we obtain day 1, which we define as the beginning of the lunar cycle; it is approximately the date of new moon. By counting forward from full moon, we define day 16, 17, and so on, until we reach the beginning of the next lunar

cycle. In this way we determine whether the particular cycle has 29 or 30 calendar days. In the 51 synodic months over the period we surveyed, there were 27 30-day months and 24 29-day months. Thus the mean length of the synodic month covered in our sample was 29.529412 days—very close to the known mean length of the synodic month.

Results

We next totaled all of the births that occurred on a first day of a lunar cycle, on a second day of a lunar cycle, and so on. These figures for the total number of live births, and also the noninduced, or natural, live births, are displayed in columns 2 and 3 of Table 1, and are displayed in Figure 1. The much smaller totals corresponding to the thirtieth day in the lunar cycle are not due to an avoidance of the day before new moon but to the fact that there were only 27 30-day months among the 51 synodic months surveyed. (In Figure 1, the totals for day 30 have been increased by the factor 51/27 so that they could be compared with the data for other dates.)

There are no obvious peaks in the numbers of births either at full moon or at any other time in the lunar cycle. There are, of course, small fluctuations in the actual total numbers of births among the successive days of the lunar cycle, but such random fluctuations are expected.

We can, in fact, use a standard statistical test to check the hypothesis that day-to-day fluctuations as large as those observed would be obtained in a random sampling from a hypothetical population in which births occur uniformly throughout the lunar cycle. If, in fact, the phase of the moon has no effect whatsoever on numbers of births, we would expect a total number of live births on each day during the period covered that is close to the average number of 395.91, except for day 30 when the expected number would be only 209.60 (which is 27/51 of 395.91). The corresponding expected numbers of natural, or noninduced, births are 275.73 and 145.97, respectively. The standard χ^2 test shows that, for the total numbers of all live births, fluctuations from day to day in the lunar cycle at least as large as those obtained here would be found about 95 percent of the time. Fluctuations in the day-to-day totals of natural births as large as those found here would occur 65 percent of the time. In other words, fluctuations such as those we have obtained are entirely to be expected, and there is no reason whatsoever to ascribe any influence to the moon on the numbers of births during the lunar cycle.

Multiple Births

The numbers of multiple births occurring during the period March 17,

TABLE 2
Multiple Births and Stillbirths at UCLA Hospital, May 17, 1974, to April 30, 1978

Phase Day Range	Number of Multiple Births	Number of Stillbirths
3-7	27	26
8-12	27	33
13-17	15	23
18-22	24	26
23-27	31	30
28-2	17	28
Totals	141	166

1974, to April 30, 1978, are given in column 2 of Table 2. The numbers in Table 2 refer to the number of instances of multiple births (that is, sets of twins), whether or not one of the twins may have been born before the mother reached the hospital; the numbers do not refer to individual births. We have grouped the numbers of multiple births in 5-day intervals in the lunar cycle to obtain numbers of births large enough to make meaningful comparisons. Note that the interval containing full moon (day 15) contains the lowest number of incidences of multiple births of any of the intervals. However, this minimum is not significantly different from fluctuations expected by chance.

If the incidence of multiple births is completely unaffected by the phase of the moon, we would expect the 141 sets of multiple births to be distributed evenly among the intervals with a mean number per interval of 23.87, except for the interval containing day 30, for which the expected number of multiple births is 21.63. Again we used the χ^2 test to compare the actual incidence of multiple births with the expected ones and found that fluctuations as large as those observed here would occur 20 percent of the time. In other words in one-fifth of all such experiments as this we would find fluctuations from the expected numbers at least as large as those we have obtained. There is, therefore, no reason to ascribe to the moon any effect on multiple births.

Stillbirths

The distribution of 168 stillbirths among the same six 5-day intervals in the lunar cycle is exhibited in column 3 of Table 2. Again, the number of stillbirths obtained during the interval containing full moon is actually the

lowest in the list. But again, there is no significance to these small fluctuations. The expected number of stillbirths, if the moon has no effect, is 28.108 for all of the intervals except the one containing day 30, when the expected number should be 25.462. A χ^2 test shows that fluctuations of the size obtained here would occur 78 percent of the time.

Conclusions

Our analysis of the nearly 12,000 live and dead births occurring at the UCLA Hospital maternity ward in an interval of 51 lunar months from 1974 to 1978 reveals no correlation between the numbers of births and full moon or any other phase of the moon. This negative result occurs whether we consider all live births, just those that are completely uninduced (that is, natural), incidence of twinning or other multiplicity, or even stillbirths.

These results were a considerable surprise to several of the nurses at the UCLA Hospital maternity ward: for they, like so many others, fully expected to find a strong correlation of birthrate with full moon. To be sure, if one combs through all of the data, an occasional lunar month can be found in which there is a greater than average number of births at or near full moon, but these are only random fluctuations; there are just as many months in which there are fewer than the expected number of births near full moon. Probably the nurses simply remember those months in which they noticed there was a full moon during a particularly busy night. Perhaps it is similar to the tendency to remember those dreams that seem to come true and forget the vast majority that do not.

Our results appear to be at odds with some of the published surveys referred to above. At least among those mothers in the Los Angeles area who are cared for at the UCLA Hospital there appears to be no influence of the moon whatsoever on the times of their deliveries. We strongly suspect that the moon has no influence on birthrates anywhere in our society and are perplexed at the seemingly discordant results, especially those obtained in the New York samples. Because three of those studies purport to cover approximately a half-million births each, a very substantial amount of effort would have been required to carry out the tests properly. Especially in view of their discordant results, perhaps a new look at those data would be appropriate.

We know of other cases where claims of effects of the full moon have not been verified by careful statistical studies. Among these are Pokorny's (1964) study of 2,497 suicides and 2,017 homicides in Texas between 1959 and 1961; Pokorny and Jachimczyk's (1974) analysis of 2,494 homicides in Texas between 1957 and 1970; Lester, Brockopp, and Priebe's (1969) analysis of 339 suicides in Erie County, New York; and Pokorny's (1968)

analysis of 4,937 mental hospital admissions—none of which shows any correlation either with the phases or the distance of the moon.

The moon has unquestioned influence on the tides and on certain other phenomena, but several pieces of evidence at hand suggest that many of the "incredible facts" about the influence of the moon on man are simply not facts at all.

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