1. The Fibonacci and Lucas numbers are related, as $L_x = F_{x+1} + F_{x-1}$.

Taking the greatest integer in the quotient which results from the division of Moore's mosaic units M_x by 1.19 (not 1.197 as in Moore's expression) the following sequence is obtained: 1, 2, 3, 5, 8, 13, 18, 21, 34, 55, 89. Clearly these are all Fibonacci numbers except 18 which is a Lucas number (the latter is to be expected, for $21.6 = 15.6 + 6.0$).

Moore's investigations (*3*) are based on close examination of a large number of Roman and Greek mosaics from England, Italy, North Africa, and the Northeast and East Mediterranean, and dating from circa 400 B.C. to about A.D. 530. The procedures of ancient mosaicists, almost completely unknown until recent times, and the thorough inspection of the samples, made Moore arrive at an "Alignment Hypothesis" which in turn led to the derivation of his mosaic units. That the occurrence of Fibonacci numbers in mosaic measurements is curious but not completely surprising is exemplified by the presence of Fibonacci properties in other situations where mathematical relationships of this type were considered unlikely at first; the numerical value of the so-called "golden ratio"

$$\lim_{x \to \infty} (F_{(x+1)}/F_x) = (1 + \sqrt{5})/2 = 1.618034 \ldots$$

has been frequently implicated in the numerical proportions of some famous Doric architectural feats such as the Parthenon of Athens. In this context, it will not be unexpected if a ruler such as the one Moore seeks (*1*) actually turns up.

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References and Notes

1. R. E. M. Moore, *Science* **161**, 1358 (1968).
2. Literature on the theory and applications of Fibonacci numbers was very scarce until 1962. Essentially the only book on this subject published before that time and containing contemporary material was N. N. Vorob'ev, *Fibonacci Numbers* (Pergamon Press, London, 1961). The man to whom these numbers are attributed, Leonardo of Pisa, son of Bonaccio (therefore nicknamed Fibonacci), wrote *Liber Abaci* in 1202. Adequate research and fruitful studies in an organized manner were started in 1962 with the founding of the Fibonacci Association of America, a mathematical society devoted to the investigation of integer sequences with special properties. It is a nonprofit organization with headquarters at San Jose State College, San Jose, Calif.
3. R. E. M. Moore, *Nature* **217**, 482 (1968); *Amer. J. Archaeol.* **72**, 57 (1968); *Nature* **209**, 128 (1966).

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I observed (*1*) a tendency for mosaic stones packed in rows to align (transversely through the rows) at certain intervals. Patterns would be smoother if mosaicists made them agree with these intervals. Observed alignment intervals coincide (*1*) with mosaic units, suggesting that this was the reason for mosaic units.

Ledin extracts Fibonacci numbers from mosaic units, and points out that the limit to $F_x : F_{(x+1)}$ is 1 : 1.618 [the special ratio known to the ancients in other contexts (*2*)]. If this was why mosaic units were used, then we have apparently unique (*3*) evidence that the ancients knew the Fibonacci series, and its connection with 1.618 (*4*).

I arrived at 1.197 cm as the constant in the generating relation (*5*) by dividing each observed value by its variable in this relation. Hypothetical values yielded by 1.197 cm fit the observations better than those yielded by either 1.196 cm or 1.198 cm, which diverge roughly symmetrically from the observations. The "odd" unit 21.6 cm can be regarded as 18×1.197 cm, but I was unaware of the Lucas series.

Ledin's information raises hope of new light on mosaic units.

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References and Notes

1. R. E. M. Moore, *Nature* **217**, 482 (1968).
2. For example, Euclid, *Elements* VI def. 3; VI prop. 30.
3. D'A. W. Thompson [*Mind* **38**, 43 (1929)] wrote of the Fibonacci series ". . . there is no account of it, nor the least allusion to it, in all the history of Greek mathematics. . ." (p. 50), but suspected (p. 52) that the Greeks knew it because of its simplicity.
4. According to H. S. M. Coxeter, *Introduction to Geometry* (Wiley, New York, 1962), Kepler was first to give the limit to this ratio.
5. R. E. M. Moore, *Science* **161**, 1358 (1968).

2 December 1968

Hypothalamic Stimulation of Growth Hormone Secretion

The significant increase of plasma growth hormone produced by stimulation of the ventromedial nucleus of the hypothalamus led Frohman and his colleagues (*1*) to propose that the hypothalamic control of growth hormone secretion resides in the ventromedial nucleus. This is an unfortunate interpretation because it raises the specter of the "neural center" concept for the hypothalamic control of growth hormone secretion. We believe this is wrong for two reasons:

1) Frohman *et al.* have not excluded the effects of their lesions or stimulations on fibers which pass through the area of the ventromedial nucleus and which originate from cells beyond that nucleus.

2) We have recently reported growth hormone release from hypothalamic stimulation in the conscious monkey (*2*) and our three stimulus sites were 4 to 5 mm from the ventromedial nucleus. Under our experimental conditions, current did not spread more than 1 mm.

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References

1. L. A. Frohman, L. L. Bernardis, K. J. Kant, *Science* **162**, 580 (1968).
2. G. P. Smith and A. W. Root, *Fed. Proc.* **27**, 319 (1968).

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We have proposed that the ventromedial hypothalamic nucleus is an important locus in the control of growth hormone secretion in the rat. As evidence, we have cited experiments demonstrating decreased pituitary and plasma growth hormone levels after destruction and increased plasma levels after stimulation of this locus. Although limited stimulations in areas just dorsal and lateral to the ventromedial nucleus have not resulted in elevated plasma growth hormone levels, it is possible that other hypothalamic areas may influence growth hormone secretion either through the ventromedial nucleus or independently. We would caution the interpretation of plasma growth hormone rises following brain stimulation in conscious but restrained monkeys. In contrast to the rat, where stress decreases plasma growth hormone levels (*1*), monkeys tend to respond to various nonspecific stimuli with elevations of plasma growth hormone (*2*).

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References

1. D. S. Schalch, *Program of the Endocrine Society, 48th Meeting, June 1966*, abstr. 62.
2. V. Meyer and E. Knobil, *Endocrinology* **80**, 163 (1967).

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