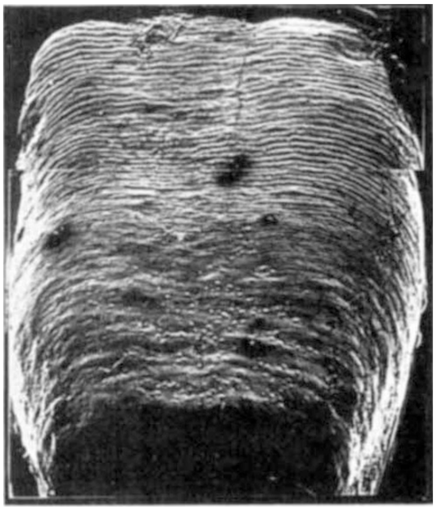
Dental caution

SIR—The study of Plio-Pleistocene hominid dentition[1-3] has challenged the notion of a prolonged maturation period throughout human evolution[4]. New information indicates that some of these conclusions[1-3] are premature and that additional research is needed to clarify the issue.

Bromage and Dean[1] counted enamel surface manifestations (perikymata) of internal bands (striae of Retzius) on nine australopithecine incisor teeth, reporting a range of 57–135 perikymata. They used these data to calculate crown-formation times and the age at death of six fossil specimens with just-completed permanent incisors. Compared with a sample of 10 modern human incisors, with a range of 165–202 perikymata, the authors concluded that growth periods for Plio-Pleistocene hominids were similar to the modern great apes. These 10 human teeth, not further identified, remain the only published sample of human incisor perikymata counts, and are the accepted standard for taxonomic interpretation[2].



The complete dentition of this individual was figured in ref. 11. Here, a montage at 9× of an upper incisor illustrates the perikymata on the labial surface of the tooth. By the method of Bromage and Dean[1], incisor perikymata counts give a crown formation time of 2.2 ± 0.1 to 3.7 ± 0.2 years, or an age at death between the late second and early fourth year in the presence of recently erupted M1s. Estimates for the time of root formation are added to crown formation times for age at death, and here follow previously published estimates for human incisors with 1–3 mm root[10-12].

To investigate further the pattern of perikymata in modern humans, we sputter-coated a sample of 12 modern human incisor teeth with gold palladium and viewed them with a scanning electron microscope at 20, 40 and 80× magnification at 6, 12 and 20 KeV, and recorded the labial surfaces by montage images on polaroid film. All teeth had complete crowns with minimal root and had perikymata observable over the entire crown surface at low binocular magnification. Ten specimens are from the archaeological site of Hasanlu (Iran), about 3000 BC, and two are from the Island Field site in Delaware, about AD 800.

In our sample, perikymata counts range from 75 to 157 (s.d. of 1–12 for individual teeth; overall mean 116; median 118; s.d. 25). These results overlap, within measurement error, the fossil sample, the original modern human range[1], and are similar to those of an unpublished survey by A.-M. Bacon on 23 additional human incisors, with a range of 111–179 perikymata.

Furthermore, perikymata are variable in expression, often missing from the cervical aspect of maxillary incisors. The use of these surface features alone to infer incremental patterns of underlying enamel is questionable. Three teeth in the present sample are from a single individual, with perikymata counts of 75 ± 7 (upper RI1), 128 ± 4 (upper RI2), and 157 ± 12 (lower RI1) (see figure). It is possible that either abrasive phenomena have differentially affected the right maxillary I1, or more internal striae exist than are reaching the surface of the tooth. If incomplete perikymata counts are a feature of enamel and sectioning of teeth is required to count internal incremental lines for accurate estimation of total crown formation time, then enamel surface counts on fossil specimens are inadequate estimators of age at death, and previous reports using these as databases need to be reconsidered[1,2,5-7].

Chronological ages derived from perikymata counts have been used to calibrate other dental events, particularly first molar eruption[2,7]. The incisor in the figure comes from a modern human whose dental sequence parallels that described for the *Australopithecus africanus* mandibular specimen, Sts 24 (refs 4, 8), and similar to Taung[9] and the *A. afarensis* LH 2 (ref. 10), including an erupted first molar[11]. This modern human is experiencing first molar eruption between three and four years of age, an abbreviated growth period relative to modern man, similar to the modern great apes[1] and to that presented for *Australopithecus*[2].

The examination of additional modern human incisors has broadened the range of variation for perikymata numbers, and results in the significant overlapping with that reported for fossil juveniles[1,2]. Initial conclusions of ape-like growth periods for Plio-Pleistocene hominids based on ages at death derived from perikymata counts are premature, and their further use to substantiate major taxonomic conclusions[2,7] should be held in abeyance.

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Third eye

SIR—Professor May, in his News and Views article[1] on the paper by Daugherty *et al.*[2] concerning the taxonomic classification of the tuatara (Sphenodon), says, as an aside on the animal's third eye, "most other vertebrates retain this organ in vestigial form as the pineal gland".

Vestigal organs have tended to disappear with advances in medical knowledge. As far back as 1931 Sir James Purves Stewart, writing in the 7th edition of his famous work *The Diagnosis of Nervous Diseases*, states "The pineal gland was formerly regarded as a 'vestigial organ', a portion of which in some reptiles develops into a rudimentary para-pineal or parietal eye. Modern observations, however, show that so far as being a mere vestigal relic, it is a glandular structure whose activity is necessary for normal metabolism in early life and that prior to the age of puberty the pineal gland is an important organ of internal secretion."

The modern observations to which Sir James refers are by Professor A. Munzer writing in 1911 and the extensive historical review by Dr L. J. Kidd in 1913 (refs. 3,4). Sir Cecil Wakeley, past president of the Royal College of Surgeons of England, in his *Faber Medical Dictionary* (1975) gives the pineal body as a structure of unknown function. The best medical report for a layman is to be found in the 37th edition of *Gray's Anatomy*, where it is clearly stated that the pineal is a powerful regulator of enzymes associated with melatonin synthesis and the output of gonadotrophins by the adenohypophysis.

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