

irradiated with, say, 3-MeV protons with a dose variation of ± 1 per cent and a LET variation of ± 10 per cent.

In summary, the use of the exo-ergic deuterium-helium-3 reaction for production of 14.7-MeV protons in an accelerator of modest energy permits the investigation of radiation effects on cells and micro-organisms under much more controllable and precisely defined conditions of LET than is possible with fast neutrons and with an advantage of two orders of magnitude in available dose rate. Moreover, the dosimetry of the proton radiation is far simpler than for fast neutrons since only simple measurements of ionization in air are needed. The radiation dose to a specimen is far less influenced by the composition of the specimen and its surroundings than is the case with neutrons. The capital cost of producing 14.7-MeV protons in the manner indicated is at least an order of magnitude smaller than if direct acceleration were used.

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BIOLOGY

Third Molar Agenesis and Variation in Size of the Remaining Teeth

SINCE third molar agenesis is clearly associated with an increased incidence of other missing teeth^{1,2} and with reduction in size of the remaining teeth³, one might also expect increased variation in size, even to the point of hypoplastic or peg teeth, when third molars are missing⁴.

Analysis of our mesio-distal tooth size data from south-western Ohio confirms this expectation. Peg-shaped or hypoplastic upper lateral incisors, smaller than 5.3 mm in crown diameter, are predominantly found in association with agenesis of the third molar in girls (Table 1).

In both sexes, superimposition of the genetic complex responsible for the suppression of the third molar has a three-fold effect on the size distribution of the upper lateral incisor. First, all measures of central tendency are displaced toward the origin, as shown in Table 1. Secondly, multimodality is introduced, especially in girls. Thirdly, size variability of I_2 is considerably greater in affected children of both sexes.

Indeed, increased size variability (σ^2) proves to be true for all classes of teeth when the third molar is missing. Comparing 78 affected children with 140 normal controls, size variance was greater in the affected boys in 11 out of 14 teeth, and to the same extent in affected girls. Against the chance hypothesis, the actual distribution (22 : 6) was highly significant by χ^2 test. Seven of 28 individual F values were significant at $P = 0.05$ or better. Both maxillary and mandibular teeth participated in this trend, as did the more mesial or more 'stable' teeth in each morphological class.

In these circumstances, it appears safe to include increased tooth size variance in the remaining teeth among the other concomitants of third molar agenesis in man⁶. In the upper lateral incisor, the entire size curve is not only

shifted toward the origin, but peg teeth and missing teeth are prevalent as well.

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Delay of Implantation in Super-ovulated Mice subjected to Crowded Conditions

It has long been established that delay of implantation may occur in lactating mice. Recently, it has been noticed that delayed implantation may also occur in super-ovulated females kept in conditions of mild crowding. Twenty-two female mice (*TT* strain) were placed, when aged about 30 days, in a cage measuring 24 in. \times 14 in. \times 7 in., which had one drinking and one eating station. They remained in this cage for the duration of the experiment. When the mice were 59 days old and weighed 30-35 g, the super-ovulation procedure was commenced. This consisted of injecting, intraperitoneally, 3 I.U. pregnant mare serum ('Gestyl', Organon) and 3 I.U. human chorionic gonadotrophin ('Pregnyl', Organon), the former 43 h, and the latter immediately, before mating at noon on day 0, when 7 males were put into the cage containing the 22 females. The males were removed at 9 a.m. on the first day and the number of females having mated, as evidenced by the presence of vaginal plugs or spermatozoa in the vaginal smear, was noted.

The 7 females that had mated were killed on the seventh to tenth days. Two had the uterine swellings characteristic of implantations, while from 4 which had no uterine swellings blastocysts were recovered. The remaining female had neither uterine swellings nor unimplanted blastocysts.

Although, at 59 days of age, immaturity of the females seemed unlikely to be an operative factor, the experiment was repeated with a group of 22 females 90 days old and weighing from 35 to 46 g. The same 7 males as before were used for mating. Ten females of this group mated. When killed on the seventh to ninth days, 5 of them had implantations, 3 had unimplanted blastocysts and 2 neither. Two of the 5 mice with implantation swellings of the uterine horns had swellings markedly smaller than those of the other 3, indicating that in these circumstances implantation may be merely delayed and not completely blocked.

In spite of the numbers involved being small, there is nothing here to suggest that immaturity is a factor in causing delayed implantation in these mice. The super-ovulation procedure itself must be suspect, but it would seem likely that the cause of the delayed implantation may be the crowded conditions at the time of mating, mild

Table 1. SIZE OF THE UPPER LATERAL INCISORS IN CHILDREN WITH THIRD MOLAR AGENESIS AND UNAFFECTED CONTROLS

Group	No. of teeth	Tooth size (mm)*											
		0	3.25	3.75	4.25	4.75	5.25	5.75	6.25	6.75	7.25	7.75	8.25
Girls' agenesis	86	6	1	1	3	2	2	6	29	17	15	4	0
Girls' control	175	2	0	0	0	0	3	18	43	67	27	14	1
Boys' agenesis	69	11	0	0	0	0	1	5	16	10	19	7	0
Boys' control	184	0	0	0	0	0	3	8	33	48	29	10	3

* Mesio-distal diameters.