

Hair Medulla Variation with Age in Human Males

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During the course of a study on the hair roots of adult males (Archer, n.d.), it was observed that the medullas of the hair shafts of youthful subjects often had a different size distribution than did the medullas of the hair shafts of elderly subjects. In each hair sample, as previously observed (Wynkoop, '29), some hairs had no observable medulla (but some medullar material is nearly always present when viewed under polarized light) (Montagna, '62); some had scanty discontinuous medullary material; some had abundant medullary material which was discontinuous or "broken"; and others had continuous medullas which varied in diameter from hair to hair. The medullas which had the largest diameters in a sample were generally continuous and were generally found in the largest hairs as noted by Hausman ('51). The maximum medulla diameter observed in many samples appeared to be related to the age of the subject.

MATERIAL AND METHODS

From the study mentioned above (Archer, n.d.) samples of hair were available from many adult males who ranged in age from 19 to 70 years. Most of these men worked underground in coal or uranium mines. A few samples from children were also studied.

A needle forceps faced with transparent tape was used to grasp a small tuft of hair in the low occipital or low parietal area of the scalp. The hair was pulled out with the attached roots by a quick jerk applied parallel to the insertion. The projecting hair roots along with about 1 cm of hair shaft were cut off with scissors and were promptly placed in a vial containing 5.0% formalin solution. The vial was tightly capped and stored until studied under a dissecting microscope several

months later. The hairs were examined in a petri dish while immersed in the aqueous preservative solution. The number of hairs in each sample varied from 2 to 127 with a mean of 30.4 per sample.

To test the consistency of the observation that hair morphology was related to age, one of the authors (E. L.) made an estimate of the age of 798 men whose hair samples were examined. No reference was made to the clinical record, so that the examiner had no knowledge of the actual age until after the estimates had been completed. About half of the men whose samples were examined were white, the others were Navajo Indians.

The age estimate was based largely on the maximum medulla diameters observed in hairs. However, other factors, such as ratio of medulla diameter to hair diameter, opacity of the medulla, or lucidity of the cortex may have entered into the subjective estimate. No attempt has been made here to relate actual measurements of hair medulla diameters to age.

RESULTS AND DISCUSSION

The range of medulla and hair diameters seen in male subjects of ages 4, 35, and 60 years is illustrated in figures 1, 2, and 3. These figures indicate that the maximum hair medulla diameter is generally small in the child, larger in middle age, and largest in old age. They also suggest that there may be a change in maximum hair diameter, and change in the ratio of medulla diameter to hair diameter accompanying age changes.

¹The work reported here was done while both authors were with the former Field Investigations and Demonstrations Branch, National Cancer Institute, Public Health Service, Department of Health, Education and Welfare. Present address: Occupational Health Field Station, Public Health Service, Fort Douglas Station, Salt Lake City, Utah.

Comparison of the age estimates based on hair examination with actual age gave the results shown in the last column of table 1. In 47.8% of cases the estimate was within \pm five years of the actual age. In 70.2% of all cases (71.2% for Indians, 69.0% for Whites) the estimate was within \pm ten years of the actual age. This is far better than could be achieved by chance alone. Race was apparently not a factor.

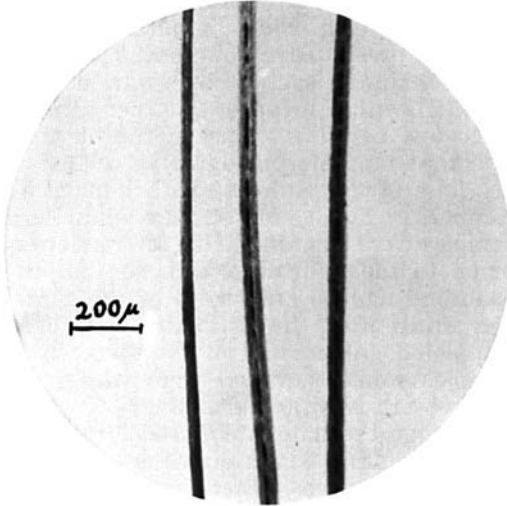


Fig. 1 Representative hair shafts of a 4 year old boy.

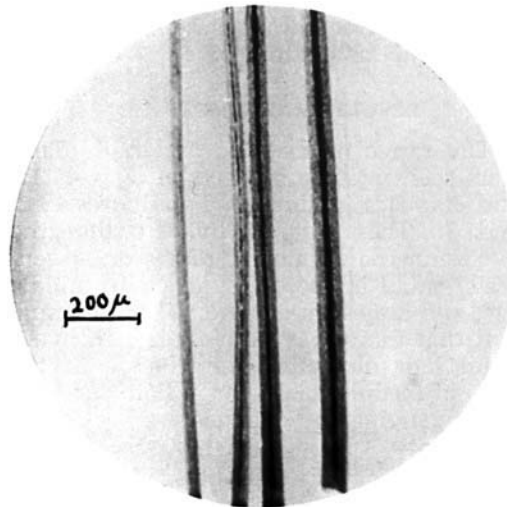


Fig. 2 Representative hair shafts of a 35 year old man.

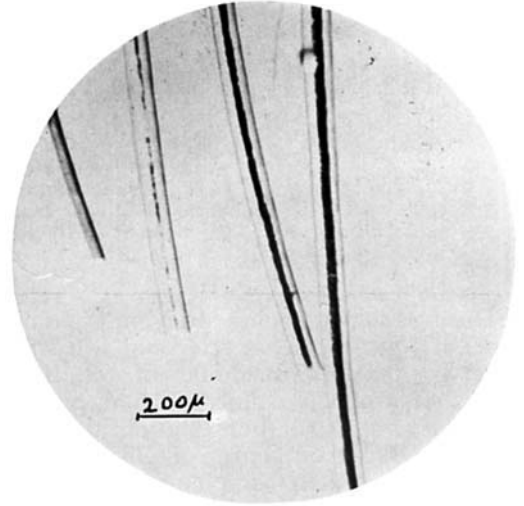


Fig. 3 Representative hair shafts of a 60 year old man.

Among those estimates which were in error by more than ten years, 28% were too high and 72% too low. This non-random distribution of error suggested two possibilities (a) that many samples were too small to be representative samples (i.e., the occasional hair with large medulla may have been absent from small samples more frequently than from large ones) or (b) that the observer was making a consistent error in judgment. To test the first possibility, the data were checked to see whether or not accuracy of the estimate rose with increasing number of hairs in the sample. These data, given in table 1, show that about 48% of the cases were estimated within five years of true age regardless of the number of hairs in the specimen. If error due to sample size was a factor, it must have been small in our material. If the consistently low estimates are indeed due to observer error, there is a good chance that further study may increase the accuracy of age estimation from hair.

In a previous study (Wynkoop, '29), three hairs were selected at random from each of 483 specimens. An unsuccessful attempt was made to demonstrate a relationship between the type of medulla (absent, scanty, broken, continuous) and age of the subject. The small number of hairs and the observational parameters appar-

TABLE 1
Accuracy of age estimates based on size and form of medulla according to the number examined

Relationship of estimate to actual age	Samples grouped by number of hairs							
	2-10 Hairs		11-30 Hairs		31 or more hairs		Totals	
	No. of samples	%	No. of samples	%	No. of samples	%	No. of samples	%
<i>in years</i>								
± 5 or less	45	48.4	188	47.1	148	48.4	381	47.8
± 6-10	22	23.7	98	24.6	59	19.3	179	22.4
± 11 or more	26	27.9	113	28.3	99	32.3	238	29.8
Totals	93	100.0	399	100.0	306	100.0	798	100.0

ently prevented the finding of the association sought. In a serial study of hair changes in 16 children (Duggins and Trotter, '51), it was noted that the fraction of hairs having observable medullas is very low at birth, increases rapidly during the first seven months of life, and thereafter is quite irregular but shows a general tendency to rise up to 14 years of age. Although not definitive, their work suggested that there may be some difference in medullas between male and female.

If the above observations relating hair diameter, maximum medulla diameter, and age can be put on an objective basis, they may be useful in the study of aging processes in man, or in criminological determinations of age.

SUMMARY

The maximum medulla diameter of male human head hair is relatively small

in youth and gradually enlarges with age. In 798 age estimates made from hair samples, 70% were within \pm ten years of actual age. Estimates were made with equal accuracy for Indians and for white persons.

LITERATURE CITED

- Archer, V. E., and E. Luell Hair root changes among uranium miners. In preparation.
- Duggins, O. H., and M. Trotter 1951 Changes in morphology of hair during childhood. *Ann. N. Y. Acad. Sci.*, 53: 569-575.
- Hausman, L. A. 1951 The relationships of the microscopic structural characters of human head-hair. *Am. J. Phys. Anthropol.*, 8: 173-177.
- Montagna, W. 1962 *The Structure and Function of the Skin*. Academic Press, New York., pp. 181-184.
- Wynkoop, E. M. 1929 A study of the age correlations of the cuticular scales, medullas, and shaft diameters of human head hair. *Am. J. Phys. Anthropol.*, 13: 177-187.