A PRELIMINARY STUDY OF THE CHINESE NASAL SKELETON WITH SPECIAL REFERENCE TO THE KUNMING SPECIMENS

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I. *Introduction.* A study of the human nasal bones in different racial groups is generally considered to be of great anthropological importance, and the nasal index, with its great variability, is regarded by many authors as one of the best criteria, if not the most distinctive, of racial characteristics[1]. A great deal of work has been done in this line but mostly confined to only three fundamental measurements, i.e. nasal height, breadth and the resulting index. A racial variation of metric characters of the nasal bridge has also been investigated before by many authors, notably, P. Broca, C. de Merejkowsky, K. V. Ryley, J. Bell, K. Pearson, T. L. Woo and G. M. Morant[2]. So the material of the metric characters of nasals available for comparison is considerably extensive. However, no similar studies have as yet been done on the

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1. Adolf H. Schultz: "Relation of the External Nose to the Bony Nose and Nasal Cartilages in Whites and Negroes", *American Journal of Physical Anthropology*, vol I, pp. 323-338, 1918.

2. a. P. Broca: "Sur l'indice nasal", *Bulletins de la Societe d' Anthropologie de Paris*, ser. 2, t. vii, p. 25, 1872.

b. C. de Merejkowsky: "Sur un nouveau caractere anthropologique", *Ibid*, ser. 3, t. v. pp. 203-364, 1882.

c. K. V. Ryley, J. Bell and K. Pearson:" A Study of the Nasal Bridge in the Anthropoid Apes and Its Relationship to the Nasal Bridge in Man", *Biometrika*, vol. IX, pp. 391-445, 1913.

d. T. L. Woo and G. M. Morant: "A Biometric Study of the Flatness of the Facial Skeleton in Man", *Ibid*, vol. XXVI, pp. 196-230, 1934.

morphological characters of nasals as well as the distribution of the incidence of their different anomalies. The material of this kind is extremely slender in the Oriental group. For purposes of racial differentiation, the feature of the latter characters can hardly be regarded as less important as the metric traits.

The writer's purpose is to explore the precise feature of the Chinese nasal bones in different respects based on a long series of modern crania and compare the intra—and interracial variation of characteristics studied.

II *The Material Described.* The material on which the present report is based consists of 500 specimens of modern Chinese crania collected at the beginning of 1933 by workers of the Anthropological Section, Institute of History and Philology, Academia Sinica. The place excavated is situated at the rear of the Yunnan University outside the northwestern gate of Kunming. The site is about 14 acres in area. The ancient name was termed An Fu Yuan (安阜園) and this region in recent time has been called Lien Hua Chih (蓮花池). The depth of the burial pit ranges from 5 to 9 feet. The colour of the clay is yellowish or yellowish brown and its character is slightly wet and moist. The place has been used as a public burial ground since the year of 1820 (or in the reign of the 25th year of Emperor Chia Ch'ing), It was originally contributed by the local philanthropists and sanctioned then by the magistrate to be used as a burial ground of the poor people. According to the inscription of a stone tablet erected there, the present area is much wider than it was *in situ*. In investigating 72 gravestones, we found that the majority of the deceased were natives of Yunnan (73 per cent) and a few cases came from its neighbouring provinces such as Szechwan, Kweichow, Kwangtung, Kwansi and Hupeh. After an anatomical sexing, 325 specimens were found to be males and the remaining 175 females. Of the total there are only 109 perfect and intact ones in which the nasal skeletons are complete and their outlines in both norma facilies and norma lateralis can be readily drawn by a diagraph. In the remaining cases their nasal bones are more or less defective especially in the lower free ends. All the possible measurements and observations, however, were made on the bones in question so far as their conditions permitted.

III. *Methods of Measurements.* The measurements which have been

made and the technique followed in each case are as follows:

1. Nasal height: a distance from nasion to nasospinale taken in a median sagittal line. The first point is defined to be a mid-point on the fronto-nasal suture cut by the median sagittal plane. It does not necessarily correspond to the upper end of the internasal suture where the frontal bone meets. The second point is defined as one, where a line tangent to the two lateral curves of the lower margin of the piriform aperture crosses the median line.

2. Nasal breadth; the maximum breadth found on the lateral margins of the nasal aperture. It should be taken perpendicularly to the median sagittal plane.

3. Chord from nasion to rhinion: a median chord taken from nasion to rhinion which is defined as the free end of the nasal bone in the median sagittal section.

4. Chord from rhinion to nasospinale; a median chord taken between the two points mentioned above.

5. Arc from nasion to rhinion; an arc measurement taken between two similar points previously stated.

6. Minimum breadth of the nasal bridge; a least width taken at right angles to the median sagittal section. It is also termed the simotic chord which has been customarily used as one of the craniometric characters by workers in the Biometric Laboratory, London.

7. Upper breadth of the nasal bones; an upper transverse width taken between two corresponding points of the intersection of the fronto-nasal, fronto-maxillary and naso-maxillary sutures.

8. Middle breadth of the nasal bones; a mid-transverse width taken in a half distance of the arc from nasion to rhinion.

9. Lower breadth of the nasal bones; a lower transverse width measured between the two free ends of the posterior border of the nasal bones.

10. Lateral length of the right nasal bone; a chord measured on the right side from the intersection of the three sutures just stated to the lower free end of the posterior border.

11. Lateral length of the left nasal bone; the same measurement as above, taken on the left side.

The chord measurements are all taken with the sliding compass while the arcual ones with the steel tape.

From a pair of absolute measurements defined above, five indices which denote the shapes of different parts of the nasal skeleton can be formed as follows:

12: Nasal index: $\frac{100 \text{ nasal breadth } (2)}{\text{nasal height } (1)}$.

13. Arc-chord index of the nasal bridge:

$$\frac{100 \text{ chord from nasion to rhinion } (3)}{\text{arc from nasion to rhinion } (5)}.$$

14. Transverse nasal index A:

$$\frac{100 \text{ upper breadth } (7)}{\text{middle breadth } (8)}.$$

15. Transverse nasal index B:

$$\frac{100 \text{ upper breadth } (7)}{\text{lower breadth } (9)}.$$

16. Transverse nasal index C:

$$\frac{100 \text{ middle breadth } (8)}{\text{lower breadth } (9)}.$$

Among these the first index is the only one which has been widely employed by anthropologists to compare the nasal shapes of different racial groups.

IV. *Sexual Comparison of Mean Measurements.* The sex ratios of different nasal characters (100 male mean/female mean) for the present series are computed and shown in Table I (Cf Appendix). In the case of absolute measurements the ratios vary from 96 to 114 with a mean value of 106.9. Of 11 characters, 9 show male dominance especially in those taken in a longitudial way. In the remaining two a reverse position is observed, the female mean being slightly greater. It should be noted that no significant difference between the two sexes is found in transverse breadths. In the case of five relative measurements or indices, two are in favour of the males and three in favour of the females, but their differences are all negligibly small with the exception of the first one in which the female appears to be significantly dominant. The mean of sex ratios for indices is merely 97.3 which is appreciably less than that (106.9) for absolute measurements. The

result is almost the same as what we have obtained in other parts of skeletal materials of the same series. On the whole, the male nose, judging from our data, is higher, wider, and his five longitudial lengths made on the bones are all longer but the nasal index which concerns the shape of the whole part is smaller.

Table I. Sex ratios of diffrent nasal Characters for the Kunming series

Characters	Sex ratios
(a) Absolute measurements:	
1. Nasal height.	103.7
2. Nasal breadth.	104.4
3. Chord: nasion-rhinion:	110.7
4. Chord: rhinion-nasospinale.	111.7
5. Arc: nasion-rhinion.	110 9
6. Minimum breadth.	96.0
7. Upper breadth.	105.3
8. Middle breadth.	93.9
9. Lower breadth.	101.8
10. Right lateral length.	112.7
11. Left lateral length.	113.9
(b) Relative measurements.	
12 Nasal index.	94.1
13. Arc-chord index.	100 2
14. Transverse nasal index A.	100.1
15. Transverse nasal index B.	93.4
16. Transverse nasal index C.	95.9

V. *Racial Comparison of Mean Measurements.* The constants of mean measurements and their ranges, standard deviations and coefficients of variation for the present series in both sexes are given respectively in the appendix to this paper. In this section we only deal with the characters for which the intra—and interracial comparisons can be made, Of all the characters, only 8 were chosen for this purpose, and these will be discussed in detail below:

The nasal height, nasal breadth and their resulting index are three well-known characters which have been widely used by anthropologists in the routine description of the crania. In Tables II and III are provided means of three nasal characters for the Kunming series and other racial groups. The majority of comparative data are cited from the Journal of *Biometrika* and a few from other periodicals.

Unfortunately, in the case of the nasal height, two different methods are adopted by previous authors. The first method is defined in the third section of this paper while the second is the length measured from the nasion to the most distal point on the lower edge of the right or left piriform aperture. The latter height is, as a rule, greater than the former. The nasal heights of the four series specially underlined were measured by the second method described above, and are given in the table for reference. In the first place, we note that mean differences of three nasal characters among seven Chinese series are fairly small. Their nasal shapes all belong to the 'mesorrhine' type (values underlined are not considered).

Considering pooled means of the same characters for seven racial groups, the Chinese as a whole have a longer nasal length and median breadth. Their nasal shapes with those of European and northern Mongolian reaces can all be classified together as the 'mesorrhine' type, but they are distinctively differentiated from the 'chamaerrhine' type[1] of the other four racial groups.

The next characters to be compared are three transverse diameters and

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1. The indices, 51.0-57.9, belong to the 'chamaerrhine' type and those, 47.00-50.9, to the 'mesorrhine' type.

II. Means of the nasal height, breadth, and index for various Chinese series (Males)

Series	Authors	Nasal height	Nasal breadth	Nasal index
Prehistoric Chinese	Black	54.7 (42)	25.8 (41)	47.6 (39)
Northern Chinese	Black	55.3 (83)	25.0 (86)	45.3 (86)
Northern Chinese	Koganei	55.5 (70)	25.0 (70)	45.2 (70)
[1]Northern Chinese	Various[1]	51.9 (13)	25.2 (46)	48.6 (13)
Fukien Chinese	Harrower	52.6 (36)	25.2 (36)	48.1 (36)
[1]Southern Chinese	Various[1]	53.1 (54)	25.6 (78)	48.2 (54)
Yunnan Chinese	Yen	53.0 (284)	26.0 (242)	49.2 (241)

[1]The nasal characters for the two series were taken by various authors and combined by M. L. Tildesley and G. M. Morant. See G. M. Mo ant: A "Study of Certain Oriental Series of Crania" *Biometrika*, Vol. XVI, pp. 47-73, 1924.

III. Pooled means of the nasal height, breadth and index for different racial groups (Males)

Races	Series pooled	Nasal height	Nasal breadth	Nasal index
(1) European	4	51.1	24.4	47.8
(2) Chinese	7	52.3[1]	25.4	48.6[1]
(3) Northern Mongolian[2]	5	54.7	26.7	48.9
(4) Indian	4	47.6	24.6	52.0
(5) Southern Oriental[2]	7	49.9	26.9	54.1
(6) Negro	7	46 5	26.6	56.4
(7) Australien	2	28.3	27.4	56.9

[1]The nasal heights measured by different method are excluded.

[2]See T. L. Woo and G. M. Morant:" A Preliminary Classification of Asiatic Races based on Cranial Measurements", Monograph of the National Research Institute of Social Sciences, Academia Sinica no. 7, 1932.

the lateral length of the nasal bones[1]. The material available, for comparison is relatively meagre except for several short series measured previously by Broca and Haberer[2]. Mean values of four characters for the Chinese series as well as for other racial groups are set forth in Table IV. We will notice at once that in the Chinese series, the lateral lengths are of similar order but a slight difference is found in the breadths possibly due to the fact that two samples represented came from different regions of the country. As to the inter-racial variation of these characters, the interesting facts are found:

IV. Means of transverse breadth and lateral length of the nasal bones for different races (Males)

Races	Upper breadth	Middle breadth	Lower breadth	Lateral length
a. Series:				
Chinese (Broca)	11.1	8.3	15.2	26.9
Chinese (Haberer	9.3	——	——	——
Chinese (Yen)	9.9	9.0	17.2	26.9
b. Racial groups:				
European (6)[3]	12.7	9.7	16.5	25.2
Negro (1)	12.2	9.8	18.3	24.6
Oceanic (3)	10.9	8.5	16.4	23.3
Asiatic (3)	10.7	8.6	16.4	26.6
Eskimo (1)	8.2	5.4	15.9	26.8

(a) The Europeans have a broader type of upper and middle nasal breadths, with the medium type of their lower width and lateral length.

(b) The Negro nasal bones are the widest, especially in the lower extremity, but their lengths are shorter.

1. The mean value of the right and left lateral lengths is used.

2. Broca's figures were cited from Martin's *Lehrbuch der Anthropologie*, Band II, S. 942. See also K. A. Haberer: *Schadel und Skeltteile aus Peking*, 1902.

3. The Figure in the bracket indicates the number of series averaged.

(c) Both Asiatic and Oceanic racial groups have a similar order of the medium breadths but their lateral lengths differ widely from each other, the latter group being the shortest.

(d) The Eskimo race is characterized by the narrowest type of the nasal width and medium type of the length.

The last character to be considered is the minimum breadth of the nasal bridge. The comparative data of this character are much more abundant. In 1934 Woo and Morant[1] made an extensive study on the flatness of the facial skeleton in man in which eight facial measurements including the simotic breadth were dealt with. Nearly 4000 specimens representing 83 different racial series in various parts of the world were examined. The average values of this character either derived from the Chinese series or from other racial groups are given in Table V. In the first place, we notice that the mean values for three Chinese series are not markedly divergent from

V. Means of the Minimum breadth of the nasal bridge for different races (Males)

Races	Minimum breadth of the nasal bridge	
a. Series:	Range of measurments	Mean
Chinese (Haberer)	2.0——10.0	6.9
Chinese (Woo)	3.2——12.6	7.6
Chinese (Yen)	2.0——14.5	7.2
b. Racial groups:	Range of means	Pooled mean
European (20)[2]	8.6——10.1	9.4
African (15)	6.8——11.7	9.4
Asiatic (29)	6.9——10.1	8.6
Oceanic (16)	6.5—— 9.3	8.1
American (5)	5.7—— 9.5	7.9

1. See T. L. Woo and G. M. Morant: *loc. cit*, pp. 222-226.
2. The Figure in the braket indicates the number of series averaged.

one another. The pooled means for European and African groups are of the same order but the range of the latter is greater. The constants for American and Oceanic groups are both small and differ slightly from each other. The Asiatic group holds an intermediate position between them. The value of the Kunming series falls at the upper extreme of the range of the Asiatic group.

VI. *Morphological Charactars.* In this section we will discuss some non-metric or morphological characters. These include: the form of nasal bones, the curvature of the nasal bridge, the lower edge of the nasal aperture, subnasal fossa, doubling groove, the shape of the nasal spine and asymmetry. The methods of observation in each case are mostly in accordance with those adopted by previous workers.

1. The form of nasal bones (frontal view). The form of nasal bones is subject to great racial variation. For the purpose of comparison, the human nasal forms may be arbitrarily grouped into three types[1]:

(a) Type I: In this type both upper and and lower breadths of nasal bones are much greater than the middle part—especially the lower one. Thus the form is constricted in their central portion.

(b) Type II. The nasal width increase gradually from the upper to the lower end, the narrowest part being found at the naso-frontal junction. This type is said to be frequently found in the Eskimos.

(c) Type III. The nasal bones are relatively wide with least difference between the upper and middle breadths.

In any race, the lower part of nasal bones is the widest but the upper and middle parts are various in size according to different racial series considered. The percentage distribution of three types for the Chinese specimens in both sexes is set forth in the table below:

Sex	Type I	Type II	Type III
	%	%	%
Male (68)	63.3	29.4	7.3
Female (41)	58 8	36.6	4.6
Male & female (109)	61.6	32.1	6.3

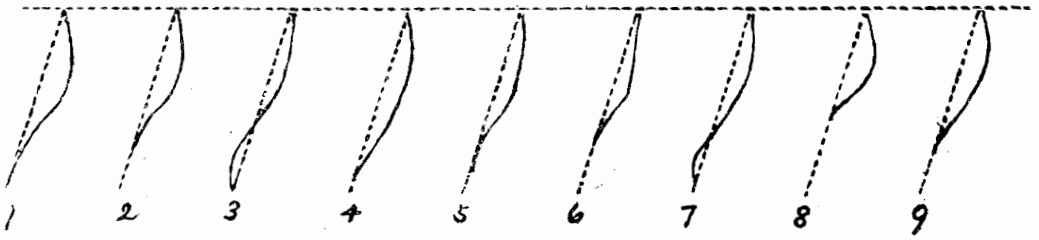
(The figures in the brackets indicate the number of cases examined).

1. Martin, R.: *Lehrbuch der Anthropologie*, Band II, S. 943-944, 1928.

It will be seen that when considering both sexes together, nearly 62 per cent of cases fall into the first type, 32 per cent into the second and only 6 per cent into the last. The sexual variation in this respect is not very marked. There should be a close correspondence between mean values of the three breadths and types classified.

2. The curvature of the nasal bridge (profile view). The curvature of the nasal bones can be precisely studied from the profile drawings of the contour. It is drawn by the use of a diagraph when the skull is orientated in such a way that the points—nasion, bregma and lambda lie in a median horizontal plane with the left norma lateralis facing up. The racial variation of the nasal curvature in the profile view was fully discussed in a paper by H. Virchow. He found nine different forms representing the types of various race[1]. It is rather unexpected that different forms as shown by Virchow can all be found in our Chinese series. These are shown in Fig I.

Fig I. Various forms of the curvature of the nasal bridge for the Kunming series (Profile view)



1. (NO. 456, M), 2. (NO. 445, M), 3. (NO. 244, M),
4. (NO. 156, M), 5. (NO. 441, M), 6. (NO. 166, F),
7. (NO. 46, M), 8. (NO. 61, F) and 9. (NO. 8, M).

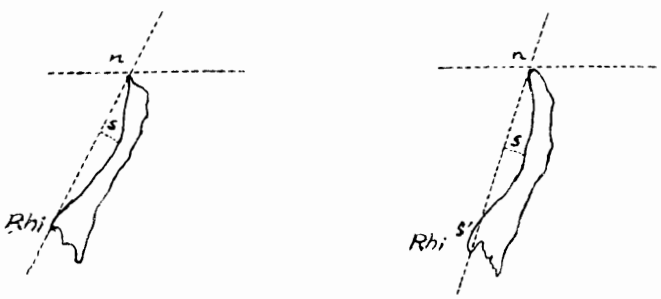
Virchow's classified forms were probably derived from a few instances instead of from an ample sample. It is quite possible that these forms may occur in the specimens of several races with different percentage distributions. For simplicity, all the forms found in our collection are classified into two types:

1. Martin, R.: *loc. cit*, Band II, S. 946.

(a) single curvature, i. e. the concave form and (b) double curvature, i. e. the superior part of the curvature being concave and its inferior part convex. Their typical forms are shown in Fig II.

Fig II. Types of the nasal bridge (Profile view)

Type I. Type II.



NO. 346 ♂ NO. 304 ♂

S=2.9mm. S=2.8mm. S'=1.0mm.

The percentages of the these two types for the series examined are given in the following table.

Sex	Single curvature	Double curvature
	%	%
Male (68)	68.5	31.5
Female (41)	50.0	50.0
Male & female (109)	61.5	38.5

From values shown above, it is clear that in males the occurrence of the first type is twice more than that of the second, but in females the percentages of two types are exactly the same. In each type the degree of the curvature is variable and this can be exactly compared by measuring the length of the subtense from the lowest point of the curvature to the line connecting two points. nasion and rhinion. In the first type, the subtense varies from 2.0 to 5.6 mms. in males, from 1.4 to 5.4 mms. in females. In the type II, the subtense of the upper concave curvature for male specimens ranges from 1.4 to 3.6 mms. and that of the lower convex curvature from 0.1 to 1.2 mms. while in females the subtense of the upper and lower curvatures varies

from 1.8 to 4.5 mms. and from 0.3 to 1.2 mms. respectively.

3. The lower edge of the piriform aperture. The lower edge of the nasal aperture which lies on the entrance of the nose and forms a crest separating the floor of the nasal cavity from the facial surface constitutes an interesting part of the morphological study of the nose. The edge of this aperture, for comparative purposes, is grouped into three grades: (a) sharp, (b) dull, and (c) untraceable[1]. A summary of percentages of three forms for both sexes is given below:

Sex	Sharp %	Dull %	Untraceable %
Male (295)	64.8	34.5	0.7
Female (143)	64.3	35.0	0.7
Male & Female (438)	64.6	34.7	0.7

From 438 specimens of both sexes, we find that there are nearly two thirds of cases (65%) with sharp edges of the nasal aperture and that a small number of instances (35%) appears with a dull or untraceable edge. The sexual difference of percentage distribution of this feature is insignificantly small. Arthur Keith[2] stated that in the most highly evolved modern skulls, the lateral margins of the nose turn inwards to the nasal spine forming a sharp lower margin at the entrance to the nose. A. N. Burkitt and G. H. S. Lightroller[3] had a full discusion in this rescept. If more abundant materials collected in an identical way were available, their theory might be quantitatively confirmed.

4. Subnasal fossae. The next feature to be considered is a fossa or groove situated below the lower margin of the piriform aperture. The degree of the fossa varies considerably in different individuals as well as races. For the present purpose, four grades of the fossa are classified and recorded on both sides of specimens. The percentage distribution of four grades for both sexes is given below:

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1. Hrdlicka, A.: *Anthropometry*, p. 115, 1920.
2. Keith, A.; *Antiquity of Man* Chapter 21, 1925.
3. Burkitt, A. N. and Lightroller, G. H. S.: "The Eveolution of the Nasal Sill," *Journal of Anatomy*, Vol. L, VII, p.295, 1923.

Sex	Small	Moderate	Large	Pronounced
	%	%	%	%
Male (266)	30.5 R	51.1 R	15.4 R	3.0 R
	31.2 L	50.4 L	15.4 L	3.0 L
Famale (138)	59.2 R	39.7 R	1.1 R	
	58.2 L	39.7 L	2.1 L	
Malle & Female (404)	40.3 R	47.2 R	10.5 R	2.0 R
	40.4 L	46.7 L	10.9 L	2.0 L

From the figures shown we will see that more than 86 per cent specimens have a small or moderate fossa. The percentages of other two grades, large or pronounced, are considerably less. The differences hetween the two sides or two sexes are both insignificant. It is of interest to note that there is some correlation between the sharpness of the lower edge of the nasal aperture and the size of the subnasal fossa. The specimens with the large or pronounced fossa are mostly accompanied with the presence of the dull or ill-defined edge of the nasal aperture. This is probably due to the pressure of the upper incisors and canine teeth[1].

5. Doubling groove. This is a groove, occasionally present, leading from the lateral margin of the piriform aperture to the entrance of the nasal sill of the floor. For the present purpose, the trait considered is simply divided into two groups, viz. simple from and doubling groove. Observations are separately made on both sides of the nasal bones. In the following table is provided a summary of occurrences and percentages on the character in the series examined.

Sex	Simple form	Doubling groove
	%	%
Male (293)	95.8 R	4.2 R
	96.3 L	3.7 L
Female (143)	97.9 R	2.1 R
	98.6 L	1.4 L
Male and Female (441)	96.5 R	3.5 R
	97.0 L	3.0 L

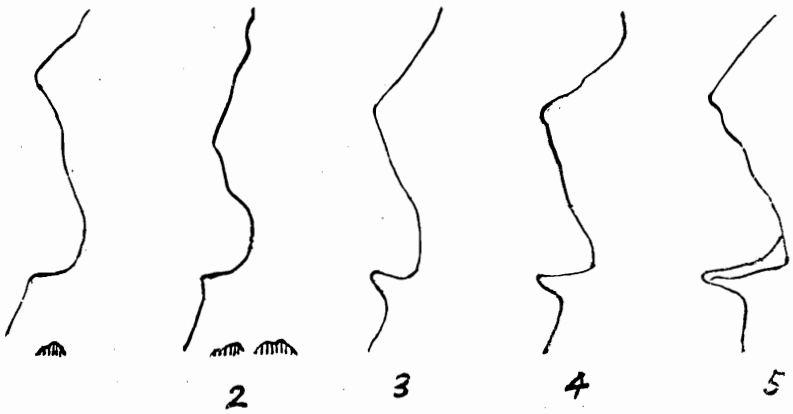
From 441 specimens observed, a very high percentage (96%) of incidence falls into the first group, while there are only less than five per cent of cases

1. Burkitt, A. N. and Lightroller, G. H. S.; *loc cit.*

which should belong to the second group. No significant difference of percentages is found between the two sides as well as sexes. The doubling groove or gutter occurs frequently in the specimen of the anthropoid apes but is scarcely present in that of modern races. A small percentage of incidence occurred simply indicates that a few specimens of this series still retain some traces of our simian heritage.

6. Shape of the nasal spine. The form of the anterior nasal spine for the present series is observed by the use of Broca's scheme[1]. His five different forms are reproduced in Fig III.

Fig III. Broca's scheme for classifying shapes of the anterior nasal spine



The nasal spine is a bony elevations, on which the front part of the septum is set. The further reduction of the front teeth in modern man has caused still greater exposure of the nasal spine. The percentages of different forms for 364 Chinese specimens observed are set forth in the table below:

Sex	Forms: I %	II %	III %	IV %	V %
Male (231)	67.5	21.5	9.0	2.0	—
Female (110)	74.0	20.2	5.0	0.8	—
Male & Female (364)	69.5	21.1	7.8	1.6	—

1. Martin, R.: *Loc. cit.*, s. 948.

It is of interest to note that a high percentage (90%) is found in the first two forms and there are only 10 per cent of cases which falls into the third and forth forms But none belong to the fifth form. Sexual differentiation in this feature is again insignificantly small.

7. *Asymmetry.* With regard to the asymmetrical problem of the nasal skeleton, four observations are separately made on various parts of the specimen, i. e. upper and lower free ends of the internasal suture, nasal septum and the dimension of the entire bones. In each case the following three descriptive terms—(a) symmetry ,(b) right dominance, (c) left dominance are adopted throughout. A median sagittal line from nasion to nasospinale is used as an arbitrary division in recording observations. A summary of occurrence with its percentage of observations made in four parts of nasals is shown below:

Parts observed	Sex	Symmetry	Right dominance	Left dominance
		%	%	%
Upper end of internasal suture	Male (86)	51.4	22.9	25.7
	Female (41)	50.0	22.5	27.5
	Male & Female (109)	50.9	22.7	26.4
Lower end of internasal suture	Male (68)	18.6	10.0	71.4
	Female (41)	37.5	7.5	55.0
	Male & Female (109)	25.7	9.1	65.2
Nasal septum	Male (275)	21.5	46.1	32.4
	Female (135)	27.5	40.7	31.9
	Male & Female (410)	23.5	44.3	32.2
Entire bones	Male (68)	28.1	40.9	31.0
	Female (41)	25.0	50.0	25.0
	Male & Female (109)	26.9	44.3	28.7

It is clearly seen that the location of the upper extremity of internasal suture is frequently found in the median line, but that of the lower one found on the

left side. In the cases of the nasal septum and entire nasal bones, nearly 44 per cent of cases are found in the favour of the right side. The sexual difference of percentage distribution is not very marked except the lower end of internasal suture in which we find more symmetrical cases in females.

VII. *Anomalies.* The nasal bone may, by irregularity of ossification, and other causes, show several kinds of anomalies[1]. Those found in specimens of this series are described below:

1. Nasal bones being encroached upon and replaced by the frontal processes of the maxillæ. This anomaly was found in six cases (No. 239, M; No. 282, F; No. 345, F; No. 296, M; No. 299, M; and No. 218, F.). The state of reduction in the first three cases appears to be similar. The upper part of a single nasal bone has been constricted to a minimum width and replaced by the medial part of the frontal process of the maxillæ on the same side. In the ~~last~~ remaining three cases, the condition of the reduction is almost similar except that both bones are affected. The space at the superior part of the nasal bridge is replaced by the extension of two frontal processes which are united together in the median plane above the nasals with different lengths of the abnormal inter-maxillary suture. In the last case, the suture referred to is longer than in any other cases.

2. Nasal bones are represented by a narrow median crest. We found two specimens (No. 371, M and No. 257, F) which should belong to this group. In both cases, the nasal bones on one or both sides are represented by a narrow median crest.

3. Obliteration of the internasal suture. It has frequently been stated by anatomists that fusion of the nasal bones by obliteration of the internasal suture is occasionally, but rarely, met with. There is only one case (No. 224, M) to be found in our series. In this case the lower free end of the nasal bones is incomplete probably due to *postmortem* destruction and its internal suture is entirely obliterated.

4. Absence of nasal bones. The complete absence of the nasals has very rarely been found in specimens of some races. In our collection, this

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1. Quain's *Anatomy*, vol. IV, part I, p, 83, and Piersol; *Human Anatomy*, p. 209.

condition is represented by only one specimen (No. 111, F) in which her nasal bones are completely absent and their place is taken by the frontal processes of the maxillæ. There is another doubtful case (No. 219, F) in which two nasals are also absent, but with a vertical plate of the ethmoid coming to the surface between the maxillæ.

5. Long extension of nasals. This condition was seen in one specimen (No. 449, M) in which his left nasal extends downwards, about 2.5 cm in length, on the lateral margin of the apertura piriformis. In view of the sharpness of the fissure and natural formation of the bone, the condition, it seems, is hardly due to the cause of a pathological fracture.

6. Obliteration of the naso-maxillary suture. The incidence of this anomaly was only found in one specimen (No. 135, F). In this case the lower parts of the nasal bones are both defective due to posthumous destruction. The left naso-maxillary suture had entirely disappeared. At first sight, one might have thought it was replaced by the process of the maxillæ. After a careful examination of its inner surface, however, a part of the traceable suture was found, so that this might be a case of the obliteration of the naso-maxillary suture.

VIII. *Summary*. The present investigation of the nasal skeleton feature was based on the material of 500 Chinese crania obtained from the neighbourhood of Kunming. Both anthropometric measurements and morphological observations were made on various parts of bones.

The sexual difference is considerably marked in several metric characters studied. The male nasal skeleton is higher and wider and his bridge is longer but the widths are slightly narrower. The index indicating the general shape of the nose is significantly smaller in males.

The racial comparisons of eight nasal characters are quite interesting. In the case of the nasal height, breadth, and the resulting index, the regional differences among various Chinese series are not very marked. The Chinese nasal shapes for all the series, prehistoric or modern, northern and southern, belong to the mesorrhine type. Among characters of the nasal bridge, there is only a small difference to be observed between the Kunming series and those from other regions. Four nasal chords of the Chinese series are definitely wider than those of the Eskimo and some of the other Asiatic and

Oceanic races, but with a few exceptions they are narrower than the European and Negro types.

The form of the Chinese nasal bones in the frontal view is dominant in the first type, i.e. both upper and lower widths are broader than the middle, and the curvature of the bridge is again dominant in the first type or in the simple concave form. Other morphological characters are also of interest. The Chinese nasal bones are characterized by the sharp lower edge of the aperture, small and median subnasal fossæ, first and second forms of the spine in Borca's scale, Very few doubling grooves are found. Their internasal suture in the majority of cases starts in the median line and then gradually turns to the left side. The entire size of nasals as well as the nasal septum are accordingly larger on the right side.

Among various anomalies examined on our specimens, there are several cases in which the superior part of nasals has been encroached upon and replaced by the frontal process or taken by a narrow median crest. Only one case was found in each of the following abnormal conditions: obliteration of the internasal suture, entire absence of nasal bones, a long extension of nasals and obliteration of the naso-maxillary suture. Altogether, the incidence of different anomalies found amounts to 2.8 percent of the total cases.

In conclusion I should like to express my great gratitude to Dr. S. N. Fu for permitting me to undertake this research in the institute, to Dr. T. L. Woo for aid in many ways during the course of the study.

Appendix I. Constants of mean measurements of the Chinese nasal skeleton for the Kunming series (in m.m.)

Characters	Males					Females				
	Number	Range	Mean	Standard deviation	Coefficient of variation	Number	Range	Mean	Standard deviation	Coefficient of variation
Absolute measurements:										
1. nasal height	284	38.0—62.0	53.0±0.1	3.5±0.1	6.60±0.19	128	37.0—56.0	48.3±0.2	3.3±0.1	6.83±0.28
2. nasal breadth	242	20.5—35.0	26.0±0.08	2.0±0.06	7.69±0.24	109	20.0—31.0	24.9±0.1	2.1±0.1	8.43±0.39
3. chord: nasion-rhinion	76	18.5—32 0	25.8±0.2	2.6±0.1	10.08±0.56	45	17.0—29.0	23.3±0.3	2.9±0.2	12.45±0.90
4. chord: rhnion-nasospinale	77	24.0—35.0	29.7±0.2	2.3±0.1	7.74±0.42	46	20.0—31.0	26.6±0.2	2.3±0.2	8.65±0.61
5. Arc: nasion-rhinion	75	20.0—35.0	27.4±0.2	2.8±0.2	10 22±0.57	44	18.5—29.5	24.7±0.3	2.8±0.2	11.34±0.83
6. Minimum breadth	266	2.0—14.5	7.2±0.07	1.9±0.06	26.39±0.82	117	3.0—11.0	7.5±0.1	1.7±0.07	22.67±0.05
7. Upper breadth	292	3.0—19.0	9.9±0.1	2.6±0.07	26.26±0.78	133	2.0—19.0	9.4±0.2	2.6±0.1	27.66±1.23
8. Middle breadth	76	5.0—13.5	9.0±0.1	1.8±0.1	20.00±1.14	45	4.5—13.0	9.1±0.2	1.6±0.1	17.58±1.29
9. Lower breadth	86	14.0—22.0	7.2±0.1	1.7±0.09	9.88±0.51	42	11.0—21.0	16.9±0.2	2.0±0.1	11.63±0.88
10. Right lateral length	107	18.5—34.5	26.6±0.2	3.1±0.01	11.65±0.54	51	18.0—29.0	23.6±0.2	2.4±0.2	10.17±0.69
11. Left lateral length	101	18.5—35.0	27.1±0.2	3.2±0.2	11.81±0.57	46	18.0—29.0	23.8±0.2	2.4±0.2	10.08±0.72
Relative measurements:										
12. Nasal index	241	35.77—73.68	49.24±0.22	5.09±0.16	10.34±0.33	106	42.72 - 66.67	52.12±0 34	5.15±0.24	9.83±0.46
13. Arc-chord index	75	84.75—100	94.46±0.22	2.78±0.15	2.94±0.16	44	89.29—100.0	94.28±0.30	2.99±0.21	3.17±0.23
14. Transverse nasal index A	76	66.67—230	115.12±2.16	27.95±1.53	24.28±1.40	45	70.00—165.22	114.97±2.10	20.85±1.48	18.14±1.33
15. Transverse nasal index B	85	17.07—100	59.21±0.98	13.35±0.69	22.55±1.22	42	26.67—111.76	61.45±1.64	15.45±1.14	25.14±1.96
16. Transverse nasal index C	73	24.39—71.43	52.59±0.74	9.38±0.52	17.84±1.03	42	40.00—78.79	54.82±0.86	8.23±0.61	15.10±1.14