

The genetics of the Australian aborigines

R. Ruggles Gates

Having studied many human races and their hybrids, it was very desirable to obtain some knowledge of the genetics of races in the Southern Hemisphere south of Asia, and particularly in Australia, New Guinea and New Zealand. The present paper will be devoted to a study of the Australian aborigines and their hybrids with other races. The results have led to some striking changes of viewpoint regarding the origin and relationships of this remarkable race which may be now approaching extinction as a "pure" race. These matters will be discussed after some personal observations of the aborigines and their hybrids have been presented.

My wife and I landed at Perth in Western Australia in July 1958 and spent about three months on the continent, travelling some 10,000 miles by train, bus and plane. We were taken to Armendale School, about 20 miles from Perth, where the Headmaster, Mr. Walker, showed us several of the classes. A number of the students were of mixed aboriginal descent. For instance, in Fig. 1, counting from the left, numbers 1, 2, 5 and 7 have aboriginal ancestry. Number 1 (shown also in Fig. 2, on the right, with blue eyes and fair hair) is completely assimilated into the white population. There is no racial character distinguishing her from the girl of purely white descent but with darker hair, on the left. Number 2 (shown also in Fig. 2A) had very curly hair, markedly sunken orbits, a large mouth and a little more skin colour than a European, these being remnants of the aboriginal characters. She won a prize for athletics. The sunken orbits appear to be the most persistent aboriginal feature in crosses with whites. Numbers 5 and 7 in Fig. 1 are also recognizable as differing in certain respects from the usual European and showing certain other combinations of the racial differences. It is obvious that segregation and recombination of the various racial characters has taken place.

From Perth to Adelaide, the capital of South Australia, is a distance of over 1600 miles. An excellent modern train crosses the Nullarbor Plain, a treeless desert of great aridity in South Australia. After various preparations, we moved northwards from Adelaide a thousand miles, by a less comfortable train, to Alice Springs in the heart of the Central Australian desert — a three day journey. Here is the centre of

the gr̄eat Arunta (now Áranda) tribe made famous by the work of Spencer and Gillen (1899). In the summer of 1896-7 large numbers of natives gathered at Alice Springs to perform the series of ceremonies called Engwura which lasted over three months. These were witnessed by Spencer and Gillen who described the elaborate ceremonial life of the aborigines. Sir Baldwin Spencer afterwards published other extensive studies of the Arunta and Luritcha tribes, showing great insight regarding their mentality, magic, witchcraft, corroborees and cannibalism. Some then wore nose plugs, as is still the case with the natives of New Guinea. Here, in isolation on the Australian continent a type of mentality survived, of which there are hints in the Paleolithic archeology of Europe. From which it appears that psychological traits may be at least as persistent as physical characters. Under the control of the old men of the tribe, the young of each generation are indoctrinated in the folklore, traditions and religion of the tribe, the severest possible initiation ceremonies serving to burn these things into their memories.

Alice Springs, just south of the tropic of Capricorn, in the centre of the continent, has essentially a tropical desert climate with hot days and cool or chilly nights. The mean daily minimum temperature in July (winter) is 40°F. and the daily maximum temperature in January (summer) is 95°F. The town, now of some 11000 inhabitants, is on a plateau about 1900 feet above sea-level and dominated by the Macdonnell Ranges. It is roughly surrounded by a ring of mountains with several breaks — Heavitree Gap, Simpson's Gap, Emily Gap — through which rivers flow inwards after heavy rains on the outer mountains. These rivers are generally dry sandy river beds, often containing large Eucalyptus trees. The Todd river, which runs through the town, and is crossed by a viaduct for pedestrians only, is subject to one or two flash floods in a year.

The original Alice Springs, founded in 1871, was three miles from the present town and now serves as a native reserve housing 300-400 aborigines, many of them of mixed descent. The first building, which still stands, was built in 1876 as a fortress for protection in the early days against attacks by hostile tribes. The first contacts with the white man began thus only some 80 years ago, so there has only been time for three generations of descendants from the first crosses. In another generation the results would have been much more difficult or impossible to record. Three generations of descendants from an original cross are necessary for a definite genetical interpretation.

In the primary school, which was visited several times, there were approximately 350 pupils under the Head Mistress, Miss Kathleen Cormier, who gave valuable assistance in locating families, as well as Sister Arlene Heath, in the Welfare Department. Fifty-two percent of the school children were of mixed descent. Captain C. L. Steep, in charge of St. Mary's (Church Army) Hostel at Heavitree Gap, also gave much assistance. In the town itself and its vicinity large numbers of Áranda are much in evidence, roaming the streets and engaged in various occupations, including street-cleaning, but living mainly outside the town.

Physique of the Australian aborigines

There are still many thousands of aborigines scattered in various parts of the Australian continent, especially in the north and west. The number in the whole Northern Territory of Australia is now estimated at 18,000. Many live their lives without contact with the white man. They are entirely naked and live a nomadic hunter's life, the women using a digging stick for roots and bulbs and grubs as their contribution to the food supplies. No other people on earth live with so few artifacts, a necessary feature of nomadism under extreme desert conditions. No other people could survive in such a severe and austere environment. Even these people may occasionally acquire knives or other articles from accidental direct or indirect contact with whites, which they usually avoid. In general they prefer to maintain undisturbed their own customs, methods and beliefs. They are, however, a remnant ultimately destined to disappear or to adopt some of the white man's ways.

All aborigines within a radius from white towns and settlements wear clothing, often the castoff and more or less dishevelled clothing of the white man. This applies equally to full-bloods and mixed breeds. With this goes employment in cattle stations and on sheep farms and as labourers in various capacities in the towns and villages. The "wild" natives construct only the most flimsy wind breaks or shelters. Some dig a hole, anywhere out in the open, for shelter, others crawl under boulders or dig themselves into dry river-bed sand. All seemingly like to take their many dogs to sleep with them for additional warmth. They generally prefer to sleep in the open with a fire. The shelter shown in Fig. 3 was made by a native, Walter Ebateringa, whose father was full-blood, his mother halfcaste. He is therefore three-quarters aborigine. He and his wife, Cordella, of pure aboriginal descent, are both artists in water colours. Their daughter Juliana is shown in Fig. 4. This shelter is much more elaborate than the "wild" natives construct.

At the village reserve called Bungalo, about 2 miles from Alice Springs, the conditions in which the full-blood natives live in huts and shelters of their own construction is shown in Fig. 5. Some are essentially like tents, others composed largely of cast-off corrugated sheet iron and oil-tins beaten out into sheets. Of course, in the tropical climate greater protection is unnecessary although in the winter season the nights can be quite cold. These photographs also show several women with their children, all belonging to the local *Áranda* (*Arunta*) tribe.

Fig. 6 represents an *Áranda* woman, Naomi, with her full-blood child. The generally streaky character of the children's tawny hair is well shown. Fig. 6A, in black and white, is a nearer view showing the characteristic features of the mother. Her eye colour was 4 (Martin scale), skin colour 2 (Gates scale), with slight brow ridges but sunken orbits and retreating glabella. Hair very dark brown but with locks of light brown. Head L 167, B 131, C.I. 78.44. Ears 55.1 × 27.3, no lobe. Some adult *Áranda* women retain some of the tawny hair colour. Fig. 7 shows a full-blood *Áranda* man named Pacy, about 30 years old. He had projecting brows; sunken orbits; long,

black, wavy hair, full beard and moustache. Eye colour 4, skin colour 2. L 198, B 140, C.I. 70.7. Ears 67×35.1 , with lobe. In Fig. 8 we see the kindergarten at Bungalo with their teacher and two white children. The great range of hair colour is well shown. The native population of Bungalo was about 240.

A considerable number of the Pintubi tribe, men, women and children, were brought by the Government from their home territory at Haast's Bluff, 168 miles southwest of Alice Springs, by truck to Bungalo to be examined for tuberculosis and other diseases. As they were just leaving, to be returned to Haast's Bluff, when we were arriving, it was only possible to study one man carefully. This was Marunka (Fig. 9). As the photograph shows, the middle face appears to be "pinched up", making the nasal notch very deep, the nose also appearing shorter than in the *Áranda*. This may represent in part a tribal difference. A thick band of human hair string was wound tightly around his scalp. A unique feature was a slight fringe of hair on the ear rims resembling that described especially in some Italians and Goans (Gates 1957), but much shorter, the hairs little longer than fuzz. It may of course have been kept short by trimming. The hairs extended around only a small portion of the ear rim. The frequency of this condition in the Pintubi or the adjacent *Aranda* tribe is quite unknown.

Marunka has a full moustache (trimmed) and beard, heavy cheek folds, extremely broad nostrils and a \pm everted lower lip. Some of these features may be characteristic of the Pintubi tribe. His further description was as follows: Heavy brow ridges, retreating glabella, orbits sunken and depressed root of the nose. These features give the ferocious appearance which is so characteristic of the native Australian face, but which completely belies his friendly and good-natured disposition. Eyes 4 in Martin's colour scale; skin near 2 in Gates colour scale but more red. Hair near black, wavy. L 201, B 140, C.I. 69.65. Ears 59×33.2 mm.

A Pintubi woman with her young child (Fig. 10), was photographed as they were boarding the truck. It is notable as showing the near white but pinkish skin colour of the infant, and its almost flaxen, very light-tawny hair.¹ This seems to show that the dark skin colour of the adults is, in a sense, largely a matter of tanning, a condition which will be referred to again later.

The native settlement at Haast's Bluff numbers at least 500 full-bloods, mainly Pintubi, Pitjantjara and *Ngalia* with a few *Aranda*. At the Hermansburg Mission, about 150 miles west of Alice Springs, there were about 420 natives, mainly *Áranda*,

¹ Taplin (1879), a missionary who came to the colony of Southern Australia in 1849, gives a full account of the Narrinyeri tribe in which he states (p. 15) that "when native children are first born they are nearly as white as Europeans. It is difficult for an inexperienced person to tell whether they are half-caste or not. The sign by which this may be known, is a smutty appearance in the pure aboriginal infant just on the upper part of the forehead, as if a smutty hand had been laid there". Smyth (1878) also says regarding the natives of Victoria (p. 21), "The children of a half-caste female and a white man are not to be distinguished from children of European parents". Subsequent readers have assumed that these statements about infants with near-white skin were exaggerations, but they are plain statements of fact. Matthew (1889) says "The newborn baby is singularly fair but becomes gradually darker with age".

but some Pitjantjara, Loritja and a few Ngalia, about 150 of them of mixed descent. Peter Wunia, 35 years old, Brinkin tribe, Daly River area (Fig. 11) has hair black and curly, body hairless, skin black or dark reddish brown according to the light in which it is viewed, prominent brow ridges, sunken orbits, rather narrow nose, and ears attached to cheek, with no lobe. Fig. 11 was taken at the Bagot Settlement, adjacent to the Gretta Dixon Home (for children), showing his fine muscular development.

At the Bagot Settlement, about six miles from Darwin, the natives are supported by the Government. Fig. 12 shows two pureblood natives of the Tiwi tribe from Melville Island, off the coast north of Darwin. Some of them have darker skin colour, nearer black than the usual chocolate-red colour. In how far this difference is environmental in origin is at present difficult to say. Both men have little or no body hair and deeply sunken orbits. The older man on the left shows body scarifications, curly hair and a grey beard. These men and others were engaged in gambling with cards. The Government has been criticized for allowing aborigines to live in idleness and spend their time gambling, at which they are as expert as the whites. However, there are circumstances in which it is at least temporarily impossible to find work for them. On the whole, there is little to criticize in the Australian Government policy with regard to the aborigines. The officials have the welfare of the natives, both pure and mixed, deeply at heart, with a view to both the present and the future. This will be referred to again later. The friendliness of the natives for the whites and vice versa is an indication of optimum racial relations. The feelings engendered by the Civil War in America still prevent such friendly interracial relations. Of course, the great difference in relative numbers of the races in the States of North and South is also important.

Here may be inserted the physical measurements of Walter Ebatarinja (Fig. 3), age 43. Eyes $\#4$, skin nearest $\#2$ but more reddish. Hair black, wavy, slight greying, eyelashes black, eyebrows slight, dark brown. Brow ridges not marked, forehead high. Head L 189, B 151, C.I. 79.89: Ears 67.9×34.3 with very big lobe. Cordella, his wife, age ca. 32, is a pure aborigine. Her father is an old man living at the Hermansburg Mission. Her eyes are $\#4$, skin colour between $\#2$ and $\#3$. Hair dark brown, wavy, tips lighter brown (her hair would have been tawny as a child), eyelashes black, eyebrows slight, near black. Forehead \pm sloping, nasal root depressed, orbits sunken (full nasal notch). L 188, B 141, C.I. 75.00, ears 69.1×28.8 long and narrow, with big lobe.

The elder daughter, Juliana, age 6 (Fig. 4), has eyes $\#4$, skin lighter than $\#2$, less red than $\#3$, darker than $\#4$. Her hair is medium brown, some parts tawny, eyelashes long and black, eyebrows very dark brown. She has the features of the aborigines with a deep nasal notch. The lower lip is everted. Ears large for her age, 60.7×30 with a big lobe. The youngest daughter Ruth, ca. $3\frac{1}{2}$ years old, has eyes $\#4$, skin between $\#3$ and $\#4$, lighter than the parents, hair tawny mixed with light brown, eyelashes black, eyebrows slight, light brown. Full nasal notch and big ear lobes.

The father's head is just on the border of brachycephaly, which is unusual in the aborigines, while the mother is at the lower limit of mesocephaly. She also has longer ears than her husband, which again is unusual.

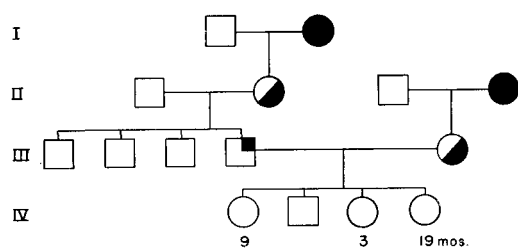
Genetics of race crossing

From a study of many racial crosses in different parts of the world, the view has been reached (Gates 1959b) that each racial character-difference depends on a small number of additive genes, generally of the order of five or less. This hypothesis is proving fruitful in the genetic analysis of various race hybrids. The conception of dominance in racial hybrids was already being abandoned in connection with studies of Negro \times Chinese (Gates 1956). One finds no necessity for the conception of dominance in hybrids of the Australian aborigines with Caucasians or Chinese, although superficially the F_1 may appear to be nearer the European or the Chinese type. Indeed, the aboriginal hybrids contain many surprises both in F_1 and later generations. The Gates colour chart, which was derived entirely from Negro \times White, was found (Gates 1958) to apply generally to other African races. As might be expected,

it does not apply so well to hybrids of the Australian aborigines, whose skin-colour genes are basically different.

It has been stated, but without supporting evidence, that the aboriginal hybrids show blending inheritance rather than genetic segregation. That, however, is a complete misconception, and the results here recorded show that segregation occurs regularly, based on a small number of genes for each racial character.

In many of the colour photographs which follow, of families in or near Alice



Textfigure 1

Springs, one of the parents is an F_1 . For instance, in Fig. 20 the mother, Mrs. Sc, was a first generation cross, her mother being full-blood aborigine and her father white. Her husband was of mixed descent, one-quarter aborigine, as shown in Textfig. 1. He was away working at a cattle station and could not be seen, but his brother (III.2), who worked at a warehouse, was observed. This brother, who wears glasses, has a near white skin, black hair and light brown eyes. The aboriginal nasal notch is half represented. Mrs. Sc. is shown with three of her four children in Fig. 20. Their physical characters are compared in Table I. The mother was born Oct. 10, 1926 and her features are as follows: Skin colour nearest $\#4$, but reddish; eye colour $\#3$; hair black, \pm wavy, eyebrows dark brown, eyelashes black; $3/4$ nasal notch. Head L 185, B 141, C.I. 76.22. Ears 59.5×29.8 , with small lobe. She is thus essentially intermediate in racial characters so far as can be judged.

Of the four children of Mrs. Sc., the eldest was born Sept. 10, 1949, and was 9 years old. Her eyes $\#3$, skin pure white, as shown in Fig. 20, arms \pm tanned, hair medium brown, slightly wavy, eyelashes black, eyebrows dark brown. The nasal root is but slightly depressed and the orbits slightly sunken. Her features are otherwise

Table I. Sc. Family, $F_1 \times \frac{1}{4}$ aborigine (See Fig. 13)

	Age	Eyes	Skin	Hair	Eyelashes	Eyebrows	Brow ridges	Nasal root	Nostrils	Orbits	L	B	C.I.	Ears
F_1 mother	32	3	nearest 4, but reddish	black, \pm wavy	black	dark brown	none	$\frac{3}{4}$ depressed	intermed.	\pm sunken	185	141	76.22	59.5 \times 29.8 with small lobe
Daughter	9	3	white	med. brown, sl. wavy	black	dark brown	none	sl. depressed	not broad	sl. sunken	—	—	—	—
Daughter	3	4	5, cheeks pink	med. brown, tawny streaks	black	medium brown	none	\pm depressed	intermed.	sl. sunken	—	—	—	50 \times 29.9
Baby	19 mos.	3	near 4, more red	dark brown, wavy	black	brown	present	not depressed	intermed.	\pm sunken	—	—	—	—

Table II. Pa. Family, $F_1 \times$ white

	Age	Eyes	Skin	Hair	Lashes	Eyebrows	Brow ridges	Nasal root	Nostrils	L	B	C.I.	Ears
F_1 mother	50	5	4-5 reddish	v. dark brown	dark	dark brown	none	not depressed	broad	190	152	80.00	67.4 \times 34 big lobe
daughter	14	4	5-6, no fit	v. dark brown	d. brown	near black	none	ca. $\frac{1}{2}$ depressed	intermed.	195	147	75.38	55.5 \times 28.2 lobe
son	13	6	nearest 5 ²	rather d. brown	d. brown	brown	none	ca. $\frac{1}{2}$ depressed	not broad	184	147	79.89	59.8 \times 35.1 small lobe
daughter	12	3	near 6, ³	light reddish ⁴ brown	brown	v. light brown	none	$\frac{1}{4}$ depressed	narrow	186	143	76.88	61 \times 37 free lobe

² Skin colour, forehead nearest 5, cheeks lighter but slightly reddish, not yellowish (not fitting the colour chart).

³ More reddish, with few freckles.

⁴ Very peculiar colour, with a trace of tawny.

completely European, and the ordinary observer would certainly consider her as such. The next child, a boy, was in a hospital and could not be examined. The third child, Joan, was born Sept. 17, 1955. Her eyes were deep brown, skin $\#5$, cheeks pink, hair medium brown with tawny streaks, eyelashes black, eyebrows medium brown. The nasal notch was partly represented, and the ears were 50×29.9 mm. The baby, 19 months old, had very dark brown eyes, skin near $\#4$ but more red; hair dark brown, wavy; eyelashes black, eyebrows brown. No nasal notch, but brow ridges and somewhat sunken orbits. All these children could easily pass for pure white.

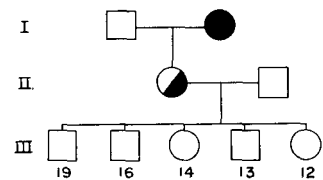
As regards skin colour, the results are very different from Negro \times White crosses. Instead of four cumulative genes for skin colour as in the Negro (Gates 1958), the melanin in this family can be accounted for by two genes, one of them producing most of the colour, the other very little.

This family had recently (three weeks ago) moved into a newly constructed very modern house built by the Government as part of a large housing development for families of mixed descent. Besides large areas of glass walls and large windows, making the house full of sunlight, there was good modern furniture and a fireplace. The house was clean and tidy and the rent low. Nor was this house exceptional in the area. Some of the other families here described lived in the same area.

In the Pa. family, the grandmother (Text figure 2) was pure aborigine, the grand-father white. The daughter, Mrs. Pa., F_1 , went to Adelaide when 12 years of age and grew up with a white family. When 26 she returned to Alice Springs and married a Scot with dark eyes and black hair. Her eyes were $\#5$, her hair reddish as a girl, now very dark brown with some grey, eyelashes dark, eyebrows dark brown. Skin colour 4-5 but more reddish. There were no brow ridges and the nasal root was not depressed. Her nostrils were broad, the nasal tip overhanging (this feature is generally more marked in Papuans). Measurements are shown in Table II. Mrs. Pa. was a pleasant, good-mannered woman, well reared in a Christian family in Adelaide. Her children were all lighter than she, as might be expected. No photograph is available. The eldest boy won a scholarship for the Intermediate examination but decided to go to work instead of to High School. He was not at home and the second son was working on a sheep station.

The daughter, 14 years old, was learning typing and domestic art at the new High School. See Table II for measurements of the three children. The third son was studying commercial subjects at High School and wants to become an electrician. The youngest daughter, aged 12, is in Primary School, 7th grade.

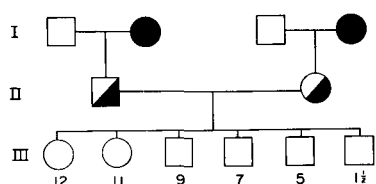
Comparing these three children with each other and with their mother, two had darker eyes ($\#4$ and $\#3$) and the son lighter eyes ($\#6$) than the mother. All three had lighter skin than the mother, but differing slightly from each other. The youngest daughter had hair colour, eyelashes and eyebrows definitely lighter than the other two children or the mother. The children seemed to show some depression of the nasal



Textfigure 2

base, which did not appear in the mother. The children all had narrower nostrils, in different degrees, than the mother. Brow ridges were absent in all. No conclusions can be drawn from the head dimensions without measurements of the father's head, but the two daughters are decidedly more mesocephalic than the son, who very closely approaches his mother's brachycephaly. It will be noticed that the eldest daughter and the son agree in head width, the daughter's head being much longer. The two daughters, whose C.I.'s were so similar, differ markedly in ear dimensions, the younger daughter having larger ears but a smaller head. The smaller size of the ears in all three children can be accounted for by their younger ages (Gates, 1954, 1958).

Text figure 3 represents an F_2 , the An. family. Both parents were F_1 's, having an aboriginal mother and a father of the white race. The parents with their six children are shown in Fig. 13. Their traits are recorded in Table III. It has generally been impossible to obtain an F_2 of a racial cross, with both parents and all the children.



Textfigure 3

This lends especial value to the present family. Genetic segregation is abundantly shown. It will be noticed that both F_1 parents have dark brown eyes ($\#4$) while in two of the children they are slightly darker,⁵ two slightly lighter, one son having hazel ($\#8$) and one daughter pure blue ($\#15$) eyes. At least one of the white grandfathers must have had blue eyes. It may be noted that the F_1 parents were extraordinarily alike in all their racial characters, being essentially intermediate between the races. The difference in brow ridges is a sexual one. The nostrils are broader in the father, but this may also be a sexual difference, as well as the more vertical forehead of the mother. The much larger head of the father is accompanied by dolichocephaly, while the mother is definitely brachycephalic. It will be noticed that both parents have practically the same head breadth, the father's head being much longer. We might have a clue to the origin of the brachycephaly if we knew the C.I. of the white grandfathers. This is another case in which a gene affecting only head length appears to be present. The parents have ears of medium size. The somewhat smaller ears of the mother, with no lobe, denotes a sex difference of general occurrence in all races.

In skin colour, one daughter and one son are essentially the same as their parents, two sons (9 years and $1\frac{1}{2}$) have white skin and fair hair, a third son (5 years) being slightly more brunet in skin and hair colour. The daughter (12 years) with blue eyes has also white skin tanned somewhat red. Thus two children have the intermediate (darker) skin colour of their parents while the remaining four have white skin, one of them (age 5) being brunet white. It thus appears that the parents were heterozygous for one main gene for skin pigmentation and a slight one producing brunet colouring. This reinforces the conclusion already drawn from the Sc. family. It shows a remarkable contrast with the genetics of skin pigmentation in Africans.

⁵ The difference between 3 and 4 in the eye colour scale is so slight that it is probably not significant.

Clearly, the two systems must have evolved independently. In this family the dark daughter (age 11), who is slightly darker than her brother (age 7) may have an additional gene for brunetness, the son age 5 having only the brunet gene, perhaps in double dose.

In hair form, parents and children all seem closely similar, i.e. lightly wavy. There is no evidence of genetic segregation in this respect. What this uniformity means is not clear, for there is much variation in hair form of the pure aborigines. In hair colour, however, the children range from light brown (daughter 12 years) to medium brown (daughter 11 years), lighter medium brown (son 7 years), to very light brown or blond (the other three sons) except that the 5 year old son appears slightly more pigmented. Probably not more than two genes in homozygous or heterozygous combinations are required here. If the hair colour of the two white grandfathers were known it would doubtless aid in an analysis. It may be recognized that hair colour, unlike skin colour, is not appreciably altered by exposure to the sun. It was recognized that one of the white grandfathers must have had blue eyes. One must also have had fair hair.

It will be observed that lighter hair colour is generally accompanied by brown rather than black eyelashes, the youngest child being an apparent exception. The same applies to the eyebrows without exception but in later families it will be seen that the colour of hair, eyelashes and eyebrows behaves more or less independently.

As already noted, the presence of brow ridges is a usual sex difference in many races. Sunken orbits is one of the most marked features of the aboriginal skull. They are present in both the parents of this family and to varying degrees in all the children. The conception of dominance seems to apply here if anywhere in racial crosses. No other feature is equally persistent, but it too can disappear in some of the descendants of an aboriginal cross (Fig. 2). A closely related feature is the depressed root of the nose, which is equally characteristic of the aboriginal cranium. These features will be considered later. In the F_1 it is partly expressed and it is shown in varying degrees in this family of children. But as a depressed nasal root is characteristic of infants the interpretation here is not clear. Probably not more than two or three cumulative genes are involved. Broad nostrils are characteristic of the aboriginal of both sexes. This feature is more marked in the F_1 father here than in his F_1 wife. Various intermediate grades occur in the children, but the data are not sufficient for an analysis in terms of genes, except to say that a very small number is indicated. The sloping forehead of the aboriginal cranium will be considered later.

The cephalic index of the father of this family is 73.2 and of the mother 80.6. Her brachycephaly might be understood if we knew the C.I. of her white father. The three eldest children are rather closely similar in C.I. to the mother, the fourth child (a son) is closely like the father, while the fifth child (also a son) is surprisingly far higher (87) in C.I. than either parent. It will be noticed that his head-breadth (134mm) is in the usual range (but high for his age), the extreme brachycephaly resulting from a very *short* head. There is other evidence that a single gene may produce a marked decrease in head-length without affecting the breadth. Much work

on the inheritance elements concerned with the C.I., which need not be reviewed here, has failed to produce any consistent scheme. Probably the best hope of progress is in the study of racial crosses in which the parent races differ markedly from each other in C.I.

The ears of races require more extensive study. The parents of this family both have medium sized ears, that of the mother without a lobe, as is more frequently the case in women than men. The measurements recorded in Table III are the result of steady growth in size in children, but it will be noticed that the boy of 7 years has ears as large as his sister at 11.

Considering this family as a whole, it is clear that both parents were heterozygous for many genes, the children showing segregation in all racial characters except hair form. Such segregation seems to show very few genes as determining each racial character. In comparison with other racial crosses, a remarkable feature is that only one major and one minor (brunet) gene, is sufficient to account for the results. I was told by persons who had been in contact with many mixed families in Alice Springs that all the children after the first generation had white skin. From my own experience this proved to be essentially nearly true, whatever the genetic basis of it. Englishmen working outdoors in Alice Springs, for instance as truckers, get their arms tanned a deep red, redder than the white-skinned children from aboriginal crosses.

The children of this family, which showed such marked genetic segregation, were like those of other mixed families, very good-mannered, and all very friendly, like ordinary school children, restraining their curiosity when asked to do so.

We may next consider the Pal. family as shown in Fig. 15 and Table IV. The man on the right was an F_1 , his mother a pure Arunta, his father white. Behind is his wife, a pure Arunta. On the left is their son, age 29, who is $3/4$ Arunta. His wife was dark but she left before her ancestry could be obtained. Their two children, a girl of 10 years and a boy of 2, are in the photograph. Judging from their appearance, the wife was probably $3/4$ aboriginal like her husband. The descriptions are as follows: The F_1 grandfather, age 60, is remarkably European in general appearance. The same is true of some other F_1 men. This man had eye colour $\ddagger 6$, skin light brown (chart not available), no brow ridges; nose large, high and relatively narrow, hair black, bald. Head L 191, B 145, C.I. 75.91. Ears 67.3×31.4 with big lobe.

The Arunta wife had eyes very dark ($\ddagger 2-3$), skin colour near $\ddagger 2$, dark brown⁶; brow ridges and sunken orbits, retreating glabella (nasal notch), nostrils broad and depressed. Hair black, nearly straight. L 177, B 141, C.I. 79.66. Ears 73×29.8 with big free lobe. Her ears were exceptionally long and rather narrow.

Their adult son has eye colour $\ddagger 6$ (light brown), skin brown but lighter than his mother, hair black and with characteristic aboriginal wave. The brow ridges, sunken orbits, halfdepressed nasal root and broad nostrils are scarcely distinguishable from the pure aborigine. L 189, B 137; C.I. 72.48. This cephalic index is found in many

⁶ The marked difference between face colour and chest colour in the photograph shows how great is the effect of exposure to the sun. In other words, the tannability is great.

Table III. An. family, $F_1 \times F_1$ (Fig. 13)

	Age	Eyes	Skin	Hair	Lashes	Eyebrows	Brow ridges	Orbits	Nasal root	Nostrils	Forehead	L	B	C.I.	Ears
F_1 father	41	4	near 5 but more reddish	dark brown, wavy	black	faint brown	light	sunken	$\frac{1}{2}$ -depressed	broad	\pm sloping	194	142	73.2	68.2 \times 31.3 lobe
F_1 mother	30	4	5, more red	d. brown, wavy	black	slight, light brown	none	sunken	depression marked	\pm broad	not sloping	175	141	80.6	63 \times 30.2 no lobe
daughter	12	15 (blue)	8, tanned red ⁷	light brown, sl. wavy	brown	light brown	none	partly sunken	\pm depressed	medium	not sloping	173	140	80.9	61.1 \times 33.3 good lobe
daughter	11	3	5, hands darker	med. brown, wavy	black	med. brown	small	sunken	sl. depressed	broader than sister	not sloping	171	136	79.5	54 \times 33 very small lobe
son	9	8	white, hands scarcely darker	v. light ⁸ brown, wavy	brown	fair	small	\pm sunken	$\frac{1}{4}$ -depressed	broader than older sister	not sloping	170	134	78.8	45 \times 32.1 no lobe
son	7	3	4-5 ⁹	med. brown wavy	black	d. brown	small	\pm sunken	$\frac{1}{2}$ -depressed	broad	not sloping	163	129	73.0	54.1 \times 32.6 very small lobe
son	5	5	brunet ¹⁰ white	blond, wavy	pale brown	blond	none	sl. sunken	$\frac{3}{4}$ -depressed	medium	high	154	134	87.0	50.6 \times 30.8 very small lobe
son	1 $\frac{1}{2}$	5	white	blond, wavy	dark brown	blond	none	sl. sunken	not depressed	intermediate	high	—	—	—	47 \times 30.2 small lobe

Table IV. Pal. family, aborigine \times F (Fig. 15)

	Age	Eyes	Skin	Hair	Brow ridges	Orbits	Nasal root	Nasal bridge	L	B	C.I.	Ears
F_1 father	60	6	light brown	black, bald	absent	\pm sunken	not depressed	narrow & high	191	145	75.91	67.3 \times 31.4, big lobe
Aranda mother	—	2-3	near 2, dark brown	black, near str.	present	sunken	depressed	broad and depressed	177	141	79.66	73 \times 29.8 big free lobe
Son	29	6	brown	black, wavy	present	sunken	depressed	broad	189	137	72.48	61 \times 30 small free lobe
Son's daughter	10	6	light brown	black, sl. wavy	Absent	sunken	depressed	broad and depressed	173.5	138	73.77	51.2 \times 31.5 small lobe
Son's son	2	5	light brown	deep brown with tawny streaks	Absent	\pm sunken	$\frac{3}{4}$ -depressed	intermediate	—	—	—	—

⁷ Face white with pink cheeks.⁸ Partly tawny.⁹ Hands slightly redder than face.¹⁰ Not tanned, cheeks pink.

Table V. Sh. family, Walthair × F₁ (Fig. 16)

	Age	Eyes	Skin	Hair	Eyelashes	Eyebrows	Brow ridges	Orbits	Nasal root	Nostrils	L	B	C.I.	Ears
F ₁ father	38	4	light reddish brown	black, ± curly	black	black	present	sunken	½-depressed	broad	190	144	75.79	67.2 × 36 small attached lobe
Mother	30	3	dark brown	black, wavy	black	black	none	sunken	½-depressed	less broad	182	136	74.73	67 × 31.1 small free lobe
Daughter	6	3	white	tawny golden, unruly	dark brown	light brown	none	± sunken	± depressed	not broad	—	—	—	53 × 29.4 small lobe
Son	2	—	white	flaxen, unruly	—	—	?	± sunken	sl. depressed	narrow	—	—	—	51.1 × 30 small lobe
Baby	8 mos.	—	light brown	near black	—	—	—	± sunken	depressed	medium	—	—	—	—

Table VI. Pr. family, White × F₁ (Fig. 17)

	Age	Eyes	Skin	Hair	Eyelashes	Eyebrows	Brow ridges	Orbits	Nasal root	Nostrils	L	B	C.I.	Ears
F ₁ father	35	4	5 but more light reddish	black	—	—	±	slightly sunken	½ depressed	medium	195	141	72.31	69.1 × 31.3 attached, no lobe
Mother	—	13 (blue)	white	light brown, wavy	fair	fair	absent	not sunken	not depr.	narrow	—	—	—	—
Daughter	10	d. brown	white	dark brown	—	—	—	—	—	—	—	—	—	—
Daughter	9	d. brown	white	med. brown	black	light brown	—	slightly sunken	—	—	—	—	—	—
Son	7	d. brown	brunet-white	med. brown	black	med. brown	—	sl. sunken	—	—	—	—	—	—
Son	4	15 (blue)	white	med. brown	dark-brown	light brown	—	sl. sunken	—	—	—	—	—	—
Son	3	12 (near blue)	white	blond	—	—	—	—	—	—	—	—	—	—
Daughter	2	14 (blue)	white	v. light brown	—	—	—	—	—	—	—	—	—	—

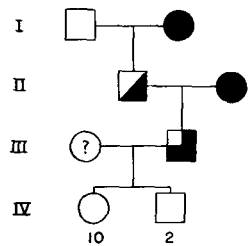
aborigines. Thus we have a man who is $\frac{3}{4}$ aborigine, but in all features except skin colour is closely similar to the pure aborigine. His daughter, age 10, had eyes ca. $\#6$ (light brown), skin light brown, slightly lighter than her father, hair black and only slightly wavy; sunken orbits, nasal root depressed, nose flat and nostrils broad. L 173.5, B 138, C.I. 73.77. Ears 51.2×31.5 with small lobe. The 2-year-old boy in arms had eyes ca. $\#5$ (brown), skin colour like his sister; hair deep brown, with tawny streaks, orbits \pm sunken and nasal root $\frac{3}{4}$ -depressed.

This family shows that with back-crossing of the F_1 to the aboriginal one gets marked reversion to that type, except in skin colour, which is scarcely darker than the father.

In the Sh. family (Fig. 16 and Table V) the father is F_1 , his mother being a full-blood Walthair and his father white. His wife is said to be a full-blood member of the Walthair tribe. Their three children show the remarkable way in which light skin and hair colour come out in the offspring. The father's age is 38, eye colour $\#4$, his skin light reddish brown (not at all fitting the Negro-White colour Chart). His hair is black and \pm curly, balding¹¹ in front in the characteristic aboriginal pattern. (His father was also bald). He has a full beard, kept shaven. A nearly complete circle of creases running from the side of the nose to the chin may possibly be characteristic of the Walthair tribe, as it is also present in his wife. He has a high forehead, sunken orbits, and the nasal root is half-depressed. Head L 190, B 144, C.I. 75.79. Ears 67.2×36 , large, with small, attached lobe. As an F_1 he is comparable with the F_1 grandfather in Fig. 16.

The mother in the Sh. family is 30 years old, her features more refined than in the Arunta women (see Fig. 15). Her eye colour is $\#3$, skin dark brown (not reddish). Her hair is black and wavy with wisps of tawny colour, her eyelashes and eyebrows black. She has a high forehead, sunken orbits, nasal root half-depressed, nostrils not so broad as in Arunta women. L 182, B -36, C.I. 74.73. Ears 67×31.1 with small, free lobe.

Of the three children, the eldest girl, age 6, has eye colour $\#3$ (dark brown), skin essentially white, hair tawny or golden and unruly, eyelashes black, eyebrows medium brown. Orbits somewhat sunken, nasal root depressed, ears 53×29.4 with small lobe. The boy, 2 years old, has the same skin colour but even lighter hair than his sister. His eyebrows are light brown, eyelashes darker. Ears 51.1×30 with small lobe. Whether the light hair colour of these two children was derived from the father's White father or from the tawny gene of the aborigines cannot be determined. The baby, 8 months old, has, by contrast, somewhat darker (brunet white) skin and



Textfigure 4

¹¹ Thomas (1906) says (p. 21) that the aborigines "never go bald", but pluck out the hairs from above their forehead. This is confirmed by Abbie and Adey (1955). Birdsell (1950), in describing the Murrayans, says "baldness shows as unusually high incidence" and makes no mention of hair plucking. Roth (1910) states that in North Queensland baldness is exceptional, only two cases being seen in old men among 410. Incidentally, these people in the Cairns area away from the coast are said to have curly hair.

near black hair, as well as \pm sunken orbits and depressed nasal base. The segregation in skin and hair colour is clear in this young family. Although the mother is supposed to be a pure-bred native, this is difficult to credit in view of the very light skin colour of two of her children. On the other hand, if she were an F_1 one would expect her to have a lighter skin colour.

In the Pr. family the mother is of pure English descent, from South Australia (Fig. 17, Table VI). Her eyes are blue ($\#13$), hair light brown (blond as a baby) and wavy. Her skin is somewhat reddish from deep tan. The father, 35 years old, was separated from his mother when he was only six years old, so he remembers very little of her. He says she was a full-blood aborigine. His father was a white Australian. He is therefore an F_1 (but owing to his light skin colour, it seems possible but not probable, the mother was herself an F_1). There is unfortunately no way of making certain about this, but one must assume he is an F_1 , his mother full-blood. He was born in the Daly River district. As shown in Fig. 17, the five young children all have white skin and medium brown to flaxen hair, so the father is heterozygous for the genes determining these characters.

The eye colour of the father is $\#4$, skin colour $\#5$ but more light reddish and with some mottlings of darker pigment (not fitting the colour chart). His hair is black and cut short, orbits slightly sunken, nasal root half-depressed, nostrils not wide, lower lip everted. L 195, B 141, C.I. 72.31. Ears 69.1 \times 31.3, attached to cheek, no lobe.

There were seven children, all with white skin, but only the five youngest could be in the photograph. The eldest daughter, 10 years, had dark hair and dark brown eyes. The next, 9 years, with dark brown eyes had medium brown hair, eyelashes black and eyebrows light brown. The next, a boy of seven (sitting in front in the photograph) had dark brown eyes and hair (fig. 17), eyelashes black, eyebrows medium brown, skin colour white-brunet.

The next (extreme left) is a boy of four. He has blue eyes ($\#15$), skin white, with pink cheeks, hair medium brown, eyelashes dark brown, eyebrows light brown, ears with large lobe. These children were considered too young to measure. They all (except the boy in centre of group) seem to show slightly sunken orbits. The next brother (centre of group) is three years old, eyes $\#12$ (near blue), hair blond. The girl (right foreground) was only two years old, eyes $\#14$ (blue), hair very light brown. She was about to have an eye operation. The baby, a boy nine months old, had red cheeks and blond hair.

Whether the father of this family was an F_1 (or *possibly* only $\frac{1}{4}$ aboriginal), the white skin and light eye and hair colouring of the children is very striking. The dark pigmentation seems to have vanished. Again, one main gene for dark skin and a minor one for brunet complexion, is all that is necessary to explain the results. The Pr. family lived under excellent conditions in the new housing section of Alice Springs.

Another type of cross is represented by the Sw. family. The father, age 39, was of mixed descent, his father $\frac{1}{4}$ aborigine, his mother of mixed descent and dark (Fig. 18, Table VII). His eye colour was very dark (ca. $\#3$), skin near $\#5$ but more red, hair brown, quite curly, eyelashes and eyebrows black. Brow ridges, sunken

Table VII. Sw. Family, F₁ × mixed (Fig. 18)

	Age	Eye colour	Skin colour	Hair	Eyelashes	Eyebrows	Brow ridges	Nasal root	Nostrils	Lips	L	B	C.I.	Ears
Father	39	3	near 5, more red	brown, ± curly	black	black	present	½-depressed	broad	lower lip everted	204	145	71.08	79.1 × 32.5 very long, with lobe
Mother	29	4	near 4, more red	d. brown, wavy	black	med. brown	none	½-depressed	medium	lower lip partly everted	184	139	75.54	59 × 28.1 with large lobe
Daughter	12	4	near 6, more red	d. brown, sl. wavy	black	light brown	none	± depressed	medium	not everted	183	134	73.22	56.1 × 30 with lobe
Son	7	5	white, few freckles	l. brown, wavy	dark	fair	present	bridge depressed	rather narrow	lower lip pouting	—	—	—	59.3 × 32 with lobe
Son	5	4	white, pink cheeks	tawny, wavy	d. brown	fair	present	bridge ± depr.	very broad	not everted	—	—	—	57 × 30.1 with big lobe
Son	3	4	white, pink cheeks	very light, wavy	dark	fair	present	bridge low	narrow	lower lip everted	—	—	—	large lobe
Son	2	4	near 6	very light, curly	black	light	none	bridge depr.	medium	lower lip everted	—	—	—	lobe
Son	6 wks.	7	white	—	—	—	—	—	—	—	—	—	—	—

orbits, $\frac{1}{2}$ -depressed nasal root and broad nostrils are aboriginal features. The lips are also markedly thick, with eversion of the lower lip only. L 204, B 145, C.I. 71.08. Ears 79.1×32.5 , very long, with lobe.

The wife (Fig. 18), age 29, was an F_1 , her mother, aborigine, father white. She was born near Oudnadatta. Her eyes were dark ($\#4$), skin nearest $\#4$ but more red, slightly lighter than her husband. Her hair was dark brown and wavy, eyelashes black, eyebrows medium brown. No brow ridges, but orbits \pm sunken, nasal root $\frac{1}{2}$ -depressed, nose narrow, nostrils medium width, lower lip partly everted. L 184, B 139, C.I. 75.54. Ears 59×28.1 , with large lobe.

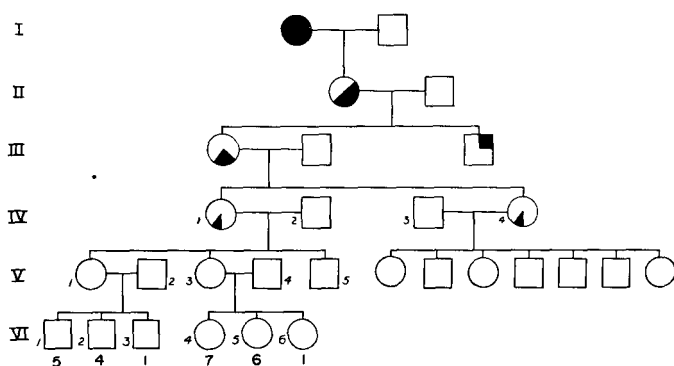
Fig. 14 shows five of the six children with their mother. The eldest daughter, age 12, standing at the rear, has dark eyes ($\#4$), skin $\#6$ but more red; hair dark brown, of uniform colour, slightly wavy, eyelashes black, eyebrows light brown. No brow ridges, orbits \pm sunken, nasal root \pm depressed. L 183, B 134, C.I. 73.22. Ears 56.1×30 , with lobe. The second child (standing by his mother in Fig. 14) was a boy aged 7, his eyes dark ($\#5$), skin white (tanned) with a few freckles, hair light brown to tawny, wavy; eyelashes dark (not black), eyebrows fair. Orbits \pm sunken nasal bridge depressed, nostrils rather narrow, lower lip pouting. Ears 59.3×32 , with lobe. The third child, a boy aged 5 (on the right in Fig. 14) also had dark eyes ($\#4$), skin white with pink cheeks; hair tawny, not uniform in colour, a shade lighter than his elder brother, wavy; eyelashes dark brown, eyebrows fair. Orbits \pm sunken, nasal bridge \pm depressed, nostrils very broad, lips not everted. Ears 57×30.1 , with big lobe. The next boy, aged 3, has dark eyes ($\#4$), skin white with pink cheeks, but a shade darker than his two brothers; hair very light but uniform in colour, wavy. Orbits \pm sunken, nasal bridge low, nostrils narrow, lower lip everted, large ear lobe. The fourth son, on his mother's lap, was about two years old. Eyes $\#4$, skin colour near $\#6$, darker than his brothers, slightly darker than his sister, same colour as his mother. Hair very light and curly, eyelashes black, eyebrows light. Orbits \pm sunken, nasal bridge depressed, nostrils medium width, lower lip everted, earlobe. The fifth son (not in the picture) was six weeks old, eyes ca. $\#7$, skin white, ears large.

The parents and six children of the Sw. family are compared in Table VII. It will be seen that they all have very dark eyes except the infant. Evidently all the white ancestors in this family must have had brown eyes. The parents were closely similar in skin colour, but their children showed wide segregation, the daughter being closely like the mother with intermediate skin colour, the two eldest sons having white skin, the third son slightly darker, perhaps heterozygous for the brunet gene. The fourth son was like his mother and the youngest child had again a white skin. Thus we have three children with white skin, two like the mother, and one probably having a single brunet gene. The analysis cannot be carried further without a full knowledge of the father's ancestry, but the results are again explainable on the basis that the pure aborigines are homozygous for one main gene and one minor gene for skin pigmentation.

The parents in this family have hair colour brown to near black. Of the five children, the eldest has dark hair like the parents, the four sons ranging from light brown

to tawny and very light. The "very light" hair may be derived from a white ancestor, but the term "tawny" implies some variegation in hair colour due to a gene already widespread in the Arunta and neighbouring tribes and not from any European source. As for hair form, the father's hair was \pm curly, but this condition appears in only one child, the other four having hair which is only mildly wavy. The segregation appears very marked, without intermediates. As regards the eyelashes and eyebrows, it will be noticed that the latter are of lighter colour in every case except the father, while the eyelashes are always black or dark brown even when the hair colour is very light.

Brow ridges were present in the father and they may perhaps develop in three of the young sons. Both parents and children show more or less depressed nasal root as well as sunken orbits.



Textfigure 5

on which measurements should be taken in racial hybrids, shows definite segregation in this family. The mother is intermediate and the father wide in this measurement. From Table VII and Fig. 14 it will be seen, for instance, that of the four boys, the nostrils of the eldest are rather narrow, of the next very broad, the third narrow and the fourth medium. Two genes in homozygous and heterozygous condition are sufficient to account for these results.

It was found by observation that a lower everted lip is frequent in the aborigines. It appears to be inherited as a single gene condition, and it occurs also in some Europeans. It is present in the father of this family, but is only partly developed in the mother. It appears in three of the five children and is probably to be considered not as a distinctive racial character but as one which is of mutational origin in various races.

The children of this family, except the eldest, were considered too young to have their heads measured. It may be pointed out that the C.I. of the eldest child is almost the exact mean of the parents. The father had an extremely long ear, but of ordinary width, while the mother's ears are rather short and exceptionally narrow. The three

as well as sunken orbits. The anatomical relations of these two features of the aboriginal skull will not be discussed here, but as already mentioned, the sunken orbits are the most persistent of racial characters. Even children which have lost all the aboriginal pigmentation frequently retain marked traces of the sunken orbits. The low nasal bridge is much less persistent, and may disappear even in the F_1 . Width of nostrils,

eldest children, at ages 5 to 12, are already approaching (and one has exceeded) the ear size of their mother. This must be because of the genes for large ears inherited from their father. As adults, their ears will be much larger than those of their mother. Both parents had a good earlobe, and the same is true in all seven of the children.

Textfigure 5 is a partial pedigree of the Po. family in six generations. Mrs. Po., IV. 1 in the pedigree is the central figure. She is in the third generation of descendants from an original cross between an aboriginal woman of pure blood and an Englishman. The half-caste daughter married a Welshman. Their quarter-caste daughter married an Englishman, the product of this marriage consisting of eight children — four sons and four daughters — of whom Mrs. Po., on the extreme right in Fig. 19, was the second. She and her siblings were therefore $\frac{1}{8}$ aborigine. Her younger sister Mrs. W. (IV. 4 in the pedigree), who is much darker in complexion, is the tall woman on the left in Fig. 19. Her seven children are represented in the pedigree (three of them, standing in front of her, in Fig. 19). One feature of this pedigree is that every male parent was white. Another is that all the children of Mrs. Po. and her sibs had a white skin.

Mrs. Po's two eldest brothers had no children. Her five other sibs all married into white families and produced a total of 29 white children. This and a great deal more is all set out in pedigree form but need not all be reproduced here. Mrs. Po. herself had three children; two daughters who have married white men and each had three children, and a younger son (the tall young man at the back in Fig. 19). The 35 descendants in the second generation from Mrs. Po. are all essentially white. One may therefore conclude that while the results of a single aboriginal cross are quickly bred out by back-crosses to the white race, yet certain inconspicuous features of the aborigines persist, and genetic segregation occurs in certain characters.

We may now describe the essential members of this pedigree. Mrs. Po. (IV 1 in Textfigure 5), age 54, has eyes $\ddagger 9$ (hazel), skin white, slightly reddish, cheeks pink; her hair was brown, now grey, eyelashes light brown, eyebrows very light brown. She has no brow ridges, but the orbits are definitely sunken, the nasal root is partly depressed and the nostrils are somewhat broad. L 175, B 145, C.I. 82.85. Ears 63.8×32.1 with big lobe.

Her sister, Mrs. W., age 49 (on the left at the back in Fig. 19) has eye colour $\ddagger 7$ (near hazel), skin colour 4-5 but red, and more reddish than her sister. Hair dyed black and strongly wavy, eyelashes and eyebrows black. L 188, B 140, C.I. 74.47. Ears 68.6×32 with very big lobe. Slight brow ridges, but orbits sunken, nasal root half-depressed, nostrils broad.

Mrs. Po.'s tall son (V, 5 in pedigree), age 19 (at the back in Fig. 19) has eye colour $\ddagger 15$ (blue), skin white, hair very light brown and wavy to curly, eyelashes and eyebrows very light brown. He has slight brow ridges, orbits slightly sunken, and a European nose only slightly depressed at the root. L 191, 155, C.I. 81.11. Ears 65.9×33.4 with medium-size lobe and a small Darwin tubercle.

Mrs. W.'s daughter, age 16 (in the rear on the right in Fig. 19) had eyes $\ddagger 7$ (light brown), skin tanned reddish brunette, arms and legs tanned reddish. Hair

dark brown and curly, eyelashes black, eyebrows dark brown. Forehead high, no brow ridges, orbits sunken, nasal root scarcely depressed. L 182, B 144, C.I. 79.12. Ears 60×31.9 . Mrs. W's. three youngest children were not examined. In Fig. 19 they are standing in front of their mother. The two boys have fair hair, the girl black. The boy on the left has his mother's skin colour, the other two lighter. Their noses are not depressed at the root, but their orbits appear to be \ddagger sunken. The three boys, VI. 1, 2 and 3, of Mrs. Po.'s eldest daughter, are in the front of Fig. 19, the youngest in his grandmother's arms. The eldest, age 5 (in the middle) has eye colour $\ddagger\ddagger 16$ (light blue), skin white, hair very light brown, eyelashes brown, eyebrows light brown.

The second son, age 4 (on the left) has eye colour $\ddagger\ddagger 13$ (blue), skin white, hair very blond, eyelashes brown, eyebrows slight, light brown. L 166, B 132, C.I. 79.52. Ears 46.4×29.2 . These two boys appear to have somewhat sunken orbits, but the nose is not depressed. The young grandson, age one year, has eye colour $\ddagger\ddagger 16$, skin white, hair very blond, eyelashes pale brown, eyebrows very slight, light brown. It is obvious that all these people, with the possible exception of Mrs. W., would be regarded by the ordinary observer as of pure white descent. The important fact is that all the descendants of Mrs. Po. and her siblings, who married white spouses, had families of white children. This is because in the aborigine there is only one main gene producing melanin in the skin together with a minor one producing only brunet coloration.

Mrs. Po.'s second daughter married a white Australian and had three children (VI. 4, 5, 6 in textfigure 5). Her husband has blue eyes and fair hair. She is V. 3 in the pedigree, her age 25. Her eye colour is $\ddagger\ddagger 5$ (brown), skin blonde white, hair light brown with blond streaks, eyelashes dark brown, eyebrows light-brown. L 180, B 143, C.I. 79.44. Ears 64.1×26.4 with small lobe. Her eldest daughter, seven years old, had near olive skin, dark eyes and fair hair. The second daughter had a fair skin with some freckles, blue eyes and very blond hair. The baby had fair white skin, brown eyes and blond hair.

As an example of the unusual trait combinations which can occur in the descendants of a population of mixed descent, we show Fig. 21. This young woman, 22 years old, belonged to a family in which both parents were of mixed descent. There were five brothers and two sisters. This one has blue eyes (nearest $\ddagger\ddagger 13$), her sibs have brown eyes. They all have about the same skin colour, nearest $\ddagger\ddagger 4$ but more reddish. Her hair is wavy and very nearly black. Her orbits appear to be slightly sunken, the nose is high and narrow, of European type but with overhanging tip (The overhanging tip, a feature of the Semitic nose, is strongly expressed in most of the natives in the western highlands of New Guinea). The lower lip is partially everted. This is probably the heterozygous condition of the single gene for everted lip. The upper lip is a cupid's bow.

Another case of mixed descent, exact ancestry unknown, is a boy 15 years old (Fig. 22) who was travelling by bus from Alice Springs to Darwin. His skin was darker than the European brunet, but he passed for white among some at least, of the pas-

sengers. His eyes were hazel, hair dark brown and unruly; ears large, with large lobe, mouth very large, lips thick and pouting like many aborigines, the lower lip only partly everted. His orbits were \pm sunken, the nasal root half-depressed, and the nostrils broad. He was tall and of slender build like the aborigines, with long thin legs but stocky body. When asked his ancestry, he said he was "pure Welsh". He had been adopted by a Welsh family in Adelaide. Many such adoptions are taking place.

Discussion of genetical results

The families here described include F_1 's, F_2 's and back-crosses of the F_1 to both parent races, as well as other mixtures. Since contact with whites only began at Alice Springs in 1870, there has only been time for about three generations of descendants. The various F_1 's show a wide range of variation, but no doubt the unknown European fathers showed also a wide range of types — blond or brunet skin, blue or brown eyes, fair to black hair. This is sufficient to account for the "variable dominance" in the F_1 . The remarkably light skin colour in many F_1 s is highly significant but not altogether unexpected in the light of early records from other parts of Australia¹². These observations are reinforced by my recent study (to be published) of crosses between Papuans and Europeans in New Guinea, where the F_1 alone is available as yet. These children are, if anything, even lighter in skin and hair colour than the F_1 of the Australian crosses. This incidentally, shows a similarity between Australian aborigines and Papuans as regards their genes for skin pigmentation. As already pointed out, it is not surprising that a skin colour chart developed for the African races applies only roughly to the remote aborigines of Australia.

The observations, taken as a whole lead to the hypothesis of one main gene for skin pigmentation, together with a minor gene corresponding with the white-brunet. Abbie (1951, 1958) also finds the usual skin colour to be "reddish brown, not black", which is in accord with the skin colour of the African Pygmies (Gates 1958).

Evidence has also been adduced that the dark skin of the adult aborigines is in considerable measure a matter of tanning. If they were taken from the intense insolation of the tropics to a northern climate their skin colour would probably "fade" to a remarkable extent — considerably more than East Indians who live in England. In fact, if residing permanently in the northern sub-arctic they could be expected to

¹² For example, Smyth (1878) says (p. 21) "The children of a half-caste female and a white man are not to be distinguished from children of European parents". Our observations confirm this in a general sense (see Tables II and VI). Basedow (1929), (p. 59) speaks of the "shallowness of the pigmentation in the aboriginal's skin". He also refers to "the fair hair of the children" in some Central Australian tribes. He further observed how the apparent skin colour changes with the light. He says (p. 44) "upon a clear day, with an open blue sky, an aboriginal always appears dark and dingy, while on a dull and cloudy day his skin is more of a chocolate-brown; when he is swimming in the open sea his colour may even become coppery and seem not much darker than that of a Javanese".

approach the "white" skin of the Ainu¹³. We may then recognize that Hooton (1946) was at least partly right when he expressed the opinion (p. 610) that "the Australian is fundamentally an archaic White". It has long been suggested, apparently with good reason, that the ancestors of the Australians originated from some of the jungle tribes of India. Investigations, not only of these tribes but also of many other races, as regards their skin colour genes and reaction to tanning are now called for.

Hair form again leads us back to the Australoid jungle tribes of India. The wide range of form, from near straight to wavy and curly, observed by explorers especially in the northeastern and northern parts of the Australian continent and more recently by Tindale and Birdsell (1941), is consonant with the hypothesis of a former Negrito occupation of eastern Australia. This matter will be discussed elsewhere in connection with observations made in Queensland (Gates 1959a). It has been shown (Gates 1957) that in South Africa two intermediate forms of hair in the Hottentots, between the peppercorn of the Bushmen and the woolly hair of the Negro, can be interpreted in terms of two or three genes, but further observations of mixed families are required. Wavy to curly in the Australian aborigines may depend on only two genes in homozygous and heterozygous condition. In an F_2 family (Table III) both parents and all six children had wavy hair. In Table VII the father had curly and the mother wavy hair. Four of the children had wavy (one slightly wavy) hair while the youngest had curly hair like the father. From these and other observations it appears that curly can segregate from wavy in the aborigines and their hybrids, as in Europeans. There is no clear difference in the genetics of hair form in the two races, except that European hair is usually less wavy.

Hair Colour

As regards hair colour, the aboriginal hair is usually stated to be black or dark brown, but in the Aranda and other tribes there is a gene for light, ginger-coloured hair especially in the children, for which Griffith Taylor's name *tawny* seems most appropriate. This apparently originated through mutation in Central Australia. Birdsell (1950) made an extensive study of the distribution and spread of this condition. He was able to distinguish a lighter and a darker form, which probably correspond to the heterozygous and homozygous state. The fact that the hair of a child's head is frequently more or less variegated, that the roots of the hair may be darker (indicating rapid darkening in colour) and that it persists to some extent in adults, especially in females, indicates that the gene is distinct from that for flaxen hair in Europeans. In some of the families here described where a European grandfather

¹³ In certain parts of Japan there are people with essentially white skin but Mongoloid features, who may be reasonably regarded as descended from early crosses between Japanese and Ainu (personal observations unpublished).

may have had fair hair, it is nevertheless difficult to decide whether the light hair of the child came from a tawny gene of the mother or a fair gene of the grandfather. Birdsell finds that tawny haired children, when they grow up, have less hair pigment than those who began with dark hair. Hrdlička made the very true observation that tawny hair lacks lustre.

Birdsell (1950) and Abbie and Adey (1953) both cite many early observations of tawny or light hair. It was first noted in Western Australia, north of Perth, in 1846, and Birdsell concludes that it can now be seen over half the continent, evidently spreading westward more rapidly than eastward. He examined 287 specimens of hair from full-blood aborigines and 454 samples collected by others. No correlation was found with skin or eye colour, but of course the range here is narrow. It was found that tawny hair contained both granular melanin and a red-gold diffuse pigment. In two tribes in Central Australia, the Pitjandjara and the neighbouring Jangkundjara, the hair samples at different ages all showed evidence of the tawny gene. The Pitjandjara were therefore regarded as the tribe in which the mutation originated and from which as a centre it spread. For instance, the Pintubi and Ngalia tribes showed about 90% tawny, the Walpari 80-90%, but among 67 Aranda samples only about 40% showed evidence of the tawny gene. Birdsell has drawn isophenic and isogenic maps of the tawny gene in Australia, allowing for ecological barriers such as the Nullarbor desert, or topographical features such as the Flinders Range which would tend to prevent gene flow to the east. He assumes that the Aranda migrated from the north and that the spread of the tawny gene, which he believes is still spreading rapidly, was due to selection, and not to genetic drift, repeated mutation or hybridization. The gene for blond hair is older than history in Europe and probably originated in North Africa. The tawny hair gene in Australia is evidently of much more recent origin. There is no suggestion as to what advantage, if any, the tawny gene confers. "Blondness" has since been found to be common in Arnhem Land. Thomas (1906) states that "yellow hair" is found in Queensland and New South Wales, but rare. Matthew (1889) mentions (p. 384) a boy in South Queensland with hair "dirty yellowish brown", and several others said to be golden-yellow. In New South Wales a family of children had "long, straw-coloured hair". The skin is described as generally "dusky copper to brownish-black".

Abbie and Adey (1953) made a study of the tawny gene in the Ngalia tribe some 200 miles northwest of Alice Springs, where they are congregated around the Government Settlement at Yuendumu. A few years ago they were completely tribal, but they have now adopted European clothes and receive supplementary rations from the Government, as well as having some schooling. In recording results, the Ridgway colour scale of browns and sepias was used, as originally introduced by Campbell and Hackett (1927). The tribe numbered 300-400 of all ages, and observations were made on over 100. Colour of hair, skin and eyes was recorded. The skin colours were divided into two series; (a) siennas and ambers containing red, black and yellow, (b) vandykes containing red and black only. The vandykes numbered nearly 3 : 1 in the females and about 2 : 1 in the males. The "Mongolian

spot" was not found in the children¹⁴. These aborigines, who have recently adopted clothing, were found to sunburn under prolonged exposure to sunlight. This is in harmony with my conclusion that the amount of melanin in the aborigine skin is relatively small, and that its development is to a considerable extent a matter of "tanning". Some observers find that skin colour intensity increases from south to north, which would be expected if there is a marked effect of exposure to insolation.

The question whether the gene for tawny hair is dominant or recessive has been much discussed. In fact it is neither. The same is true of the multiple additive genes which are concerned in the production of many racial characters.

The most common eye colours were mummy brown and burnt umber, but there was no correlation with skin colour, or with age or sex.

The eyebrows and lashes were always dark brown to black, and the pubic hair also. The axillary hair too was the same colour, except in a few females in which it was medium brown. The head hair from ash-blond to light brown was classed as "fair", from medium brown to black, as "dark". In both sexes the hair changes from fair to dark, but the shift is much more abrupt in the males. At ten years of age, the children of both sexes were about 85% fair and 15% dark. After the age of 11 the boys are nearly all dark, the darkening beginning about the 8th year. The body hair remained fair in both sexes until after puberty, the amount being sparse to medium in females and slightly more abundant in males. One male was partly bald at 55, and a woman over 60 was slightly bald.

Racial skull characters

The marked brow ridges are not only a feature of the male aboriginal skull, but they are also found sometimes in the female. And of course they are a more or less marked feature of various other races. They are evidently derived, presumably by loss mutations, from the torus of such skull types as *Sinanthropus* and Rhodesian man and other earlier Paleolithic skulls. The fact that brow ridges show a marked sexual dimorphism, being generally absent in the female of such races as the Australians, whites and the Ainu, makes the study of their inheritance much more difficult. Brow ridges are, moreover, widespread in Europeans and in India, sometimes to a marked degree, yet we have no knowledge of their genetics and I am unable to provide any evidence from the present observations.

In an earlier investigation of the evolution of the human nose a comparative study was made of the brows and nasal region in various fossil and modern skull. It was pointed out (Gates 1956, p. 284) that the Australians and the Mount Carmel Neandertaloids have in common the nasal notch which is not present in the South European Neandertals (but present at least in *La Chapelle-aux-Saints*) nor in *Sinanthropus*. The two characteristic features of the Australian skull are the heavy brow

¹⁴ Cleland and Hackett (1927) in examination of a newborn infant, also found no sacral spot.

ridges and the retreating glabella accompanied by sunken orbits and a depressed root of the nose. These two features, brow ridges and retreating glabella, appear to be more or less independent of each other although they accentuate the nasal notch. As pointed out elsewhere (Gates 1959b), the only African skull which has both these features is the Florisbad. Galloway (1937), in a study of this skull, concludes that it is closely akin to the Proto-Australian and that it could be ancestral to the Boskop type in Africa and the Wadjak (Java) type of skull, having a Boskop vault and an Australian forehead. This view seems very reasonable.

Other African skulls, with only heavy brow ridges, should not be called "Australoid" because they have no necessary relation to the Australian race. I have suggested (Gates 1959b) that they be called "megaphroid". The retreating glabella accompanied by sunken orbits and a depressed nasal root is represented among modern races only by the Australian aborigines and some Melanesians in New Guinea. The heavy brow ridges, although widely present in various other races, are presumably on the way out in human evolution. The partially depressed root of the nose in many aborigine \times white hybrids is probably controlled by a very small number of additive genes.

The nose in these aboriginal hybrids, as shown in Tables I-VII, shows great variation in two features; (a) the nasal root may be depressed or high and narrow (Fig. 21), even in F_1 (Fig. 15), (b) the nostrils range from broad as in the aborigines to narrow as in Europeans. As previously stated, the everted lower lip (Table VII) is not confined to the Australians and probably depends on a single gene with fuller expression in the homozygous state.

The idea has persisted widely that the Australian aborigines are really a survival of Neandertal man. This view is strengthened by the resemblances already mentioned, —namely the heavy brow ridges and the nasal notch, — between the aborigines and some of the Neandertaloids of Mount Carmel. However, as previously shown, the Neandertal skulls of Europe do not have the nasal notch. A low, retreating forehead has also been regarded as a feature of the aborigines, but in fact this is seldom met with and is by no means characteristic of the aboriginal head. One must conclude that the aborigines are neanthropic, and not descendants of Neandertal man, and also their genes for skin colour seem to hark back to the Caucasian race. On the other hand, the cranial capacity is definitely below that of modern Europeans.

This view, that the aborigines are neanthropic and not Neandertaloid, is in harmony with the conclusions of Birdsell (1950) and Abbie (1951). The latter (p. 91) says "The judgment which sets the aboriginal skull with that of Neandertal man is based upon a quasi-statistical assemblage of extreme physical developments". The aborigine may have a receding forehead with large supraorbital and occipital ridges, small mastoids, protuberant jaws and a broad, flattened nose, but equally he may have a broad, high forehead with small supraorbital and occipital ridges, large mastoids, a relatively high, narrow nose [this last I have not seen in men of pure descent] and nearly orthognathous jaws. The strongly retreating lower jaw of the Tasmanians has been recorded in some aborigines from South East Australia. From observations of many skulls in the Australian Museums, an account of which I hope to publish

later, they range in vertical view from pentagonoid to ellipsoid, and the mastoids from large to very small, even in skulls which otherwise appear to be male. While the brain size is "within normal limits", Abbie points out that the known cranial capacity ranges from 850-1500 cc in the aborigines, whereas in Europeans it is 788-2300 cc. Wood-Jones (1932) finds that 7% of female Australian skulls have a capacity of 1000 cc or less, smaller heads occurring especially in the North and West. He cites two skulls measured by Sir William Turner in 1884 having capacities of 930 and 946 cc respectively. Hrdlička measured 916 skulls in Australian Museums with the following results: N 521 ♂ L 189.1 B 132.2 [C.I. 69.91].

N 395 ♀ L 179.4 B 127.6 [C.I. 71.68]. Basibregmatic height 127.4, but it may be as high as 137 mm. The female head is thus far smaller than the male, but many male heads are of European dimensions. Elkin (1948) states that the thickness of the cranium is a primitive character, the average cranial capacity being 20% less than that of the European. In agreement with Birdsall, Abbie finds the aborigines linked with, (a) the Vedda of Ceylon and the pre-Dravidians of India, (b) the Ainu. The skull form in Mount Carmel, Palestine, as described by McCown and Keith (1939) and the prehistoric skulls from the Indus valley (Piggott 1950) Abbie regards as "similar *in toto* to that of the aborigines".

Howells (1937), in a study of measurements of natives of Arnhem Land, concluded (with Keith) that the aborigines are the most archaic surviving race of man. Although the most primitive in physical type and in culture, yet they have "the most formidable systems of kinship known to anthropology". The relatively small cranial capacity, especially in the females, as well as the heavy brow ridges and the sunken nasal root probably entitle them to be regarded as survivors from an earlier evolutionary level.

Skulls of primitive character appear in the population from time to time, but can no longer be regarded as typical. Cunningham (1907) described the skull of a native who died at the age of 47 after eleven years in an asylum. He had very prominent brow ridges, a very narrow, receding and sloping forehead, an extremely deep nasal notch and a retreating chin. Cunningham remarks that "among Australian natives it is not uncommon to meet with cases in which the forehead is exceedingly flat and receding, but this is by no means a constant feature of the race". Burkitt and Hunter (1922) later described the skull of a native woman whose skeleton was exhumed at Tamworth in 1880. It was described as Neandertaloid, showing "enormous development of the superciliary ridges and glabella", a well developed bregmatic eminence and marked development of the torus occipitalis. All races thus, in lesser degree, trail, not "clouds of glory" but reminiscences of their earlier selves perpetuated by heredity. The "extremely low sloping forehead", massive undivided tori supraorbitales, and the marked projection of the glabella contrasted with a less primitive face, which was orthognathous and is even described as leptorrhine. There was great thickness of the bones of the cranial vault, but the cranial capacity was 1211 cc. Other measurements were L 203, B 132, C.I. 65.02.



Fig. 1. School girls in West Australia. Nos. 1, 2, 5 and 7 have aboriginal ancestry



Fig. 4. The daughter in this family



Fig. 2. Girl on left with blue eyes and fair hair had an aboriginal ancestor

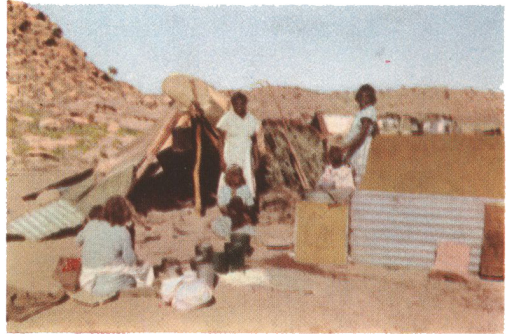


Fig. 5. Group showing shelters, at Bungalo reserve



Fig. 2A. No. 2 in Fig. 1



Fig. 6. Aranda woman with her tawny-haired child

Fig. 3. Full aborigine artist and family in front of their shelter



Fig. 6A. Nearer view of same woman



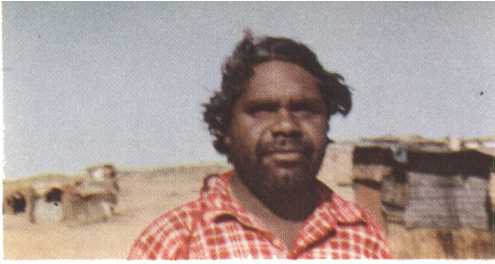


Fig. 7. Full-blood adult Aranda



Fig. 10. Pintubi woman and baby with near-white skin and golden hair



Fig. 8. Kindergarten at Bungalo: 9 native children (one with very tawny hair), 2 children of the white Superintendent, and the teacher

Fig. 9. Marunka, a Pintubi from Haast's Bluff

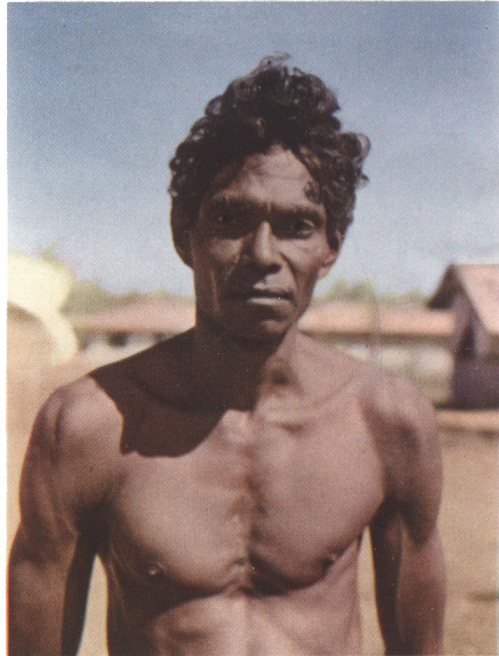
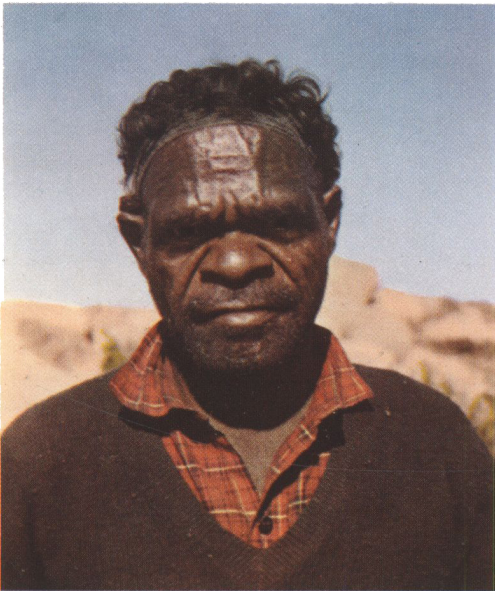


Fig. 11. Peter Wunia, 35, Brinkin tribe; photo at Bagot settlement near Darwin



Fig. 12. Two Melville Island men. Note lack of body hair and deeply sunken orbits



Fig. 15. Pal. family at Alice Springs. Mother pure aborigine, father F_1 , also son's two children (Table IV)



Fig. 13. An. family at Alice Springs. Both parents were F_1 , the children F_2 (Table III)

Fig. 14. Sw. family at Alice Springs. 5 children with Mother F_1 , (father mixed Fig. 18)

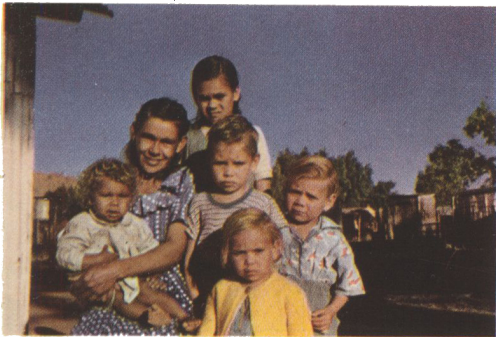


Fig. 16. Sh. family, Alice Springs. Mother full-blood Walthair, father F_1 . (Table V)





Fig. 17. Pr. family, Alice Springs. Mother white, father F_1 (Table VI)



Fig. 20. Mrs. Sc. (F_1) and three of her children, the father one-quarter aborigine (See Text - fig. 1 and Table I)

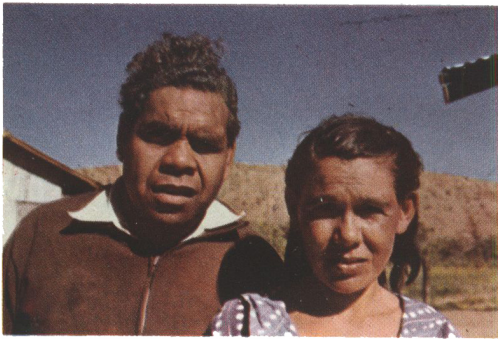


Fig. 18. Sw. family, Alice Springs. Mother F_1 , father mixed (Table VII)

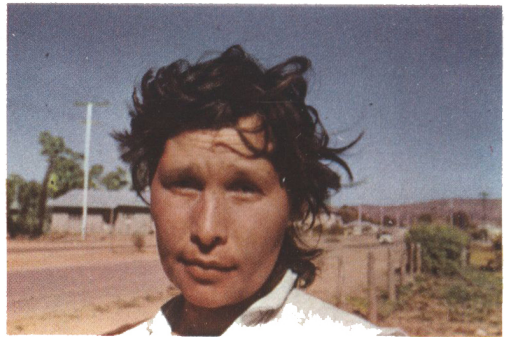
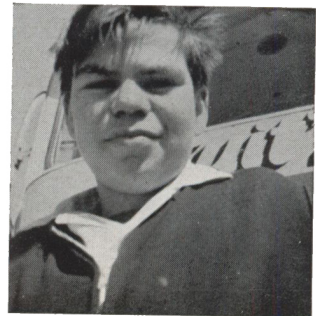


Fig. 21. Both parents of mixed descent. See text, page 16

Fig. 19. Po. family, Alice Springs. See text and text figure 5



Fig. 22. An adopted boy of mixed descent. (Black and White)



T. H. Huxley¹⁵, von Luschan and others found the aborigines to be a single type of persisting Neandertal man — a view that seems no longer tenable, although they are more retarded physically than other living races. But their wits are sharp enough when one meets them personally.

Although some writers regard the Australian aborigines as a relatively homogeneous race derived from one source, there have been suggestions of two or three elements from the earliest days. For example, Topinard (1872) says (p. 106) “J’admets qu’il existe en Australie deux éléments ethniques primordiaux qui par leur mélange en proportions variable forment une série dont les deux extrêmes correspondent à deux races distinctes”. The two elements are characterized thus: 1. Tall, dolichocephalic, robust and well proportioned, with long hair, straight and smooth, skin colour chocolate or dark copper. They form the mass of the population. 2. Short, more dolichocephalic, *mal faite du corps*, skin colour *noir foncé*, hair curly or frizzy, head small and round¹⁶, jaws very prognathous, sclera yellowish, no calves, flat feet, etc., and less intelligent. This inadequate description might answer to the Negritoid type in Queensland, having short stature and curly hair, but they are now less rather than more dolichocephalic than other aboriginals and their head measurements are slightly larger.

Matthew (1889) accepted the relation of the Australians to the “Dravidians” of India. He says (p. 337) “Australia was first occupied by a homogeneous people, a branch of the Papuan family and closely related to the (Oceanic) Negroes”. They occupied the whole continent and crossed to Tasmania before it was separated from the mainland. Then followed one if not two invasions of people with a “much fairer complexion” but still dark. They were taller, more lithe and wiry, less hirsute, with straight hair. This type was attributed to Malay contacts in the north, west of the Gulf of Carpentaria, but these were probably much later than he supposed, and Malay crosses would yield a different racial type. Matthew says (p. 340) “The aborigines of Australia were Papuans and were ancestors of the Tasmanian race”. He supports his thesis with evidence from their physiology, mythology, implements, customs and language. He quotes another observer, that “the stray covering of hair all over the body so often met with in the south is almost absent on the north coast”. An old native in New South Wales is described (p. 385) as having “the trunk in front completely covered with dense hair which spreads over the shoulder and down the outside of the upper arm”, his beard “thick, long and curly”. This is quite comparable with the Ainu. Matthew proceeds to say (p. 385), “There could hardly be a more striking contrast than that between the lank, tall, smooth, small-featured Northern Territory man and such a Victorian” as he has just described. Here is a foretaste of Birdsell’s Murrayans and Carpentarians. The Papuan nose, “with the apex turned downwards” which is almost universal in Papuans, is also

¹⁵ Abbie (1958) finds that Huxley was not trying to prove that the aborigines represented Neandertal man, but rather that some characters of the aborigines matched certain features of Neandertal man.

¹⁶ This is a contradiction with the previous line, presumably a mistake.

seen in Australia and Tasmania. This so-called Semitic nose is more extreme than (generally) in the Semites themselves, and is probably of independent origin. The Malay element Matthew regarded as another cause of divergence of the Australians from Papuans.

Tribes of Aborigines

A number of aboriginal tribes in different parts of the continent have already been mentioned. Australia has long been recognized as an area in which the native population was divided into a great number of tribes, large and small, having more or less definitely delimited areas of occupation and hunting. These were never completely static, tribal raids and wars keeping them always in a state of moving equilibrium. A long drought in one area often forced a tribe to seek sustenance elsewhere, which led to tribal conflicts. But the tribal groups appear to have been much more stabilized than the Indian tribes of North America. In short, they formed a mosaic of the whole continent, more sparsely or densely settled according to conditions. Even the most arid desert areas appear to have had some tribal occupiers, if only at certain seasons or after exceptional rains.

Tindale (1941) has published a survey and map of tribal distributions, representing the conditions before the Europeans came. Some 400 tribes are mapped. This is a much larger number than the Indian tribes of North America, which perhaps indicates a longer period of occupation and differentiation. The differences of speech were in language rather than dialect, even in the case of some small tribes, although some linguists believe all the Australian languages can be traced to a single source. In the Cairns area a dozen small Tasmanoid mixed tribes survive.

Sir Arthur Keith (1948), in a well-known book, set forth the main thesis of what he calls the Group theory of human evolution in the following words: (p. 3) "during the whole period of human evolution mankind had been divided into a vast number of isolated local communities, each inhabiting a delimited area or territory... My main thesis was that right down to the dawn of civilization the habitable earth formed a mosaic of separated territories and of peoples, and that such a grouping favoured rapid evolutionary change".

It is not proposed to enter here into a study of tribal differences, but reference may be made to recent detailed observations of the Njalia (Ngalia) or Walpari tribe by Abbie and Adey (1955). Besides the high incidence of blondness already referred to (p. 19), all individuals of both sexes were devoid of hair on the second phalanx of all the fingers. The epicanthic eye fold was confined to children and was much less marked than in Europeans, even though the nasal bridge is always depressed. "The forehead in the aborigines presents nothing remarkable in slope, height or development of brow ridges". The latter probably continue to grow after maturity, but this does not apply to females with big ridges. Shape of the nasal septum changes with age from straight to convex (overhanging tip) and more markedly in males. As such detailed studies of individual tribes increase, significant tribal differences

may emerge, but there has probably been enough gene exchange across tribal boundaries to maintain relative uniformity except between the most distant tribes.

In a metrical study of the same tribe (Abbie 1957), in which 30 measurements were made on each individual, and 22 indices were calculated, a few of the main results are included in Table VIII. They are in general harmony with previous studies. The stature is shorter than the mean for mankind, and there may be a north westerly cline of increasing stature. Growth ceases at 16 years in the female and 20 in the male. Both sexes have relatively shorter trunk and longer legs than any other

Table VIII. Measurement of adult Walpari (Abbie)

	Range ♂	Mean	Range ♀	Mean
Stature	1595-1801	1697.9	1493-1662	1571
L	175-202	191.36	170-200	183.65
B	128-148	140.09	128-145	135.35
C.I.	57.4-82.9	73.32	68.4-82.4	73.89
Head height	115-141	130.10	115-134	126.10
N.I.	80.4-137.5	99.53	75.5-106.8	91.89

N = 20-22

ethnic group, this condition being established at an early period in growth. The tibio-femoral index is very high, and the same is true of the radio-humeral index in both sexes. Shoulders, chest and hips are narrow, the physique being markedly linear, with lean bodies, long, slender hands and feet and thin calves. The C.I. occasionally exceeds 80 in both sexes. The range of head heights (Table VIII) is fairly large, from very low to quite high, i.e. hypsiccephalic, the bizygomatic diameter is high, and the mandible less massive than in Europeans. The nose is generally very wide and the bridge low.

In an early account devoted mainly to language, Curr (1886) divides the tribes of Australia into Western, Central and Eastern, characterized by particular words and customs. He reckoned several hundred "forms of speech", some of the languages showing close relationships while others were very different. He shows (Vol. 2 p. 172) that "population was sometimes spread by means of small parties, which marched long distances into the wilderness, where they remained isolated for a considerable time" and so formed the beginning of a new tribe. He cites Fraser's Island, near Brisbane, which is 85 miles long and about 12 miles wide. It was first occupied by whites in 1849. It then contained about 2000 aborigines divided into 19 tribes or groups. They were cannibals, practiced polygamy, but did not have circumcision¹⁷. Curr quotes (Vol. 1, p. 203) the "Narrative of the Voyage of H.M.S. Rattlesnake"

¹⁷ Eyre (in *The Native Tribes of South Australia*, by various authors, Adelaide, 1879, pp. 316) says that circumcision was unknown in S., SE. & E. Australia but common in the N., W. and SW.

by Capt. Macgillivray, who found that the inhabitants of the Torres Strait Islands (except the first island) were Papuans with frizzled hair, while the Kowrarega in the Prince of Wales group close to Cape York were a "Papuanized colony of Australians", the result of racial fusion. From this situation he concluded that the Australians came into York peninsula from the south. But this does not preclude a much earlier movement of ancestral aborigines into Australia from New Guinea before New Guinea was peopled by Melanesians.

As notable qualities of the aborigines, Matthew (1889) mentions "gaiety of heart", which they certainly appear to have, and powers of mimicry. The question of languages cannot be entered into here, but this author, in a long and careful account of them based on wide experience, finds that the languages increase in complexity from the West to the East, the most elaborate languages being found in New South Wales and Southern Queensland. Many languages, e.g. English and Portuguese, evolve in the opposite way, with much simplification.

That Paleolithic man had artistic instincts of a high order is shown by the coloured frescoes in caves of France and Spain, perhaps 50,000 years old. Albert Namatjira, a full-blood member of the *Áranda* tribe, took up water-colour painting with the aid of an Australian artist and has made a great success in painting the Australian landscape. His four sons, as well as other families (p. 3) have also succeeded, and shown individuality in their productions. However, the numerous drawings and engravings on rocks in Australian caves and shelters sometimes have little artistic merit. But the "X-ray" type of drawings are highly skilled, and an old order of rock drawings are in the same style as the Bushmen drawings of South Africa or the probably Mesolithic figures in Spanish caves. Mountford (1954) has reproduced some of these strikingly different styles in colour. Apparently all natives can produce more fragile drawings on bark in their idle time; they are all natural artists.

Miscegenation

Many early accounts refer to the mixtures of whites with natives. Topinard (1875) accepted the view of Broca and others, now found to be mistaken, that some racial crosses were sterile. He refers to the conditions on the Islands in Bass Strait about 1800-1805. They were frequented by seal hunters and fishermen from England and Australia. The islands remained uninhabited until the remnant of Tasmanians was taken to Flinders Island. Then crossing began, from which arose a mixed population of excellent sailors, fishermen and harpooners. They had "une complexion rougeâtre foncé, de beaux yeux et de belles dents". On one island were 25 children.

Various later studies of miscegenation have been made. Zabrowski (1907) says that Freycinet saw two or three racial hybrids, about 1800. They were common in the first half of the 19th century. The greater number of children near Adelaide under 15 were by white fathers. In 1865 one tribe was supposed to be composed entirely of *métis*. In other areas the natives destroyed before puberty all children of white fathers. The statement is made that for 50 years these *métis* have continued to accu-

mulate, but the author asks: Where are their descendants? They must either have passed for European or been eliminated. Probably many have been absorbed into the white population, this being facilitated by their light skin and near European appearance.

The rapid decrease in native numbers is illustrated by the native population of 12000 in S. Australia and Adelaide in 1842, reduced to 3953 in 1876, partly through European diseases. In Adelaide and SW Australia in 1901 there were 3888 natives, of whom 502 were mixed. In the period from 1901-06 the pure-bloods were reduced in number by 250 while the mixed increased by 591. Thus, in accordance with the usual history of crossing between a primitive and an advanced race, those of pure blood decrease through the decades while those of mixed blood continue to multiply.

In a study of racial mixture in New South Wales, Griffith Taylor and Jardine (1924) show that the aborigines were in contact with civilization even in the late 18th Century and their culture rapidly disappeared. The census of NSW in 1882 showed 6540 full-bloods and 2379 half-castes. By 1921 these numbers had been reversed — 1281 full-blood and 6270 mixed. The Kamilaroi tribe were located northwest of Sydney. They were early in contact with civilization and their culture rapidly disappeared. In 40 years no full-bloods were left. Taylor and Jardine produced interesting photographs of a number of families, one of Chinese mixture, but with no attempt at genetic analysis.

In 1914, Davenport (1925) visited Brewarrina on a fork of the Darling River, about 60 miles south of the Queensland border, a reservation where most of the inhabitants were mixed. He measured six men and seven women, with a mean stature of 167 and 152 cm. respectively. This is somewhat shorter than Spencer and Gillen (1899) obtained for the Arunta. He found their sitting height far shorter than any other race, whereas their legs were the longest in the world. He also reported (p. 84) „clear evidence of the segregation of traits” in eye and skin colour and in C.I., which ranged (among 12♂ and 20♀) from 81.9 in a man to 67.5 in a woman, but the numbers measured were not large enough to draw genetic conclusions. Davenport also concludes, in accordance with views then current, that the shorter leg of Europeans was dominant to the long leg of the aborigines.

Tindale (1941) made an extensive survey of the half-caste problem. He found in South Australia 2684 natives of full-blood and 2197 of mixed descent (probably many of the latter had “disappeared” by passing). In all Australia 24,718 were of mixed origin. Many nomadic tribes had been decimated and finally broken up. The rationing of tribes was found to be undesirable, as it breaks up their customs. He finds that even a small degree of association with whites is more detrimental to them than the severest droughts.

The fourth generation of crossing was reached in 1940, a century after it began. The progenitors were not only whites but also Chinese, Malay, Maori, Negro, Filipino and East Indian. There are thus many small partially assimilated groups in parts of Australia, and there are Tasmanian mixed-bloods on Cape Barren and

Flinders Islands. Genetic studies of some of these crosses will be described elsewhere. The exigencies of small hybrid groups are illustrated by the case of a white man who, about 1863, escaped from the Murray River area into the wilds with his two native wives and was not discovered for thirty years. The colony then numbered 28 healthy persons. They were brought into civilized conditions and became extinct.

Tindale (p. 87) suggested that skin colour is controlled by multiple factors, but he found "steady dilution of tone with access of white blood". We have seen that the reversion to near white or completely white skin is quite remarkable. There were no "throw-backs" to dark skin colour, (neither have I seen any). Birdsell measured 1200 of mixed descent, but (p. 92) "no case of true or even marked segregation of aboriginal characters" was seen. This is presumably because the racial traits depend upon a small number of multiple genes without dominance. The F_2 was found to have a greater range of variation than the F_1 , some showing a closer approach to the aborigine; but again, no marked segregation was discovered. One aboriginal woman had 15 children (14 of them living) by an F_1 husband. These all married and had a total of 127 children (102 living), an extremely rapid rate of reproduction.

As with the American Indians, when the full-bloods have disappeared there is probably a tendency to regard those who are $3/4$ or $7/8$ aborigine as full-bloods. The rapid decrease of full-bloods after white contact results partly from higher infant mortality, leading to their virtual extinction by the third generation. The mixed-bloods were often found to be physically superior in running, football, boxing and athletics generally, but they were mostly mediocre and a few were markedly inferior in mental calibre.

In a smaller study of the mixed-blood marriages in NSW., Reay (1951) interviewed 264 women of mixed descent in north-western NSW. The women tend to marry men of their own caste or lighter and the mixed-bloods are being slowly assimilated. Of the 1551 children, 276 were preponderantly aboriginal, 483 half-castes, 792 predominantly European.

The Australian Yearbook for 1957 (the latest available) shows the total population from the census of 1954 to be 9,033,168. This includes an estimated total of 46638 full aborigines or 0.5%, and 27,179 mixed. The small number of the latter, not greatly exceeding half the aborigines, shows that many of them must have been already absorbed into the white population. The aborigines are now nearly all found in Western Australia, the Northern Territory (which includes Alice Springs and Darwin) and Queensland in the North East. Their reserves occupy about 66,000 square miles and their numbers have changed little since 1947. The number of pure-bloods ceased to decline about 1953 and have begun to increase. In 1953 the natives were made wards of the Government, which provides for training in agriculture (which means in Australia sheep farms and cattle ranches) or apprenticeships. For their protection there are institutions under the supervision of Aboriginal Boards "where these people are housed and encouraged to work", the children receiving an elementary education. Learning to work regularly is one of the most difficult things for a primitive food-gathering people. They usually live at Mission Stations,

but many are nomadic, receiving food and clothing when they call. Others rarely come to the Stations. In the century and three-quarters since European influence in Australia began, even the wildest of the aborigines have largely given up such customs as tribal wars, cannibalism and such signs of savagery as nose and ear plugs, all of which are still widespread in New Guinea, where extensive white contacts in the interior only date from about 1930.

Macintosh (1952) made a study of the tribes in the Tandandjal and Mainoru regions in SW Arnhem Land. He found a high proportion of intratribal breeding, departures from this being between adjacent tribes. Measurements of 20 adult males of the Djauan tribe showed a range of stature from 151.1 cm. to 182.2 cm., mean stature 164.5 cm. The increments are fairly small and steady up to 169.5, the two tallest being 174.0 and 182.2 respectively. Six men of the Djinba tribe similarly ranged from 152.4 to 180.4. Such graded mixtures of tall to short stature were found in tribes of three separate areas. This is believed to dispose of the conception of a tall, linear type in the north, a people of medium height in the south-east and a pygmoid type for the "far south". This will depend, however, on the genetical background. If stature depends on multiple genes, as appears to be usually the case in populations of various races, then such mixed results would be expected. It was concluded (Gates 1958) that the African Pygmies were the result of a single dwarf mutation. But there are many other types of racial dwarfs in the world and the indications are that in some at least of these a graduated series of multiple genes are involved.

Tindale (1953) made a study of intertribal marriages. He finds that about 15% of aboriginal marriages transgress the tribal boundaries. In larger tribal blocks these matings range from 7% to 21%. The rate is high in the Atherton Tableland, the North Queensland Barrineans or "Negritos", ca. 10% in the South coastal (Murrayan) stock, 15% in Central Australia and 8% in the Ngalia and the Carpentarian areas. His study included 760 full-blood marriages in tribal (breeding) groups of 150-600 individuals.

Serology

Much has now been done with the Australian blood groups. The A group tends to be highest in Eastern Australia, as Mourant (1954) shows in his excellent summary. It is less than 10% around the Gulf of Carpentaria but rises to 40% in Southern Australia. A north - south cline is indicated in Eastern and Western Australia, but there is also a more marked east - west cline. Low frequency of A in the Carpentarians is indicated. A₂ is totally absent. B is absent except in York Peninsula and in a few coastal records from Arnhem Land to New South Wales, indicating a modern coastal spread southward. The M group ranges from 5-40%, as in New Guinea¹⁸. It is lowest in the west and highest in the Northern Territory. The very high N allies the

¹⁸ M was only 2.5% in 864 natives in the Chimbu valley, Central highlands of New Guinea (Ivinskis et al. 1956), 9.9% on the Sepik river, 16.7% in Port Moresby natives.

aborigines with the Ainu. High N and high CDe are like the conditions in New Guinea and other islands to the north. This supports the evidence from physical characters indicating that the ancestors of the Murrayans at least sojourned in New Guinea on their way south. Almost complete absence of S distinguishes the Australians from the Papuans, in which it is 14%, in both the MS and NS combinations. S appears to be completely absent in West Australia. The Lutheran and Kell antigens appear to be absent at least from West Australia and the Northern Territory. The Diego group is also absent, while Duffy was present in all the 49 tested. No sickle cells have been found. CDe (R_1) is about 60%, but much lower than in New Guinea, and cDE (R_2) is relatively high. From testing of some Tasmanian hybrids in the southern islands it is suggested that the Tasmanians may also have been high in N and low in B and A, like the Australians. Kooptzoff and Walsh (1957) confirm the probable absence of S from Australia. The number of aborigines tested was 166 from different parts of the continent. B was higher in Queensland than in the Northern Territory.

In a later study from Central Australia by Simmons, Semple, Cleland and Casley-Smith (1957) about 125 natives were tested. The O blood group was 44.4%, A_1 55.6%; M 4%, MN 39.2% and N 56.8%. The Rh subgenes were tested. 2.9% were Rh_0 but none (in 105) were Rh—. The Lewis and Diego antigens were absent and P was present in 23%.

Schwartz et al. (1957) find that the serum cholesterol level is lower in the aborigines than in white controls, and it does not rise with age. This probably results from a lower fat intake in the diet. Phospholipid levels are, on the contrary, higher than for white females or aboriginal males.

The nomadic Pintubi tribe are found (Schwartz and Casley-Smith 1958) to have a highly significant depression of the serum mucoprotein level compared with a detribalized group of aborigines (mainly Pintubis, Pitjantjaras and Arandas) or with White Australians. This difference appears to be environmental in origin and to be associated with the low incidence of atheroma and atherosclerotic heart disease in the "wild" natives.

In a study of native tribes west of Alice Springs, Casley-Smith (1958) finds that haemoglobin values in aboriginal males are slightly greater than in Europeans, those in aboriginal females being markedly greater than in European women, perhaps because of less loss of menstrual blood. Other features of the erythrocytes were studied.

Origin of the aborigines

Anthropologists appear to be now agreed that the Australian aborigines show affinities with "Australoid" jungle tribes of India, and also with the hairy Ainu of Japan. As the latter have an essentially white skin colour, the present finding that the dark aboriginal skin colour is like a veneer which quickly vanishes in crosses with Caucasoids greatly strengthens this Ainu relationship. Studies of the genetics of crosses between the Indian Australoids and Europeans are necessary to determine

whether these Indian tribes, and the Veddas of Ceylon, also have a single main gene for melanin production combined with great powers of tanning.

Abbie (1951), in a discussion of human evolution, lays great stress on processes of foetalization. He agrees that, as regards cranial characters, the Veddas of Ceylon, the pre-Dravidians of India and the Ainu of Hokkaido, Saghalien and the Ryukyu Islands could all have been derived from some of the skull types found at Mount Carmel. Abbie also agrees (p. 62) that „the physical affinities of the aborigines appear to be more with white than with coloured peoples”. On the other hand, he regards the Australian aborigines as a homogeneous race. Evidence published elsewhere (Gates 1959a) supports the view that some Queensland tribes are of Negrito origin and represent in part the ancestry of the Tasmanians. My personal observations have not been sufficient to discuss the differences between Murrayans and Carpentarians, but such differences have impressed observers from the earliest days.

It is not proposed to discuss here the evidence to be derived from the Talgai, Wadjak, Aitape, Keilor and Cohuna skulls. They will be considered later in comparison with the modern aboriginal skull.

Views still differ widely as to when the aborigines entered Australia. During the glacial period, when water was withdrawn from the oceans, it is probable that the Torres Strait was mainly dry land; but this could only be a brief Late-Pleistocene connection, probably never complete, or the higher placental mammals would have entered Australia. Probably a gap remained, which man crossed by boat or raft, bringing the dingo with him. Wood Jones (1921) discussed the status of the dingo and showed, especially from the dentition, that it originated, like other true dogs, from northern species of wolf. The carnassial teeth are larger than those of domestic dogs, not so large as in wolves. He is therefore *Canis familiaris dingo*. Torres Strait is about 90 miles wide, bridged by islands, and only occasionally more than 60 feet deep. That a land barrier formerly connected SE Australia with Tasmania is evident, because the marine fauna is markedly different east and west of the Wilson's promontory. When this bridge sank is a matter for geologists to determine. Noetling (1910) discussed the subject, suggesting that immigration to Tasmania was as late as 5000 to 3000 B.C. The depth of Bass Strait nowhere exceeds 50 fathoms, the distance being about 184 miles. The depression of sea-level during a glacial period is frequently estimated at 250 feet. The dingo never reached Tasmania, so he was probably not in S. Australia at the time of the transmigration. Noetling estimated that the shell heaps in Tasmania were several thousand years old. It is important to obtain C¹⁴ dating from them. Birdsell (1950) believes that the broad Sahul Shelf north of Australia was dry land through which the Carpentarians entered Australia on a broad front.

Tindale (1941) and Birdsell (1950) both suggest that man may have come to Australia during the last glacial period, when sea-level was 40 fathoms below the present, and the Sunda and Sahul shelves were dry land. Mahony (1943), discusses the geological and palaeontological evidence and supports the view that man came to Australia in the Pleistocene. Abbie (1951), on the contrary, concludes that man

has been on the continent only about 6000 years, and finds no evidence to support a late Pleistocene occupation.¹⁹

Until recent years, the many stone implements described in Australia were all surface finds, so that chronology did not exist before 1930. The many types of stone tools include sumatraliths, (an elongated-oval trimmed core), horsehoofs (another form of core), elouera (a scraper), bondi points, pirrie points and microliths. Hale and Tindale (1930) began excavations in the Murray River Valley, finding a full-length skeleton as well as food remains and other evidence of aboriginal occupation. Reference may be made to a few other excavations. McCarthy (1943) described the implements frequently accompanied by aboriginal skeletal remains, found at eight sites on the south coast of NSW. He subsequently (1947) made an analysis of the large stone implements from five workshops on the north coast of NSW. The distance between the old and new shore-lines is as much as 13 miles in some places, the old middens having been abandoned and others developed on the new coast infilled by deposition.

Noone (1943) described stone implements from West Australia. Among other things, these showed pressure working, gum hafting, edge-grinding of axes, and a highly developed flaking technique, all from surface finds. Many types of microliths were described by Campbell and Noone (1943). They conclude that the microliths belong to an extinct aboriginal culture. McCarthy, Bramell and Noone (1946), in a paper with full bibliography and with definitions of types of implements, show that there had been much confusion regarding typology and nomenclature.

Bones of giant extinct marsupials were sent from Lake Colongulac to Owen in London in 1846. Later geological and paleontological evidence (Gill 1951) shows that a native skeleton and certain artefacts as well as dingo and marsupial bones (Diprotodon, Thylacoleo, *Macropus titan*) were all Late Pleistocene in age.

Tindale (1947) has constructed a tentative correlation of Pleistocene geology in Australia and Europe. Davidson and McCarthy (1957) discuss the origin and spread of various implements to Western Australia, including grindstones and mortars, mullers, biface spear points. The Kodja axe is used alternatively with the hafted

¹⁹ Birdsell (1957) has recently discussed the rate at which an aboriginal population would spread across the continent of Australia from the point of entrance. The argument is based on various assumptions concerning the rate of population increase and the conditions under which new colonies would be formed, as well as the effects of various topographical barriers. He reaches the short estimate of 2202 years for sparsely peopling the continent, assuming that the population would roughly double in each generation of 16 years, and that new hordes would hive off when the local population reached about 60 per cent of saturation, based on available food supply. This rough estimate may be subject to revision, but appears to be within the bounds of possibility. Geologically speaking, it would be almost instantaneous. On the other hand, he reaches the tentative conclusion that the original entry of Negritos into Australia was as much as 32,000 years ago. This, which seems excessive, is based on the assumption that Negritos and Murrayans *successively* peopled the whole continent, followed later by the Carpentarians. If the Negritos and Murrayans both came in thorough Torres Strait, as seems to the present writer most probable for various reasons, then there seems to be no reason to assume that the Negritos ever wandered across the whole continent. The archaeological evidence up to now would suggest a much shorter time of occupation.

adze, one or the other being found in any area. In a study of culture contacts along the north coasts of Australia, McCarthy (1953) concludes that the aborigines "had prolonged contact over a period of centuries with both the gardening Papuans of the Torres Strait islands and the rice-growing Indonesians from Celebes and possibly elsewhere". These visitors did not change the semi-nomadism of the aborigines nor introduce any new food plants. McCarthy shows that aboriginal culture has "advanced to a marked degree since their ancestors arrived in Australia". Isolation was not complete, but dispersion of culture elements took place from Western Papua into north eastern Australia. Later it was pushed into Western Australia by cultural elements which had arisen in Eastern Papua. The Malayan influence may have begun only three centuries ago. The adoption of agriculture, even with shifting cultivation, would have meant a drastic alteration in their religion, which is tied to local "sacred places". McCarthy regards the aboriginal culture pattern as "remarkably homogeneous", although he states that a number of areas are distinguished by secondary local characters. Davidson showed that diffusion from New Guinea and Indonesia into Australia consisted in netting and basketry techniques, to which he adds weapons and fire-making.

McCarthy (1953) lists the coastal culture succession of SE Australia, beginning with the oldest, as 1. Gambieran (flint axes and scrapers), 2. Kartan (uniface pebble choppers, horsehoofs and hammerstones). 3. Bondian (delicate stone (Bondi) points, scrapers, knives, many microliths. 4. Eloueran (edge-ground axes, knives and chisels, elouera, cairns, fishhooks). The inland cultures are listed as Tartangan, Pirrian, Mudukian and Murundian (youngest).

In an important contribution, Tindale (1957) regards the Kartan culture of Kangaroo Island and Tasmania as the oldest, dating from 11,000 years before the present (B.P.) and earlier. The end of Pleistocene glaciation and the rise of sea-level is placed at 10,000 B.P. The succeeding Tartangan culture, originally excavated on the Murray, is placed by C¹⁴ dating at 8700-6020 B.P. The Pirrian culture of Devon Downs on the Murray River is dated 4250 ± 180 B.P. The Mudukian culture, in which microliths are a prominent feature, is listed as beginning 3000 B.P. A C¹⁴ dating which may belong to this culture in Victoria is as late as 538 ± 200 B.P. At Devon Downs rock shelter there is an abrupt change to the Murundian culture, the change perhaps occurring over 2000 years ago. This tentative chronology has been extensively criticized by McCarthy (1958). No doubt many more excavations will be necessary before a firm chronology is reached.

In another recent discussion of Australian stone industries, Allchin (1957) points out that choppers and chopping tools, core and flake implements, both bifacial and unifacial, are all still in use, this stone culture corresponding in general with the chopper and chopping tool complex of South-East Asia, as described by Movius (1944). Allchin finds no evidence that any of these are of Pleistocene age in Australia. The ground stone axe has a square butt, as in SE. Asia and N. China, whereas the other has a pointed butt. From this one may argue that the Australoid tribes of India are of secondary rather than primary relation to the Australians. Great variation is

shown in each type of tool, and various uses may be combined in the same tool, e.g. a spear thrower may also function as an adze, and may even be widened so as to serve as a dish.

Mentality

From the earliest days the most diverse views have been expressed regarding the mentality of the aborigines. For instance, the Rev. George Taplin (1879) says, "In intellectual capacity the Aborigines seem to occupy a low position in the scale of humanity... They seem to be like children. Their brain seems to be only partially developed, and they cannot be instructed beyond a certain point. The writer is aware that others who have intimate acquaintance with the Aboriginal tribes hold somewhat different views... Their perception faculties are great, and this is evidenced by their wonderful skill as trackers in the bush... Without a history, they have no past; without a religion they have no hope; and without habits of forethought or providence, they can have no future. Their doom is sealed, and all that the civilized man can do, now that the process of annihilation is so rapidly overtaking the Aborigines of Australia, is to take care that the closing hour shall not be hurried on by want, caused by culpable neglect on his part". This well represents the general attitude in the 19th Century, but is unacceptable now. The aborigines were undoubtedly "wilder" than the survivors now, after a century of mainly indirect contact with civilization. It was then difficult or impossible to get sufficiently *en rapport* with them to learn anything important about their mentality.

By contrast, Broom (1926), an able naturalist and palaeontologist, who spent nine months in N. Queensland on a sheep farm in 1892, found them "not much if at all inferior in mental capacity to the whites". They could play euchre as well as whites, and a full-blood man drew games with him at checkers. My own impression, after a more limited period of contact with the aborigines, both pure and mixed, agrees with that of Broom. Abbie (1951) also agrees that they are mentally not inferior to white. They are, however, still ridden with ideas of magic, which makes their mentality and their reactions quite different from ours. We like to think we are rational, whereas rationality scarcely enters into the aboriginal mind. This, together with the severe initiation ceremonies, which are enforced by the old men of the tribe, prevents any marked change in methods of thought or in the adoption of the White man's way of life. They must also have a religion to replace their immemorial conceptions of the dreamtime and free their minds from local tribal areas.

General impressions are of little value compared with psychological tests, but very little modern work has been found which bears directly on the mentality of the aborigines. Fry and Pilleine (1931) point out that they lived for a long period apart from world competition, also that the brain and skull are smaller than in Europeans, the skull capacity averaging ♂ 1290, ♀ 1140. The Bushmen and Andamanese have equally small brains, but they are also of shorter stature. The insula of the brain is frequently exposed and the sulcus lunatus is distinct. A school teacher is quoted to

the effect that the children have little difficulty in the lower grades but are very difficult to educate beyond the 4th grade. The senior boys with some white blood are superior to the full-bloods, but the numbers considered were few. In tests of muscular strength made at Hermannsburg Mission they were less strong than white boys and girls. But in keenness of vision, in which there was strong competition, they were three times the average for white children. In motor and sensory abilities and attributes the native children did not differ from whites, but they were much less sensitive to pain.

Careful tests by Porteus (1933), the well-known psychologist, on a tribe in the Kimberley District of NW Australia gave an average mental age of 10.48 years for 65 adult males, practically coinciding with a mean mental age of 10.52 years obtained by Piddington for 24 males. For 25 females a mean age of 8.41 was found. For children of mean chronological age 9.54 years the I.Q. was found to be 98, while for children of age 12.4 years the I.Q. was 82. Precocious early development was thus followed by a period of marked slowing down, and it was concluded that there is an "earlier cessation of brain growth than in Europeans". Porteus claims that the aborigines have a very inferior auditory rote memory, like that of the feebleminded, the visual rote memory being also defective. These qualities would make for failure in school. Simpson (1951), on the contrary, points to their ability to remember an extensive mythology, religious ritual and cycles of corroboree songs. He also lauds their prowess at poker, and finds that in bush life they show initiative and enterprise. On the other hand Porteus found that the men made a good showing in the maze tests (invented by him) for competence in manual arts and crafts. The aboriginal minds are apparently not suited for abstract thought, which has developed in Europeans through the millenia of history. A much fuller study of native psychology in various tribes was also made by Porteus (1937). Thus we can arrive at some understanding of the differences between the "primitive" or "savage" and the "civilized" mentality. Elkin (1954) has written an intimate account of the mind that believes in magic and myth. Another book (Elkin 1945) is especially concerned with the magicians.

Apart from the genetic studies, which are the main contribution of this paper, we have briefly considered the cranial characters of the aboriginal skull as well as the origin and relationships of the race. Reference has also been made to the tribal distribution in Australia, as well as the serology, archaeology and mentality of these interesting people. Further excavations will probably settle the question whether they first arrived on the continent during the last glacial period. The evidence seems to indicate more than one racial element in the population.

Acknowledgements

Among the many to whom I am indebted, let me first mention all those who so willingly gave me information about their ancestry and also allowed me and my wife to take photographs and measurements. Their cheerful and intelligent cooperation

left nothing to be desired. In connection with the arrangements for the expedition I am indebted to the Government authorities, and to Professors A. A. Abbie and A. P. Elkin for useful information and help. Dr. N. B. Tindale was also involved in the kindly loan of anthropometric instruments, and to Professor L. S. Penrose I am indebted for the loan of Martin's *Augenfarbentafel*. Other friends too numerous to mention brightened our sojourn in Australia. In Alice Springs, Sister Arlene Heath, in the Welfare Department, and Captain C. L. Steep, St. Mary's Hostel, Heavitree Gap, were particularly helpful in giving us information about families, the latter also in aiding us with transportation. My wife took all the colour photographs with which this paper is illustrated, and has aided in preparing it for the press. I am also indebted to Miss M. Currier and her staff of librarians at the Peabody Museum of Harvard University for aid in finding additional literature.

Summary

In this genetical study of crosses between the Australian aborigines and Whites, in which the Áranda (Arunta) tribe at Alice Springs, in the desert heart of Australia, were mostly involved, many families were studied and their physical characters recorded. These include many F_1 s, also an F_2 family and back-crosses to White, to aborigine, and to mixed. These studies provided an exceptionally wide basis for interpretation of the genes. It is evident that reciprocal crosses produce similar results.

Depression of the nasal root, a characteristic of the aboriginal skull, in crosses with the high European nose, probably involves not more than two or three cumulative genes. Sometimes the high, narrow European nose appears to be dominant (Fig. 15). High nasal bridge and narrow nose may be due to linked genes or to genes which affect both height and breadth of the nose. The brow ridges are an equally marked feature of the male skull, but they are frequently absent or much less noticeable in the female, so the manner of inheritance is not yet known. Wide nostrils of the aborigines again appear to depend on a small number of additive genes compared with the narrow nose of the white man. The lips of the aborigines tend to be thick throughout, but generally not everted. Eversion of the lower lip alone, especially in the central part, appears to depend on a single gene effect which is more marked in the homozygous than the heterozygous condition. This gene also occurs in Europeans and is anatomically quite distinct from the everted lips of the Negro.

In Tables I to VII about 15 physical characters are recorded for parents and children. Eye colour, skin colour, hair colour and form, colour of eyelashes and eyebrows, depression of nasal root, sunken orbits, width of nostrils, lips, length and breadth of head, cephalic index, ear size and earlobes are included. The colour of hair, eyelashes and eyebrows may all be different in the same individual, the eyelashes tending to be darkest and eyebrows lightest of the three. Hair form ranges from near straight, through wavy to curly, the number of genes involved being very small.

Skin colour of the F_1 is remarkably near the white, and when the F_1 (male or

female) is back-crossed to White the children mostly have white skin (Figs. 15-17). Some are near-white like the F_1 , but none darker than either parent have been seen. Study of the various crosses leads to the conclusion that *a single main gene for melanin in the skin is present in the aborigines, together with a minor gene which alone produces brunet-white skin colour.* The aboriginal skin, which is normally reddish mahogany or chocolate brown (not black, except perhaps in some northern tribes), is very subject to tanning (see Fig. 15) and evidently contains much less melanin than the full black Negro skin. The genetics of skin colour in the aborigines is thus very different from that of the African races. Both the skin colour and facial features in the hybrids are much akin to the Caucasian race, substantiating the view of anthropologists that such a relationship exists.

The skull is markedly dolichocephalic and about 20% smaller in cranial capacity than the European. It has two special archaic features — heavy brow ridges and the nasal notch. The latter involves a retreating glabella as well as a depressed root of the nose and sunken orbits. The Mongolian race has the nasal root depressed as in Neandertal man, but no nasal notch. These two, heavy brows and nasal notch, are the most persistent features in aboriginal hybrids. The skull most closely resembles some of the Mount Carmel Neandertaloids with a nasal notch, but the Australian race is neanthropic and not Neandertal, the Neandertals of S. Europe not having the nasal notch, and a low, sloping forehead being exceptional in the aboriginal.

The aborigines, especially those of SE Australia, with relatively hairy bodies, show relations with the Ainu, as well as with the jungle tribes of India. The Negrito element in N. Queensland is considered elsewhere (Gates 1959a). The gene (mutation) for tawny hair, especially in the children, probably originated in Central Australia and may be still spreading. Whether this is from a single event or from repeated mutations is uncertain.

The aborigines are similar to the Papuans in skin colour genetics (published later). Some Papuans show the nasal notch of the Australians. The overhanging nasal tip of the Papuans may occasionally be seen in the Australians. Miscegenation between aborigines and Australians is not a serious problem because (1) the two races are mutually friendly, (2) the number of full-blood aborigines is only 0.5%, (3) the half-caste married to White generally produces children with a white or near-white skin and near-European features.

Archaeological excavations show probably four successive culture levels, the oldest having a radiocarbon date of 8700 years. Whether the earliest entrance of man into Australia was during the last glaciation, when land bridges with New Guinea and Tasmania developed, remains uncertain.

Bibliography

- ABBIE, A. A. 1951a: The Australian aborigine. *Oceania*, 22: 91-100.
— 1951b: A new outlook on physical anthropology. *Rept. Austr. & N. Z. Assoc. Adv. Sci.*, 28: 52-63.
— 1957: Metrical characters of a Central Australian tribe. *Oceania*, 27: 220-243.
— 1958: The original Australians. *The Leech (Johannesburg)* 28: 120-130.
-

- & ADEY, W. R. 1953: Pigmentation in a central Australian tribe with special reference to fair-headedness. *Am. J. Phys. Anthropol.*, 11: 339-360.
- 1955: The non-metrical characters of a Central Australian tribe. *Oceania*, 25: 198-207.
- ALLCHIN, B. 1957: Stone industries of Australia past and present. *J. Roy. Anthropol. Inst.* 87: 113-136.
- BASSEDOW, H. 1929: *The Australian Aboriginal*. Adelaide. pp. 422.
- BIRDSELL, J. B. 1950: Some implications of the genetical concept of race in terms of spatial analysis. *C. S. H. Symposia on Quant. Biol.*, 15: 259-314.
- BIRDSELL, J. B. 1957: Some population problems involving Pleistocene man. *Cold Spring Harbor Symp.* 22: 47-69.
- BROOM, R. 1926: Mental capacity of Australian aborigines. *Nat. History*, 26: 104-5.
- BURKITT, A. ST. N. & HUNTER, J. I. 1922: The description of a Neandertaloid Australian skull, with remarks on the production of the facial characteristics of Australian skulls in general. *J. Anat.* 57: 31-54.
- CAMPBELL, T. D. & HACKETT, C. J. 1927: Descriptive and anthropological observations. *Trans. Roy. Soc. S. Austr.*, 51: 65-75.
- Noone, H. V. V. 1943: Australian microlithic stone implements. *Rec. S. Austr. Mus.*, 7: 281-307.
- CASLEY-SMITH, J. R. 1958: The haematology of the Central Australian aborigine. I. Haemoglobin and erythrocytes. *Austr. J. Exptl. Biol. & Med. Sci.*, 36: 23-37.
- CLELAND, J. B. & HACKETT, C. J. 1927: Observations on a new-born Australian aboriginal infant. *Trans. & Proc. Roy. Soc. S. Australia*, 51: 141-143.
- CUNNINGHAM, D. J. 1907: The head of an Australian aboriginal. *J. Roy. Anthropol. Inst.* 37: 47-57.
- CURR, E. M. 1886: *The Australian Race*. Melbourne & London. 4 Vols.
- DAVENPORT, C. B. 1925: Notes on physical anthropology of Australian aborigines and black-white hybrids. *Am. J. Phys. Anthropol.*, 8: 73-94.
- DAVIDSON, D. S. & MCCARTHY, F. D. 1957: The distribution and chronology of some important types of stone implements in West Australia. *Anthropos*, 52: 390-458.
- ELKIN, A. P. 1945: *Aboriginal Men of high Degree*. Sydney. pp. 148.
- 1954: *The Australian Aborigines: how to understand them*. Sydney. pp. 349.
- FRY, H. K. & PULLEINE, R. H. 1931: The mentality of the Australian aborigine. *Austr. J. Exp. Biol. & Med. Sci.*, 8: 153-167.
- GALLOWAY, A. 1937: The nature and status of the Florisbad skull as revealed by its non-metrical characters. *Am. J. Phys. Anthropol.*, 23: 1-16.
- GATES, R. R. 1956: Studies in race crossing. IV. Crosses of Chinese, Amerindians and Negroes, and their bearing on racial relationships. *Z. Morph. Anthropol.*, 47: 233-315.
- 1957a: Records of Y-inherited hairy ears in India. *Acta Genet. Med. et Gemell.*, 6: 103-108.
- 1957b: Forms of hair in South African races. *Man*, 57: 81-83.
- 1958: The African Pygmies. *Acta Genet. Med. et Gemell.*, 7: 159-218.
- 1959a: Racial elements in the aborigines of Queensland, Australia. *Zeit. Morph. Anthropol.* 50:
- 1959b: *Race Crossing* (in press.).
- GILL, E. D. 1951: New evidence from Victoria relative to the antiquity of the Australian aborigines. *Austr. J. Sci.* 14: 69-73.
- HALE, H. M. & TINDALE, N. B. 1930: Notes on some human remains in the Lower Murray Valley, South Australia. *Rec. S. Austr. Mus.*, 4: 145-218.
- HOOTON, E. A. 1946: *Up from the Ape*, McMillan, New York, pp. 788.
- HOWELLS, W. W. 1937: Anthropometry of the natives of Arnhem Land and the Australian race problem. *Papers of Peabody Museum, Harvard*, 16: 1-97.
- IVINSKIS, V., KOOPTZOFF, O., WALSH, R. J. & DUNN, D. 1956: A medical and anthropological study of the Chimbu natives in the Central highlands of New Guinea. *Oceania*, 27: 143-157.
- KOOPTZOFF, O. & WALSH, R. J. 1957: The blood groups of a further series of Australian aborigines. *Oceania*, 27: 210-213.
- MCCARTHY, F. D. 1943: An analysis of the knapped implements from eight Elouera industry stations on the south coast of NSW. *Rec. Austr. Mus.*, 21: 127-153.
- 1947: An analysis of the large stone implements from five workshops on the North coast of NSW. *Rec. Austr. Mus. Sydney.*, 21: 411-430.
-

- 1953: The Oceanic and Indonesian affiliations of Australian aboriginal culture. *J. Polyn. Soc.*, 62: 243-261.
- 1958: Culture succession in SE. Australia. *Mankind*, 5: 177-190.
- BRAMEL, F. & NOONE, H. V. V. 1946: The stone implements of Australia. *Mem. Austr. Mus.*, 9: 1-94.
- MCCOWN, T. & KEITH, Sir A. 1939: *The Stone Age of Mount Carmel*. Oxford University Press, Vol. II. pp. 390.
- MACINTOSH, N. W. G. 1952: Stature in some aboriginal tribes in South-West Arnhem Land. *Oceania*, 22: 208-215.
- MAHONY, D. J. 1943: The problem of the antiquity of man in Australia. *Mem. Nat. Mus. Melbourne*, No. 13, pp. 1-56.
- MATTHEW, Rev. J. 1889: The Australian aborigines. *J. Roy. Soc. N. S. W.*, 23: 335-449.
- MOUNTFORD, C. P. 1954: *Aboriginal paintings, Arnhem Land*, New York. Pls. 31.
- MOURANT, A. E. 1954: *The Distribution of the Human Blood Groups*. Oxford Univ. Press., pp. 438.
- MOVIUS, H. L., Jr. 1944: Early man and Pleistocene Stratigraphy In Southern and Eastern Asia. *Papers Peabody Museum, Harvard Univ.* Vol. 19, No. 3, pp. 125.
- NOETLING, F. 1910: *The antiquity of man in Tasmania*. *Proc. Roy. Soc. Tasmania*, pp. 231-278.
- NOONE, H. V. V. 1943: Some aboriginal stone implements of Western Australia. *Rec. S. Austr., Mus.*, 7: 271-280.
- PIGGOTT, S. 1950: *Prehistoric India*, London, pp. 293.
- PORTEUS, S. D. 1933: Mentality of Australian aborigines. *Oceania*, 4: 30-36.
- 1937: *Primitive Intelligence and Environment*, New York pp. 325.
- REAY, M. 1951: Mixed-blood marriage in north-western New South Wales. *Oceania*, 22: 116-129.
- ROTH, W. E. 1910: North Queensland ethnography. *Records Austr. Mus.*, 8: 1-106.
- SCHWARTZ, C. J. & CASLEY-SMITH, J. R. 1958: Atherosclerosis and the serum mucoprotein levels of the Australian aborigine. *Austr. J. Exptl. Biol. & Med. Sci.*, 36: 117-120.
- DAY, A. J. PETERS, J. A. & CASLEY-SMITH, J. R. 1957: Serum cholesterol and phospholipid levels of Australian aborigines. *Austr. J. Exptl. Biol. & Med. Sci.*, 35: 449-456.
- SIMMONS, R. T., SEMPLE, N. M., CLELAND, J. B. and CASLEY-SMITH, J. R. 1957: A blood group genetical survey in Australian aborigines at Haast's Bluff, Central Australia. *Am. J. Phys. Anthropol.* 15: 547-553.
- SIMPSON, C. 1951: *Adam in Ochre*, Sydney & London. pp. 221.
- SMYTH, R. B. 1878: *The aborigines of Victoria*, London, pp. 483.
- SPENCER, B. & Gillen, F. J. 1899: *The Native Tribes of Central Australia*, London, pp. 671.
- TAPLIN, Rev. GEORGE, & OTHERS. 1879: *The native tribes of South Australia*, Adelaide. pp. LII+316.
- TAYLOR, G. & JARDINE, F. 1924: Kamilaroi and white: a study of racial mixture in New South Wales. *J. Proc. Roy. Soc. NSW*, 58: 268-294.
- THOMAS, N. W. 1906: *Natives of Australia*, London, pp. 256.
- TINDALE, N. B. 1940: Distribution of the Australian aboriginal tribes: a field survey. *Trans. Roy. Soc. S. Austr.*, 64: 140-231.
- 1941a: Distribution of Australian aboriginal tribes: a field survey. Adelaide, pp. 231.
- 1941b: Survey of the half-caste problem in South Australia. *Proc. Roy. Geogr. Soc., S. Austr. Branch, Session 1940-41*, pp. 66-161.
- 1941c: Antiquity of man in Australia. *Australian J. Sci.*, 3: 144-7.
- 1947: Subdivision of Pleistocene time in South Australia. *Rec. S. Austr. Mus.*, 8: 619-652.
- 1953: Tribal and intertribal marriage among the Australian aborigines. *Hum. Biol.*, 25: 169-190.
- 1957: Culture succession of South Eastern Australia from Late Pleistocene to the Present. *Rec. S. Austr. Mus.*, 13: 1-49.
- & BIRDSSELL, J. B. 1941: Tasmanoid tribes in North Queensland. *Rec. S. Austr. Mus.*, 7: 1-9.
- TOPINARD, P. 1872: *Etude sur les races indigènes de l'Australie*. Paris. pp. 120.
- 1875: Note sur les métis d'Australiens et d'Européens. *Rev. d'Anthrop.*, 3: 243-249.
- VERHOEVEN, T. 1953: Proto-Negrito in den Grotten auf Flores. *Anthropos*, 53: 229-232.
- WOOD JONES, F. 1921: The status of the dingo. *Trans. Roy. Soc. S. Austr.* 45: 254-263.
- 1932: A small-headed type of female Australian. *Man*, 32: 38-40.
- ZABOROWSKI, M. 1907: Métis d'Australiens et d'Anglais. *Bull. et Mem. Soc. d'Antrop. de Paris*, 8: 384-393.

RIASSUNTO

In questo studio genetico degli incroci fra gli aborigeni australiani ed i bianchi, nel quale figura per la maggior parte la tribù Aranda (Arunta) a Alice Springs, nel cuore deserto dell'Australia, molte famiglie furono studiate ed i loro caratteri fisici notati. Queste comprendono molte F_1 , una famiglia F_2 , ed anche reincroci coi bianchi, cogli aborigeni, e coi misti. Questi studi hanno provveduto una base eccezionalmente larga per l'interpretazione dei geni. È evidente che gl'incroci reciproci producono risultati analoghi.

La depressione della radice nasale, caratteristica del cranio aboriginale, negli incroci col naso alto europeo, probabilmente comprende non più di due o tre geni cumulativi. Qualche volta, il naso europeo, alto e stretto, sembra essere dominante (fig. 15). L'alto osso nasale e il naso stretto possono essere dovuti a geni legati o ai geni che influiscono sull'altezza come sulla larghezza del naso. La fronte prominente è un tratto caratteristico ugualmente notevole del cranio maschile, però è frequentemente assente o molto meno notevole nella femmina, cosicchè il modo dell'eredità rimane ancora ignoto. Le narici dilatate degli aborigeni sembrano ancora una volta dipendere dal piccolo numero dei geni [additive] in confronto al naso stretto dell'uomo bianco. Le labbra degli aborigeni tendono ad essere spesse ma in genere non everse. L'eversione del labbro inferiore specie nella parte centrale, sembra dipendere dall'effetto di un solo gene, il quale è più marcato nella condizione omozigote che non in quella eterozigote. Questo gene si trova anche negli Europei ed è anatomicamente ben diverso dalle labbra everse del Negro.

Nelle Tavole I a VII, sono riportati circa 15 caratteri fisici per i genitori e per i figli. Color degli occhi e della pelle, color e forma dei capelli, color delle ciglia e delle sopracciglia, depressione della radice nasale, orbite incassate, dilatazione delle narici, larghezza delle labbra, lunghezza e larghezza della testa, indice cefalico, grandezza dell'orecchio, e lobi dell'orec-

chio vi sono tutti compresi. Il colore dei capelli, delle ciglia e delle sopracciglia può essere diverso nello stesso individuo, il colore delle ciglia tendendo ad essere più scuro e quello delle sopracciglia più chiaro di tutti e tre. La forma dei capelli va da quelli quasi lisci, a quelli ondulati, fino a quelli ricci, il numero dei geni in questo caso essendo molto piccolo.

Il color della pelle della F_1 si avvicina notevolmente al bianco e quando la F_1 (maschio o femmina) è reincrociata al Bianco, si trova che la maggior parte dei figli hanno la pelle bianca (fig. 15-17). Alcuni sono quasi bianchi come la F_1 , ma non si è mai visto nessuno di loro più scuro di qualsiasi dei genitori. Lo studio degli incroci rari porta alla conclusione che *un solo gene principale per la melanina nella pelle è presente negli aborigeni, assieme con un gene minore il quale solo produce il color di pelle bruno chiaro-bianco*. La pelle aboriginale, la quale è normalmente di color rossastro-mògano o cioccolato-marrone (non nero, eccetto forse fra alcune tribù settentrionali) è molto suscettibile all'abbronzamento (vedi fig. 15) e contiene evidentemente molto meno melanina che la pelle carica e nera del Negro. La genetica del colore di pelle negli aborigeni è in questo modo molto diversa da quella delle razze africane. Tanto il color di pelle, quanto le fattezze del volto negli ibridi sono molto simili alla razza caucasica, ciò che dà fondamento alla credenza degli antropologi che esista una tale parentela.

Il cranio è accentuatamente dolicocefalo ed è del 20% più piccolo nella capacità cranica di quello europeo. Esso ha due speciali caratteristiche arcaiche — le sopracciglia pesanti e l'indentatura nasale. Questa comprende non solo una glabella sfuggente ma anche una radice depressa del naso e le orbite incassate. La razza mongolica ha la radice nasale depressa come nell'uomo Neanderthal, ma non ha l'indentatura nasale. Queste due fattezze, le sopracciglia pesanti e l'indentatura nasale, costituiscono i tratti caratteristici più persistenti degli ibridi abo-

iginali. Il cranio rassomiglia di più ad alcuni dei Neandertaloidi di Monte Carmel coll'indentatura nasale, ma la razza Australiana è neantropica e non deve niente al Neanderthal, dato che quest'ultimo, europeo, ha l'indentatura nasale, e che la fronte bassa e inclinante non si trova che eccezionalmente nell'aboriginale.

Gli aborigeni, specie quelli dell'Australia sud-orientale col corpo relativamente peloso, mostrano dei rapporti e con gli Ainu, e con le tribù della giungla dell'India. L'elemento Negritico nel N. Queensland è trattato altrove (Gates 1959). Il gene (la mutazione) per i capelli fulvi, specie fra i bambini ebbe origine probabilmente nell'Australia centrale e forse si sta ancora diffondendo. È incerto se questo provenga da un solo evento e da mutazioni ripetute.

Gli aborigeni rassomigliano ai Papuani nella genetica del color di pelle (da essere pubblicato più tardi).

Alcuni dei Papuani mostrano l'indentatura nasale degli Australiani. La punta adunca del naso che si trova fra i Papuani, si può vedere occasionalmente negli Australiani. I matrimoni fra gli aborigeni e gli Australiani non rappresentano un problema grave perchè 1) le due razze sono mutualmente amichevoli, 2) il numero degli aborigeni di puro sangue non è che del 0.5%, 3) quelli di razza mista sposati coi Bianchi producono generalmente dei figli colla pelle bianca o quasi bianca, e colle fattezze del volto quasi europee.

Gli scavi archeologici mostrano probabilmente quattro livelli successivi di cultura, fra i quali il più antico porta una data radiocarbonica di 8700 anni. Rimane dubbio se il primo ingresso dell'uomo abbia avuto luogo durante l'ultimo periodo glaciale, allorchè si svilupparono ponti di terra con la Nuova Guinea e con la Tasmania.

RÉSUMÉ

Dans cette étude génétique sur le croisement entre les indigènes d'Australie et les Blancs, concernant en particulier la tribu des Arandas (Aruntas) à Alice Springs, dans le centre du désert d'Australie, on a étudié beaucoup de familles et enregistré leurs traits physiques. Parmi elles se trouvent beaucoup de F_1 s, une F_2 ainsi que des croisements avec des Blancs des indigènes et des métis. Ces recherches fournissaient une très large base pour l'interprétation des gènes.

La dépression de la racine nasale, trait caractéristique du crâne des indigènes d'Australie par opposition au nez haut de l'Européen, probablement n'engage plus que deux ou trois gènes cumulés. Quelques fois le nez haut et étroit de l'Européen paraît être dominant (Fig. 15). La hauteur du dos nasal et l'étroitesse du nez se doivent aux gènes liés ou bien aux gènes qui affectent la hauteur ainsi que la largeur du nez. Les arcades sourcilières sont aussi un trait caractéristique du crâne masculin, mais comme

elles manquent fréquemment ou sont moins perceptibles dans le crâne féminin, la manière de transmission n'est pas encore connue. Les narines larges des indigènes paraissent dépendre d'un petit nombre de gènes additifs comparées au nez étroit du Blanc. Les lèvres des indigènes tendent à l'épaisseur partout sans être éversives. Seulement l'éversion de la lèvre inférieure, spécialement à la partie centrale, paraît dépendre de l'effet d'un seul gène qui est plus marqué sous la condition homozygotique que hétérozygotique. Ce gène figure aussi chez les Européens et les Chinois et est anatomiquement complètement différent des lèvres éversives du nègre.

Dans les Tables de I à VII sont enregistrés à peu près 15 traits physiques pour parents et enfants; y sont inclus: la couleur des yeux, la couleur de la peau, la couleur et la forme des cheveux, la couleur des sourcils et des cils, la dépression de la racine nasale, l'enfoncement des orbites, la largeur des narines, les lèvres, la

longuer et la largeur de la tête, l'indice céphalique, la grandeur des oreilles et les lobes des oreilles. La couleur des cheveux, des cils et des sourcils peut différer dans le même individu, les cils ayant la tendance à être les plus foncés et les sourcils à être les plus clairs. Les cheveux peuvent être presque plats, ondulés et frisés, avec un très petit nombre des gènes dans ce dernier cas.

La couleur de la peau de la F_1 (masculin ou féminin) s'approche remarquablement à celle du Blanc, et si croisée au Blanc, les enfants pour la plupart ont la peau blanche (Fig. 17). Quelques-uns sont presque blancs comme la F_1 , mais aucun n'est plus foncé que l'un ou l'autre des parents. La recherche des croisements divers mène à la conclusion *qu'un seul gène principal pour la mélanine est présent dans la peau des indigènes à côté d'un gène secondaire qui seul produit la couleur foncée de la peau*. La peau des indigènes étant en général rougeâtre acajou ou brune chocolat (pas noire, à l'exception peut-être de quelques tribus du nord) est très susceptible à être hâlée (cf. Fig. 15) et contient évidemment beaucoup moins de mélanine que la peau noire foncée du nègre. La composition génétique de la couleur de la peau dans les indigènes est donc très différente de celle des races africaines. La couleur de la peau ainsi que les traits du visage chez les hybrides sont étroitement apparentés à la race caucasienne, confirmant l'opinion des anthropologistes à l'égard de l'existence d'un tel rapport.

Le crâne est en haut degré dolichocéphalique et a une capacité crânienne à peu près de 20% plus petite que celle de l'Européen. Il possède deux caractéristiques spéciales archaïques — la protubérance sourcilière et la coche nasale. La dernière emporte une glabella fuyante ainsi qu'une racine nasale dépressée et des orbites enfoncées. La race mongolienne a la racine nasale dépressée comme l'homme de Neandertal, mais sans la coche nasale. La protubérance

sourcilière et la coche nasale sont les deux traits les plus persistants qui figurent chez les hybrides indigènes. Le crâne a la plus forte ressemblance à quelques-uns des Neandertaloïdes à la coche nasale de Mont Carmel, mais la race australienne est néanthropique et non pas Neandertaloïde puisque les Neandertal de l'Europe du Sud n'ont pas de coche nasale, et le front bas et fuyant représente une exception chez les indigènes d'Australie.

Les indigènes, en particulier ceux du Sud-Est de l'Australie, au corps relativement velu, montrent une relation avec les Ainus, aussi bien que avec les tribus de la jungle de l'Inde. L'élément négritoïde dans le Queensland du Nord est considéré ailleurs. Le gène (mutation) pour les cheveux fauves, spécialement chez les enfants, a probablement son origine dans l'Australie centrale et il se peut qu'il s'étend encore. Il est incertain, si ce phénomène tire son origine d'une seule source ou d'une mutation répétée.

Les indigènes ressemblent aux Papouasiens dans leur constellation génétique de la couleur de la peau (la publication va paraître). Quelques Papouasiens laissent voir la coche nasale des indigènes. Le bout du nez en surplomb des Papouasiens peut être observé parfois chez les Australiens. Le croisement des races entre les indigènes et les Australiens n'est pas un problème sérieux parce que 1) les deux races ont des rapports amicaux, 2) le nombre des indigènes de sang pur n'est que de 0.5%, 3) le métis marié avec un Blanc produit en général des enfants à la peau blanche ou presque et aux traits presque européens.

Selon toute apparence, les fouilles archéologiques montrent quatre couches successives de culture, la plus ancienne ayant une date de radio-carbon de 8.700 ans. Il est incertain si la première entrée de l'homme en Australie ait eu lieu pendant la dernière période glaciaire quand les ponts de terre se développaient entre la Nouvelle-Guinée et la Tasmanie.

ZUSAMMENFASSUNG

Diese genetische Forschung über Kreuzungen zwischen der australianischen Urbevölkerung und Weissen, hauptsächlich unter Mitwirkung des Stammes Aranda (Arunta) aus Alice Springs, im wüstenreichen Zentrum Australiens enthält die Untersuchung vieler Familien und die Aufzeichnung ihrer Körpermerkmale. Sie umfasst viele F_1 s und auch eine F_2 Familie, sowie Rückkreuzungen mit Weissen, mit Urbewohnern und Mischlingen. Diese Studien bieten eine ausserordentlich breite Basis für die Deutung der Gene. Es ist klar, dass gegenseitige Überkreuzungen ähnliche Ergebnisse herbeiführen.

Die eingedrückte Nasenwurzel, ein Kennzeichen der einheimischen Schädelform, umfasst bei Kreuzung mit der hohen europäischen Nase nicht mehr als zwei oder drei Kumulativgene. Manchmal scheint die schmale, europäische Nase zu dominieren (Abb. 15). Ein hoher Nasenknochen und eine schmale Nase können durch verkettete Gene oder durch Gene bedingt sein, die sowohl die Höhe als die Breite der Nase beeinflussen. Die hervortretenden Augenbrauen sind ebenfalls ein deutliches Kennzeichen des männlichen Schädels, aber bei den Frauen fehlt es häufig oder ist nur wenig ausgeprägt, sodass der Erbgang davon noch nicht bekannt ist. Die weiten Nasenlöcher der Urbevölkerung scheinen wiederum auf einer im Vergleich zur engen Nase der Weissen kleinen Anzahl zusammenwirkender Gene zu beruhen. Die Lippen der Urbewohner sind durchwegs eher dick, aber meistens sind es keine Schwalstlippen. Eine nach aussen gestülpte Oberlippe, besonders in deren Mitte, scheint durch die Einwirkung eines einzelnen Gens bedingt zu sein, die sich mehr bei Homozygoten als bei Heterozygoten zeigt. Diese Gen kommt auch bei Europäern vor und ist anatomisch von dem der Schwalstlippen der Neger völlig verschieden.

In den Tabellen I bis VII wurden etwa 15 Körpermerkmale für Eltern und Kinder notiert, darunter: Augenfarbe, Hautfarbe, Haar-

farbe und -Form, Farbe der Augenwimpern und -Brauen, Eindrückung der Nasenwurzel, Einsenkung der Nasenwurzel, Weite der Nasenlöcher, Lippen, Kopflänge und -Breite, Schädelindex, Ohrengrösse und Ohrläppchen. Die Farben von Kopfhaar, Augenwimpern und Augenbrauen können alle in ein und derselben Person verschieden sein, wobei die Augenwimpern gewöhnlich am dunkelsten und die Augenbrauen am hellsten sind. Die Haarform geht von fast glatt über gewellt bis zu kraus, wobei recht wenig Gene beteiligt sind.

Die Hautfarbe von F_1 nähert sich merklich der weissen und bei Rückkreuzung von F_1 (männlich oder weiblich) mit Weissen sind die Kinder meistens weisshäutig (Abb. 15-17). Manche sind fast-weiss wie F_1 , aber keins ist dunkler als einer der Eltern. Die Untersuchungen über die verschiedenen Kreuzungen führen zu der Schlussfolgerung, dass bei der Urbevölkerung, zugleich mit einem Nebengen, welches allein eine brunette-weisse Hautfarbe hervorruft, ein Hauptgen für Melanin vorhanden ist. Die Haut der Urbevölkerung, die gewöhnlich Mahagonirot oder Schokoladenbraun (nicht schwarz, mit Ausnahme vielleicht einiger nördlicher Stämme) ist, bräunt sich sehr leicht (S. Abb. 15), wahrscheinlich enthält sie viel weniger Melanin als die vollschwarze Negerhaut. Die Genetik der Hautfarbe bei der Urbevölkerung unterscheidet sich somit sehr von der der afrikanischen Rassen. Die Hautfarbe sowie die Gesichtszüge der Mischlinge ähneln sehr der kaukasischen Rasse, was den Standpunkt der Anthropologie über die Existenz solcher Beziehungen bekräftigt.

Der Schädel ist sichtlich dolichocephalisch und ungefähr 20% geringer im Volumen als bei den Europäern. Er hat zwei besondere archaische Merkmale: die hervortretenden Augenbrauen und die Nasengrube. Letztere bringt die zurückweichende Glabella, die eingedrückte Nasenwurzel, sowie die eingesunkenen Augäpfel mit sich. Die mongolische Rasse hat eine eingedrückte Nasenwurzel, wie

der Neandertaler Mensch, aber keine Nasengrube. Die beiden Merkmale — die hervortretenden Augenbrauen und die Nasengrube — lassen sich bei den Mischlingen der Urbevölkerung fast ausnahmslos beobachten. Der Schädel erinnert stark an einige der Neandertaler mit Nasengrube vom Berg Carmel, aber die australianische Rasse ist neantropisch und nicht neandertalisch, während die Neandertaler Südeuropas keine Nasengrube und eine niedrige fliehende Stirn haben, die bei der Urbevölkerung eine Ausnahme darstellt.

Die Urbevölkerung, besonders in SO-Australien, mit verhältnismässig behaartem Körper, zeigen Ähnlichkeit mit den Ainu, sowie mit den Dschungel-Stämmen Indiens auf. Das Negrito-Element in Nordqueensland wurde an anderer Stelle erörtert (Gates 1959). Das Gen (Mutation) für rötliches Haar, besonders bei den Kindern, nimmt wohl seinen Ursprung in Zentralaustralien und dürfte sich noch weiter verbreiten. Es ist ungewiss, ob es sich dabei um einen einmaligen Vorgang oder um wiederholte Mutationen handelt.

In Bezug auf die Hautfarbgenetik (spä-

ter veröffentlicht) ähnelt die Urbevölkerung den Papua. Einige Papua haben die Nasengrube der Australianer. Manchmal sieht man bei den Australianern die herunterhängende Nasenspitze der Papua. Rassenmischungen zwischen der Urbevölkerung und den Australianern stellen kein ernsthaftes Problem dar, da 1) die beiden Rassen gegenseitig freundschaftliche Beziehungen unterhalten, 2) der Anteil der reinrassigen Urbevölkerung nur 0,5% beträgt, 3) die halbblütigen Urbewohner, die mit Weissen verheiratet sind, gewöhnlich Kinder hervorbringen, die fast-weiße oder gar weiße Haut und europäische Gesichtszüge aufweisen.

Archäologische Ausgrabungen zeigen, dass man vier aufeinanderfolgende Kulturschichten annehmen kann, von denen die älteste, radio-karbonisch betrachtet, 8700 Jahre zurückliegt. Es bleibt allerdings noch ungewiss, ob der früheste Einbruch des Menschen in Australien während der letzten Eiszeit stattfand, als das Land Brücken zu Neu-Guinea und Tasmanien bildete.